Nº de expediente: 008440-000656-22 **Fecha: 01.12.2022**

Universidad de la República Uruguay - UDELAR

UNIVERSIDAD DE LA REPÚBLICA URUGUAY

ASUNTO

ANGELA MARIANA GÓMEZ, SOLICITUD DE INGRESO AL RÉGIMEN DE DEDICACIÓN TOTAL.

Unidad	SECCIÓN SECRETARÍA COMISIÓN DIRECTIVA - CENTRO MONTEVIDEO - ISEF
Tipo	DEDICACION TOTAL - SOLICITUD DE

Funcionario/s:

Documento	Nombre completo	Correo	Número de cargo	Escalafón	Grado	Horas
45932955	Angela Mariana Gómez	mgomez@isef.edu.uy	556439	G	2	30

Categoría:	Docente
Dependencia:	Departamento de Educación Física y Salud
Nro. de expediente anterior:	

La presente impresión del expediente administrativo que se agrega se rige por lo dispuesto en la normativa siguiente: Art. 129 de la ley 16002, Art. 694 a 697 de la ley 16736, art. 25 de la ley 17.243; y decretos 55/998, 83/001 y Decreto reglamentario el uso de la firma digital de fecha 17/09/2003.-

	Expediente Nro. 008440-000656-22 **Actuación 1**	Oficina: SECCIÓN PERSONAL - CENTRO MONTEVIDEO - ISEF Fecha Recibido: 01/12/2022 Estado: Cursado

TEXTO

A solicitud del interesado se incia el trámite para ingreso al régimen de dedicación total. Pase a comisión de dedicación total ISEF, cumplido siga a UGP.

Gonzalo Castro

Firmado electrónicamentemente por Gonzalo Martín Castro el 01/12/2022 14:22:23.

Nombre Anexo	**Tamaño**	**Fecha**
CarreraFuncional_ANGELA_GOMEZ_20221201133150_45932955.pdf	43 KB	01/12/2022 13:40:29
cv-ANII - Mariana Gómez.pdf	238 KB	01/12/2022 13:40:29
Formulario de ingreso - Mariana Gómez.pdf	146 KB	01/12/2022 13:40:29
Artículo_publicado_Gómez_Bia_Zocalo_2021_JCDD.pdf	605 KB	01/12/2022 13:40:29
fnut-09-856198.pdf	3217 KB	01/12/2022 13:42:28
fspor-04-799659.pdf	3690 KB	01/12/2022 13:42:28
Contribución personal a las publicaciones - Mariana Gómez.pdf	146 KB	01/12/2022 13:42:28
Resumen proyecto investigación - Mariana Gómez.pdf	129 KB	01/12/2022 13:42:28
PLAN DE ACTIVIDADES DEDICACIÓN TOTAL - Mariana Gómez.pdf	256 KB	01/12/2022 13:43:05

Universidad de la República - ISEF

Carrera Funcional

GOMEZ GARCIA, ANGELA MARIANA - Documento: 45932955

Nº CARGO	DENOMINACIÓN	CATEGORÍA	ESC/SUB	CARRERA	CARÁCTER	FORMA DE ACCESO	GRADO	HORAS
556439	Asistente	Docente	G.0.01	Docente	Efectivo	Llamado aspirantes	2	10

INSTITUCIONAL: 26.001.550.07.04.01 - MVD/ EFySalud/ Fundamentos Biológicos

PARTIDA PRESUPUESTAL: 155110100 - ISEF Centro Montevideo

MOVIMIENTO	ÓRGANO EMISOR	Nº RESOLUCIÓN	FECHA RESOL.	Nº EXPEDIENTE	FECHA DESDE	FECHA HASTA	HORAS	PORCENT.	PART. PRESUPUESTAL
Designación (Docente)	Comisión Directiva	56	26/08/22	008150-500557-21	01/10/22	30/09/24			155110100
Extensión Horaria Docente	Comisión Directiva	21	04/11/22	008440-000530-22	01/10/22		10-30		155110100

Nº CARGO	DENOMINACIÓN	CATEGORÍA	ESC/SUB	CARRERA	CARÁCTER	FORMA DE ACCESO	GRADO	HORAS
556155	Asistente	Docente	G.0.01	Docente	Interino	Llamado aspirantes	2	30

INSTITUCIONAL: 26.001.550.07.04.03 - MVD/ EFySalud/ Práct Corporales y Salud

PARTIDA PRESUPUESTAL: 155110100 - ISEF Centro Montevideo

MOVIMIENTO	ÓRGANO EMISOR	Nº RESOLUCIÓN	FECHA RESOL.	Nº EXPEDIENTE	FECHA DESDE	FECHA HASTA	HORAS	PORCENT.	PART. PRESUPUESTAL
Modificacion de Cargo - Cambio	Comisión Directiva	19	11/02/22	008150-500688-21	01/04/22				155110100
Cese en el Cargo - Cese por motivos regl	Comisión Directiva	56	26/08/22	008150-500557-21		30/09/22			155110100

Nº CARGO	DENOMINACIÓN	CATEGORÍA	ESC/SUB	CARRERA	CARÁCTER	FORMA DE ACCESO	GRADO	HORAS
556155	Asistente	Docente	G.0.01	Docente	Interino	Llamado aspirantes	2	20

INSTITUCIONAL: 26.001.550.07.04.03 - MVD/ EFySalud/ Práct Corporales y Salud

PARTIDA PRESUPUESTAL: 155110100 - ISEF Centro Montevideo

MOVIMIENTO	ÓRGANO EMISOR	Nº RESOLUCIÓN	FECHA RESOL.	Nº EXPEDIENTE	FECHA DESDE	FECHA HASTA	HORAS	PORCENT.	PART. PRESUPUESTAL
Designación (Docente)	Comisión Directiva	63	28/02/20	008150-000711-19	01/04/20	31/03/21			155110100
Prórroga en el Cargo	Comisión Directiva	49	26/02/21	008440-501734-20	01/04/21	31/03/22			155110100
Prórroga en el Cargo	Comisión Directiva	30	25/03/22	008440-503414-21	01/04/22	31/03/23			155110100
Extensión Horaria Docente	Comisión Directiva	3	17/04/20	008150-000298-20	01/04/20	31/03/21	20-30		155110100
Prórroga de EXT.HOR.DOC.	Comisión Directiva	37	26/03/21	008440-502289-20	01/04/21	31/03/22			155110100

Universidad de la República - ISEF

Carrera Funcional

GOMEZ GARCIA, ANGELA MARIANA - Documento: 45932955

Nº CARGO	DENOMINACIÓN	CATEGORÍA	ESC/SUB	CARRERA	CARÁCTER	FORMA DE ACCESO	GRADO	HORAS
556260	Ayudante	Docente	G.0.01	Docente	Interino	Llamado aspirantes	1	20

INSTITUCIONAL: 26.001.550.01.01 - Unidad de Apoyo Ed. Perman

PARTIDA PRESUPUESTAL: 155110100 - ISEF Centro Montevideo

MOVIMIENTO	ÓRGANO EMISOR	Nº RESOLUCIÓN	FECHA RESOL.	Nº EXPEDIENTE	FECHA DESDE	FECHA HASTA	HORAS	PORCENT.	PART. PRESUPUESTAL
Designación (Docente)	Comisión Directiva	23	19/10/20	008100-500120-20	06/11/20	05/11/21			155110100
Cese en el Cargo - Renuncia	Comisión Directiva	18	21/05/21	008500-500100-21		29/04/21			155110100

Nº CARGO	DENOMINACIÓN	CATEGORÍA	ESC/SUB	CARRERA	CARÁCTER	FORMA DE ACCESO	GRADO	HORAS
555769	Ayudante	Docente	G.0.01	Docente	Interino	Llamado aspirantes	1	20

INSTITUCIONAL: 26.001.550.06.04.01 - Centro Montevideo

PARTIDA PRESUPUESTAL: 155110100 - ISEF Centro Montevideo

MOVIMIENTO	ÓRGANO EMISOR	Nº RESOLUCIÓN	FECHA RESOL.	Nº EXPEDIENTE	FECHA DESDE	FECHA HASTA	HORAS	PORCENT.	PART. PRESUPUESTAL
Modificacion de Cargo - Cambio	Personal	1	23/10/18		01/10/18				155110100
Prórroga en el Cargo	Comisión Directiva	37	21/06/19	008440-000842-19	01/07/19	30/06/20			155110100
Cese en el Cargo - Cese por motivos regl	Comisión Directiva	63	28/02/20	008150-000711-19		31/03/20			155110100
Prórroga de EXT.HOR.DOC.	Comisión Directiva	45	12/07/19	008440-000869-19	01/07/19	30/06/20			155110100
Licencia Con Goce de Sueldo	Dir. de Inst. o Serv	2	17/09/19	008440-003072-19	19/09/19	28/09/19			

Nº CARGO	DENOMINACIÓN	CATEGORÍA	ESC/SUB	CARRERA	CARÁCTER	FORMA DE ACCESO	GRADO	HORAS
555769	Ayudante	Docente	G.0.01	Docente	Interino	Llamado aspirantes	1	20

INSTITUCIONAL: 26.001.550.06.04.01 - Centro Montevideo

PARTIDA PRESUPUESTAL: 155073131 - Conv. ISEF - SENADE

MOVIMIENTO	ÓRGANO EMISOR	Nº RESOLUCIÓN	FECHA RESOL.	Nº EXPEDIENTE	FECHA DESDE	FECHA HASTA	HORAS	PORCENT.	PART. PRESUPUESTAL
Designación (Docente)	Comisión Directiva	46	18/08/17	008150-000229-17	01/10/17	30/06/18			155073131
Prórroga en el Cargo	Comisión Directiva	36	29/06/18	008440-000717-18	01/07/18	30/06/19			155073131

Universidad de la República - ISEF

Carrera Funcional

GOMEZ GARCIA, ANGELA MARIANA - Documento: 45932955

Extensión Horaria Docente	Comisión Directiva	9	13/03/18	008150-000207-18	01/04/18	30/06/18	20-30		155073131
Prórroga de EXT.HOR.DOC.	Comisión Directiva	37	29/06/18	008440-000813-18	01/07/18	30/06/19			155073131

Nº CARGO	DENOMINACIÓN	CATEGORÍA	ESC/SUB	CARRERA	CARÁCTER	FORMA DE ACCESO	GRADO	HORAS
555219	Ayudante Fisiología I	Docente	G.0.01	Docente	Interino	Llamado aspirantes	1	11

INSTITUCIONAL: 26.001.550.03.02.02 - T/C Área Ciencias Biológicas

PARTIDA PRESUPUESTAL: 155110100 - ISEF Centro Montevideo

MOVIMIENTO	ÓRGANO EMISOR	Nº RESOLUCIÓN	FECHA RESOL.	Nº EXPEDIENTE	FECHA DESDE	FECHA HASTA	HORAS	PORCENT.	PART. PRESUPUESTAL
Designación (Docente)	Otros	33	27/02/15	008150-001028-14	09/03/15	08/03/16			155110100
Prórroga en el Cargo	Comisión Directiva	76	15/04/16	008440-000099-16	09/03/16	31/03/17			155110100
Prórroga en el Cargo	Comisión Directiva	26	10/03/17	008440-004613-16	01/04/17	31/03/18			155110100
Cese en el Cargo - Cese por motivos regl	Comisión Directiva	46	18/08/17	008150-000229-17		30/09/17			155110100
Subrogación (DO)	C.D.A.	47	20/10/15	008150-000588-15	01/08/15	31/12/15			155110100
Extensión Horaria Docente	Comisión Directiva	45	16/09/16	008440-003212-16	01/04/16	31/03/17	11-19		155073131
Extensión Horaria Docente	Comisión Directiva	70	07/04/17	008440-000659-17	01/04/17	31/03/18	11-20		155073131

CVUY

ANII AGENCIA NACIONAL DE INVESTIGACIÓN E INNOVACIÓN

MARIANA GÓMEZ

M. Sc.

SNI

Ciencias Médicas y de la Salud / Ciencias de la Salud
Categorización actual: Iniciación (Activo)

Fecha de publicación: 30/11/2022
Última actualización: 30/11/2022

Datos Personales

IDENTIDAD

Nombre en citaciones bibliográficas: Gómez-García, M.
Documento: Cédula de identidad - 45932955 ,Pasaporte - 45932955
Sexo: Femenino
País de pasaporte: Uruguay
Fecha de nacimiento: 16/02/1991
Lugar de nacimiento: Uruguay / Montevideo / Montevideo
Nacionalidad: Uruguaya

DIRECCIÓN PERSONAL

Dirección: Islas Canarias 6330 esquina Camino lecocq / 11900
País: Uruguay / Montevideo / Montevideo
Teléfono: 099597430
Correo electrónico: mgomez@isef.edu.uy

Datos Generales

INSTITUCIÓN PRINCIPAL

Universidad de la República/ Instituto Superior de Educación Física / Departamento de Educación Física y Salud - Núcleo Biológico / Uruguay

DIRECCIÓN INSTITUCIONAL

Institución: Universidad de la República / Instituto Superior de Educación Física / Sector Educación Superior/Público
Dirección: Parque José Batlle y Ordoñez S/N. / 11800
País: Uruguay / Montevideo / Montevideo
Teléfono: 24800102
Correo electrónico/Sitio Web: uai@isef.edu.uy http://isef.edu.uy/

Formación

Formación académica

CONCLUIDA

MAESTRÍA

Programa de Investigación Biomédica (2018 - 2020)

Universidad de la República - Facultad de Medicina , Uruguay
Título de la disertación/tesis/defensa: TRÍADA "ACTIVIDAD FÍSICA, CONDUCTAS SEDENTARIAS Y HORAS DE SUEÑO EN NIÑOS" Asociación con el estado hemodinámico, estructural y funcional arterial en la infancia.
Tutor/es: Daniel Bia Santana - Carolina Chamorro Viña
Obtención del título: 2020

GRADO

Licenciatura en Educación Física (2011 - 2016)

Universidad de la República - Instituto Superior de Educación Física , Uruguay
Título de la disertación/tesis/defensa: Discursos de salud que subyacen de la práctica del CrossFit
Tutor/es: Maria Rosa Corral
Obtención del título: 2016

Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias Biomédicas Sociales /

TÉCNICO

Técnico en Operador de PC (2007 - 2007)

Administración Nacional de Educación Pública - Universidad del Trabajo, UTU - Paso de la Arena , Uruguay
Título de la disertación/tesis/defensa: Operador informático
Obtención del título: 2007

ESPECIALIZACIÓN/PERFECCIONAMIENTO

Fundamentos del Entrenamiento en Deportes de Endurance (2019 - 2020)

Instituto Deporte y Vida, Grupo Sobre Entrenamiento (G-SE) , España
Título de la disertación/tesis/defensa: Fundamentos del Entrenamiento en Deportes de Endurance
Obtención del título: 2020

Especialista en Triatlón, Medio Ironman e Ironman (2019 - 2020)

Instituto Deporte y Vida , España
Título de la disertación/tesis/defensa: Especialista en Triatlón, Medio Ironman e Ironman
Obtención del título: 2020

EN MARCHA

DOCTORADO

Programa de Investigación Biomédica (2020)

Universidad de la República, Facultad de Medicina ,Uruguay
Título de la disertación/tesis/defensa: Evaluación integral de la condición física y patrones de conducta sedentaria, actividad física y sueño, mediante ergoespirometría, bioimpedancia segmental multifrecuencia y acelerometría triaxial: asociación con el estado cardiovascular

GRADO

Licenciatura en Fisioterapia (2014)

Universidad de la República, Escuela Universitaria de Tecnología Médica ,Uruguay
Título de la disertación/tesis/defensa: Fisioterapia

Formación complementaria

CONCLUIDA

CURSOS DE CORTA DURACIÓN

Fisiología del ejercicio (03/2019 - 12/2019)

Sector Educación Superior/Público / Universidad de la República / Facultad de Medicina / Cátedra de Medicina del Deporte , Uruguay
240 horas
Palabras Clave: Fisiología del ejercicio Evaluación Rehabilitación
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte /

Actualización en enfermería hemato-oncológica pediátrica (04/2019 - 11/2019)

Sector Organizaciones Privadas sin Fines de Lucro/Organizaciones No Gubernamentales / Organizaciones Sin Fines de Lucro / Fundacion Perez Scremini , Uruguay
32 horas
Palabras Clave: Hemato-oncología Pediatría Enfermería
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias y Servicios de Cuidado de la Salud /

Taller de redacción de tesis (08/2019 - 11/2019)

Sector Educación Superior/Público / Universidad de la República / Comisión Académica de Posgrado , Uruguay
30 horas
Palabras Clave: Redacción Tesis

Bioética (09/2019 - 11/2019)

Sector Educación Superior/Público / Universidad de la República / Facultad de Medicina , Uruguay
25 horas

Navigating life as a long-term survivor of childhood cancer (11/2019 - 11/2019)

Sector Extranjero/Internacional/Otros / Canadian Association of Psychosocial Oncology , Canadá
2 horas
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte /

Bioestadística (03/2019 - 06/2019)

Sector Educación Superior/Público / Universidad de la República / Facultad de Medicina / Departamento de métodos cuantitativos , Uruguay
90 horas
Palabras Clave: Bioestadística Métodos cuantitativos Investigación

Evaluación funcional del movimiento de la rodilla durante la marcha y actividades motoras (04/2019 - 04/2019)

Sector Educación Superior/Público / Universidad de la República / Facultad de Medicina / Núcleo de Ingeniería Biomédica , Uruguay
36 horas
Palabras Clave: Evaluación Marcha Traumatología Rehabilitación Deportología Imagenología Ingeniería Biomédica
Areas de conocimiento:
Ciencias Médicas y de la Salud / Biotecnología de la Salud / Biotecnología relacionada con la Salud /

Exercise Physiology Seminar (10/2018 - 12/2018)

Sector Extranjero/Internacional/Otros / University of Calgary / Human Performance Lab , Canadá
30 horas
Palabras Clave: Research Exercise Physiology
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Fisiología del ejercicio

EndNote Desktop (11/2018 - 11/2018)

Sector Extranjero/Internacional/Otros / University of Calgary / Health Service Library , Canadá
4 horas
Palabras Clave: Gestor bibliográfico EndNote

Cancer and exercise training for health and fitness professionals (08/2018 - 08/2018)

Sector Extranjero/Internacional/Otros / University of Calgary / Health and Wellness Lab , Canadá
20 horas
Palabras Clave: Cancer Exercise training Health Prescription
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias y Servicios de Cuidado de la Salud / Ejercicio físico y cáncer

Instructor de Spinning (08/2017 - 08/2017)

Sector Empresas/Privado / Empresa Privada / Spinning Instructor Training , Uruguay
10 horas
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Spinning

Curso anual de preparación física 2015 (03/2015 - 11/2015)

Sector Gobierno/Público / Ministerio de Turismo y Deporte / Dirección Nacional de Deporte , Uruguay
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias de la Salud / Entrenamiento

deportivo

III Jornadas de preparación física general y capacitación para personal trainers (07/2015 - 07/2015)

Sector Extranjero/Internacional/Otros / Fuerza y potencia , Argentina
20 horas
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Deporte y alto rendimiento

Taller intensivo de velocidad (06/2015 - 06/2015)

Sector Enseñanza Técnico-Profesional/Secundaria/Privado / Institutos privados de enseñanza técnico profesional / Institutos de idiomas / URUDEPORTE , Uruguay
5 horas
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Deporte y alto rendimiento

Taller de entrenamiento en futbol (06/2015 - 06/2015)

Sector Enseñanza Técnico-Profesional/Secundaria/Privado / Institutos privados de enseñanza técnico profesional / Institutos de idiomas / URUDEPORTE , Uruguay
7 horas
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Deporte y alto rendimiento

Taller intensivo de halterofilia (04/2015 - 04/2015)

Sector Enseñanza Técnico-Profesional/Secundaria/Privado / Institutos privados de enseñanza técnico profesional / Institutos de idiomas / URUDEPORTE , Uruguay
7 horas
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Deporte y alto rendimiento

Actualización en flexibilidad (09/2014 - 09/2014)

Sector Empresas/Privado / Empresa Privada / Instituto Universitario Asociación Cristiana de Jóvenes , Uruguay
8 horas
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Flexibilidad

Planificación estratégica y formulación de proyectos para nuestra comunidad (03/2007 - 03/2007)

Sector Educación Superior/Privado / Universidad Centro Latinoamericano de Economía Humana / Universidad CLAEH , Uruguay
12 horas

PARTICIPACIÓN EN EVENTOS

XVIII Encuentro Nacional XIII Internacional de Investigadores en Educación Física IV Encuentro Nacional de Extensión en Educación Física (2020)

Tipo: Encuentro
Institución organizadora: Instituto Superior de Educación Física, Uruguay

21st World Congress of Psycho-Oncology (2019)

Tipo: Congreso
Institución organizadora: Canadian Association of Psychosocial Oncology (CAPO) in partnership with the International Psycho-oncology Society (IPOS), Canadá
Palabras Clave: Psycho-oncology Pediatric oncology Exercise Quality of life
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias y Servicios de Cuidado de la Salud /

iPOEG - Pediatric Oncology Exercise Guidelines (2019)

Tipo: Encuentro

Institución organizadora: University of Calgary and Social Science and Humanities Reasearch Council of Canada, Canadá
Palabras Clave: Exercise guidelines Pediatric oncology
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Este encuentro tuvo como objetivo el comenzar a elaborar las primeras guías internacionales de ejerc

Evaluación, actividad física y promoción de salud (2019)

Tipo: Seminario
Institución organizadora: Cátedra de Medicina del Deporte - Instituto Superior de Educación Física, Uruguay
Palabras Clave: Evaluación Ergoespirometría Investigación Actividad física
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte /

8th Annual Dough Lockhart Memorial Pediatric oncology Lecture and Research Day (2018)

Tipo: Simposio
Institución organizadora: Royal College of Physicians and Surgeons of Canadá and University of Calgary, Canadá
Palabras Clave: Research Pediatric Oncology Medical education
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias y Servicios de Cuidado de la Salud / Investigación en Oncología Pediátrica

Deporte participativo y alto rendimiento frente a los desafíos ambientales contemporáneos (2013)

Tipo: Congreso
Institución organizadora: Universidad de Ciencias de la Cultura Física y el Deporte "Manuel Fajardo", Cuba
Palabras Clave: Alto Rendimiento Deporte Entrenamiento
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte /

Jornada de actualización sobre actividad física y entrenamiento (2012)

Tipo: Encuentro
Institución organizadora: Instituto Superior de Educación Física, Uruguay
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Entrenamiento deportivo

OTRAS INSTANCIAS

Ejercicio Físico en el Embarazo y Post Parto (2021)

España
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias de la Salud / Prácticas corporales en el embarazo y en el post-parto

Curso anual de Preparación Física (2015)

Uruguay
Palabras Clave: Preparación Física Periodización Entrenamiento deportivo Especialización
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Entrenamiento deportivo

Idiomas

Inglés

Entiende muy bien / Habla muy bien / Lee muy bien / Escribe muy bien

Areas de actuación

CIENCIAS MÉDICAS Y DE LA SALUD
Ciencias de la Salud /Ciencias del Deporte /Fisiología del ejercicio

CIENCIAS MÉDICAS Y DE LA SALUD
Ciencias de la Salud /Ciencias de la Salud /Ejercicio físico y cáncer

CIENCIAS MÉDICAS Y DE LA SALUD
Medicina Básica /Fisiología /Fisiología Cardiovascular

Actuación profesional

SECTOR EDUCACIÓN SUPERIOR/PÚBLICO - UNIVERSIDAD DE LA REPÚBLICA - URUGUAY

Instituto Superior de Educación Física

VÍNCULOS CON LA INSTITUCIÓN

Funcionario/Empleado (09/2022 - a la fecha) Trabajo relevante
Asistente 30 horas semanales
Escalafón: Docente
Grado: Grado 2
Cargo: Efectivo

Funcionario/Empleado (04/2020 - a la fecha)
30 horas semanales
Escalafón: Docente
Grado: Grado 2
Cargo: Interino

Funcionario/Empleado (11/2020 - 04/2021)
Ayudante de la Unidad de Apoyo a Posgrados y Educación Permanente 20 horas semanales
Escalafón: Docente
Grado: Grado 1
Cargo: Interino

Funcionario/Empleado (03/2015 - 03/2020) Trabajo relevante
Grado 1 30 horas semanales
Escalafón: Docente
Grado: Grado 1
Cargo: Interino

Funcionario/Empleado (06/2015 - 03/2016)
Asistente 11 horas semanales
Escalafón: Docente
Grado: Grado 2
Cargo: Interino

ACTIVIDADES

LÍNEAS DE INVESTIGACIÓN

Educación Física y Salud (09/2017 - a la fecha)
El grupo reúne un amplio espectro de temas e intereses de investigación enmarcados en el campo de las actividades físicas orientadas a la salud. A nivel experimental el foco se centra en los aspectos biológicos de la actividad física, la aptitud física y la nutrición en su relación con la salud. A nivel crítico-reflexivo nuestro objetivo es problematizar asuntos que consideramos fundamentales en la producción de conocimientos sobre las relaciones existentes entre ejercicio físico y salud, aptitud física y salud, y entre nutrición y salud; asuntos que, en nuestra opinión, no están siendo tratados con la profundidad y el cuidado que la complejidad del tema exige.
Aplicada
30 horas semanales , Integrante del equipo

Equipo: Mariana Gómez
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Fisiología del ejercicio

PROYECTOS DE INVESTIGACIÓN Y DESARROLLO

Aplicabilidad de un programa de ejercicio físico e hipnosis en niños con leucemia y linfoma en los primeros 3 meses de tratamiento oncológico (09/2018 - a la fecha)

Objetivos: Determinar la aplicabilidad y potenciales beneficios de un programa de ejercicio físico (EF) y terapia de hipnosis (TH) durante los primeros tres meses de tratamiento en pacientes pediátricos con diagnóstico de leucemia y linfoma. Métodos: Este estudio controlado aleatorizado buscará reclutar a 30 niños recién diagnosticados (de 4 a 14 años de edad), en dos fases (I, II). Fase (I) en el hospital: dos brazos serán comparados durante 30 días. Los participantes en el brazo (IA) participarán en un programa de EF individualizado y supervisado (fuerza, equilibrio, flexibilidad y ejercicios aeróbicos), 5 veces por semana. Los participantes en el brazo (IB) no recibirán consejos de ejercicio, pero recibirán TH 2 veces por semana con un enfoque en el tratamiento de la ansiedad, el dolor y la náusea. Fase (II) se realizará en el hospital y en el hogar: ambos brazos completarán una intervención combinada de EF y TH en el hospital y en el hogar durante 60 días. Análisis estadístico: La fase I comparará las diferencias en todos los resultados entre los brazos A y B utilizando la prueba SPSS/Mann-Whitney. La prueba previa a la fase II se realizará para todos los resultados utilizando SPSS/pruebas pareadas t. Evaluaciones: aplicabilidad (reclutamiento y adherencia), desarrollo motor (MOON test), capacidad funcional (TUG), calidad de vida y fatiga (módulo de cáncer PedsQL y fatiga). Evaluaciones realizadas en 3 puntos de tiempo (día 1, día 31, día 92). Resultados: Esperamos encontrar si un programa de EF y una TH son viables en Uruguay y si existe una disminución en el deterioro de la condición física y los niveles de fatiga, evitando el círculo vicioso de descondicionamiento físico y mejorando la calidad de vida de los pacientes. Conclusiones e implicaciones clínicas: Este es el primer estudio de este tipo de intervención en Uruguay. El estudio agregará evidencia de la viabilidad de la TH y el EF como terapias adyuvantes durante el tratamiento oncológico. Un estudio multicéntrico posterior tendrá como objetivo incluir todos los diagnósticos como una forma de incorporar el EF y la TH como parte de la atención estándar en oncología pediátrica en Uruguay.
20 horas semanales
Investigación
Coordinador o Responsable
En Marcha
Alumnos encargados en el proyecto:
Pregrado:3
Especialización:1
Doctorado:1
Equipo: Mariana Gómez

Comparación de los efectos de tres modalidades de entrenamiento intenso en parámetros de salud cardiometabólica y aptitud física. (07/2019 - 12/2020)

La incidencia de enfermedades no transmisibles (ENT) ha crecido exponencialmente en las últimas décadas. La inactividad física se ha asociado positivamente con la fisiopatología de muchas de estas enfermedades, teniendo una gran repercusión en el gasto sanitario y la mortalidad en todo el mundo. Frente a esta problemática compleja, la Actividad Física (AF) aparece como una intervención económica y de amplia aplicación para la prevención y tratamiento de estas enfermedades, presentando una fuerte evidencia científica. Un gran número de investigaciones señalan los beneficios cardiometabólicos que aporta la AF de alta intensidad. El "High Intesity Interval Training" (HIIT) ha mostrado ser un método de entrenamiento particularmente eficaz por ser de fácil aplicación, adecuada tolerancia y bajo tiempo de implicancia semanal. Sin embargo, gran parte de los trabajos presentes en la literatura realizan comparaciones de propuestas muy diferentes en cuanto a los parámetros de carga, y en muchas ocasiones el volumen de tiempo excede las recomendaciones de AF semanal de ejercicio intenso. Por otro lado, existe necesidad de estudiar propuestas de AF más emparentadas con la vida cotidiana, fuera de situaciones controladas de laboratorio. Por lo tanto, el objetivo del presente proyecto es investigar los efectos de tres programas de entrenamiento intenso de simple aplicación y equiparados en sus cargas de trabajo (volumen e intensidad) en marcadores de rendimiento físico y salud cardiometabólica.
15 horas semanales
Investigación
Integrante del Equipo
En Marcha
Alumnos encargados en el proyecto:

Pregrado:2
Maestría/Magister:1
Doctorado:2
Financiación:
Comisión Sectorial de Investigación Científica, Uruguay, Apoyo financiero
Equipo: Gómez-García, M.

DOCENCIA

Fisiología del ejercicio (04/2015 - a la fecha)

Grado
Asistente
Asignaturas:
Fisiología del ejercicio, 96 horas, Teórico-Práctico
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Fisiología del ejercicio

Licenciatura de Educación Física (05/2019 - a la fecha)

Grado
Asistente
Asignaturas:
Educación Física Adaptada, 64 horas, Teórico-Práctico
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias de la Salud /

Licenciatura en Educación Física (04/2015 - 03/2020)

Grado
Asistente
Asignaturas:
Fundamentos anátomo fisiológicos, 96 horas, Teórico
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte / Fisiologia y anatomía

EXTENSIÓN

Proyecto de Espacio de Formación Integral - Educación física y salud (04/2019 - 08/2020)

Educación física y salud 5 horas

Programa "Más y mejor vida". Programa de cooperación entre ISEF y VERA+. (07/2019 - 12/2019)

5 horas

GESTIÓN ACADÉMICA

Integrante por el orden docente a la Comisión de Carrera Local de Montevideo (03/2019 - 03/2021)

Participación en cogobierno 2 horas semanales

Asistente de Dirección del Departamento de Educación Física y Salud (08/2019 - 03/2021)

Educación física y salud Gestión de la Enseñanza 10 horas semanales
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte /

Coordinación de horarios de 11 unidades curriculares del departamento de Educación Física y Salud. (06/2019 - 03/2021)

Gestión de la Enseñanza 5 horas semanales

Proyecto de apoyo a la enseñanza de la unidad curricular Fundamentos Anátomo Fisiológicos junto al programa de apoyo al aprendizaje (PROGRESA) (03/2019 - 03/2020)

Gestión de la Enseñanza 2 horas semanales

SECTOR EDUCACIÓN SUPERIOR/PÚBLICO - UNIVERSIDAD DE LA REPÚBLICA - URUGUAY

Laboratorio de Investigación y Evaluación Biomédica en Reposo y Ejercicio / Instituto Superior de Educación Física; Facultad de Medicina; Centro Hospitalario Pereira Rossell

VÍNCULOS CON LA INSTITUCIÓN

Otro (03/2022 - a la fecha) Trabajo relevante

Estudiante de doctorado 30 horas semanales
Escalafón: Docente
Grado: Grado 2
Cargo: Efectivo

SECTOR EDUCACIÓN SUPERIOR/PÚBLICO - UNIVERSIDAD DE LA REPÚBLICA - URUGUAY

Centro Universitario de Investigación, Innovación y Diagnóstico Arterial

VÍNCULOS CON LA INSTITUCIÓN

Otro (08/2020 - a la fecha)

Estudiante de doctorado 30 horas semanales

Otro (12/2019 - 09/2020)

Estudiante de maestría del equipo de investigación 20 horas semanales

ACTIVIDADES

LÍNEAS DE INVESTIGACIÓN

Centro Universitario de Investigación, Innovación y Diagnóstico Arterial - Movimiento, Actividad, Salud" (CUiiDARTE-MAS) (12/2019 - a la fecha)

El grupo se encuentra destinado a realizar actividades de diagnóstico y terapéutica, investigación, innovación, extensión y formación de recursos humanos (grado, pre?grado, pos?grado) en el área de la valoración no?invasiva morfo?funcional del sistema cardiovascular, el movimiento humano y la condición (aptitud) física.
Mixta
30 horas semanales , Integrante del equipo
Equipo: Gómez-García, M. , BIA D / BIA SANTANA D / SANTANA DB , ZOCALO Y

PROYECTOS DE INVESTIGACIÓN Y DESARROLLO

Actividad física, conducta sedentaria, tiempo de sueño, indeminidad tisular y composición corporal en sujetos saludables medidos con acelerometría triaxial y bioimpedancia segmental-multifrecuencia. Impacto de diferentes sitios de registro, algoritmos (06/2020 - a la fecha)

-
30 horas semanales
Investigación
Integrante del Equipo
En Marcha
Alumnos encargados en el proyecto:
Maestría/Magister:1
Doctorado:2
Equipo: Mariana Gómez , Daniel BIA SANTANA (Responsable) , Yanina Zócalo , Carlos Magallanes , Gustavo Grinspan

Evaluación integral de la condición física y patrones de conducta sedentaria, actividad física y sueño, mediante ergoespirometría, bioimpedancia segmental multifrecuencia y acelerometría triaxial: asociación con el estado cardiovascular. (08/2020 - a la fecha)

El proyecto estudiará la relación entre el movimiento corporal realizado durante al menos una semana (24 horas / 7 días), condición física y la salud cardiovascular de niños, adolescentes y

adultos, empleando diversa tecnología no-invasiva, portable y operador-independiente. Se investigará cuáles variables y/o parámetros empleados para caracterizar el movimiento y la condición física: (1) se asocian al estado del sistema cardiovascular, (2) permiten predecir que el sistema cardiovascular trabaja alejado de su punto "óptimo", y (3) en qué medida la asociación y/o capacidad predictiva, depende de aspectos metodológicos del empleo de los dispositivos. El presente proyecto realizará aportes relacionados con: aspectos fisiológicos/fisiopatológicos de la relación movimiento-salud cardiovascular, identificar potenciales biomarcadores del estado "normal o alterado" del sistema cardiovascular, y aspectos específicos del empleo práctico de diversa tecnología.
30 horas semanales
Investigación
Coordinador o Responsable
En Marcha
Alumnos encargados en el proyecto:
Maestría/Magister:1
Doctorado:3
Financiación:
Agencia Nacional de Investigación e Innovación, Uruguay, Beca
Equipo: Gómez-García, M. , BIA D / BIA SANTANA D / SANTANA DB , ZOCALO Y

Relaciones entre parámetros de Actividad Física y Función Hemodinámica en la población uruguaya. (05/2020 - a la fecha)

Este estudio intenta describir niveles de actividad física en diversas poblaciones de Uruguay, indagando sus relaciones con el funcionamiento y estructura cardiovascular y arterial.
5 horas semanales
Investigación
Integrante del Equipo
En Marcha
Alumnos encargados en el proyecto:
Maestría/Magister:2
Maestría/Magister prof:2
Doctorado:3
Equipo: Mariana Gómez

TRÍADA "ACTIVIDAD FÍSICA, CONDUCTA SEDENTARIA Y HORAS DE SUEÑO" EN NIÑOS: Asociación con el estado hemodinámico, estructural y funcional arterial en la infancia (01/2020 - 09/2020)

Fundamentación: Trabajos previos demostraron que la exposición a factores de riesgo cardiovascular (FRCV; ej. obesidad, hipertensión arterial [HTA]), impacta tempranamente en el sistema cardiovascular (CV) de niños y adolescentes. Adicionalmente, se demostró que la magnitud del impacto difiere en función del territorio arterial considerado (ej. arterias elásticas vs. musculares vs. transicionales; arteriales centrales vs. periféricas), del parámetro evaluado (hemodinámico vs. estructural vs. funcional) y/o mediante efectos presión arterial (PA)-dependientes y/o independientes. Actualmente, se desconoce si en niños con edades cercanas al inicio de la etapa escolar (5-6 años), los componentes o subcomponentes de la tríada "actividad física (AF), conductas sedentarias (CS) y/o tiempo de sueño" se asocian a variaciones interindividuales (alejamiento del punto medio de trabajo) en características hemodinámicas, estructurales o funcionales del sistema CV (en la propia infancia). Objetivo general: Nos planteamos contribuir a caracterizar la potencial asociación entre los componentes y subcomponentes de la tríada "AF, CS y tiempo de sueño", y: (i) las variables de la tríada en sí mismas, (ii) características de los niños y nivel de exposición a FRCV tradicionales y (iii) características hemodinámicas, funcionales y estructurales CVs de niños preescolares. Objetivos específicos: En niños de 5-6 años determinar si los componentes y/o subcomponentes de la tríada, se asocian: (i) entre sí y/o con el nivel de cumplimiento de las recomendaciones internacionales, (ii) con características demográficas y/o nutricionales de los niños y/o con el nivel de exposición a FRCV, y (iii) con el estado hemodinámico, estructural y funcional de su sistema arterial. De existir asociación entre componentes y/o subcomponentes de la tríada y el estado CV determinar si: (iv) la fortaleza asociativa varía en función del parámetro arterial (ej. estructural vs. funcional), del territorio arterial (ej. arteria elástica, muscular o transicional) y/o del nivel de PA existente durante el estudio. Adicionalmente planteamos (v) determinar si la asociación es independiente del nivel de otro componente y/o subcomponente de la tríada y/o de otros FRCV (pasados y presentes). Finalmente, apuntamos a valorar el impacto real de las asociaciones, mediante (vi) modelización del nivel de variación interindividual en características CVs teóricamente explicables por variaciones interindividuales en componentes y subcomponentes de la tríada.

30 horas semanales
Investigación
Coordinador o Responsable
Concluido
Alumnos encargados en el proyecto:
Maestría/Magister:1
Doctorado:2
Financiación:
Facultad de Medicina, Uruguay, Beca
Equipo: Gómez-García, M. , BIA D / BIA SANTANA D / SANTANA DB , ZOCALO Y , Carolina Chamorro

SECTOR EDUCACIÓN SUPERIOR/PÚBLICO - UNIVERSIDAD DE LA REPÚBLICA - URUGUAY

Facultad de Medicina

VÍNCULOS CON LA INSTITUCIÓN

Becario (03/2020 - 09/2020)

Asistente 30 horas semanales
Beca de maestría del Programa de Investigación Biomédica
Escalafón: Docente
Grado: Grado 2
Cargo: Interino

SECTOR GOBIERNO/PÚBLICO - MINISTERIO DE TURISMO Y DEPORTE - URUGUAY

Dirección General de Secretaría / Plaza de deportes - N°7

VÍNCULOS CON LA INSTITUCIÓN

Funcionario/Empleado (05/2016 - 04/2019)

Instructor de Spinning 8 horas semanales

SECTOR EXTRANJERO/INTERNACIONAL/OTROS - CANADÁ

University of Calgary

VÍNCULOS CON LA INSTITUCIÓN

Profesor visitante (09/2018 - 12/2018)

40 horas semanales
La actividad desarrollada en la Ciudad de Calgary se basó fundamentalmente en dos ramas, la primera llevándose a cabo en el laboratorio de Fisiología del Ejercicio del Dr. Juan Murias ubicado en la Universidad de Calgary y la segunda en cáncer y ejercicio físico llevadas a cabo en el Hospital Alberta Children?s Hospital, en la Fundación Kids Cancer Care y en la Universidad de Calgary. Las actividades principales desarrolladas en el laboratorio (Human Performance Lab) de Fisiología del Ejercicio fueron en torno al estudio de la limitación cardiovascular periférica y central, así como la realización de las pruebas y sus respectivos análisis. Por otra parte, se analizaron posibles técnicas a utilizar en la población oncológica pediátrica para evaluar el beneficio de un programa de ejercicios para pacientes en la fase aguda del tratamiento. Las actividades realizadas en cáncer y ejercicio físico en el Hospital Alberta Children´s Hospital se basaron principalmente en el funcionamiento de la unidad oncológica pediátrica, se formó parte de las visitas médicas con los oncólogos, así como de las juntas médicas diarias. Por otra parte, las nurses a cargo explicaron los cuidados y funcionamiento del área. Por otra parte, dentro del hospital se encuentra la escuela Dr. Gordon Towsend, en la misma realicé actividades de voluntariado en el PEER program (Pediatric Cancer Survivors Engaging in Exercise for Recovery), este es un programa gratuito de actividad física segura que tiene como objetivo disminuir el desacondicionamiento físico asociado al tratamiento oncológico, este programa ayuda en la adopción de conductas saludables y capacita a los niños con cáncer para que sean físicamente activos. En este programa formé parte de la organización y planificación de sesiones, así como las modificaciones necesarias para realizar ejercicio físico durante la internación en el hospital. En la Universidad de Calgary trabajé en el

laboratorio de Salud y Bienestar (Health and Wellness Lab) a cargo de la Dr. Nicole Culos-Reed, formando parte de las actividades realizadas en los programas para adultos con cáncer ACE (Alberta Cancer Exercise Program), este programa forma parte de un estudio que evalúa el beneficio de los programas comunitarios de ejercicios para sobrevivientes de cáncer en Alberta. El objetivo principal de ACE es ayudar a las personas que actualmente reciben tratamiento contra el cáncer, o que han completado el tratamiento en los últimos 3 años a adoptar un estilo de vida activo. Por otra parte, desarrollé el protocolo de intervención a realizarse en Uruguay, el programa de ejercicio físico de 12 semanas en hospital y a domicilio, así como las evaluaciones a realizarse en la Fundación Pérez Scremini y el Hospital Americano.

ACTIVIDADES

PROYECTOS DE INVESTIGACIÓN Y DESARROLLO

Feasibility of an exercise program and hypnosis therapy in children with leukemia and lymphoma during the first three months of oncology treatment. (10/2018 - a la fecha)

Objetivos: Determinar la aplicabilidad y potenciales beneficios de un programa de ejercicio físico (EF) y terapia de hipnosis (TH) durante los primeros tres meses de tratamiento en pacientes pediátricos con diagnóstico de leucemia y linfoma. Métodos: Este estudio controlado aleatorizado buscará reclutar a 30 niños recién diagnosticados (de 4 a 14 años de edad), en dos fases (I, II). Fase (I) en el hospital: dos brazos serán comparados durante 30 días. Los participantes en el brazo (IA) participarán en un programa de EF individualizado y supervisado (fuerza, equilibrio, flexibilidad y ejercicios aeróbicos), 5 veces por semana. Los participantes en el brazo (IB) no recibirán consejos de ejercicio, pero recibirán TH 2 veces por semana con un enfoque en el tratamiento de la ansiedad, el dolor y la náusea. Fase (II) se realizará en el hospital y en el hogar: ambos brazos completarán una intervención combinada de EF y TH en el hospital y en el hogar durante 60 días. Análisis estadístico: La fase I comparará las diferencias en todos los resultados entre los brazos A y B utilizando la prueba SPSS/Mann-Whitney. La prueba previa a la fase II se realizará para todos los resultados utilizando SPSS/pruebas pareadas t. Evaluaciones: aplicabilidad (reclutamiento y adherencia), desarrollo motor (MOON test), capacidad funcional (TUG), calidad de vida y fatiga (módulo de cáncer PedsQL y fatiga). Evaluaciones realizadas en 3 puntos de tiempo (día 1, día 31, día 92). Resultados: Esperamos encontrar si un programa de EF y una TH son viables en Uruguay y si existe una disminución en el deterioro de la condición física y los niveles de fatiga, evitando el círculo vicioso de descondicionamiento físico y mejorando la calidad de vida de los pacientes. Conclusiones e implicaciones clínicas: Este es el primer estudio de este tipo de intervención en Uruguay. El estudio agregará evidencia de la viabilidad de la TH y el EF como terapias adyuvantes durante el tratamiento oncológico. Un estudio multicéntrico posterior tendrá como objetivo incluir todos los diagnósticos como una forma de incorporar el EF y la TH como parte de la atención estándar en oncología pediátrica en Uruguay.
15 horas semanales
Investigación
Integrante del Equipo
En Marcha
Alumnos encargados en el proyecto:
Maestría/Magister:1
Equipo: Mariana Gómez (Responsable) , Carlos Alberto MAGALLANES MIRA (Responsable) , Paloma Ximena Amarillo Martínez (Responsable) , Chamorro Vina, C. (Responsable) , Flavia Chamorro Viña , Nicole Culos-Reed
Palabras clave: Ejercicio físico Hipnosis Oncología pediátrica
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte /

PASANTÍAS

Pasantía en laboratorio Health and Wellness Lab de la Universidad de Calgary (10/2018 - 12/2018)

20 horas semanales
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias de la Salud /

Pasantía en laboratorio Human Performance de la Universidad de Calgary (10/2018 - 12/2018)

15 horas semanales
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte /

ACTIVIDAD HONORARIA

Pediatric Cancer Survivors Engaging in Exercise for Recovery (PEER) volunteer (09/2018 - 12/2018)

6 horas semanales
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte /

CARGA HORARIA

Carga horaria de docencia: 20 horas
Carga horaria de investigación: 30 horas
Carga horaria de formación RRHH: Sin horas
Carga horaria de extensión: 5 horas
Carga horaria de gestión: 5 horas

Producción científica/tecnológica

Actualmente, mi producción está enfocada en dos grandes líneas:
1) Movimiento, condición física y salud cardiovascular. A través del proyecto "Actividad física, conducta sedentaria, tiempo de sueño, indeminidad tisular y composición corporal en sujetos saludables medidos con acelerometría triaxial y bioimpedancia segmental-multifrecuencia". Dentro de esta línea se estudia el impacto de diferentes sitios de registro, los algoritmos de acondicionamiento de señales y/o análisis de datos en la capacidad predictiva del estado hemodinámico, estructural y funcional cardiovascular. Esta línea se enmarca en el nuevo centro Interdisciplinario creado entre investigadores del Núcleo CUiiDARTE, ISEF y Centro Hospitalario Pereira Rossell.
2) Ejercicio físico y cáncer. El ejercicio físico ha surgido como una importante terapia para disminuir el desarrollo de enfermedades crónicas, mejorar la calidad de vida y recientemente ha demostrado disminuir la mortalidad. La intervención que desarrollaré será pionera en Latinoamérica y será el primer programa de ejercicio físico desarrollado en poblaciones oncológicas pediátricas en Uruguay. En los últimos años, el área de ejercicio físico en oncología pediátrica se ha venido desarrollando ampliamente. El desarrollo de este proyecto se realiza en conjunto con la Dr. Chamorro Vina, profesor asistente de la Universidad de Calgary y de la Dr.Gotte investigadora del Hospital Universitario de Münster, Alemania. Este apoyo me permitirá desarrollar esta área a gran escala en Uruguay promoviendo un gran impacto en la calidad de vida y el desarrollo motor de los niños con cáncer.

Producción bibliográfica

ARTÍCULOS PUBLICADOS

ARBITRADOS

Fat-free mass index, visceral fat level and muscle mass percentage better explain deviations from the expected value of aortic pressure and structural and functional arterial properties than body fat indices (Completo, 2022) Trabajo relevante

Gómez-García, M. , JUAN TORRADO , BIA D / BIA SANTANA D / SANTANA DB , ZOCALO Y
Frontiers in Nutrition, 2022
Medio de divulgación: Internet
ISSN: 2296861X
DOI: https://doi.org/10.3389/fnut.2022.856198
https://www.frontiersin.org/articles/10.3389/fnut.2022.856198/full
Scopus

Influence of Epoch Length and Recording Site on the Relationship Between Accelerometry-derived Physical Activity Levels and Structural, Functional and Hemodynamic Properties of Central and Peripheral Arteries (Completo, 2022) Trabajo relevante

Gómez-García, M. , BIA D / BIA SANTANA D / SANTANA DB , ZOCALO Y , Juan Torrado
Frontiers in Sports and Active Living, 2022
Medio de divulgación: Internet
ISSN: 26249367
DOI: https://doi.org/10.3389/fspor.2022.799659

https://www.frontiersin.org/journals/sports-and-active-living

Aging-dependent Moderation of the Link Between Compliance with Physical Activity Recommendations and the Hemodynamic, Structural, and Functional Status of Central and Peripheral Elastic, Transitional, and Muscular Arteries in 3619 Subjects Aged 3 to 90 Years (Completo, 2022) Trabajo relevante

ZOCALO Y , Gómez-García, M. , BIA D / BIA SANTANA D / SANTANA DB , Torrado, J.
Frontiers in Sports and Active Living, 2022
Medio de divulgación: Internet
ISSN: 26249367
DOI: https://doi.org/10.3389/fspor.2022.800249
https://www.frontiersin.org/journals/sports-and-active-living

Physical Activity, Sedentary Behavior and Sleep Time: Association with Cardiovascular Hemodynamic Parameters, Blood Pressure and Structural and Functional Arterial Properties in Childhood (Completo, 2021) Trabajo relevante

Gómez-García, M. , BIA D / BIA SANTANA D / SANTANA DB , ZOCALO Y
Journal of Cardiovascular Development and Disease, 2021
Medio de divulgación: Internet
ISSN: 23083425
DOI: https://doi.org/10.3390/jcdd8060062
https://www.mdpi.com/journal/jcdd

LIBROS

The Active Female: Health Issues throughout the Lifespan, 3rd Edition (Participación , 2019)

Chamorro Viña , Gómez García, M. , María Fernández del Valle
Publicado
Editorial: Springer , Berlin
Tipo de puplicación: Investigación
Referado
Escrito por invitación
Palabras clave: Exercise physiology immunity Exercise
Medio de divulgación: Internet
ISSN/ISBN: 978-1-4614-8884-2
https://www.springer.com/us

Capítulos:
Excessive Exercise and Immunity: The J Shaped Curve
Organizadores: Jacalyn McComb, Mimi Zumwalt
Página inicial 405, Página final 420

PUBLICACIÓN DE TRABAJOS PRESENTADOS EN EVENTOS

TRÍADA "ACTIVIDAD FÍSICA, CONDUCTA SEDENTARIA Y HORAS DE SUEÑO" EN NIÑOS: Asociación con el estado hemodinámico, estructural y funcional arterial en la infancia. (2020)

Gómez-García, M. , BIA D / BIA SANTANA D / SANTANA DB , Yanina Zócalo
Publicado
Completo
Evento: Internacional
Descripción: XVIII Encuentro Nacional XIII Internacional de Investigadores en Educación Física IV Encuentro de Extensión
Ciudad: Montevideo
Año del evento: 2020
Publicación arbitrada
Medio de divulgación: Internet
https://encuentro2020.isef.edu.uy/

Impacto del sitio de registro de actividad física mediante acelerometría triaxial (muñeca vs. cintura) en la capacidad predictiva del estado hemodinámico, estructural y funcional arterial (2020)

Gómez-García, M. , BIA D / BIA SANTANA D / SANTANA DB , Yanina Zócalo , Carlos Magallanes , Gustavo Grinspan , SANTIAGO GUIDO , Stefano Benitez
Publicado
Completo
Evento: Internacional
Descripción: XVIII Encuentro Nacional XIII Internacional de Investigadores en Educación Física IV Encuentro de Extensión
Ciudad: Montevideo
Año del evento: 2020
Publicación arbitrada
Medio de divulgación: Internet
https://encuentro2020.isef.edu.uy/

Asociación entre el estado hemodinámico, estructural y funcional arterial y parámetros obtenidos mediante impedancia bioeléctrica corporal mono- y multi-frecuencia: análisis de equivalencia entre dispositivos y parámetros de bioimpedancia (2020)

Gómez-García, M. , BIA D / BIA SANTANA D / SANTANA DB , Yanina Zócalo , Lucia Stefanelli , SANTIAGO GUIDO , Carlos Magallanes , Stefano Benitez , Gustavo Grinspan
Publicado
Completo
Evento: Internacional
Descripción: XVIII Encuentro Nacional XIII Internacional de Investigadores en Educación Física IV Encuentro de Extensión
Ciudad: Montevideo
Año del evento: 2020
Publicación arbitrada
Medio de divulgación: Internet
https://encuentro2020.isef.edu.uy/

Acute physiological effects of three comparable training protocols applied on real-world conditions (2020)

Stefano Benítez , Gómez García, M. , Carlos Magallanes
Publicado
Completo
Evento: Internacional
Descripción: European College of Sport Science (ECSS) congress
Ciudad: Sevilla
Año del evento: 2020
Publicación arbitrada
Medio de divulgación: Otros
https://www.ecss-congress.eu/2020/20/index.php

Feasibility of an exercise program and hypnosis therapy in children with leukemia and lymphoma during the first three months of oncology treatment: a study protocol in Uruguay. (2019) Trabajo relevante

Gómez García, M.
Publicado
Resumen
Evento: Internacional
Descripción: IPOS/CAPO World Congress of Psycho-Oncology
Ciudad: Banff (Canada)
Año del evento: 2019
Palabras clave: Exercise Hypnosis Pediatric oncology Cancer care
Medio de divulgación: Internet
Financiación/Cooperación:
Comisión Sectorial de Investigación Científica / Apoyo financiero, Uruguay
https://ipos2019.com/

Producción técnica

Otras Producciones

CURSOS DE CORTA DURACIÓN DICTADOS

Ejercicio físico en oncología pediátrica II (2021)

Gómez-García, M.
Especialización
País: Uruguay
Idioma: Español
Medio divulgación: Internet
Duración: 6 semanas
Institución Promotora/Financiadora: Instituto Superior de Educación Física

Ejercicio físico en oncología pediátrica (2020)

Gómez García, M.
Especialización
País: Uruguay
Idioma: Español
Medio divulgación: Internet
Tipo de participación: Organizador
Duración: 4 semanas
Ciudad: Montevideo
Institución Promotora/Financiadora: Instituto Superior de Educación Física
Información adicional: Este curso teórico-práctico se presentó en tres unidades temáticas. La primera unidad busca introducir las bases biológicas del cáncer y los tratamientos oncológicos en la población pediátrica uruguaya. En la segunda unidad se introdujeron los aspectos psicosociales tanto para el niño como para la familia. Por último, la unidad tres desarrolló los principales aspectos a tener en cuenta en la planificación del ejercicio físico, los beneficios que este posee, los aspectos de seguridad, las recomendaciones generales, así como las adaptaciones del ejercicio frente a los efectos secundarios comunes a corto y largo plazo.

PROGRAMAS EN RADIO O TV

Más y mejor vida (2019)

Gómez García, M.
Otro
País: Uruguay
Idioma: Español
Web: http://veramas.com.uy/
Emisora: VERA+
Tema: Programa de cooperación entre ANTEL e ISEF. Será un programa de difusión de contenidos sobre calidad de vida.
Ciudad: Montevideo

ORGANIZACIÓN DE EVENTOS

Aspectos biológicos de la actividad física, la aptitud física, el comportamiento sedentario y la nutrición en su relación con la salud. (2022)

Gómez-García, M.
Congreso
Sub Tipo: Organización
Lugar: Uruguay ,Montevideo
Idioma: Español
Medio divulgación: Internet
Web: https://isef.udelar.edu.uy/noticias/encuentro-2022-educacion-fisica-y-tiempos-de-cambio-teorias-tecn
Duración: 1 semanas
Institución Promotora/Financiadora: Instituto Superior de Educación Física
Información adicional: Grupo de Trabajo Temático 2 - Aspectos biológicos de la actividad física, la aptitud física, el comportamiento sedentario y la nutrición en su relación con la salud Responsables: Mariana Gómez - Carlos Magallanes - Yanina Zócalo Diversos estudios señalan que la aptitud física, la actividad física, el comportamiento sedentario y los hábitos alimentarios influyen en el estado de salud. No obstante, aún existe necesidad de clarificar cuáles son los mecanismos fisiológicos subyacentes, tanto independientes como vinculados (interacciones) entre dichos factores y la salud. Este GTT pretende ser un espacio para compartir resultados de investigaciones e intervenciones vinculadas al estudio de los efectos agudos y crónicos de diferentes protocolos de ejercicio físico

y/o intervenciones nutricionales en el comportamiento de variables morfológicas y fisiológicas vinculadas a la salud, así como también trabajos orientados a indagar las relaciones entre diferentes componentes de la aptitud física, la actividad física, la conducta sedentaria, los hábitos alimentarios y la salud.

OTRA PRODUCCIÓN TÉCNICA

MOON test - test for MOtor performance in pediatric ONcology (2018)

Gómez García, M. , Gotte, M. , Kesting, S.

País: Uruguay
Idioma: Español
Medio divulgación: Otros
Traducción del manual MOON test del portugués y alemán a español e ingles para luego realizar su validación en Uruguay.
Lugar: Montevideo, Montevideo

Evaluaciones

EVALUACIÓN DE PROYECTOS

COMITÉ EVALUACIÓN DE PROYECTOS

Evaluadora del Programa de Iniciación a la Investigación - Comisión Sectorial de Investigación científica (CSIC) (2021)

Sector Educación Superior/Público / Universidad de la República / Comisión Sectorial de Investigación Científica , Uruguay
Cantidad: Mas de 20

EVALUACIÓN DE EVENTOS Y CONGRESOS

Primera Jornada Nacional de Epidemiología y Salud Pública en Uruguay (2021 / 2021)

Revisiones
Uruguay

CURE-Rocha, Escuela de Nutrición, Instituto Superior de Educación Física, y de las Facultades de Odontología, Enfermería, Medicina y Ciencias Sociales.
Los ejes temáticos abordados son: Sistemas de Vigilancia en Salud, Formación con un enfoque integral en el área de salud pública, Salud, ambiente y sociedad, y Políticas y Sistemas de Salud.

EVALUACIÓN DE CONVOCATORIAS CONCURSABLES

Referente local del Departamento de Educación Física y Salud en el Centro Universitario Paysandú (2020)

Comité evaluador
Uruguay
Cantidad: Menos de 5

Llamado Asistente - Departamento de Educación Física y Salud (núcleo Salud Cultura y Sociedad). (2020)

Comité evaluador
Uruguay
Cantidad: Menos de 5
Instituto Superior de Educación Física

JURADO DE TESIS

Licenciatura en Educación Física (2022)

Jurado de mesa de evaluación de tesis
Sector Educación Superior/Público / Universidad de la República / Instituto Superior de Educación Física / Departamento de Educación Física y Salud , Uruguay

Nivel de formación: Grado

Licenciatura en Educación Física (2020)

Jurado de mesa de evaluación de tesis
Sector Educación Superior/Público / Universidad de la República / Instituto Superior de Educación Física / Departamento de Educación Física y Salud , Uruguay
Nivel de formación: Grado

Formación de RRHH

TUTORÍAS CONCLUIDAS

GRADO

Actividad física, comportamiento sedentario y su asociación a factores de riesgo de enfermedades no transmisibles: Estudio de caso en funcionarios TAS de ISEF Montevideo.

Tesis/Monografía de grado
Sector Educación Superior/Público / Universidad de la República / Instituto Superior de Educación Física , Uruguay
Tipo de orientación: Tutor único o principal
Nombre del orientado: Agustín Sosa - Andrés Gallo - Florencia Gilardi
País: Uruguay
Areas de conocimiento:
Ciencias Médicas y de la Salud / Ciencias de la Salud / Ciencias del Deporte

OTRAS

Pasantía Instituto Superior de Educación Física- Programa de Respaldo al Aprendizaje

Otras tutorías/orientaciones
Sector Educación Superior/Público / Universidad de la República / Instituto Superior de Educación Física , Uruguay
Tipo de orientación: Asesor
Nombre del orientado: Pablo Ferraro - Santiago Deminco
País: Uruguay

Otros datos relevantes

PREMIOS, HONORES Y TÍTULOS

Beca de Doctorado - Agencia Nacional de Investigación e Innovación (2021)

(Nacional)
Agencia Nacional de Investigación e Innovación
Beca de Posgrado de nivel doctorado brindada por 36 meses

Proyecto financiado - Programa de Iniciación a la Investigación (2021)

(Nacional)
Comisión Sectorial de Investigación Científica

Beca de maestría del Programa de Investigación Biomédica (2020)

(Nacional)
Programa de Investigación Biomédica
Esta beca se brinda a los estudiantes que hayan obtenido las mejores valoraciones en sus informes de avance en el Programa de Investigación Biomédica. La misma tuvo una duración de 5 meses durante el año 2020.

Beca modalidad congreso del Programa de Movilidad e Intercambios Académicos (2019)

(Internacional)
Comisión Sectorial de Investigación Científica
La presente beca me permitió realizar la presentación del trabajo "Feasibility of an exercise program and hypnosis therapy in children with leukemia and lymphoma during the first three

months of oncology treatment: a study protocol in Uruguay." en el congreso mundial "IPOS/CAPO World Congress of Psycho-Oncology" en la ciudad de Banff (Canadá).

Beca del programa de Movilidad e Intercambios Académicos (2018)

(Internacional)
Comisión Sectorial de Investigación Científica
El Programa de Movilidad e Intercambios Académicos me permitió realizar una pasantía en la Universidad de Calgary (Canadá) en dos laboratorios: Human Performance Lab y Health and Wellness Lab. La pasantía tuvo una duración de 3 meses.

PRESENTACIONES EN EVENTOS

XIX Encuentro Nacional XIV Internacional de Investigadores Educación Física. V Encuentro Nacional de Extensión en Educación Física. (2022)

Encuentro
El índice de masa libre de grasa, el nivel de grasa visceral y el porcentaje de masa muscular explican mejor las desviaciones del valor esperado de la presión aórtica y de las propiedades arteriales estructurales y funcionales que los índices de grasa corporal.
Uruguay
Tipo de participación: Expositor oral
Nombre de la institución promotora: Instituto Superior de Educación Física
Título: El índice de masa libre de grasa, el nivel de grasa visceral y el porcentaje de masa muscular explican mejor las desviaciones del valor esperado de la presión aórtica y de las propiedades arteriales estructurales y funcionales que los índices de grasa corporal. Autores: Mariana Gómez-García - Juan Torrado - María Pereira - Daniel Bia - Yanina Zócalo Resumen: Los índices derivados del análisis de impedancia bioeléctrica (BIA) [por ejemplo, los índices de masa grasa (FMI) y libre de grasa (FFMI), el nivel de grasa visceral (VFL)] se utilizan para caracterizar la obesidad como factor de riesgo cardiovascular (FRC). Todavía se discute cuál es el índice derivado de la BIA que mejor predice la variabilidad arterial. Objetivos: Determinar: (1) la asociación de los índices clásicos [peso, altura, índice de masa corporal (IMC), tasa metabólica basal (TMB)] y los derivados de la BIA, con las desviaciones de las propiedades arteriales respecto a los valores esperados (puntuaciones z arteriales); (2) las variaciones arteriales máximas atribuibles a los índices derivados de la BIA; (3) si la composición del cuerpo total, del tronco y/o de las extremidades está más estrechamente asociada a las variaciones arteriales.

XIX Encuentro Nacional XIV Internacional de Investigadores Educación Física. V Encuentro Nacional de Extensión en Educación Física. (2022)

Encuentro
Influencia de la longitud de epoch y sitio de registro en la relación entre los niveles de actividad física valorados con acelerometría triaxial y las propiedades estructurales, funcionales y hemodinámicas de las arterias centrales y periféricas
Uruguay
Tipo de participación: Expositor oral
Nombre de la institución promotora: Instituto Superior de Educación Física
Título: Influencia de la longitud de epoch y sitio de registro en la relación entre los niveles de actividad física valorados con acelerometría triaxial y las propiedades estructurales, funcionales y hemodinámicas de las arterias centrales y periféricas Autores: Mariana Gómez-García - Juan Torrado - Daniel Bia - Yanina Zócalo Resumen: Actualmente, queda por establecer hasta qué punto los niveles de actividad física (AF) de los individuos se asocian de forma independiente con las desviaciones del estado "óptimo" del sistema arterial. Los acelerómetros se han propuesto como medio para obtener datos fiables y objetivos de la AF. Las decisiones en el momento de la colocación del acelerómetro y su posterior procesamiento de datos podrían influir en la asociación entre los índices obtenidos a través de la acelerometría y las propiedades arteriales. Objetivos: (i) Identificar hasta qué punto la fuerza de la asociación entre las propiedades arteriales y los índices derivados de la acelerometría dependen del lugar de registro y/o de la duración del epoch; (ii) determinar si algunas características arteriales (hemodinámicas vs. estructurales vs. funcionales) o regiones (arterias elásticas vs. de transición vs. musculares; centrales vs. periféricas) tienen niveles más altos de asociación con los índices derivados de la acelerometría.

XVIII Encuentro Nacional XIII Internacional de Investigadores en Educación Física IV Encuentro Nacional de Extensión en Educación Física (2020) (2020)

Encuentro
Presentación del trabajo: TRÍADA "ACTIVIDAD FÍSICA, CONDUCTA SEDENTARIA Y HORAS DE SUEÑO" EN NIÑOS: "Asociación con el estado hemodinámico, estructural y funcional arterial en la

infancia."
Uruguay
Tipo de participación: Expositor oral
Nombre de la institución promotora: Instituto Superior de Educación Física

XVIII Encuentro Nacional XIII Internacional de Investigadores en Educación Física IV Encuentro Nacional de Extensión en Educación Física (2020) (2020)

Encuentro
Presentación del trabajo: Impacto del sitio de registro de actividad física mediante acelerometría triaxial (muñeca vs. cintura) en la capacidad predictiva del estado hemodinámico, estructural y funcional arterial
Uruguay
Tipo de participación: Expositor oral
Nombre de la institución promotora: Instituto Superior de Educación Física

XVIII Encuentro Nacional XIII Internacional de Investigadores en Educación Física IV Encuentro Nacional de Extensión en Educación Física (2020) (2020)

Encuentro
Presentación del trabajo: "Asociación entre el estado hemodinámico, estructural y funcional arterial y parámetros obtenidos mediante impedancia bioeléctrica corporal mono- y multi-frecuencia: análisis de equivalencia entre dispositivos y parámetros de bioimpedancia"
Uruguay
Tipo de participación: Expositor oral
Nombre de la institución promotora: Instituto Superior de Educación Física

European College of Sport Science (ECSS) (2020)

Congreso
La incidencia de enfermedades no transmisibles (ENT) ha crecido exponencialmente en las últimas décadas. La inactividad física se ha asociado positivamente con la fisiopatología de muchas de estas enfermedades, teniendo una gran repercusión en el gasto sanitario y la mortalidad en todo el mundo. Frente a esta problemática compleja, la Actividad Física (AF) aparece como una intervención económica y de amplia aplicación para la prevención y tratamiento de estas enfermedades, presentando una fuerte evidencia científica. Un gran número de investigaciones 8 señalan los beneficios cardiometabólicos que aporta la AF de alta intensidad. El "High Intesity Interval Training" (HIIT) ha mostrado ser un método de entrenamiento particularmente eficaz por ser de fácil aplicación, adecuada tolerancia y bajo tiempo de implicancia semanal. Sin embargo, gran parte de los trabajos presentes en la literatura realizan comparaciones de propuestas muy diferentes en cuanto a los parámetros de carga, y en muchas ocasiones el volumen de tiempo excede las recomendaciones de AF semanal de ejercicio intenso. Por otro lado, existe necesidad de estudiar propuestas de AF más emparentadas con la vida cotidiana, fuera de situaciones controladas de laboratorio. Porlo tanto, el objetivo del presente proyecto es investigarlos efectos de tres programas de entrenamiento intenso de simple aplicación y equiparados en sus cargas de trabajo (volumen e intensidad) en marcadores de rendimiento físico y salud cardiometabó
España
Tipo de participación: Poster
Nombre de la institución promotora: European College of Sport Science (ECSS)

21st World Congress of Psycho-oncology (2019)

Congreso
Presentación de protocolo de investigación sobre ejercicio físico e hipnosis en pacientes pediátricos oncológicos en Uruguay
Canadá
Tipo de participación: Otros
Carga horaria: 35
Nombre de la institución promotora: Canadian Association of Psychosocial Oncology (CAPO) in partnership with the International Psycho-oncology Society (IPOS)
Palabras Clave: Ejercicio fisico Hipnosis Oncologia pediátrica
Autores: Mariana Gómez1, Paloma Amarillo2,3, Carlos Magallanes1, Nicole Culos-Reed4,5,6, Luis Alberto Castillo7,3, Gustavo Dufort7,3, Flavia Chamorro Viña2, Yoandre Baudín Azcaris8, Carolina Chamorro Viña9,4 1Instituto Superior de Educación Física, Universidad de la República, Montevideo, Uruguay. 2Facultad de Medicina, Universidad de la República, Montevideo, Uruguay. 3Fundación Pérez Scremini, Montevideo, Uruguay. 4University of Calgary, Faculty of Kinesiology, Calgary, Canada. 5Alberta Health Services, Cancer Care, Tom Baker Cancer Centre, Department of Psychosocial Resources, Calgary, Canada. 6University of Calgary, Department of Oncology,

Cumming School of Medicine, Calgary, Canada. 7Centro Hospitalario Pereira Rossell, Montevideo, Uruguay. 8Universidad de Ciencias Medicas , Santiago de Cuba, Cuba. 9Kids Cancer Care Foundation of Alberta, Calgary, Canada

Seminario Tesina (2017)

Otra
Presentación del informe final de investigación de tesis de grado
Uruguay
Tipo de participación: Expositor oral
Nombre de la institución promotora: Instituto Superior de Educación Física

CONSTRUCCIÓN INSTITUCIONAL

Cumplí la función de asistente académica de la Dirección del Departamento de Educación Física y Salud del Instituto Superior de Educación Física en el período 2019-marzo 2021. En dicha función formé parte de comisiones de grado (Comisión de Departamentos Académicos, Comisión Académica de Grado) y proyectos enfocados a la construcción de la institución como fue el proyecto de cooperación de Antel VERA + e ISEF y el proyecto de apoyo a la enseñanza de la unidad curricular Fundamentos Anátomo-Fisiológicos junto al Programa de Apoyo al Aprendizaje (PROGRESA) para el curso 2020. Asimismo, elaboré los horarios de las unidades curriculares del departamento de Educación Física y Salud (11 en total) de las carreras Licenciatura en Educación Física, del programa de Maestría en Educación Física (ProMEF), Tecnicatura en Deporte y Formación en guardavidas. Esta tarea implica tanto la coordinación con los docentes así como con la Coordinación de Carreras del ISEF. Actualmente soy integrante titular de la Comisión de Carrera Local de Montevideo por el orden docente.
Por otra parte, acompañe el proceso de constitución y actualmente formo parte del equipo interdisciplinario "Laboratorio de Investigación y Evaluación Biomédica en Reposo y Ejercicio (LIEBRE)" conformado por el Instituto Superior de Educación Física, el Centro Hospitalario Pereira Rossell y el Centro Universitario de Investigación Innovación y Diagnóstico arterial. En él se integran profesionales de diversas disciplinas y subdisciplinas, conjugando diferentes visiones relacionadas con protocolos, aspectos epidemiológicos, tecnológicos, mecanicistas, diagnósticos y terapéuticos de la evaluación, indicación y prescripción de actividad física. En él se desarrollan líneas de trabajo en investigación básica, aplicada, clínica y/o epidemiológica.

Indicadores de producción

PRODUCCIÓN BIBLIOGRÁFICA	**10**
Artículos publicados en revistas científicas	4
Completo	4
Trabajos en eventos	5
Libros y Capítulos	1
Capítulos de libro publicado	1
Otros tipos	5
PRODUCCIÓN TÉCNICA	**5**
EVALUACIONES	**6**
Evaluación de proyectos	1
Evaluación de eventos	1
Evaluación de convocatorias concursables	2
Jurado de tesis	2
FORMACIÓN RRHH	**2**
Tutorías/Orientaciones/Supervisiones concluidas	2

Tesis/Monografía de grado	1
Otras tutorías/orientaciones	1

Formulario de Ingreso al Régimen de Dedicación Total

Datos Personales
Apellidos: Gómez García
Nombres: Angela Mariana
Fecha de Nacimiento: 16/02/1991
Correo electrónico: marigg216@gmail.com
Número de Identidad: 4.593.295-5

Cargo o cargos docentes desempeñados por el postulante
Para cada cargo desempeñado, indicar:
Servicio: Instituto Superior de Educación Física
Instituto / Departamento o Cátedra: Departamento de Educación Física y Salud (núcleo biológico)
Nombre del cargo: Asistente
Grado: 2
Dedicación horaria semanal: 30

Cargo o cargos docentes en los cuales solicita la Dedicación Total
A efectos de contestar este ítem el docente deberá tener en cuenta que, el grado docente en el cual solicita la DT debe ser 2 o superior. Además deberá guiarse por el Art. 78 del Estatuto del Personal Docente que dice: "*Todo docente de la Universidad podrá solicitar la concesión de régimen de dedicación total en cargos docentes que desempeñe en efectividad, siempre que el conjunto de los mismos satisfaga las siguientes condiciones:*
a) Que las obligaciones funcionales inherentes a los cargos no signifiquen una disparidad de disciplinas o campos de trabajo.
b) Que estas obligaciones no incluyan en forma permanente tareas de rutina que interferirían previsiblemente en forma significativa con los propósitos del régimen enunciados en el Artículo 74.
Estas condiciones serán sin perjuicio de las que rijan por concepto de incompatibilidad u otras disposiciones legales o universitarias pertinentes.
Si los cargos docentes universitarios en que es concedido el régimen de dedicación total no constituyen la totalidad de los desempeñados por el docente en el momento de la concesión, deberá presentar renuncia a los restantes con anterioridad a la efectividad de su ingreso al régimen." .
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Área y Sub-Área del conocimiento (Indique título, área de conocimiento (Agraria, Artística, Básica, Salud, Social o Tecnológica), disciplina y hasta 2 sub-disciplinas en que se inscribe su Plan de Actividades.)

Título del Plan de Actividades: Fortalecimiento del área biológica y de las prácticas corporales vinculadas a la salud en el Instituto Superior de Educación Física
Área: Salud
Disciplina: Fisiología
Sub-disciplina 1: Fisiología cardiovascular y respiratoria
Sub-disciplina 2: Valoración de la condición física

Journal of *Cardiovascular Development and Disease*

MDPI

Article

Physical Activity, Sedentary Behavior and Sleep Time: Association with Cardiovascular Hemodynamic Parameters, Blood Pressure and Structural and Functional Arterial Properties in Childhood

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Abstract: An association between movement behavior (MB) components (sleep time (ST), physical activity (PA) and sedentary behavior (SB)) and the state of the cardiovascular (CV) system in children has been postulated. However, it is still controversial whether MB components and/or subcomponents (domains) during childhood are independently associated with aortic and peripheral blood pressure (BP), and structural or functional arterial properties. Aims: (1) to evaluate MB components and subcomponents associations with CV characteristics, (2) to analyze the explanatory capacity of interindividual variations in MB on CV properties inter-individual variations at the beginning of school age. Methods: Anthropometric, aortic and peripheral BP, hemodynamic levels (cardiac output, systemic vascular resistances), wave reflection indexes, and arterial structural (diameter, intima–media thickness) and functional (blood flow velocities, Doppler-indexes, local and regional arterial stiffness) parameters of elastic (carotids), transitional (brachial) and muscular (femoral) arteries and time spent in MB (PA questionnaires) were assessed in 816 children (5–6 years). Cardiovascular variables were standardized (z-scores), using age- and sex-related mean values and standard deviations obtained from subjects non-exposed to CV risk factors (CRFs) and who complied with 24 h MB recommendations (reference subgroup). Multiple linear regression models were constructed considering the CV z-scores as dependent variables and CRFs and MB components and subcomponents as independent variables. Results: CV variables showed independent association with MB variations. However, their explanatory capacity on CV characteristics was lesser than that of anthropometric indexes, sex and/or high BP. Conclusions: MB components and sub-components were associated with CV characteristics regardless of other factors, but their capacity to explain variations was lesser than that of anthropometric data, sex or high BP state. MB subcomponents (e.g., sedentary play and screen time in case of SB) showed different (even opposite) associations with CV parameters. ST was associated mainly with indexes of the ventricle ejective function, rather than with CV structural characteristics. SB component and subcomponents were associated with BP, but not with structural parameters. PA component and subcomponents were associated with both BP and structural parameters. The different arterial types, as well central and peripheral parameters showed independent associations with MB components and subcomponents. None of these were independently associated with arterial stiffness.

Keywords: aortic pressure; arteries; blood pressure; cardiovascular risk factors; children; movement behaviors; physical activity; sedentary behavior; sleep

Citation: Gómez-García, M.; Bia, D.; Zócalo, Y. Physical Activity, Sedentary Behavior and Sleep Time: Association with Cardiovascular Hemodynamic Parameters, Blood Pressure and Structural and Functional Arterial Properties in Childhood. *J. Cardiovasc. Dev. Dis.* **2021**, *8*, 62. https://doi.org/10.3390/jcdd8060062

Received: 15 January 2021
Accepted: 21 May 2021
Published: 31 May 2021

1. Introduction

In adults, an active lifestyle has been shown to be associated with a reduction in cardiovascular (CV) morbidity and mortality. Beneficial effects were initially thought to be associated to changes (improvement) in traditional cardiovascular risk factors (CRFs) profile. However, this could explain only about half of the CV risk reduction associated with an active lifestyle [1]. Then, movement behavior (MB) would also have direct effects on adults CV system [2]. MB can be characterized on the basis of data on its components, namely physical activity (PA), sedentary behavior (SB) and sleep time (ST). In this respect, recently, the 24 h movement guidelines established measurable recommendation thresholds for MB components considering children, adolescents and adults separately [3–5]. Compliance with guidelines recommendations was associated with better 'critical health indicators' (e.g., adiposity, cardiometabolic biomarkers, physical fitness, emotional regulation, psychological distress, behavioral conduct, cognition, quality of life/well-being, bone density, motor skills and self-esteem) [6–9]. However, the aim is to determine whether levels of PA, SB, ST and/or their sub-components (e.g., screen time, sedentary play for SB, active transport (walking, cycling), physical education at kindergarten for PA) are independently associated with CV status in childhood itself.

The associations between CRFs (e.g., obesity, blood pressure (BP)) and CV properties in children have shown dependence on the CV parameter (e.g., structural vs. functional) and vascular territory (e.g., elastic vs. muscular arteries, central vs. peripheral vessels) considered [10–14]. Based on this, it could be postulated that something similar might occur with the association between the MB and the CV system in children. Regarding this, data regarding the relationship between MB and CV status are not coincident but show divergences associated with (i) the arterial type or recording site (e.g., carotid vs. abdominal aorta [15], large vs. small arteries [16]), (ii) the MB sub-component analyzed [17,18] and/or (iii) the exposure to CRFs [15]. However, to our knowledge, to date there are no works that have comprehensively analyzed the association between MB and CV status in children, considering (i) hemodynamic variables (e.g., cardiac output, systemic vascular resistances), (ii) peripheral and central measurement (e.g., BP levels), (iii) wave reflections' contribution to recorded BP and (iv) structural (intima–media thickness and diameters) and functional (e.g., local and regional arterial stiffness) arterial properties, analyzing different vascular territories.

This work's aims were (i) to evaluate the strength of association of MB components (PA, SB, ST) and subcomponents, with CV properties, including cardiac output, systemic vascular resistances, central and peripheral BP levels, aortic wave analysis-derived components and structural and functional properties of elastic, transitional and muscular arteries and (ii) to analyze the capacity of interindividual variations in MB to explain interindividual differences in CV parameters in childhood (at the beginning of school age).

2. Materials and Methods

2.1. Study Population

The study was carried out in the context of CUiiDARTE Project [14,19–21]. The protocol was approved by the Institutional Ethics Committee (Comité de Ética en Investigación, Centro Hospitalario Pereira Rossell; Ethical approval: 29112013/29122015). Both parents' written consent and children's assent were obtained prior to the evaluation. The cohort (n=816) was defined based on probabilistic, bi-stage and stratified sampling of subjects attending public kindergartens in Montevideo. It is a sub-sample of the population included in the longitudinal study 'Patrón de crecimiento, estado nutricional y calidad de alimentación en la primera infancia: análisis de su impacto sobre la estructura y función vascular y el riesgo cardiovascular relativo en niños uruguayos' (CUiiDARTE-Agencia Nacional de Investigación e Innovación (ANII), Ministerio de Desarrollo Social (MIDES), United Nations Children's Fund (UNICEF)), which started in 2010 and had a second phase in 2016.

The study approach consisted in clinical and anthropometric assessment, questionnaires on MB, lifestyle and family history and a non-invasive CV evaluation.

2.2. Clinical and Anthropometric Evaluation

Anthropometric data (body weight (BW) and height (BH)) at birth were obtained from health control records (mandatory within the first 0–36 months (m) of life according to Health Ministry regulations) and/or from self-reports documented during interviews with parents [10]. Current BW (electronic scale, 841/843, Seca Inc., Hamburg, Germany; model HBF-514C and Omron Inc., Chicago, IL, USA) and BH (portable stadiometer) were measured with the participants wearing light clothing and no shoes. Considering measurements from our technicians and data from the health controls, we obtained the BW and BH values corresponding to 0 m (birth) and 6 years (y). BW for BH and body mass index (BMI; BW-to-squared BH ratio) were calculated. Then, using World Health Organization software (Anthro-v.3.2.2; Anthro-Plus-v.1.0.4), z-scores for males and females were obtained for different anthropometric variables (i.e., z-BW, z-BH, z-BMI, z-BW for BH). z-BMI was also calculated at the time of the CV study [10].

None of the included subjects were taking medications, had congenital, chronic or infectious diseases at the time of the CV evaluation. Clinical and anthropometric evaluations enabled to assess exposure to CRFs. Hypertension, dyslipidemia and diabetes were considered present if they had been previously diagnosed [10]. Subjects who had brachial artery systolic and/or diastolic BP (baSBP, baDBP) >95th percentile for sex, age and BH during the study were considered with high BP levels. Obesity was defined as z-BMI ≥2. A family history of CV disease was defined by presence of first and/or second-degree relatives with early (<55 y: males; <65 y: females) CV disease.

2.3. Cardiovascular Evaluation

Cardiovascular studies were performed at the educational centers. Evaluations were carried out after at least 10 min of rest in supine position in a quiet, temperature-controlled room, which enabled reaching steady BP and heart rate conditions.

2.4. Peripheral and Central Pressure and Aortic Wave-Derived Parameters

Heart rate, baSBP, baDBP and tibial artery systolic (taSBP) and diastolic BP (taDBP) were obtained at 5 min intervals (Hem-4030, Omron Inc., Hoffman Estates, IL, USA). Brachial and tibial pulse pressure (PP) were calculated: baPP = baSBP − baDBP; taPP = taSBP − taDBP. Mean BP (MBP) was calculated as: MBP = baDBP + baPP/3. The Ankle Brachial Index (ABI; marker of central–peripheral BP amplification) was calculated as: ABI= taSBP/baSBP [22].

Subendocardial viability ratio (SEVR), systolic, diastolic and pulse central aortic BP (aoSBP, aoDBP and aoPP); wave reflection indexes (e.g., augmentation index (AIx) and forward (Pf) and backward (Pb) BP components, were assessed (random order) using two commercially available devices: SphygmoCor-CvMS ((SCOR); v.9, AtCor Medical, Australia) and Mobil-O-Graph PWA monitor system ((MOG); I.E.M.-GmbH, Stolberg, Germany) [23]. Radial and carotid BP waves were obtained by applanation tonometry (SCOR device). Acquired waves were calibrated to MBP and baDBP (HEM-433INT; Omron Healthcare Inc., IL, USA). Aortic BP (aoBP) waves were derived from radial recordings using a general transfer function. Radial artery systolic, diastolic and pulse pressure (raSBP, raDBP, raPP, raPP = raSBP − raDBP) were obtained. Carotid artery pulse waves (carotid applanation tonometry) were supposed to be equal to aortic BP waves (due to the proximity of the arterial sites). Thus, a general transfer function was not applied to obtain central waves from carotid records. The aoSBP, aoDBP and aoPP levels were quantified from the obtained aoBP waves. Considering a triangular flow model, Pf and Pb components were separated [23]. Only accurate waveforms on visual inspection and high-quality recordings (in-device quality index > 75%) were considered. Additionally, baBP levels and waves were obtained with MOG (brachial cuff-based oscillometric device) [23]. The system determined aoBP levels and waves from brachial recordings (general transfer func-

tion). Then, by means of pulse wave and wave separation analysis, Pf and Pb were obtained [23]. Only high-quality records (index ≤ 2) and satisfactory waveforms (visual inspection) were considered.

First (P1) and second (P2) peaks in the aoBP wave were identified. Then, their height (amplitude) and time were determined. The difference between P2 and P1 was computed as central augmented pressure (AP), used to quantify aortic AIx (AIx = AP/aoPP). AIx depends on heart rate. Thus, AIx adjusted to 75 beats/minute (AIx@75) was calculated [23]. It is worth noting that AIx is a measure of reflections contribution to aoBP. It depends mainly on timing and magnitude of the reflected (backward) wave and is influenced by the stiffness and structure of vessels distal to the recording site, as well as by the distance to reflection sites and left ventricle function. Basically, greater Pb and/or AIx values indicate increased net and relative reflections, respectively, and/or earlier return of reflected waves due to increased stiffness and/or closer reflection sites.

The use of different recordings and approaches to assess aoSBP, Pf, Pb, SEVR and AIx@75 (i.e., brachial artery oscillometry vs. applanation tonometry; carotid vs. radial tonometry), is justified or explained by the fact that although 'the same parameters' are obtained, the physical-mathematical models underlying their calculations are not the same and have shown (in some cases) differences in the values they allow to arrive at [23]. Thus, aiming at minimizing the risk of bias in our findings, we opted for using more than one device and approach to assess some CV parameters (e.g., those for which yet there is not an approach considered the 'gold standard'). Data from the different devices/approaches are shown and analyzed comparatively.

Systemic vascular resistances, cardiac output and cardiac index were quantified from brachial pulse contour analysis (MOG, I.E.M.-GmbH, Stolberg, Germany) [24]. Subjects' values are the average of at least six records obtained in a single visit.

2.5. Regional Arterial Stiffness: PWV (cfPWV and crPWV) and PWV Ratio

Carotid-femoral (aortic) and carotid-radial (upper arm) pulse wave velocity (cfPWV and crPWV), markers of regional arterial stiffness, were assessed (applanation tonometry, SCOR, AtCor-Medical, Sidney Australia). cfPWV and crPWV values depend on the algorithm used to detect the so-called 'foot of the wave' and on the pathway considered [21,25]. This can be the 'direct distance' between recording sites (e.g., carotid and femoral) or the distance obtained by subtracting the carotid measurement site to the sternal notch distance from the sternal notch to peripheral measurement site distance (e.g., femoral) [25]. Following international recommendations, we used the direct distance multiplied by 0.8 for cfPWV (which enabled obtaining the real cfPWV). In turn, we considered the subtracted distance for crPWV [25]. cfPWV and crPWV values were obtained as the median of three measurements (random order).

Arterial stiffness is influenced by BP levels during the examination, which, if not considered, could lead to inaccurate conclusions. To overcome this problem, we calculated β-PWV= (Ln(baSBP/baDBP)) × ((PWV^2 × 2ϱ)/baSBP − baDBP)), where Ln is natural logarithm, PWV is cfPWV or crPWV and ϱ is blood density (assumed 1060 kg/m^3) [21]. Brachial BP, PWV and ϱ were entered into the equation in Pa, m/s and kg/m^3, respectively. β-PWV was suggested to better reflect structural changes of the arterial wall (with independence of arterial distending BP). Finally, PWV Ratio and β-PWV Ratio, an index of central-to-peripheral arterial stiffness gradient, was quantified as cfPWV/crPWV and βcfPWV/βcrPWV [21,25,26].

2.6. Arterial Diameter, Intima-Media Thickness and Local Arterial Stiffness

Left and right common carotid artery (CCA) and femoral artery (CFA) and left brachial artery (BA) were analyzed using ultrasound (6–13 MHz, M-Turbo, Sonosite Inc., Bothell, WA, USA). Sequences of images (30 s, B-Mode, longitudinal views) were stored for off-line analysis. Beat-to-beat diameter waves were obtained using border detection software. Peak systolic and end-diastolic diameters (SystD, DD) as well as intima–media

thickness (IMT; far wall, end diastole) values were obtained averaging at least 20 beats [22]. CCA diameter and IMT were measured a centimeter proximal to the bulb; CFA diameter and IMT were measured in a straight segment in the penultimate centimeter proximal to the bifurcation and BA measurements were obtained at elbow level in a straight segment of at least one centimeter [22].

Local stiffness was quantified by pressure-strain elastic modulus (EM) and Stiffness Index (β; a 'BP-independent' index) [25]: EM = (SBP − DBP)/((SystD − DD)/DD); β = Ln(SBP/DBP)/((SystD − DD)/DD). aoSBP and aoDBP values were used to quantify CCA stiffness, whereas baSBP and baDBP were used to assess CFA and BA stiffness.

2.7. Carotid, Femoral and Brachial Doppler-Derived Blood Velocity

Peak systolic (PSV), mean, end-diastolic (EDV) and peak reversal (for CFA and BA) velocity levels were computed from CCA, CFA and BA blood velocity waves (Doppler Mode, 6–13 MHz, M-Turbo, Sonosite Inc, Bothell, WA, USA). Doppler-derived resistive, pulsate and systo-diastolic indexes were calculated.

2.8. Movement Behavior Evaluation

From a movement perspective, time in a 24 h period is divided (distributed) into PA, SB and ST. In our work, MB components were assessed by a pediatrician in an interview with the responsible adults (parents or legal tutors), using a questionnaire developed in agreement with national and international guidelines. The selected interviewer-administered questionnaire was found to be a valid and reliable assessment tool in children, as evidenced by its overall good correlation with accelerometry measurements, and was used in previous cross-sectional and longitudinal works [27–29]. The questionnaire was used to gather information pertaining to the child's participation in physical activity across several domains (subcomponents) (Figure 1):

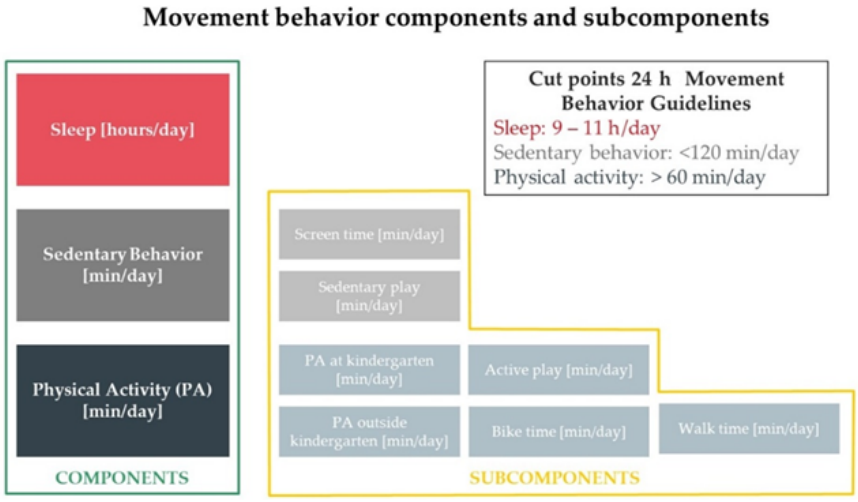

Figure 1. Movement behavior components and subcomponents (domains) measurement and cut-off points according to 24 h Movement Behavior Guidelines.

SB (outside of the kindergarten) was quantified as the sum (min/day) of (i) sedentary play (e.g., time spent reading, drawing, doing homework, playing a musical instrument or board games) and (ii) screen time (e.g., time spent watching television or videos, playing video/computer games and internet surfing). ST was quantified as the sum of nighttime sleep and naps. Total PA was calculated as the sum of several domains: (i) PA at

kindergarten, as part of physical education classes (defined as any exercise class supervised by a teacher during kindergarten time), (ii) PA outside of kindergarten defined as any extramural organized sport activity (e.g., in sports clubs, soccer teams), (iii) time of active play, which refers to PA outside of kindergarten, not as part of an organized sport activity (e.g., skipping, running, traditional games, playing with a ball) and (iv, v) biking and walking times (i.e., walking or biking to and from the kindergarten). The amount of each component and subcomponent was calculated by multiplying or adding the reported frequencies and times of the different activities. Based on the described parameters, we calculated children's weekly (min/week) and daily (min/day) PA (Table 1).

Table 1. Demographic, anthropometric, clinical and movement behavior (components and sub-components) data.

	MV	SD	Min	p25th	p50th	p75th	Max
Demographic, anthropometric and factors related with increased cardiovascular risk							
Age (years)	5.83	0.35	4.62	5.58	5.84	6.10	6.60
Body weight (Kg)	22.14	4.35	13.95	19.20	21.10	24.10	43.40
Body height (cm)	113.9	5.4	99.0	110.2	113.9	117.2	140.0
z-Body weight for height at birth (SD)	0.39	1.14	−4.06	−0.27	0.45	1.07	4.64
z-Body height for age at birth (SD)	−0.47	1.33	−6.12	−1.15	−0.35	0.46	4.75
z-Body weight for age at birth (SD)	−0.22	1.24	−5.98	−0.77	−0.07	0.61	2.56
z-Body mas index for age at birth (SD)	0.13	1.21	−7.00	−0.55	0.24	0.85	3.65
Current z-Body mass index (SD)	0.90	1.20	−3.03	0.09	0.70	1.59	5.00
baSBP percentile	68	19	3	57	72	84	99
baDBP percentile	64	16	17	53	64	75	99
High blood pressure state (%)				14.3			
Family history of cardiovascular disease (%)				36.9			
Diabetes (%)				0.0			
Dyslipidemia (%)				0.0			
Hypertension (%)				0.0			
Obesity (%)				16.6			
Physical activity, sedentary behavior and sleep time							
Sedentary play (min/day)	108	80	0	60	90	140	480
Screen time (min/day)	151	105	0	80	120	180	600
Sedentary behavior (min/day)	255	133	0	150	240	330	690
Sleep time (hours/day)	10	1	7	9	10	11	17
PA at kindergarten (min/week)	40	34	0	0	40	70	90
PA out of kindergarten (min/week)	30	66	0	0	0	0	260
PA: active play (min/week)	238	293	0	0	120	350	1200
PA: biking (min/week)	19	49	0	0	0	0	250
PA: walking (min/week)	104	109	0	30	75	150	500
Total PA (min/week)	448	365	0	190	350	600	1800
Total PA (min/day)	64	52	0	27	50	86	257
International recommendations compliance							
Sedentary behavior (%)				18.00			
Sleep time (%)				75.60			
Total weekly PA (%)				41.60			

MV: mean value. SD: standard deviation. Min., Max.: minimum and maximum. p25th, p50th, p75th: percentile 25, 50 and 75. z: z-score. PA: physical activity. SBP, DBP: systolic and diastolic blood pressure.

Compliance with 24 h movement international recommendations was analyzed [3]. A child was deemed to comply with the recommendations if calculated times were (i) <120 min/day for SB, (ii) 9–11 h/day for ST and (iii) ≥60 min/day for moderate-to-vigorous PA

[3]. PA intensity was classified based on values from compendia of energy costs, specifically developed for youth [30–32]. To estimate the intensity of each PA, <2 and ≥4 metabolic equivalent (MET) values were considered upper bound and lower bound for sedentary and moderate-to-vigorous intensity PA, respectively [33].

To improve the characterization of children's MB, they were classified according to the time spent on (i) sedentary activities (>240, 180–240, 120–180 or <120 min/day), (ii) sleeping (<9, 11–13, 9–11 or >13 h) and (iii) moderate-to-vigorous PA (<30, 30–60, 60–90 or >90 min/day) (Table 1).

2.9. Data Analysis

A stepwise analysis was performed. First, descriptive statistics were obtained (Tables 1 and 2). Second, CV variables were expressed as z-scores. To this end, subjects non-exposed to CRFs and who complied with 24 h movement recommendations were selected (reference subgroup) (Table S1). Working with the reference subgroup, age- and sex-related mean values (MV) and standard deviations (SD) were determined for each variable. Individual data were converted into z-scores, obtained by subtracting the reference MV to the measured value, dividing the result by the reference SD. Tables S2 and S3 show z-scores for the reference subgroup and for all the studied children. z-scores for the different CV variables showed a wide range of variation.

Table 2. Central and peripheral blood pressure, structural and functional arterial characteristics.

	MV	SD	Min	p25th	p50th	p75th	Max
Central and peripheral blood pressure, heart rate and hemodynamic parameters							
aoSBP (mmHg)	86	6	69	82	86	90	103
aoDBP (mmHg)	60	6	45	57	60	64	82
aoPP (mmHg)	26	5	14	22	26	29	51
baSBP (mmHg)	99	6	80	95	99	104	121
baDBP (mmHg)	59	5	45	56	59	62	81
baPP (mmHg)	40	5	24	36	40	44	60
taSBP (mmHg)	115	8	92	110	115	120	140
taDBP (mmHg)	60	6	44	56	60	64	81
taPP (mmHg)	55	7	29	50	55	60	76
raSBP (mmHg)	94	9	71	88	93	100	121
raDBP (mmHg)	59	6	45	55	59	62	81
raPP (mmHg)	35	8	19	29	34	40	69
Heart rate (beats/minute)	92	11	58	84	91	99	134
Ankle Brachial Index	1.16	0.08	0.96	1.1	1.15	1.2	1.45
Cardiac output (L/min)	4.24	0.47	3.1	3.9	4.22	4.5	6.17
Systemic vascular resistances (mmHg/L/min)	1.15	0.11	0.82	1.08	1.15	1.22	1.45
Cardiac Index (L/min/m^2)	5.15	0.67	3.4	4.67	5.1	5.58	7.85
Common carotid artery (CCA)							
CCA SystD (mm)	5.96	0.45	4.84	5.64	5.97	6.24	7.45
CCA DD (mm)	5.29	0.42	4.28	4.97	5.29	5.57	6.95
CCA IMT (mm)	0.42	0.02	0.36	0.41	0.42	0.43	0.52
CCA EM (mmHg)	208	51	101	177	205	237	447
CCA β	2.88	0.71	1.31	2.39	2.8	3.31	5.87
CCA PSV (cm/s)	129	21	82	116	127	141	209
CCA EDV (cm/s)	34	6	17	30	34	38	57
CCA RI	0.74	0.04	0.59	0.71	0.74	0.76	0.86
CCA PI	1.73	0.27	1.09	1.54	1.7	1.88	2.71
CCA S-D Index	3.91	0.69	2.44	3.44	3.83	4.27	7.17

Common femoral artery (CFA)							
CFA SystD (mm)	4.72	0.49	3.6	4.39	4.72	5.01	6.37
CFA DD (mm)	4.40	0.49	3.26	4.08	4.38	4.68	5.92
CFA IMT (mm)	0.33	0.03	0.27	0.32	0.33	0.35	0.41
CFA EM (mmHg)	606	222	291	446	572	697	1978
CFA β	7.78	2.81	3.46	5.96	7.28	8.9	23.57
CFA PSV (cm/s)	125	25	71	108	123	142	231
CFA EDV (cm/s)	−17.88	15.8	−55.3	−26.4	−20.2	−13	41.85
CFA RI	0.98	0.11	0.65	0.91	0.94	1.05	1.8
CFA PI	5.49	3.49	1.71	3.35	4.52	6.35	29.15
CFA S-D Index	29.81	42.21	−0.34	9.03	11.2	15.63	192.3
Brachial artery (BA)							
BA SystD (mm)	2.5	0.31	1.49	2.31	2.48	2.69	3.52
BA DD (mm)	2.33	0.31	1.39	2.1	2.32	2.5	3.32
BA EM (mm)	572	214	210	420	521	687	1583
BA β	7.33	2.61	3.21	5.59	6.72	8.74	19.58
BA PSV (cm/s)	100.13	23.69	49	82.2	98.1	116.6	191.1
BA EDV (cm/s)	9.76	8.67	−20.9	7.21	10.75	14.4	33
BA RI	0.91	0.09	0.76	0.86	0.89	0.92	1.27
Regional arterial stiffness							
cfPWV (m/s)	5.04	0.69	3.1	4.5	5	5.4	7.7
β cfPWV	0.67	0.18	0.26	0.54	0.65	0.77	1.45
crPWV (m/s)	7.45	1.48	4.4	6.6	7.5	8.2	12.3
β crPWV	1.48	0.59	0.52	1.12	1.44	1.71	3.74
PWV Ratio	0.68	0.13	0.42	0.61	0.68	0.72	1.05
β PWV Ratio	0.47	0.18	0.17	0.37	0.46	0.53	1.11
Aortic pressure levels, wave components, reflection and wave-derived parameters							
aoSBP (RT, SCOR) (mmHg)	83	6	64	78	83	87	100
aoSBP (CT, SCOR) (mmHg)	91	11	69	84	90	97	152
aoSBP (MOG) (mmHg)	86	6	71	82	86	90	101
AIx@75 (RT, SCOR) (%)	17.5	9.3	−10.0	11.0	18.0	24.0	43.0
AIx@75 (CT, SCOR) (%)	−10.4	12.3	−50.0	−18.0	−11.0	−4.0	28.0
AIx@75 (MOG) (%)	28.5	9.6	3.0	22.3	28.1	34.0	65.0
SEVR (RT, SCOR) (%)	116	19	59	101	116	128	179
SEVR (CT, SCOR) (%)	110	18	57	96	110	120	156
aoBPPf (RT, SCOR) (mmHg)	19.9	4.6	7.0	17.0	19.0	23.0	43.0
aoBPPf (CT, SCOR) (mmHg)	31.7	9.7	17.0	25.0	30.0	37.0	76.0
aoBPPf (MOG) (mmHg)	17.6	3.6	10.3	15.0	17.2	19.6	33.6
aoBP Pb (RT, SCOR) (mmHg)	10.0	2.1	3.0	9.0	10.0	11.0	17.0
aoBP Pb (CT, SCOR) (mmHg)	11.2	2.7	7.0	9.0	11.0	13.0	24.0
aoBP Pb (MOG) (mmHg)	9.3	2.1	4.2	7.9	9.2	10.7	17.3

MV: mean value. SD: standard deviation. Min, Max: minimum and maximum. p25th, p50th, p75th: percentiles 25, 50, 75. SBP, DBP, PP: systolic, diastolic and pulse pressure (ao: aortic, ba: brachial, ta: tibial, ra: radial). SysD, DD: peak systolic and end-diastolic diameter. PSV, EDV: peak systolic and end diastolic velocity. IMT: intima–media thickness. BP: blood pressure. EM: elastic modulus. cfPWV, crPWV: carotid-femoral and carotid-radial pulse wave velocity. MOG: Mobil-O-Graph. SCOR: SphygmoCor. PI: Pulsatile Index. Pf, Pb: forward and backward components of aortic blood pressure. RI: resistive index. S-D: Systo-Diastolic index. RT, CT: radial and carotid tonometry. SEVR: subendocardial viability ratio. AIx@75: augmentation index corrected for 75 beats/minute. β: Beta Index.

Third, multiple linear regression models (input: stepwise) were constructed considering the CV z-scores as dependent variables and MB and CRFs as independent variables (Table 3, Table S4). A variance inflation factor <5 was selected to evaluate (discard) significant multicollinearity.

Table 3. Associations between cardiovascular parameters, movement behavior components, CRFs and anthropometric data.

Dependent Variable	Independent Variables	Bu	SE	C.I. LL	C.I. UL	Bs	*p*	VIF	R	R^2	Adj R^2
Central (aortic) and peripheral blood pressure and hemodynamic parameters											
z-aoDBP (SD)	Constant	−0.172	0.093	−0.355	0.011		0.066		0.416	0.173	0.165
	HBP (1:Yes, 0:No)	1.101	0.154	0.798	1.404	0.362	<0.001	1.007			
	Current z-BW (SD)	0.095	0.039	0.018	0.173	0.122	0.016	1.007			
	Screen time (min/day)	**0.001**	**0.000**	**0.000**	**0.002**	**0.121**	**0.017**	**1.006**			
z-baSBP (SD)	Constant	−0.060	0.082	−0.221	0.101		0.463		0.636	0.404	0.399
	HBP (1:Yes, 0:No)	1.938	0.129	1.684	2.192	0.545	<0.001	1.016			
	Current z-BW (SD)	0.164	0.056	0.055	0.273	0.171	0.003	2.562			
	Current z-BH (SD)	0.183	0.068	0.049	0.317	0.154	0.008	2.554			
	PA, Kinder (min/w)	**−0.003**	**0.001**	**−0.006**	**−0.001**	**−0.093**	**0.011**	**1.014**			
z-baDBP (SD)	Constant	−0.393	0.091	−0.572	−0.214		<0.001		0.512	0.262	0.258
	HBP (1:Yes, 0:No)	1.621	0.141	1.343	1.899	0.461	<0.001	1.005			
	Current z-BW (SD)	0.153	0.038	0.078	0.228	0.161	<0.001	1.007			
	Screen time (min/day)	**0.001**	**0.000**	**0.000**	**0.002**	**0.100**	**0.014**	**1.004**			
z-taSBP (SD)	Constant	0.069	0.118	−0.163	0.301		0.560		0.504	0.254	0.242
	HBP (1:Yes, 0:No)	0.931	0.152	0.632	1.229	0.311	<0.001	1.012			
	Current z-BW (SD)	0.252	0.041	0.171	0.332	0.314	<0.001	1.024			
	Sedentary play (min/day)	**−0.002**	**0.001**	**−0.003**	**−0.001**	**−0.146**	**0.004**	**1.016**			
	PA, Kinder (min/w)	**−0.004**	**0.002**	**−0.007**	**−0.001**	**−0.148**	**0.004**	**1.029**			
	PA (min/w)	**0.000**	**0.000**	**0.000**	**0.001**	**0.118**	**0.021**	**1.023**			
z-taDBP(SD)	Constant	0.080	0.111	−0.139	0.299		0.473		0.470	0.221	0.208
	HBP (1:Yes, 0:No)	1.004	0.169	0.672	1.336	0.311	<0.001	1.029			
	Obesity (1:Yes, 0:No)	0.657	0.148	0.365	0.948	0.231	<0.001	1.029			
	Sex (1:Female, 0:Male)	0.409	0.115	0.182	0.635	0.186	<0.001	1.035			
	Sedentary play (min/day)	**−0.002**	**0.001**	**−0.003**	**0.000**	**−0.124**	**0.018**	**1.032**			
	PA: bike time (min/w)	**0.002**	**0.001**	**0.000**	**0.005**	**0.109**	**0.037**	**1.021**			
z-taPP (SD)	Constant	−0.021	0.119	−0.255	0.213		0.862		0.310	0.096	0.084
	Sex (1:Female, 0:Male)	−0.393	0.117	−0.625	−0.162	−0.187	0.001	1.020			
	Current z-BW (SD)	0.127	0.046	0.037	0.218	0.154	0.006	1.011			
	PA: active play (min/w)	**0.001**	**0.000**	**0.000**	**0.001**	**0.142**	**0.012**	**1.027**			
	PA, Kinder (min/w)	**−0.004**	**0.002**	**−0.007**	**0.000**	**−0.117**	**0.036**	**1.014**			
z-raDBP (SD)	Constant	−1.158	0.486	−2.115	−0.201		0.018		0.467	0.218	0.203
	HBP (1:Yes, 0:No)	1.036	0.180	0.680	1.391	0.347	<0.001	1.011			
	Current z-BW (SD)	0.184	0.049	0.087	0.280	0.226	<0.001	1.007			
	Sex (1:Female, 0:Male)	0.249	0.116	0.020	0.477	0.129	0.033	1.001			
	Sleep (hours/day)	**0.099**	**0.047**	**0.007**	**0.191**	**0.129**	**0.034**	**1.011**			
z-Ankle-brachial Index (SD)	Constant	0.220	0.112	0.000	0.441		0.051		0.234	0.055	0.045
	Sedent behavior (min/day)	**−0.001**	**0.000**	**−0.002**	**0.000**	**−0.161**	**0.005**	**1.001**			
	HBP (1:Yes, 0:No)	−0.302	0.137	−0.573	−0.032	−0.124	0.029	1.001			
	PA: active play (min/w)	**0.000**	**0.000**	**0.000**	**0.001**	**0.111**	**0.050**	**1.000**			
z-Cardiac Output (SD)	Constant	0.591	0.342	−0.082	1.264		0.085		0.561	0.315	0.300
	Current z-BW (SD)	0.355	0.071	0.216	0.494	0.538	<0.001	4.501			
	Sex (1:Female, 0:Male)	−0.588	0.088	−0.761	−0.415	−0.340	<0.001	1.012			
	HBP (1:Yes, 0:No)	0.575	0.127	0.326	0.825	0.232	<0.001	1.027			
	Current z-BMI (SD)	−0.335	0.080	−0.494	−0.177	−0.500	<0.001	5.631			
	Obesity (1:Yes, 0:No)	0.637	0.180	0.283	0.991	0.288	<0.001	2.598			

	Sleep (hours/day)	**−0.068**	**0.032**	**−0.132**	**−0.005**	**−0.108**	**0.035**	**1.012**			
Arterial structural parameters											
z-CCA SystD(SD)	Constant	−0.252	0.097	−0.443	−0.060		0.010		0.479	0.230	0.218
	Current z-BW (SD)	0.265	0.044	0.179	0.351	0.374	<0.001	1.008			
	Sex (1:Female, 0:Male)	−0.370	0.116	−0.598	−0.141	−0.200	0.002	1.052			
	PA, out kinder (min/w)	**0.002**	**0.001**	**0.001**	**0.004**	**0.199**	**0.002**	**1.057**			
z-CCA DD (SD)	Constant	−0.252	0.102	−0.453	−0.051		0.014		0.485	0.235	0.224
	Current z-BW (SD)	0.273	0.046	0.183	0.363	0.365	<0.001	1.008			
	Sex (1:Female, 0:Male)	−0.423	0.122	−0.663	−0.183	−0.218	0.001	1.052			
	PA, out kinder (min/w)	**0.003**	**0.001**	**0.001**	**0.004**	**0.205**	**0.001**	**1.057**			
z-CCA IMT (SD)	Constant	−0.720	0.158	−1.031	−0.409		<0.001		0.400	0.160	0.148
	Current z-BMI (SD)	0.234	0.061	0.113	0.355	0.245	<0.001	1.009			
	Sex (1:Female, 0:Male)	−0.602	0.161	−0.920	−0.285	−0.240	<0.001	1.003			
	PA, Kinder (min/w)	**0.006**	**0.002**	**0.001**	**0.011**	**0.167**	**0.010**	**1.007**			
z-CFA SystD(SD)	Constant	−0.668	0.156	−0.975	−0.361		<0.001		0.521	0.271	0.260
	Current z-BH (SD)	0.446	0.074	0.300	0.591	0.369	<0.001	1.004			
	Sex (1:Female, 0:Male)	−0.640	0.152	−0.939	−0.341	−0.261	<0.001	1.034			
	PA: typical week (min/w)	**0.001**	**0.000**	**0.000**	**0.001**	**0.202**	**0.001**	**1.037**			
z-CFA DD (SD)	Constant	−0.547	0.159	−0.861	−0.232		0.001		0.502	0.252	0.241
	Current z-BH (SD)	0.450	0.075	0.301	0.598	0.368	<0.001	1.004			
	Sex (1:Female, 0:Male)	−0.607	0.155	−0.912	−0.301	−0.245	<0.001	1.034			
	PA: typical week (min/w)	**0.001**	**0.000**	**0.000**	**0.001**	**0.183**	**0.004**	**1.037**			
z-BA SystD(SD)	Constant	−0.759	0.098	−0.954	−0.565		<0.001		0.485	0.235	0.217
	Current z-BW (SD)	0.406	0.078	0.252	0.560	0.627	<0.001	2.459			
	PA: walk time (min/w)	**0.002**	**0.001**	**0.001**	**0.003**	**0.246**	**0.002**	**1.008**			
	Obesity (1:Yes, 0:No)	−0.690	0.256	−1.196	−0.185	−0.325	0.008	2.465			
z-BA DD (SD)	Constant	−0.715	0.104	−0.920	−0.510		<0.001		0.477	0.227	0.209
	Current z-BW (SD)	0.419	0.082	0.256	0.581	0.617	<0.001	2.459			
	PA: walk time (min/w)	**0.002**	**0.001**	**0.001**	**0.003**	**0.235**	**0.003**	**1.008**			
	Obesity (1:Yes, 0:No)	−0.692	0.269	−1.225	−0.160	−0.311	0.011	2.465			
Blood flow velocity and Doppler-derived parameters											
z-CCA EDV (SD)	Constant	0.648	0.108	0.434	0.861		<0.001		0.252	0.063	0.054
	Current z-BW (SD)	−0.153	0.053	−0.258	−0.048	−0.197	0.004	1.005			
	PA, Kinder (min/w)	**−0.004**	**0.002**	**−0.008**	**0.000**	**−0.145**	**0.035**	**1.005**			
z-CCA RI (SD)	Constant	−0.531	0.100	−0.728	−0.334		<0.001		0.299	0.090	0.080
	Current z-BH (SD)	0.187	0.057	0.074	0.300	0.220	0.001	1.004			
	PA: typical week (min/w)	**0.001**	**0.000**	**0.000**	**0.001**	**0.189**	**0.005**	**1.004**			
z-CCA PI (SD)	Constant	−0.784	0.088	−0.957	−0.611		<0.001		0.380	0.144	0.132
	Current z-BW (SD)	0.155	0.039	0.078	0.232	0.261	<0.001	1.012			
	PA: typical week(min/w)	**0.001**	**0.000**	**0.000**	**0.001**	**0.270**	**<0.001**	**1.060**			
	PA: bike time (min/w)	**−0.002**	**0.001**	**−0.004**	**0.000**	**−0.134**	**0.048**	**1.066**			
z-CCA S-D Index (SD)	Constant	−0.549	0.091	−0.729	−0.370		<0.001		0.346	0.120	0.111
	Current z-BH (SD)	0.195	0.052	0.093	0.298	0.248	<0.001	1.004			
	PA: typical week (min/w)	**0.001**	**0.000**	**0.000**	**0.001**	**0.226**	**0.001**	**1.004**			
z-CFA PSV (SD)	Constant	−0.304	0.125	−0.550	−0.059		0.015		0.304	0.092	0.078
	PA: walk time (min/w)	**0.002**	**0.001**	**0.000**	**0.003**	**0.164**	**0.019**	**1.016**			
	Sex (1:Female, 0:Male)	0.365	0.143	0.082	0.648	0.176	0.012	1.003			
	HBP (1:Yes, 0:No)	0.445	0.197	0.056	0.833	0.157	0.025	1.013			
z-CFA RI (SD)	Constant	0.046	0.140	−0.229	0.322		0.741		0.380	0.145	0.131
	Obesity (1:Yes, 0:No)	−0.861	0.207	−1.271	−0.452	−0.283	<0.001	1.033			
	HBP (1:Yes, 0:No)	−0.567	0.227	−1.014	−0.120	−0.170	0.013	1.031			
	Sedent play (min/day)	**0.002**	**0.001**	**0.000**	**0.004**	**0.148**	**0.029**	**1.006**			
z-CFA S-D Index (SD)	Constant	−3.661	1.571	−6.760	−0.563		0.021		0.239	0.057	0.047
	PA: bike time (min/w)	**0.005**	**0.002**	**0.002**	**0.009**	**0.203**	**0.005**	**1.016**			
	Age (years)	0.595	0.273	0.056	1.134	0.154	0.031	1.016			
z-BA EDV (SD)	Constant	−0.081	0.098	−0.275	0.112		0.409		0.384	0.148	0.122

	Screen time (min/day)	**−0.001**	**0.000**	**−0.002**	**0.000**	**−0.234**	**0.005**	**1.026**			
	PA, out kinder (min/w)	**−0.002**	**0.001**	**−0.003**	**0.000**	**−0.206**	**0.012**	**1.012**			
	Current z-BMI (SD)	0.248	0.080	0.089	0.406	0.572	0.002	5.340			
	Current z-BW (SD)	−0.185	0.080	−0.344	−0.026	−0.426	0.023	5.341			
Aortic pressure levels, wave components, reflection and wave-derived parameters											
	Constant	−2.169	0.865	−3.874	−0.464		0.013				
	HBP (1:Yes, 0:No)	1.206	0.153	0.905	1.507	0.436	<0.001	1.004			
z-aoSBP (RT) (SD)	Current z-BW (SD)	0.232	0.041	0.152	0.312	0.315	<0.001	1.009	0.576	0.332	0.320
	PA, Kinder (min/w)	**−0.004**	**0.001**	**−0.007**	**−0.001**	**−0.154**	**0.008**	**1.068**			
	Age (years)	0.395	0.153	0.094	0.695	0.147	0.010	1.062			
	Constant	−0.509	0.149	−0.804	−0.214		0.001				
	Sex (1:Female, 0:Male)	0.744	0.157	0.434	1.055	0.321	<0.001	1.021			
z-AIx@75 (CT) (SD)	Current z-BW (SD)	−0.240	0.067	−0.372	−0.107	−0.240	<0.001	1.002	0.440	0.194	0.176
	Sedent play (min/day)	**−0.002**	**0.001**	**−0.004**	**0.000**	**−0.171**	**0.013**	**1.023**			
	z-BWH birth (SD)	0.165	0.073	0.022	0.309	0.153	0.024	1.004			
	Constant	0.209	0.134	−0.054	0.472		0.119				
	Sex (1:Female, 0:Male)	0.810	0.127	0.560	1.060	0.343	**<**0.001	1.002			
z-AIx@75 (MOG) (SD)	Current z-BW (SD)	−0.248	0.049	−0.344	−0.152	−0.275	**<**0.001	1.007	0.477	0.227	0.216
	HBP (1:Yes, 0:No)	0.459	0.182	0.101	0.817	0.136	0.012	1.008			
	Screen time (min/day)	**0.001**	**0.001**	**0.000**	**0.003**	**0.136**	**0.012**	**1.009**			
	Constant	−0.931	0.152	−1.231	−0.631		<0.001				
	PA: typical week (min/w)	**0.001**	**0.000**	**0.000**	**0.001**	**0.218**	**0.002**	**1.022**			
z-SEVR (CT) (SD)	HBP (1:Yes, 0:No)	−0.621	0.225	−1.064	−0.178	−0.185	0.006	1.000	0.400	0.160	0.142
	z-BWH birth (SD)	0.189	0.071	0.050	0.328	0.180	0.008	1.005			
	Sex (1:Female, 0:Male)	−0.381	0.151	−0.678	−0.084	−0.171	0.012	1.017			
	Constant	−4.335	2.261	−8.808	0.138		0.057				
	Age (years)	1.156	0.368	0.428	1.884	0.246	0.002	1.014			
	HBP (1:Yes, 0:No)	1.282	0.395	0.501	2.063	0.257	0.001	1.030			
z-aoBPPf (CT) (SD)	**PA: bike time (min/w)**	**0.005**	**0.002**	**0.001**	**0.009**	**0.210**	**0.009**	**1.034**	0.460	0.212	0.182
	Sleep (hours/day)	**−0.187**	**0.087**	**−0.360**	**−0.014**	**−0.168**	**0.034**	**1.019**			
	Current z-BH (SD)	0.224	0.113	0.001	0.447	0.157	0.049	1.023			

z: z-score. SBP, DBP, PP: systolic, diastolic and pulse pressure (ao: aortic, ba: brachial, ta: tibial, ra: radial). SysD, DD: peak systolic and end-diastolic diameter, respectively. RI, PI: resistive and pulsatile index. S-D: Systo-Diastolic. IMT: intima–media thickness. PSV, EDV: blood flow peak systolic and end-diastolic velocity. MOG: Mobil-O-Graph. RT, CT: radial and carotid tonometry. SEVR: subendocardial viability ratio. AIx@75: augmentation index for 75 beats/minute. Pf: forward pressure wave components. HBP: high blood pressure. PA: physical activity. BW, BH: body weight and height. BMI: body mass index. Bu y Bs: un- and standardized coefficients. R: Pearson coefficient. Adj: adjusted. VIF: variance inflation factor. SE: standard error. L.L, U.L: Lower and upper limit. C.I: 95% confidence interval. w: week. Only significant (p <0.05) variables entered in the models are shown. Bold: movement behavior component or subcomponent.

Aimed at providing data about non-adjusted associations, bivariate correlations were analyzed. The results are included in Supplementary Materials Tables S5–S9. Specifically, we analyzed the association between (i) MBs levels and compliance with recommendations (Table S5), (ii) MBs levels and exposure to CRFs (Table S6), (iii) CV parameters and CRFs (Table S7), (iv) MB levels and CV z-scores (Table S8) and (v) CV z-scores and CRFs (Table S9). Two-tailed simple bivariate correlations (continuous variables) and point biserial correlations (continuous and dichotomous variables) were always performed. An association was considered significant only if the 95% confidence interval of Pearson's coefficient, quantified by Bootstrapping, did not contain the 0 value. Bootstrap-derived 95% confidence intervals (1000 samples) were obtained applying bias-corrected and accelerated methods for computing confidence interval limits.

Fourth, by using (i) multiple linear regression models non-standardized β coefficients, (ii) MV and SD data (reference subgroup) and (iii) minimum and maximum values for each MB variable (variation range), it was possible to quantify for the different CV variables (in their respective units) (1) the maximum variation (in our group of children) that could be associated (attributed) to different values obtained for MB components or

subcomponents and (2) the variations that could be (theoretically) expected considering inter-individual variations in time spent on SB, ST and PA (and their subcomponents). Data are shown in Table 4 (ordered by the CV parameter) and Table S10 (ordered by MB component and subcomponent).

Table 4. Impact of interindividual variations in MB, on central and peripheral blood pressure, cardiac output and arterial characteristics.

Dependent Variable			Cardiovascular Variations Related to Movement Behavior Parameters Variations									
Variable	**MV (RG)**	**SD (RG)**	**Modeled Variation (Δ Minutes):**	**60**	**120**	**180**	**240**	**300**	**Min**	**Max**	**Δ**	**Δ%**
Central (aortic) and peripheral blood pressure and cardiac output												
aoDBP (mmHg)	59.2	5.4	Screen time (m/d)	0.4	0.7	1.1	1.5	1.8	0	3.6	3.6	6.1
baSBP (mmHg)	98.4	5.2	PA, Kinder (m/w)	−1.1	−2.1	−3.2	−4.2	−5.3	0	−1.59	1.59	1.62
baDBP (mmHg)	58.8	3.9	Screen time (m/d)	0.3	0.5	0.8	1.1	1.4	0	2.71	2.71	4.60
taSBP (mmHg)	113.6	7.5	Sedent. play (m/d)	−0.8	−1.6	−2.3	−3.1	−3.9	0	−6.25	6.25	5.50
			PA, Kinder (m/w)	−2.0	−4.0	−6.0	−8.0	−10.0	0	−3.01	3.01	2.65
			PA, typical week (m/w)	0.2	0.3	0.5	0.6	0.8	0	4.58	4.58	4.03
taDBP (mmHg)	58.1	5.3	Sedent. play (m/d)	−0.5	−1.0	−1.5	−2.0	−2.5	0	−4.05	4.05	6.97
			PA: bike time (m/w)	0.8	1.6	2.4	3.1	3.9	0	3.27	3.27	5.63
taPP (mmHg)	55.5	7.0	PA: active play (m/w)	0.2	0.5	0.7	0.9	1.1	0	4.55	4.55	8.20
			PA, Kinder (m/w)	−1.5	−3.1	−4.6	−6.1	−7.7	0	−2.30	2.30	4.14
raDBP (mmHg)	57.6	5.7	Sleep (h/d)	0.6	1.1	1.7	2.3	2.8	3.95	9.58	5.64	9.79
Ankle Brachial Index	1.15	0.09	Sedent. behavior (m/d)	−0.01	−0.01	−0.02	−0.02	−0.03	0	−0.06	0.06	5.43
			PA: active play (m/w)	0.00	0.00	0.01	0.01	0.01	0	0.04	0.04	3.21
CO (L/min)	4.41	0.54	Sleep (h/d)	−0.04	−0.07	−0.11	−0.15	−0.19	−0.26	−0.63	0.37	8.41
Arterial structural parameters												
CCA SystD (mm)	6.05	0.49	PA, out Kinder (m/w)	0.07	0.15	0.22	0.29	0.37	0	0.32	0.32	5.25
CCA DD (mm)	5.38	0.43	PA, out Kinder (m/w)	0.07	0.14	0.21	0.28	0.35	0	0.30	0.30	5.66
CCA IMT (mm)	0.43	0.02	PA, Kinder (m/w)	0.01	0.01	0.02	0.03	0.04	0	0.01	0.01	2.52
CFA SystD (mm)	5.01	0.40	PA: typical week (m/w)	0.02	0.04	0.05	0.07	0.09	0	0.54	0.54	10.81
CFA DD (mm)	4.64	0.40	PA: typical week (m/w)	0.02	0.03	0.05	0.06	0.08	0	0.49	0.49	10.49
BA SystD (mm)	2.66	0.37	PA: walk time (m/w)	0.04	0.08	0.12	0.15	0.19	0	0.32	0.32	12.09
BA DD (mm)	2.45	0.35	PA: walk time (m/w)	0.04	0.07	0.11	0.15	0.19	0	0.31	0.31	12.59
Blood flow velocity and Doppler-derived parameters												
CCA EDV (cm/s)	31.68	6.28	PA, Kinder (m/w)	−1.63	−3.26	−4.90	−6.53	−8.16	0	−2.45	2.45	7.73
CCA RI	0.75	0.05	PA: typical week (m/w)	0.00	0.00	0.00	0.01	0.01	0	0.04	0.04	5.85
CCA PI	1.86	0.35	PA: typical week (m/w)	0.01	0.03	0.04	0.05	0.07	0	0.40	0.40	21.44
			PA: bike time (m/w)	−0.05	−0.09	−0.14	−0.19	−0.23	0	−0.19	0.19	10.40
CCA S-D Index	4.11	0.81	PA: typical week (m/w)	0.03	0.05	0.08	0.11	0.14	0	0.82	0.82	19.97
CFA PSV (cm/s)	122.64	23.32	PA: walk time (m/w)	2.11	4.22	6.32	8.43	10.54	0	17.57	17.57	14.32
CFA RI	0.97	0.08	Sedent. play (m/d)	0.01	0.02	0.03	0.04	0.05	0	0.07	0.07	7.56
CFA S-D Index	34.04	33.03	PA: bike time (m/w)	10.59	21.17	31.76	42.35	52.93	0	44.11	44.11	129.57
BA EDV (cm/s)	13.21	14.07	Screen time (m/d)	−1.11	−2.21	−3.32	−4.42	−5.53	0	−11.05	11.05	83.64
			PA, out Kinder (m/w)	−1.44	−2.88	−4.32	−5.76	−7.20	0	−6.24	6.24	47.22
Aortic pressure levels, wave components, reflection and wave-derived parameters												
aoSBP (RT) (mmHg)	81.00	7.06	PA, Kinder (m/w)	−1.68	−3.36	−5.04	−6.72	−8.39	0	−2.52	2.52	3.11
AIx@75 (CT) (%)	−5.18	11.09	Sedent. play (m/d)	−1.48	−2.97	−4.45	−5.93	−7.41	0	−11.86	11.86	228.94
AIx@75 (MOG) (%)	21.81	8.28	Screen time (m/d)	0.73	1.45	2.18	2.91	3.63	0	7.27	7.27	33.32
SEVR (CT) (%)	122.18	15.70	PA: typical week (m/w)	0.67	1.33	2.00	2.66	3.33	0	19.98	19.98	16.36
aoBPPf (CT) (mmHg)	28.22	6.42	PA: bike time (m/w)	2.07	4.14	6.22	8.29	10.36	0	8.63	8.63	30.59
			Sleep (h/d)	−1.20	−2.40	−3.60	−4.80	−6.00	−8.40	−20.40	12.00	42.52

z: z-score. RG: reference group. MV: mean value. SD: standard deviation. Min, Max: minimum and maximum. SBP, DBP, PP: systolic, diastolic and pulse pressure (ao: aortic, ba: brachial, ta: tibial, ra: radial). SysD, DD: peak systolic and end-diastolic diameter. RI, PI: resistive and pulsatile index. S-D: Systo-Diastolic. IMT: intima–media thickness. PSV, EDV: peak systolic and end diastolic velocity. MOG: Mobil-O-Graph. CO: cardiac output. RT, CT: radial and carotid tonometry. SEVR: subendocardial viability ratio. AIx@75: augmentation index for 75 beats/minute. Pf: forward aortic pressure wave components. PA: physical activity. (m/d): minute/day. (m/w): minute/week. (h/d): hours/day. Δ was calculated as: (Max−Min) [net value]. Δ% was calculated as: ((Max−Min)/MV) × 100. Kinder: at kindergarten. PA out of Kinder: Physical activity outside of kindergarten. Sedent.: Sedentary.

According to the central limit theorem, a normal distribution was considered (taking into account Kurtosis and Skewness coefficients distribution and number of studied subjects with sample size >30) [34]. The number of subjects studied (n =816) was higher than the minimum number calculated for α = 0.05, β = 0.20 and a hypothesized or anticipated correlation coefficient (r) equal to 0.1 (n =782), 0.5 (n =29) or 0.9 (n =7). Analyses were carried out using SPSS Software (v.26, IBM-SPSS Inc., Chicago, IL, USA). A p <0.05 was considered statistically significant.

3. Results

3.1. Movement Behavior, Blood Pressure and Arterial Characteristics' Associations

We found that in children 5–6 y old, variations in MB components and/or subcomponents contributed to explain cardiac output, central BP, peripheral BP and arterial structural and functional parameters' deviations from expected (reference mean) values, regardless of (i) demographic characteristics (age, sex), (ii) current and at birth anthropometric data (z-BW, z-BH, z-BW for BH, z-BMI) or (iii) exposure to traditional CRFs (e.g., high baBP, obesity). At the same time, the explanatory capacity was independent of the other MB components and subcomponents (Tables 3 and 4). Some associations between MB levels and CV properties depended on exposure to traditional CRFs, since they 'disappeared' when passing from simple bivariate to multiple linear models. As a general rule, CV variations were explained by anthropometric data (e.g., z-BMI), followed by sex and high BP and finally by MB characteristics (relative contribution order from highest to lowest, according to standardized β) (Table 3).

All arterial territories (elastic, transitional and muscular arteries; central and peripheral territories) were sensitive to variations in MB components or sub-components (Tables 3 and 4). However, results showed that (i) ST were mainly associated with 'central' variables, particularly with the ventricle ejective function (cardiac output and Pf), rather than with arterial (structural or functional) properties, and (ii) SB component and subcomponents were associated with BP (aoBP, baBP and taBP) levels, but not with structural parameters. In turn, (iii) PA component and subcomponents were associated with BP as well as with the structural properties of the different arterial types. On the contrary, none of MB components and sub-components showed association with local or regional arterial stiffness (disregard of the arterial territory analyzed) (Table 3, Table S10).

3.2. Sedentary Behavior and Cardiovascular Properties: Independent Associations

Longer screen times were positively associated with z-baDBP, z-aoDBP and z-AIx@75(MOG) levels. Regardless of other factors, variations in screen time (considering data observed in our population) explain variations of 7.27% in AIx@75(MOG), 2.7 mmHg in baDBP and 3.6 mmHg aoDBP, which represent variations of 33.3%, 4.6% and 6.1%, respectively (considering reference values) (Tables 3 and 4, Table S10).

Sedentary play was not associated with z-baBP or z-aoBP, but it was negatively associated with z-taBP and z-AIx@75 (CT). Sedentary play explains variations up to 4.05 mmHg in taDBP, 6.25 mmHg in taSBP and 11.86% in AIx@75(CT), which represent variations of 6.97%, 5.50% and 229%, respectively (Tables 3 and 4, Table S10).

SB (min/day) was not associated with z-BP but was negatively associated with z-ABI. A maximum variation in ABI equal to 5.43% could be explained by differences in SB times observed in our group of children (Tables 3 and 4, Table S10).

3.3. Sleep Time and Cardiovascular Properties: Independent Associations

ST was negatively associated with Pf (CT) and cardiac output; differences in ST explain variations equal to 12 mmHg and 0.37 L/min (42.5% and 8.4%), respectively (Tables 3 and 4, Table S10).

3.4. Physical Activity and Cardiovascular Properties: Independent Associations

PA in kindergarten was negatively associated with taSBP, taPP, bSBP and aoSBP (RT) levels. In turn, active play, biking and total PA were positively associated with taPP, taDBP and taSBP, respectively.

Structural arterial characteristics showed positive associations with PA subcomponents: (i) PA at kindergarten was associated with CCA IMT, (ii) PA outside of kindergarten was associated with CCA diameters, (iii) total PA (min/week) was associated with CFA diameters and (iv) walking time (min/week) was associated with BA diameters. Differences in PA could explain variations equal to 0.011 mm in CCA IMT, 0.30 mm in CCA DD, 0.32 mm in CCA SysD, 0.54 mm in CFA SysD, 0.49 mm in CFA DD, 0.31 mm in BA DD and 0.32 mm in BA SystD, representing variations of 2.52%, 5.66%, 5.25%, 10.81%, 10.49%, 12.59% and 12.09%, respectively (Tables 3 and 4, Table S10).

Blood velocities z-scores showed low levels of association with MB. Longer PA time at and outside of kindergarten were negatively associated with CCA and BA EDV levels. Walking time was positively associated with CFA PSV levels (Tables 3 and 4, Table S10).

There were no significant associations between PA and arterial stiffness indexes. This was the case (i) before and after adjusting for BP, (ii) for both, local and regional arterial stiffness and (iii) when analyzing center-periphery stiffness gradient (Table 3).

4. Discussion

To our knowledge, this is the first study to evaluate the independent associations of PA, SB and ST and their subcomponents (domains) with the CV status in early life (5–6 y), analyzing in a large sample several arterial pathways and complimentary parameters using different non-invasive approaches (always considering the gold standard if available). This study showed that in children aged 5–6 y, ST, SB and PA are already associated with the CV system status (maybe exerting their initial direct effects). This would be the case for a given MB component, irrespective of the others and of the exposure to traditional CRFs.

4.1. Sedentary Behavior and Cardiovascular Inter-Individual Variations: Independent Associations

4.1.1. SB and Central and Peripheral Blood Pressure

Our results showed that screen time was positively associated with baDBP (0.3 mmHg h/day), whereas time spent on sedentary play showed no association with baBP, but it was negatively associated with taSBP (0.8 mmHg h/day) and taDBP (0.5 mmHg h/day). Then, SB subcomponents would be associated with different BP characteristics and the associations would be the opposite.

At least three aspects should be highlighted when interpreting these results. First, works that examined the association between SB (mainly screen time) and BP in children arrived at dissimilar findings. Whereas some studies reported 'positive associations' (higher screen time, higher baBP) [35–38], others found that the associations were not significant [39,40]. This controversy could be explained, at least partially, by the existence of differences not only in the time spent on the activity ('screen time'), but also in the time of day at which the exposition occurs [41]. Regardingthis, recently Pedersen et al. (2020), in a study of pre-school children followed over 2 y (n =963), found no significant prospective association between 'total screen time' and baBP or prevalence of high BP. However, days per week with 'screen time before bedtime' (2–5 or ≥6 days/week) was independently and positively associated with the prevalence of high BP at age 5 y (e.g., covariates included BMI, sleep time, PA level) [41]. On the other hand, the dissimilar findings could also be explained by differences in kind of screen-related activity. In adolescents (aged 13–17 y), Martinez-Gomez et al. (2012) found that console videogames, but not computer games, were positively associated with a clustered cardiometabolic risk score, which included

baDBP and MBP [42]. Unfortunately, in this work (like in many others), activities includingthe screen-related ones were not registered and classified according to their characteristics and time of the day in which they were carried out.

Second, in agreement with this work's results, in previous works it was proposed that SB sub-components could show opposite associations with baBP. In a prospective study (5 y follow-up; n =821, age: 6.7 y at baseline) Gopinath et al. (2014) reported that after adjusting for cofactors (e.g., age, baseline BH, BP, BMI, time in different PAs), (i) every h/day spent on screen activities was positively associated with baDBP (0.69 mmHg) and MBP (0.59 mmHg), while (ii) time spent 'doing homework' was negatively associated with baSBP (−1.12 mmHg, p at the significance umbral, 0.10) [43]. This agrees with the authors' findings in adolescents (n =2353; mean age: 12.7). In this group, after adjusting for cofactors, positive association between baDBP and every h/day spent on (i) screen activities (0.44 mmHg), (ii) watching TV (0.99 mmHg) or (iii) playing video games (0.64 mmHg) were reported. Similarly, significant positive associations were observed between screen activities, TV watching and MBP. However, (i) time spent reading was negatively associated with baSBP (0.91 mmHg for every h/day), baDBP (0.69 mmHg for every h/day) and MBP (−0.76 mmHg for every h/day) and (ii) time spent doing homework was negatively associated with baSBP (0.80 mmHg for every h/day) and MBP (0.51 mmHg for each h/day, p =0.07). Additionally, every hour spent on homework was associated with a 19% reduction in the odds of having high BP [44]. The above agrees with our findings, since in this work, 'time spent reading or doing homework' were considered subcomponents of 'sedentary play', which was negatively associated with BP. Similarly, works that analyzed factors other than CV characteristics found that different SB subcomponents (e.g., reading, sitting, playing video games) and different SB patterns could differently impact health status. For example, screen time may be detrimental and reading beneficial to cognitive development in early years of life [45]. In addition, screen time, but not other SB activities, showed positive associations with z-BMI and waist circumference [46]. Then, data from Gopinath et al. (2012, 2014) [43,44] and this work suggest that whereas 'screen time' would be associated with increased baBP and aoBP, 'sedentary play' would not only not be associated with higher BP levels (brachial or aortic), but might even show association with lower BP values (in the tibial artery).

Finally, differences in SB patterns and levels between groups (sample characteristics) could contribute to explain the dissimilar findings. In the work of Chinapaw et al. (2014) (in which there was no association between screen time and BP), children had an average screen-time of 1.2 h/day, whereas in our work, children were exposed to screen-based activities for an average of 2.5 h/day. Considering the low screen times reported by Chinapaw et al., it may not have included children exposed to screen times above thresholds necessary to observe (or establish) an association with baBP [40].

Additionally, our results showed that higher screen times were positively associated with aoBP levels and AIx@75(MOG). Thus, the positive association between BP and time spent on screen activities would not only represent a peripheral phenomenon (e.g., increase in pulse amplification), but would also involve central arteries, determining a real increase in ventricle load. Taking into account the association between AIx@75 and screen time, it could be stated that an increase (relative) in reflected waves contribution to aortic pulse wave could be an explanatory factor for the increased aoBP observed in association with higher screen times. In this regard, it should be pointed out that pulse wave in a given arterial site results from integration of both incident and reflected components [25]. The above was not a homogeneous finding among the different approaches (e.g., it was not observed when using SCOR device). Further works are necessary to enhance our knowledge and comprehension of the physiological phenomenon that accounts for or underlies the association between SB aortic wave analysis-derived (levels and components) characteristics.

4.1.2. SB and Arterial Structural and Functional Parameters

In this work, SB components or subcomponents showed no association with arterial structural and functional parameters.This is in agreement with previous works in which no association was reported between self-reported or objectively measured SB time and arterial stiffness or CCA IMT in children [47,48]. In primaryschool children (aged 6–8; *n* =136), Haapala et al. (2017) reported no independent association between SB (accelerometry) and an arterial stiffness index (measured at the fingertip by pulse contour analysis) [47]. Similar findings were reported by the authors when applying questionnaires (instead of accelerometry) to the same cohort, which enabled to divide SB into (i) screen-based SB (e.g., watching TV, using a computer and playing video games, using a mobile phone) and (ii) other SB (e.g., listening to music, playing a musical instrument, reading, writing, drawing, arts and crafts, playing board games, resting) [48]. In agreement with the described above are findings reported by Nettlefold et al. (2012), who analyzed the association between SB (accelerometry) and large arteries compliance (*n* =102, age: 8–11 y) [16]. In the same line are the results of Kochli et al. (2019), who used questionnaires to assess the association between screen time and arterial stiffness (oscillometry) in children (*n* =1171, age: 6–8 y) [49]. The described findings showed that in children (aged5–10 y), SB would be associated with CRFs and BP (as discussed above), but not with variations in structural and functional arterial properties (Table 3). The observations are consistent with the fact that structural and/or functional changes represent a slow process that requires long-term exposure to a given condition (e.g., unhealthy sedentary lifestyle).

4.2. Sleep Time and Cardiovascular Inter-Individual Variations

ST was negatively associated with cardiac output and forward (Pf) aoBP component. Thus, lower ST, higher cardiac output and incident aoBP component are determinants of BP levels. The referred factors could contribute to explain the negative association between ST and baBP reported in some works that did not include them in multiple regression analysis [50–52]. Regardingthis, in this work there was positive association between cardiac output and high baBP (Table 3). Then, at least in theory, the higher baBP levels associated with shorter ST could be explained by relative 'hyperdynamic' state, rather than by higher SVR and/or arterial stiffness levels. Similarly, in obese children, higher baBP levels were observed together with increased cardiac output and forward component of the pressure wave, but not with higher arterial stiffness or SVR [14].

In agreement with the hypothesis that ST would impact cardiac parameters (rather than arterial properties), Feng et al. (2016) reported an (independent) association between short ST and cardiac remodeling in adolescents (e.g., increased interventricular septum thickness, left ventricle end-diastolic diameter, posterior wall thickness, left ventricle mass and mass index). In addition, authors found a trend towards higher resting heart rates in subjects reporting short ST (≤7 h/night). Consequently, in adolescents, a reduced (insufficient) ST could be a factor independently associated with deleterious structural cardiac changes, which in turn could be related to an hyperdynamic state (as observed in obese children) [53].

In this work, ST was not associated with structural and functional arterial parameters.Thus, for at least at 5–6 years of life, ST would be associated with cardiac parameters rather than with vascular variations.

4.3. Physical Activity and Cardiovascular Inter-Individual Variations

4.3.1. PA and Central Pressure, Peripheral Pressure and Blood Flow Velocities

In this work, PA at kindergarten was negatively associated with taSBP (2 mmHg per each h/week), taPP (1.5 mmHg per each h/week), baSBP (1.1 mmHg per each h/week) and aoSBP(RT) (1.7 mmHg per each h/week). In general terms, the findings agree with previous works that showed a negative association between PA and baBP[54–56]. However, it isworth noting that similar to that reported by Gopinath et al. (2011), in this work, the

association was only observed for PA at kindergarten. In their work (*n* =1765, age: 6.7 ± 0.4 y), Gopnath et al. found that after adjusting for cofactors (e.g., age, sex, BH and BMI), time spent on outdoor activities was not associated with baBP, whereas indoor activities were negatively associated with baDBP (2.4 mmHg per each h/week) and MBP (2.2 mmHg per each h/week) [56]. The finding that PA at kindergarten was the single PA subcomponent associated with (the expected) negative trend towards lower BP levels could be explained by the fact that subcomponent could be the most regular, structured (and objectively measurable) activity developed, ableto classify children based on time spent on the specific PA (0, 30, 60 or 90 min/week). PA at kindergarten would be mainly an´indoor´ activity, which increases the probability of reaching high levels of intensity. About this, it was stated that compared to outdoor activities (e.g., soccer), those developed indoors (e.g., soccer, basketball) would involve shorter sessions of more intense activity since indoor sports are typically played on smaller areas so that participants cover less total distance [56].

We found that active play, biking and total PA times were positively associated with taPP (0.2 mmHg per each h/week), taDBP (0.8 mmHg per each h/week) and taSBP (0.2 mmHg per each h/week), respectively. Further works would contribute to the understanding of the meaning and explanatory factors for this (original) finding. However, it could be proposed that an increased blood flow in lower limbs could contribute to the higher peripheral (tibial artery) BP levels observed in active children. In other words, the activity itself could conduct to an adaptive CV response to accurately fulfill the metabolic necessities (e.g., associated with increased muscular mass and/or requirements). In this context, it is worth noting that PA subcomponents were associated with larger CFA diameters and PSV, which would result in larger CFA blood flow (blood flow = cross sectional area*blood flow velocity). On the other hand, PA subcomponents were also associated with higher CFA S-DIndex levels (indicators of local–regional resistances). Consequently, both ultrasound-derived (diameters, velocities, S-DIndex) and oscillometric-derived (taBA) data suggest that higher PA times would be associated with higher blood flow, blood pressure and vascular resistances levels in lower limbs. Once again, future works are necessary to contribute to define the described associations, as well as to deepen understanding oflocal hemodynamic phenomena that may occur in specific arterial territories during growth (e.g., as adaptive process).

4.3.2. PA and Arterial Structural Parameters

PA (component or subcomponents) was associated with arterial structural characteristics. PA at kindergarten was positively associated with CCA IMT, whereas CCA, CFA and BA diameters were positively associated with PA out of kindergarten, total PA and walking time, respectively. These results are in agreement with the report by Ried-Larsen et al. (2013), who in a prospective study (*n* =205, age: 9 y at baseline, 6y follow up) evaluated PA (accelerometry) and measured CCA IMT (at age 15 y (*n* =254). Adjusted models showed positive (at significance umbral) relationships between CCA IMT and both mean PA intensity from childhood to adolescence and change in moderate-to-vigorous or vigorous PA intensity in the same period [17]. Additionally, in a previous work, the authors had found that children who rode bicycles every day showed a trend towards higher CCA IMT compared to those (boys) who rode <3 times/week [18]. The finding of a positive association between PA and CCA IMT might be considered unexpected, if we think of IMT in terms of its demonstrated association with CV risk and disease (e.g., atherosclerotic). However, as previously analyzed, PA during growth and development (e.g., in early lifestages such as childhood) might be associated to adaptive CV changes that could include an enlargement of the medial layer of the arterial wall. During high-intensity PA, shear-stress and cyclic strain are (acutely) increased. In turn, long-term exercise has shown to be associated with an enlarged arterial diameter and could also associate wall hypertrophy (e.g., IMT increase). According to 'Law of Laplace', wall stress relates positively with arterial diameter (radius) and negatively with wall thickness. Therefore, conditions

associated with increased diameters may be counteracted by compensatory mechanisms in order to maintain the 'arterial tensional homeostasis'. The above contributes to comprehension of the observed associations between PA and arterial structure (e.g., diameters and/or IMT). Nonetheless, it is worth noting that data on PA and CCA IMT relationship are not universal, but have shown differences. Regardingthis, opposite ofthe above-described, there are works that showed no association between the described parameters and works in which the association was negative. The dissimilar findings could be explained by differences in the PA subcomponent considered, in the cofactors analyzed and/or in the age of the subjects [2,15,57].

4.3.3. PA and Arterial Functional Parameters

In this work, PA levels showed no significant association with wave reflections (e.g., AIx@75) or arterial stiffness (local, regional, central-to-peripheral stiffness ratio) levels, both before (ME and PWV) and after (β and β-PWV) adjusting for BP. This agrees with data from other works in which local stiffness, regional stiffness and/or AIx@75 were assessed in children (e.g., aged 5 and 8 y; 6–8 y; 8–11 y) and/or adolescents (12–14 y; 17 y; 15 y) [2,15–17,49,58].

There are also works that reported a negative linear association between arterial stiffness and some PA intensity levels. Haapala et al. (2017) studied the association between PA and cardio-respiratory fitness and a 'global arterial stiffness index'in children (aged6–8; *n* =136). Moderate, vigorous and cumulative time spent in PA were inversely associated with stiffness. However, in subjects with PA <3 METS, PA was not associated with arterial stiffness [47]. Therefore, it could be said that PA would be associated with arterial stiffness once an intensity threshold is surpassed. In the same line, it could be said that PA and arterial stiffness association could depend on the distribution of PA intensities in the studied subjects.

Similarly, in boys (*n* =169), Ried-Larsen et al. found that those who rode bicycles every day (not near every day) had lower arterial stiffness (lower EM, higher distensibility and compliance) than boys who rode <3 times/week. However, authors did not observe any differences in arterial stiffness across categories of bicycling in girls [18]. Finally, Vijalainen et al. (2016) reported that unstructured PA time (but not total PA time or time spent on other PA subcomponents) was negatively associated with stiffness (but not with reflection) indexes. The independent association disappeared when cofactors related with cardio-respiratory fitness were considered [48]. Unfortunately, stiffness indexes capable of characterizing intrinsic arterial properties with independence on BP (e.g., β index) were not assessed in available works. In this regard, it is worth noting that arterial pressure and diameter show a non-linear passive relationship. Thus, BP variations associate passive and non-linear changes in arterial diameter with resultant variations in arterial stiffness [21,25]. An accurate analysis of the impact of PA on the arterial stiffness would require not only considering adjusting data on a population basis (e.g., using multiple linear regressions), but also on an individual basis (e.g., adjusting for the subject BP levels during the study). However, such approaches are seldomused, which makes it difficult to define whether PA and arterial stiffness association would depend on (or be explained by) PA impact on BP (not eliminated when using multiple linear regressions).

4.4. Movement Behavior and Cardiovascular Properties: Independence and Impact on Different Arteries

We found that variations in MB components and/or subcomponents contributed to the explained deviations (from expected reference mean) of several CV variables, regardless of (i) demographic, (ii) current and at birth anthropometric data and (iii) exposure to traditional CRFs. At the same time, the explanatory capacity of a given MB component or subcomponent was independent of others. As was analyzed, the findings agree with results of previous works.

In this work, we found that all the arterial territories (elastic, transitional and muscular arteries; central and peripheral territories) were sensitive to variations in MB components or sub-components. Therefore, MB would be associated with characteristics of the CV system as a whole, rather than with properties limited to a specific component. However, our results also showed that in children aged 5–6 y, the associations between MB and the CV system would vary depending on the component and subcomponent of MB and/or on the CV variable considered. ST would be associated with parameters related with the ventricular ejective function (cardiac output, Pf) but not with the arterial function, and SB (component and subcomponents) would be associated with BP, rather than with arterial structural properties. On the contrary, PA components and subcomponents would show association with BP and with the structural characteristics of the different arteries. None of the MB components or subcomponents were associated with arterial stiffness.

Looking at our findings, it could be said that in a hierarchical order (defined from greater to lesser explanatory capacity), variations in CV parameters could be explained by (i) current anthropometric data, (ii) sex or high BP and (iii) by MB characteristics. Similarly, in previous works from our group, z-BMI at the time of CV evaluation showed the greatest capacity to explain variations in central and peripheral BP and CV (structural and functional) properties at 6 and 18 y old subjects. It should be noted that z-BMI explanatory capacity was higher than that of CRFs such asfamily history of CV, hypertension, dyslipidemia or smoking [10]. This agrees with works previously described in that after adjusting multiple association analyses for several cofactors, anthropometric (nutritional) characteristics mostly remain in the models, suggesting they could be a final common pathway (mediator) by which MBs are associated with the CV system. In this regard, it is worth noting that even remaining in the models, the relative contribution of MB (standardized β) would be mostly lower than that of anthropometric parameters.

4.5. Strengths and Limitations

This work has strengths and limitations that should be considered. First, as CV disease manifests in later life, studies in children can only be performed with outcomes such as CRFs levels, BP and CV characteristics as an estimate of early life CV 'damage' or deviation from expected levels for sex and age. Our work included a comprehensive non-invasive evaluation of CV properties, obtained from a relatively large population sample of children. Second, different methodological approaches were considered to assess CV parameters (e.g., wave reflection parameters, aortic BP) in order to not bias our results to a particular approach. By using different devices and approaches, we were able to analyze whether associations for a given parameter would vary (or not) depending on the approach or device considered. This would be particularly useful when analyzing parameters yet under research and/or for which the gold standard (technique and/or approach) is to be defined. Third, defining a reference subgroup made it possible to determine inter-individual variations (z-scores) of CV variables. Since the reference subgroup included Uruguayan children non-exposed to CRFs, who complied with MB recommendations, we avoided using bibliographical data from children who do not necessarily present characteristics similar to those of the Uruguayan children. In this regard, it is worth noting that our group has identified differences in CV characteristics among subjects from different populations [21,24]. Fourth, the number of subjects and the statistical approach were designed in order to increase the reliability of the confidence intervals and to analyze the association between MB and CV characteristics with independence of exposure to CRFs and MB components or subcomponents other than those being evaluated. However, although we adjusted for several covariates, we cannot discard the possibility of residual confounding factors (e.g., parental activity levels, genetic variation and socio-cultural characteristics) that could have influenced our results. Fifth,in this work, central and peripheral SBP and DBP were used to quantify central and peripheral arterial stiffness levels. This should be considered a strength. In previous works, CCA stiffness was quantified using baPP, which could lead to inaccuracies that would be greater at lower ages [15,17].

We are aware that our research may have limitations. First, it is a cross-sectional study. Since children were not followed over time, the temporal profiles of the CV characteristics, the exposure to different CRFs and the time spent on MB components and subcomponents are unknown. Second, parent-filled questionnaires were used as a tool to collect data on MB, despite the fact there are methods that allow PA to be evaluated more objectively and independently of the operator (e.g., accelerometry). Consequently, the completeness and accuracy of information may have been influenced by how parents and/or teachers perceived the questions. However, it should be noted that other techniques or approaches proposed to assess MB have limitations, particularly in children. As an example, there are controversies regarding (i) where the accelerometer should be placed (wrist vs. waist), (ii) which would be the best functions (equations) to quantify ST vs. rest, (iii) PA thresholds that should be used to classify PA as light, moderate or vigorous, (iv) the minimum recording time that should be considered representative of PA and (v) the algorithms (e.g., epoch length, sampling frequency) that should be used to assess PA. Additionally, the activity monitor does not capture some activities carried out especially in the evaluated ages (e.g., bicycling) [17]. Considering the described controversies, economic cost and mainly the age and number of children to be evaluated and the work design, we opted for assessing MB working with validated questionnaires elaborated based on international recommendations. Third, the age range was small. Thus, a robust analysis in terms of association between components and subcomponents of MB and children age was not possible. However, the small age range could also be considered as a strength for the analysis, avoiding effects on the results due toage differences. Finally, in this work, sex was considered when determining mean values and standard deviations (reference subgroup) used to typify (z-scores) CV data and when defining regression models (sex was introduced as an independent variable). The first is a very important issue since sex-related differences in CV parameters could be observed not only in mean values, but also in standard deviations. On the other hand, sex was included in the regression models as a co-factor. In this, we ensure that sex is not globally influencing the results obtained. However, it is worth noting that we did not perform 'moderation/mediation' analysis to evaluate whether associations between MB behavior components and CV z-scores varied depending on sex and/or other variables (e.g., z-BMI, ST, PA, SB). In this opportunity, we opted for not including such a subanalysis.

5. Conclusions

Variations in MB components and/or subcomponents contributed to explaining the deviation of CV variables from expected values, regardless of demographic, anthropometric, other MB components/subcomponents data and exposure to CRFs. All the arterial territories (elastic, transitional and muscular arteries; central and peripheral) were sensitive to variations in MB components or sub-components. As a general rule, according to a hierarchical order (defined from greater to lesser explanatory capacity), variations in CV parameters could be explained by (i) current anthropometric data, (ii) sex or high BP and (iii) MB characteristics.

When considering SB, screen time was positively associated with baDBP, whereas time spent on sedentary play showed no association with baBP and was negatively associated with taBP. SB subcomponents showed different associations (and even in the opposite direction) with different BPs. Longer screen times were positively associated with aoBP and AIx@75(MOG). SB was not associated with arterial structural and functional parameters.

ST was negatively associated with cardiac output and forward (Pf) aoBP component.

PA at kindergarten was negatively associated with taSBP, taPP, baSBP and aoSBP(RT). In contrast, time of active play, biking time and total PA time were positively associated with taPP, taDBP and taSBP, respectively. PA at kindergarten was positively associated with CCA IMT, while CCA, CFA and BA diameters were positively associated with PA outside of the kindergarten, total PA and walking time, respectively. Thus, PA (components or sub-components) showed association with structural arterial characteristics. On the contrary, PA showed no association with reflection parameters or arterial stiffness.

Supplementary Materials: The following are available online, Table S1, Hemodynamic, structural and functional arterial parameters of preschool-aged children: Reference Subgroup (subjects non-exposed to CRFs and who complied with 24 h movement recommendations). Table S2, Hemodynamic, structural and functional cardiovascular parameters z-scores of preschool-aged children (Reference subgroup). Table S3, Hemodynamic, structural and functional cardiovascular parameters z-scores of preschool-aged children (Allchildren). Table S4, Association between cardiovascular z-scores (dependent variables) and triad, CRF and anthropometric parameters (independent variables) in preschool-aged children. Table S5, Association between physical activity, sedentary behavior and sleep time components and sub-components. Table S6, Association between movement behavior and factors related to increased cardiovascular risk. Table S7, Central and peripheral blood pressure and vascular parameters: association with factors related to increased cardiovascular risk. Table S8, Association between blood pressure and structural and functional arterial parameters z-scores with movement behaviors components and sub-components. Table S9, Association between blood pressure and structural and functional arterial parameters z-scores with cardiovascular risk factors. Table S10, Impact of interindividual variations in movement behaviors (independent variables) on cardiovascular characteristics (dependent variables), in preschool-aged children.

Author Contributions: Conceptualization, D.B. and Y.Z.; Formal analysis, M.G.-G., D.B. and Y.Z.; Funding acquisition, D.B. and Y.Z.; Investigation, D.B. and Y.Z.; Methodology, M.G.-G., D.B. and Y.Z.; Project administration, D.B. and Y.Z.; Visualization, M.G.-G., D.B. and Y.Z.; Writing—original draft, M.G.-G., D.B. and Y.Z.; Writing—review and editing, M.G.-G., D.B. and Y.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Agencia Nacional de Investigación e Innovación (ANII), Ministry for Social Development (MIDES); United Nations Children's Fund (UNICEF), grant FSPI_X_2015_1_108484, PRSCT-008-020; and extra-budgetary funds provided by CUiiDARTE (Bia, Zócalo).

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of Centro Hospitalario Pereira Rossell, Universidad de la República, Montevideo, Uruguay (Protocol code: 01; Date of approval: 29 November 2013 and 29 December 2015).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in the study are available within the article and in supplementary material.

Acknowledgments: We thank the children and their families for their participation in the study. The authors thank the staff from CUiiDARTE. CUiiDARTE Centre and Project is directed by D. Bia and Y. Zócalo.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Abbreviations

ABI	Ankle Brachial index
AIx@75	AIx adjusted to a 75 beats/min heart rate
aoBP	Central (aortic) blood pressure
aoDBP	Aortic diastolic blood pressure
aoPP	Aortic pulse pressure
aoSBP	Aortic systolic blood pressure
BA	Brachial artery
baBP	Brachial artery blood pressure
baDBP	Brachial artery (peripheral) diastolic blood pressure
baPP	Brachial artery pulse pressure
baSBP	Brachial artery (peripheral) systolic blood pressure
BH	Body height
BMI	Body mass index
BP	Blood pressure

BW	Body weight
CCA	Common carotid artery
CFA	Common femoral artery
cfPWV	Carotid-femoral pulse wave velocity
CRFs	Cardiovascular risk factors
crPWV	Carotid-radial pulse wave velocity
CV	Cardiovascular
DD	End-diastolic arterial diameter
EDV	End-diastolic blood flow velocity
EM	Pressure-strain or Petrson arterial elastic modulus
IMT	Intima-media thickness
MB	Movement behavior
MBP	Brachial artery mean blood pressure
MET	Metabolic equivalent
MOG	Mobil-O-Graph PWA-monitor device (MOG; I.E.M.-GmbH, Stolberg, Germany)
PA	Physical activity
Pb	Amplitude of the aortic pressure waveform backward component
Pf	Amplitude of the aortic pressure waveform forward component
PSV	Peak systolic blood flow velocity
raDBP	Radial artery diastolic blood pressure
raPP	Radial artery pulse pressure
raSBP	Radial artery systolic blood pressure
SB	Sedentary behavior
SCOR	SphygmoCor-CvMS device (SCOR; v.9, AtCor-Medical, Australia)
ST	Sleep time
SystD	Peak systolic arterial diameter
taDBP	Tibial artery diastolic blood pressure
taPP	Tibial artery pulse pressure
taSBP	Tibial artery systolic blood pressure
β	Beta or stiffness (local) index

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frontiers | Frontiers in Nutrition

ORIGINAL RESEARCH
published: 29 April 2022
doi: 10.3389/fnut.2022.856198

Fat-Free Mass Index, Visceral Fat Level, and Muscle Mass Percentage Better Explain Deviations From the Expected Value of Aortic Pressure and Structural and Functional Arterial Properties Than Body Fat Indexes

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Specialty section:
This article was submitted to Nutritional Epidemiology, a section of the journal Frontiers in Nutrition

Received: 16 January 2022
Accepted: 21 March 2022
Published: 29 April 2022

Citation:
Gómez-García M, Torrado J, Pereira M, Bia D and Zócalo Y (2022) Fat-Free Mass Index, Visceral Fat Level, and Muscle Mass Percentage Better Explain Deviations From the Expected Value of Aortic Pressure and Structural and Functional Arterial Properties Than Body Fat Indexes. Front. Nutr. 9:856198. doi: 10.3389/fnut.2022.856198

Bioelectrical impedance analysis (BIA)-derived indexes [e.g., fat (FMI) and fat-free mass indexes (FFMI), visceral fat level (VFL)] are used to characterize obesity as a cardiovascular risk factor (CRF). The BIA-derived index that better predicts arterial variability is still discussed.

Aims: To determine: (1) the association of classical [weight, height, body mass index (BMI), basal metabolic rate (BMR)] and BIA-derived indexes, with arterial properties deviations from expected values (arterial z-scores); (2) maximum arterial variations attributable to BIA-derived indexes; (3) whether the composition of total body, trunk and/or limbs is most closely associated with arterial variations.

Methods: Hemodynamic, structural, and functional parameters of different histological types of arteries were assessed (n = 538, 7–85 years). Classical and BIA-derived indexes [fat mass and percentage, FMI, VFL, muscle mass percentage (PMM), FFMI, and percentage] were measured (mono- and multi-segmental devices). Arterial z-scores were obtained using age-related equations derived from individuals not-exposed to CRFs (n = 1,688).

Results: First, regardless of the classical index considered, the associations with the arterial properties showed a specific hierarchy order: diameters and local stiffness > aortic and brachial blood pressure (BP) > regional stiffness. Second, all the associations of FMI and FFMI with z-scores were positive. Third, FFMI exceeded the association obtained with BMI and BMR, considering structural z-scores. In contrast, FMI did not exceed the association with z-scores achieved by BMI and BMR. Fourth, regardless of CRFs and classical indexes, arterial z-scores would be mainly explained by FFMI, VFL,

and PMM. Fifth, regardless of the body-segment considered, the levels of association between FMI and z-scores did not exceed those found for classic and FFMI. Total fat mass and trunk indexes showed a greater strength of association with z-scores than the FMI of limbs. Sixth, compared to lower limb FFMI indexes, total and upper limbs FFMI showed higher levels of association with z-scores.

Conclusions: FFMI (but not FMI) exceeded the strength of association seen between BMI or BMR and structural z-scores. Regardless of the body segment analyzed, the associations between FMI and z-scores did not exceed those found with classic and FFMI. Arterial z-scores could be independently explained by FFMI, VFL, and PMM.

Keywords: aortic pressure, arterial stiffness, bioelectrical impedance analysis, body composition assessment techniques, cardiovascular diagnosis, cardiovascular research, epidemiological research, intima-media thickness

INTRODUCTION

The rate of progression of structural and functional arterial disease is directly associated with the exposure to an increasing number of cardiovascular risk factors (CRFs) (1, 2). In Latin America, as well as in all western societies, overweight and obesity represent a major public health concern, which affects virtually all age groups of different socioeconomic status (3, 4). Obesity has the particularity to increase the risk of other CRFs such as diabetes and hypertension, all of which further accelerate the development of arterial disease (5). Over the past years, there has been significant efforts of the medical community to reduce the obesity, which resulted in different countries to introduce policies aimed at obesity prevention, intensification of the control of associated CRFs, and early arterial disease screening (i.e., using non-invasive arterial evaluation) (6). Furthermore, there has been growing interest in trying to better understand the association between body composition and early arterial changes and/or disease by investigating, which is the best approach to characterize both body composition indexes [using fast, simple, non-invasive, and easily repeatable analyses such as bioelectrical impedance analysis (BIA)] and arterial impairment among subjects (7). Despite the fact that overweight and obesity have been associated with worse cardiovascular status and disease prognosis, classic indexes used to characterize abnormal or excessive fat accumulation [e.g., body weight (BW) or body mass index (BMI)] have shown predictive limitations (7). For instance, BMI does not consider fat distribution and may not indicate adequately fat content. In this regard, it could overestimate the degree of adiposity in both individuals who are overweight but very muscular (e.g., athletes) and in older patients who have lost body height (BH) secondary to spine osteoporosis. On the other hand, BMI may underestimate adiposity in elder individuals who have lost muscle mass in association with aging (8). Undoubtedly, this could result in inaccurate cardiovascular risk prediction at the patient level.

Recently, BIA-derived body fat distribution and the use of new indexes, such as fat mass and fat-free mass indexes (FMI and FFMI) have been used to characterize overweight and obesity. These parameters have shown an acceptable accuracy in estimating several health outcomes compared with classical anthropometric indexes (9, 10). Moreover, several studies have reported that FMI and FFMI are trustworthy obesity markers and are associated with cardiovascular abnormalities such as increased arterial stiffness, carotid wall thickness, and blood pressure (BP) (9, 11, 12). Yet, it remains unclear which BIA-derived body composition parameter better predicts structural, functional, and hemodynamic arterial changes. Additionally, the whole-body BIA (total or mono-segmental) aimed at measuring body composition could not be sensitive enough to detect specific segmental changes [i.e., increase in central (trunk), but not in lower limb adiposity]. Consequently, the measurement of both, the total body composition (mono-segmental BIA) and different body segments (trunk, lower and upper limbs; multi-segmental BIA) could theoretically provide complementary information about the link between body composition characteristics and cardiovascular properties.

Recently, our group has shown that traditional and non-traditional CRFs present different levels of association with parameters of arterial structure and function of different arterial territories [i.e., different histological type of arteries: elastic (carotids), transitional (brachial), and muscular (femoral)], as well as with different hemodynamic properties (13–19). We found that the impact of different CRFs, including time in sedentary behavior and sleep time (13), low birth weight and catch-up growth (14), physical activity level (e.g., assessed using

Abbreviations: aoBP, Aortic blood pressure; aoDBP, Aortic diastolic blood pressure; aoSBP, Aortic systolic blood pressure; BA, Brachial artery; baDBP, Brachial artery diastolic blood pressure; baMBP, Brachial artery mean blood pressure; baSBP, Brachial artery systolic blood pressure; BH, Body height; BIA, Bioelectrical impedance analysis; BMI, Body mass index; BMR, Basal metabolic rate; BP, Blood pressure; BW, Body weight; CCA, Common carotid artery; CFA, Common femoral artery; cfPWV, Carotid-femoral pulse wave velocity; CRFs, Cardiovascular risk factors; crPWV, Carotid-radial pulse wave velocity; DD, End-diastolic arterial diameter; EM, Elastic modulus; FFMI, Fat-free mass index; FMI, Fat mass index; IB, In body [multi-frequency (20 kHz and 100 kHz) and multi-segmental bioelectrical impedance device (InBody-120, InBody Co., Seoul, Korea)].; IMT, Intima-media thickness; MV, Mean value; OM, Omron [mono-frequency (50 kHz) and mono-segmental bioelectrical impedance device (HBF-514C (OM), Omron Healthcare, Inc., Illinois, USA)]; PBF, Body fat percentage; PWV, Pulse wave velocity; PWV Ratio, Pulse wave velocity ratio (cfPWV/crPWV quotient); SCOR, SphygmoCor-CvMS device; SD, Standard deviation; SysD, Peak systolic arterial diameter; VFL, Visceral fat level; z-, z-score; β, Beta (stiffness) index.

hip- and wrist-worn accelerometers) (15), high BP (17) and z-BMI (as a continuous variable) or obesity (18, 19) could differ, depending on the arterial parameter (structural vs. functional) or territory (central vs. peripheral, elastic, muscular or transitional) considered. To our knowledge, there are no studies to date that have comprehensively analyzed the association between classical anthropometric and BIA-derived body composition indexes (i.e., fat mass, fat-free mass) and arterial properties, considering (i) central and peripheral BP levels, (ii) carotid, femoral, and brachial diameters, and wall thickness, and (iii) regional and local arterial stiffness of different vascular territories. On the other hand, an important issue would be to identify to what extent BIA-derived indexes are associated with arterial properties, independently of the exposure to other CRFs (including classical anthropometric indexes). BIA-derived indexes showing an independent association could be the most useful to indicate the expected values of arterial parameters regardless of other individuals' characteristics (e.g., age, sex, high BP, BMI).

As in previous studies, for each analysis that included the arterial system, we analyzed the levels at which each arterial parameter deviates from the expected "optimal" value, accounting for the subject age (z-score) (13–15). The z-score describes the position of a subject-specific raw score in terms of its "distance" from the mean value in standard deviation units. For instance, a z-score for arterial stiffness equal to + 2 or −2 indicates that a particular individual has stiffness levels of two standard deviations above or below the expected value, respectively, for an age-matched healthy individual not exposed to traditional CRFs (13–15). Thus, our analysis focuses on identifying the extent to which classical anthropometric and BIA-derived indexes would explain the level of deviation of the arterial system from the values considered "optimal," independently of other factors. In this way, it is possible to analyze whether the levels of the body composition indexes are able to explain the "deviations from normality," and not simply whether they are associated with the levels of the cardiovascular variables, which are expected to vary with age.

In this context, the aims of this work were (in healthy children, adolescents, and adults):

- First (Aim 1), to characterize the level of association between (i) classical [BW, BH, BMI, basal metabolic rate (BMR)], (ii) fat mass, and (iii) fat-free mass indexes, and cardiovascular z-scores (considering hemodynamic, structural, and functional parameters; central and peripheral arteries).
- Second (Aim 2), to evaluate and compare classical anthropometric variables with fat mass and fat-free mass indexes (mono-segmental BIA-derived), as potential explanatory variables of cardiovascular z-scores levels.
- Third (Aim 3), to quantify the maximum variations in cardiovascular variables (*effect size*), which can be attributed to variations in BIA-derived indexes.
- Finally (Aim 4), to analyze whether fat and fat-free mass distribution analysis (multi-segmental BIA) is able to identify specific body regions (e.g., total body vs. trunk vs. upper limbs vs. lower limbs) that are significantly associated with cardiovascular z-scores.

MATERIALS AND METHODS

Study Population

This study was carried out in the context of the Centro Universitario de Investigación, Innovación y Diagnóstico Arterial (CUiiDARTE) project (13–27). This includes data derived from community-based studies on demographic and anthropometric variables, exposure to CRFs, personal and family history of cardiovascular disease and data on hemodynamic, structural, and functional vascular parameters. From this database, 538 subjects with body composition measurements with single-frequency mono-segmental BIA device were selected (110 of whom were also evaluated with multi-frequency multi-segmental BIA) (**Table 1**). Additionally, a "Reference Group" (n = 1,688) was selected from the CUiiDARTE project database (n = 3,619) in order to quantify cardiovascular z-scores (15, 21–25). All procedures were conducted in agreement with the Declaration of Helsinki (1975 and reviewed in 1983), and the study protocol was approved by the Institution's Ethics Committee. In adults, written informed consent was obtained prior to the evaluation. In children and adolescents (<18 y), parents' written consent and children's assent were provided before the study.

Anthropometric and Clinical Evaluation

The participants were asked to avoid exercise, tobacco, alcohol, caffeine, and food intake 4 h before the evaluation, and not to perform strenuous physical activity in the previous 24 h. Additionally, the participants should empty their bladder 30 min before the anthropometric and body composition assessment. A clinical interview and the anthropometric evaluation enabled us to assess CRFs exposure, defined according to the criteria described below (data analysis). A family history of cardiovascular disease was defined by the presence of at least one first-degree (for all the subjects) or second-degree (for subjects ≤18 y) relatives with early (<55 y in males; <65 y in females) cardiovascular disease.

Body weight and BH were measured with the participants wearing light clothing and no shoes. BH was measured using a portable stadiometer and recorded to the nearest 0.1 cm. BW, fat mass, fat-free mass, muscle mass, BMR, and visceral fat level (VFL) were measured with two validated BIA devices: (i) mono-frequency (50 kHz) and mono-segmental [Omron HBF-514C (OM), Omron Healthcare, Inc., Illinois, USA)] and (ii) multi-frequency (20 kHz and 100 kHz) multi-segmental [InBody-120 (IB), InBody Co., Seoul, Korea]. To minimize variations due to fluid shifts in the body, the different BIA devices were placed side by side so that the subject could move from unit to unit without wasting time and too much movement. FMI and FFMI were calculated by dividing fat mass and fat-free mass by the square of the BH, respectively. Specific variables per segment (i.e., FMI and FFMI of trunk, upper, and lower limbs) were also calculated using the fat mass and fat-free mass of each segment and the same BH. BMI was calculated as BW divided by the square of BH. Body fat percentage (PBF) was calculated, dividing body fat mass by BW and multiplied by 100 (**Figure 1**). Detailed information on the validity of BIA measurements using InBody and OMRON technology,

TABLE 1 | Characteristics of subjects evaluated by bioelectrical impedance analysis (OMRON HBF-514C device).

	All (n = 538)				Male (n = 286)				Female (n = 252)			
	MV	**SD**	**Min**	**Max**	**MV**	**SD**	**Min**	**Max**	**MV**	**SD**	**Min**	**Max**
Cardiovascular risk factors												
Age (years)	29.70	18.17	7.00	85.79	32.55	19.02	7.00	75.00	26.46	16.61	11.00	85.79
Current smoker (%)	9				9.2				8.9			
Hypertension (%)	13				17.9				8.1			
Dyslipidemia (%)	16				17.1				13.8			
Diabetes (%)	2				3.2				1.6			
Obesity (%)	13				14.8				9.9			
History of CVD (%)	0				0				0			
Family History of CVD (%)	8				7.2				9.0			
On anti-hypertensive drug (%)	11				15.3				5.7			
On anti-HLD drug (%)	9				12.1				4.9			
On anti-diabetic drug (%)	3				3.9				2.0			
Anthropometric indexes												
Body Height (OM) (m)	1.68	0.10	1.21	1.96	1.74	0.08	1.21	1.96	1.60	0.06	1.32	1.75
Body Weight (OM) (kg)	69.53	17.09	27.80	134.7	76.88	16.88	27.80	134.7	61.34	13.17	40.20	120.0
BMI (OM) (kg/m^2)	24.56	4.85	15.10	48.20	25.24	4.71	15.10	40.60	23.82	4.90	16.50	48.20
BMR (OM) (kcal)	1,544	276	1,044	2,392	1,736	209	1,178	2,392	1,323	152	1,044	1,994
Body fat mass indexes												
BFM (OM) (kg)	20.00	10.15	2.60	65.40	18.32	10.18	2.60	52.50	21.86	9.81	5.42	65.40
PBF (OM) (%)	27.97	10.34	5.40	68.00	22.21	8.60	5.40	68.00	34.35	8.13	11.00	59.40
FMI (OM) (kg/m^2)	7.19	3.80	0.93	28.60	5.99	3.24	0.93	17.25	8.54	3.94	2.07	28.60
VFL (OM) (range: 1–30)	7.18	4.94	1.00	27.00	8.96	5.47	1.00	27.00	5.13	3.21	1.00	23.20
Body fat-free mass indexes												
FFM (OM) (kg)	49.88	12.22	24.70	97.25	59.39	8.52	24.70	97.25	39.33	4.72	27.97	62.43
PMM (OM) (%)	32.32	7.12	16.90	49.20	37.11	5.75	23.20	49.20	26.80	3.73	16.90	46.00
FFMI (OM) (kg/m^2)	17.51	2.72	7.62	25.93	19.49	1.97	7.62	25.93	15.29	1.41	12.91	21.56
PFFM (OM) (%)	72.03	10.34	32.00	94.60	77.79	8.60	32.00	94.60	65.65	8.13	40.60	89.00
Arterial structural parameters												
L-CCA DD (mm)	7.11	0.90	5.43	10.81	7.29	0.87	5.55	10.81	6.55	0.79	5.43	8.65
R-CCA DD (mm)	7.13	0.84	5.37	10.40	7.31	0.83	5.62	10.40	6.57	0.60	5.37	7.85
L-CFA DD (mm)	8.28	1.38	5.21	11.86	8.71	1.22	5.51	11.86	6.93	0.94	5.21	8.91
R-CFA DD (mm)	8.33	1.39	5.04	12.79	8.72	1.24	5.33	12.79	7.12	1.12	5.04	9.19
BA DD (mm)	4.20	0.71	2.67	5.72	4.39	0.64	2.67	5.72	3.50	0.46	2.90	4.38
Arterial functional parameters												
L-CCA IMT (mm)	0.72	0.20	0.29	1.24	0.75	0.20	0.29	1.24	0.65	0.19	0.41	1.17
R-CCA IMT (mm)	0.72	0.20	0.36	1.56	0.74	0.20	0.36	1.56	0.64	0.16	0.41	0.98
L-CCA EM (mmHg)	992	393	315	2,129	1,042	397	316	2,129	833	345	348	1,482
L- CCA Beta	9.93	3.72	3.51	21.87	10.37	3.83	3.51	21.87	8.56	3.05	4.36	14.07
R-CCA EM (mmHg)	943	387	279	2,291	984	379	397	2,291	815	390	279	1,632
R- CCA Beta	9.53	3.73	3.67	22.28	9.88	3.74	4.37	22.28	8.40	3.54	3.67	16.27
L-CFA EM (mmHg)	1,234	476	417	2,494	1,293	485	462	2,494	1,052	407	417	2,103
L- CFA Beta	12.61	4.64	4.41	27.16	13.07	4.78	4.41	27.16	11.18	3.93	5.68	19.69
R-CFA EM (mmHg)	1,215	502	416	2,990	1,263	516	458	2,990	1,066	434	416	2,181
R- CFA Beta	12.32	4.69	5.09	26.90	12.68	4.87	5.09	26.90	11.20	3.99	5.46	21.77
BA ME (mmHg)	1,471	827	346	3,792	1,592	833	408	3,792	1,025	641	346	2,902
BA Beta	14.96	8.15	3.75	40.36	16.02	8.20	4.93	40.36	11.05	6.85	3.75	30.86
cfPWV (m/s)	8.24	1.73	4.42	15.57	8.34	1.75	4.95	15.57	7.90	1.65	4.42	10.69
crPWV (m/s)	10.80	1.35	7.70	13.80	10.68	1.36	7.70	13.80	11.21	1.28	8.70	13.00
PWV Ratio	0.77	0.18	0.37	1.42	0.79	0.19	0.37	1.42	0.70	0.11	0.48	0.96

(Continued)

TABLE 1 | Continued

	All (n = 538)				Male (n = 286)				Female (n = 252)			
	MV	**SD**	**Min**	**Max**	**MV**	**SD**	**Min**	**Max**	**MV**	**SD**	**Min**	**Max**
Arterial blood pressure												
aoSBP (mmHg)	111	11	83	131	113	10	87	131	104	10	83	120
aoDBP (mmHg)	75	8	53	94	76	8	53	94	72	8	53	85
baSBP (mmHg)	125	11	102	152	127	11	102	152	119	9	102	138
baDBP (mmHg)	74	7	55	90	75	7	55	90	70	7	56	82

MV, mean value; SD, standard deviation; Min, Max., minimum and maximum; R, right; L, left; BMI, body mass index; HLD, hyperlipidemic; OM, Omron bioelectrical impedance device; PBF, body fat percentage; PMM, muscle mass percentage; BMR, basal metabolic rate; VFL, visceral fat level (30 levels); PFFM, fat-free mass percentage; FFMI, fat-free mass index; FMI, fat mass index; SBP, DBP, systolic and diastolic blood pressure (suffix: ao: aortic, ba: brachial artery); CCA, CFA, BA, common carotid, common femoral and brachial artery; DD, diastolic diameter. IMT, intima-media thickness; EM, elastic modulus; cfPWV, crPWV, carotid-femoral and carotid-radial pulse wave velocity.

and technical characteristics of both devices can be found in **Supplementary File 1**.

Cardiovascular Evaluation

All measurements were performed in a temperature-controlled environment (21–23°C), with the subject in supine position and after resting for at least 10–15 min. Cardiovascular evaluation in the CUiiDARTE project included assessing hemodynamic, structural, and functional parameters (21–27). In this study, we focused on central and peripheral BP levels, a beat-to-beat arterial diameter, intima-media thickness (IMT), and regional and local arterial stiffness indexes.

Peripheral and Central Blood Pressure

Using a validated oscillometric device (HEM-433INT; Omron Healthcare Inc., Lake Forest, IL, USA), heart rate and brachial systolic and diastolic BP (baSBP, baDBP) were recorded simultaneously and/or immediately before or after each non-invasive echographic, tonometric, and oscillometric record. Brachial mean BP (baMBP) was quantified as baDBP + (baSBP-baDBP)/3.

Systolic and diastolic aortic BPs (aoSBP, aoDBP) were non-invasively obtained by means of applanation tonometry [SphygmoCor-CvMS (SCOR), v.9, AtCor-Medical, Australia] (20, 22). Briefly, radial BP waveform was obtained by tonometry, and the aortic BP (aoBP) waveform was then derived indirectly from the calibration of the acquired radial waveforms and application of a general transfer function. Radial waveforms were calibrated with baDBP and baMBP (**Figure 1**).

Regional Arterial Stiffness and Central-to-Peripheral Stiffness Gradient

Carotid-femoral (cfPWV, a marker of aortic stiffness) and carotid-radial pulse wave velocity (crPWV, a marker of upper arm arteries stiffness) were obtained by tonometry (SCOR) (23, 28). cfPWV and crPWV were obtained as the median of three recordings. The pulse wave velocity (PWV) ratio (a marker of a central-peripheral stiffness gradient) was quantified: cfPWV/crPWV (23, 29, 30) (**Figure 1**).

Local Arterial Stiffness, Diameter, and Intima-Media Thickness

Left (L-) and right (R-) common carotid arteries (CCA), common femoral artery (CFA), and left brachial artery (BA) were analyzed using ultrasound (6–13 MHz, M-Turbo, Sonosite Inc., WA, USA). Sequences of images (30 s, B-Mode, longitudinal views) were stored for off-line analysis. A beat-to-beat diameter and IMT waves were obtained using border detection software (HemoDyn 4-M, Dinap s.r.l., Bs.As., Argentina). Peak systolic (SysD) and end-diastolic (DD) diameters and IMT (far wall, end diastole) values were obtained by averaging at least 20 beats. The CCA diameter and IMT were measured a centimeter proximal to the carotid bulb. The CFA diameter was measured in the penultimate centimeter proximal to the bifurcation. BA measurements were acquired at the elbow level in a straight segment of at least one-centimeter long (26) (**Figure 1**).

Local arterial stiffness was quantified by the elastic modulus (EM) and the beta index (β). The EM measures the ability of the artery to change its dimensions in response to the BP caused by cardiac ejection [BP change required for (theoretic) 100% increase in diameter]: EM = (SBP-DBP)/(SysD-DD)/DD). To minimize the impact that BP levels have on stiffness, the β was quantified: β = Ln (SBP/DBP)/[(SysD-DD)/DD]. The baSBP and baDBP were used to quantify CFA and BA EMs and βs; aoSBP and aoDBP were used to quantify CCA EM and β (**Figure 1**).

Data Analysis

Standardized Cardiovascular Variables (z-Scores)

Considering specific inclusion and exclusion criteria, the subjects to be included in the reference group were identified to get standardized cardiovascular variables expressed as z-scores (**Supplementary File 2**: **Table S1**). As in previous works, the reference group was determined by selecting a healthy sub-population from the CUiiDARTE database (n = 1,688) that included children, adolescents, and adults who did not meet any of the following exclusion criteria: (i) history of cardiovascular disease; (ii) use of BP-, lipid- or glucose-lowering drugs; (iii) arterial hypertension (≥18 y: baSBP ≥140 mmHg or baDBP ≥90 mmHg; <18 y: baSBP and baDBP >95th percentile for sex, age, and BH); (iv) current smoking; (v) diabetes, defined as self-reported or fasting plasma glucose ≥126 mg/dL (if available); (vi) dyslipidemia, defined as self-reported or total cholesterol ≥ 240 mg/dL or HDL cholesterol <40 mg/dL (if available); (vii) obesity (≥18 y: BMI ≥30 kg/m2; < 18 y: z-BMI ≥2.0) (23–25). None of the subjects had congenital or chronic conditions, infectious diseases, or significant cardiac arrhythmias.

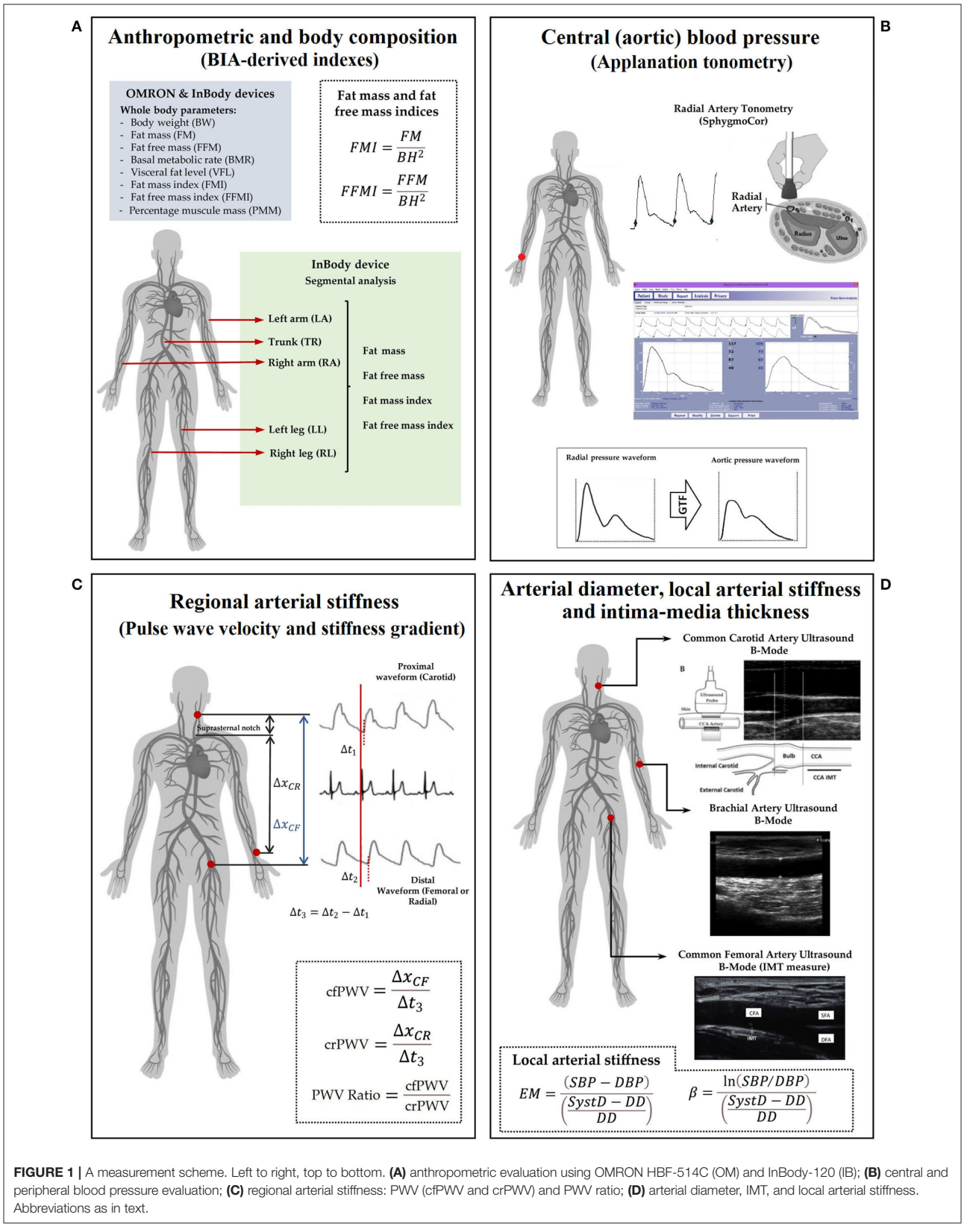

FIGURE 1 | A measurement scheme. Left to right, top to bottom. **(A)** anthropometric evaluation using OMRON HBF-514C (OM) and InBody-120 (IB); **(B)** central and peripheral blood pressure evaluation; **(C)** regional arterial stiffness: PWV (cfPWV and crPWV) and PWV ratio; **(D)** arterial diameter, IMT, and local arterial stiffness. Abbreviations as in text.

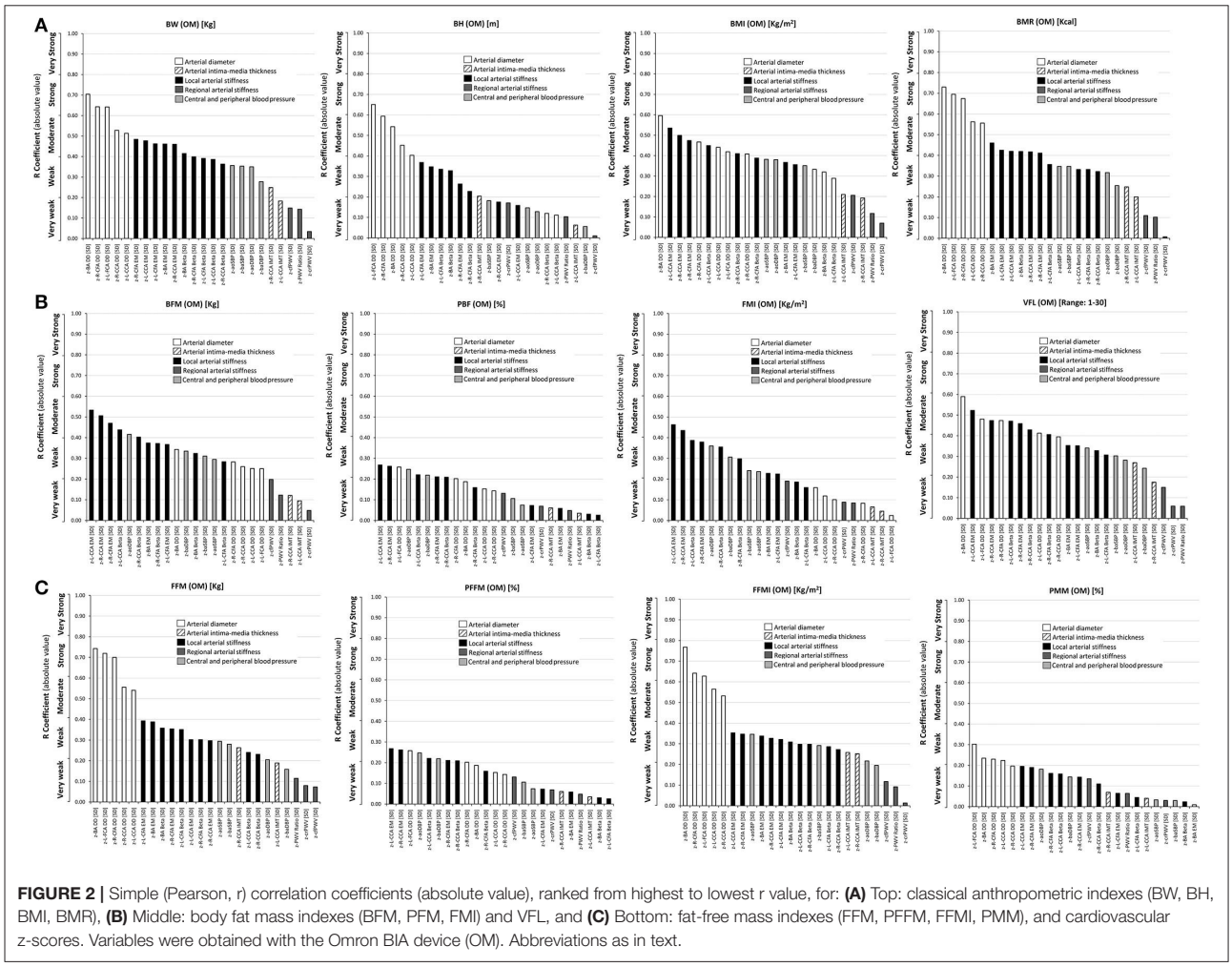

FIGURE 2 | Simple (Pearson, r) correlation coefficients (absolute value), ranked from highest to lowest r value, for: **(A)** Top: classical anthropometric indexes (BW, BH, BMI, BMR), **(B)** Middle: body fat mass indexes (BFM, PFM, FMI) and VFL, and **(C)** Bottom: fat-free mass indexes (FFM, PFFM, FFMI, PMM), and cardiovascular z-scores. Variables were obtained with the Omron BIA device (OM). Abbreviations as in text.

Once the reference group was built, age-related equations were obtained for mean value (MV) and standard deviation (SD). To this end, we implemented parametric regression methods based on various types of models (fractional polynomials, polynomial, ratios of polynomials) (23–25, 31, 32).

Figure S1, in **Supplementary File 3**, exemplifies (for a baSBP variable) the fractional polynomial models used to obtain these equations. This procedure provides different age-related equations for each model to calculate z-scores, and then the most adjusted model is chosen to calculate an individual's cardiovascular z-scores (**Supplementary File 2**: **Table S2**). Subsequently, by using these equations, we were able to quantify the z-score levels of each arterial variable in the subjects who had BIA-derived measurements (**Supplementary File 2**: **Tables S3, S6**; **Supplementary File 3**: **Figure S1**).

Mono-Segmental BIA-Derived Body Composition Indexes: Correlation and Regression Models

Two-tailed simple bivariate correlations were performed to quantify the strength of association between exposure to CRFs and classical anthropometric and mono-segmental BIA-derived indexes, and cardiovascular z-scores (**Figures 2**, **3**; **Supplementary File 2**: **Table S4**). Multiple linear regression models (Input: stepwise) were constructed, considering the cardiovascular z-scores as dependent variables and CRFs, classical anthropometric and mono-segmental BIA-derived indexes as independent variables (**Table 2**). In addition, by using: (i) multiple linear regression-derived non-standardized B coefficients, (ii) MV and SD data (the reference group), and (iii) the minimum and maximum values (range) of each mono-segmental BIA-derived indexes, it was possible to quantify for each arterial variable (in the respective units): (i) the maximum variation that could be associated (attributed) to the different values obtained on body composition indexes and (ii) the variations that could be (theoretically) expected, considering the inter-individual variations on BIA-derived body composition indexes (**Table 3**, **Figure 4**).

Agreement Between Mono-and Multi-Segmental BIA Devices

Lin's concordance correlation coefficient and Bland-Altman tests were performed to evaluate the agreement between BIA

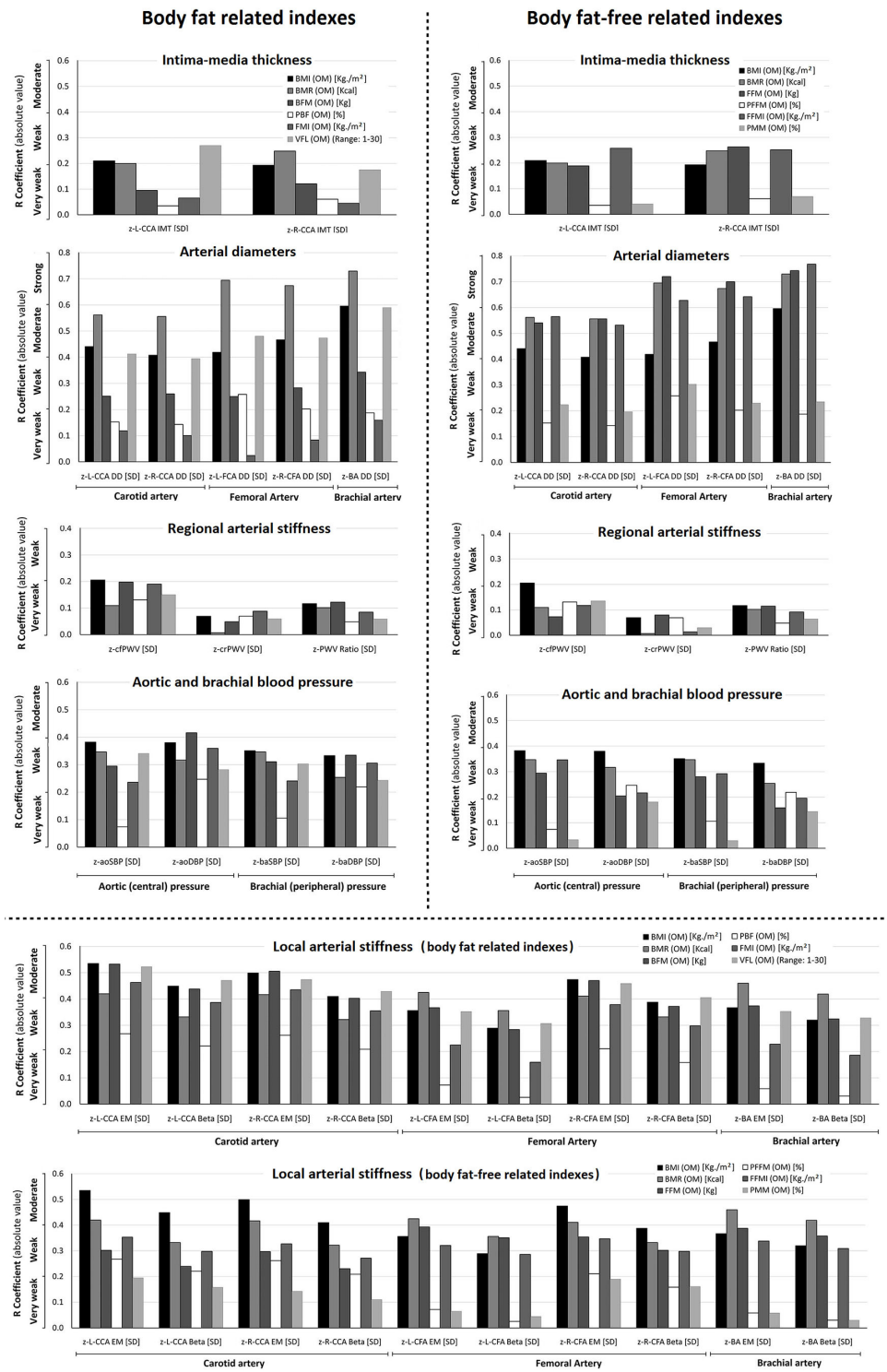

FIGURE 3 | Comparison of the levels of association (r, absolute value) between cardiovascular z-scores and classical anthropometric (BMI, BMR) vs. fat mass indexes (BFM, PBF, FMI, VFL), and classical anthropometric (BMI, BMR) vs. fat-free mass indexes (FFM, PFFM, FFMI, PMM). The variables were obtained with the Omron BIA device (OM). Abbreviations as in text.

TABLE 2 | Association between cardiovascular z-scores (dependent variable) and cardiovascular risk factors, classical anthropometric and body composition indices (independent variables) (OMRON HBF-514C device).

Dependent variable	Independent variables	Bu	SE	95% CILL	95% CIUL	Bs	*p*	VIF	*R*	R^2	Adj R^2
Arterial structural parameters											
z-L-CCA DD (SD)	Constant	−2.331	0.397	−3.112	−1.550		<0.001		0.51	0.26	0.25
	FFMI (OM) (kg/m^2)	0.159	0.025	0.109	0.209	0.422	<0.001	2.16			
	Age (years)	−0.014	0.003	−0.021	−0.008	−0.265	<0.001	1.91			
	Diabetes	0.879	0.299	0.292	1.467	0.140	0.003	1.08			
	VFL (OM)	0.037	0.017	0.003	0.071	0.174	0.035	3.23			
z-R-CCA DD (SD)	Constant	−2.890	0.340	−3.558	−2.221		<0.001		0.43	0.18	0.18
	FFMI (OM) (kg/m^2)	0.172	0.019	0.135	0.210	0.435	<0.001	1.00			
z-L-FCA DD (SD)	Constant	−1.217	0.604	−2.407	−0.027		0.045		0.69	0.48	0.47
	Sex (1:Female; 0:Male)	−0.863	0.171	−1.201	−0.525	−0.443	<0.001	3.54			
	History of CVD	−0.586	0.265	−1.108	−0.064	−0.108	0.028	1.09			
	FFMI (OM) (kg/m^2)	0.108	0.032	0.045	0.171	0.318	0.001	4.11			
	Age (years)	−0.006	0.003	−0.012	−0.001	−0.130	0.021	1.44			
z-R-CFA DD (SD)	Constant	−2.110	0.647	−3.384	−0.836		0.001		0.66	0.44	0.44
	FFMI (OM) (kg/m^2)	0.141	0.032	0.078	0.204	0.374	<0.001	3.12			
	Sex (1:Female; 0:Male)	−0.695	0.182	−1.053	−0.337	−0.325	<0.001	3.12			
z-BA DD (SD)	Constant	−4.720	0.373	−5.457	−3.984		<0.001		0.72	0.52	0.52
	FFMI (OM) (kg/m^2)	0.258	0.020	0.219	0.296	0.727	<0.001	1.00			
z-L-CCA IMT (SD)	Constant	−1.002	0.361	−1.711	−0.292		0.006		0.22	0.05	0.04
	FFMI (OM) (kg/m^2)	0.069	0.020	0.029	0.109	0.181	0.001	1.04			
	Diabetes	0.678	0.337	0.016	1.340	0.107	0.045	1.04			
z-R-CCA IMT (SD)	Constant	−1.565	0.431	−2.413	−0.717		<0.001		0.34	0.12	0.11
	FFMI (OM) (kg/m^2)	0.102	0.024	0.055	0.150	0.217	<0.001	1.04			
	Diabetes	1.395	0.400	0.608	2.182	0.179	0.001	1.04			
	Family History CVD	0.689	0.223	0.250	1.129	0.155	0.002	1.00			
Arterial functional parameters											
z-L-CCA EM (SD)	Constant	−2.995	0.422	−3.824	−2.165		<0.001		0.39	0.15	0.14
	BMI (OM) (kg/m^2)	0.086	0.011	0.064	0.107	0.412	<0.001	1.13			
	PMM (OM) (%)	0.029	0.007	0.014	0.043	0.204	<0.001	1.13			
z-L-CCA Beta (SD)	Constant	−2.505	0.419	−3.329	−1.680		<0.001		0.3	0.10	0.09
	FMI (OM) (kg/m^2)	0.105	0.018	0.069	0.141	0.430	<0.001	2.18			
	PMM (OM) (%)	0.054	0.009	0.035	0.072	0.425	<0.001	2.18			
z-R-CCA EM (SD)	Constant	−0.917	0.148	−1.208	−0.626		<0.001		0.50	0.25	0.24
	VFL (OM)	0.086	0.013	0.060	0.113	0.422	<0.001	1.02			
	Diabetes	0.847	0.311	0.232	1.461	0.177	0.007	1.03			
	Family History CVD	0.477	0.203	0.076	0.878	0.151	0.020	1.00			
z-R-CCA Beta (SD)	Constant	−0.929	0.148	−1.221	−0.637		<0.001		0.43	0.18	0.17
	VFL (OM)	0.079	0.013	0.053	0.105	0.404	<0.001	1.00			
	Family History CVD	0.462	0.204	0.060	0.864	0.152	0.025	1.00			
z-L-CFA EM (SD)	Constant	−0.942	0.424	−1.777	−0.106		0.027		0.18	0.03	0.03
	FFMI (OM) (kg/m^2)	0.067	0.023	0.021	0.113	0.184	0.004	1.00			
z-L-CFA Beta (SD)	No variables were entered into the equation.										
z-R-CFA EM (SD)	Constant	−0.697	0.448	−1.579	0.185		0.121		0.23	0.05	0.04
	Hypertension	0.405	0.175	0.060	0.751	0.155	0.022	1.14			
	FFMI (OM) (kg/m^2)	0.050	0.025	0.000	0.099	0.133	0.050	1.14			
z-R-CFA Beta (SD)	Constant	0.158	0.069	0.023	0.293		0.022		0.14	0.02	0.01
	Hypertension	0.332	0.151	0.034	0.630	0.141	0.029	1.00			
z-BA EM (SD)	Constant	−1.898	0.835	−3.552	−0.244		0.025		0.36	0.13	0.11
	FFMI (OM) (kg/m^2)	0.153	0.041	0.072	0.234	0.330	<0.001	1.03			
	Age (years)	−0.019	0.008	−0.035	−0.003	−0.212	0.018	1.03			

(Continued)

TABLE 2 | Continued

Dependent variable	Independent variables	Bu	SE	95% CILL	95% CIUL	Bs	*p*	VIF	*R*	R^2	Adj R^2
z-BA Beta (SD)	Constant	−2.068	0.728	−3.510	−0.626		0.005		0.24	0.06	0.05
	FFMI (OM) (kg/m^2)	0.104	0.037	0.030	0.178	0.249	0.006	1.00			
z-cfPWV (SD)	Constant	0.056	0.063	−0.067	0.180		0.370		0.24	0.06	0.05
	Diabetes	1.097	0.341	0.427	1.767	0.168	0.001	1.03			
	Hypertension	0.430	0.156	0.123	0.738	0.144	0.006	1.03			
z-crPWV (SD)	No variables were entered into the equation										
z-PWV Ratio (SD)	No variables were entered into the equation										
Arterial Blood Pressure											
z-aoSBP (SD)	Constant	−2.444	0.351	−3.135	−1.753		<0.001		0.37	0.14	0.13
	FFMI (OM) (kg/m^2)	0.107	0.025	0.058	0.155	0.273	<0.001	1.65			
	BMI (OM) (kg/m^2)	0.031	0.014	0.004	0.059	0.140	0.027	1.65			
z-aoDBP (SD)	Constant	0.579	0.251	0.085	1.073		0.022		0.47	0.22	0.21
	VFL (OM)	0.055	0.011	0.033	0.077	0.261	<0.001	1.29			
	PMM (OM) (%)	−0.030	0.007	−0.043	−0.016	−0.202	<0.001	1.02			
	Diabetes	0.993	0.295	0.413	1.573	0.163	0.001	1.07			
	History of CVD	−0.845	0.331	−1.496	−0.195	−0.126	0.011	1.11			
	Hypertension	0.323	0.152	0.024	0.622	0.116	0.035	1.35			
z-baSBP (SD)	Constant	−2.456	0.584	−3.609	−1.302		<0.001		0.37	0.13	0.13
	BMI (OM) (kg/m^2)	0.103	0.021	0.061	0.144	0.373	<0.001	1.00			
z-baDBP (SD)	Constant	−2.036	0.591	−3.204	−0.867		0.001		0.32	0.10	0.10
	BMI (OM) (kg/m^2)	0.090	0.021	0.048	0.132	0.328	<0.001	1.00			

Bu y Bs: un- and standardized coefficients. R, Pearson coefficient; R^2, adjusted squared R; VIF, variance inflation factor (a VIF <5 was defined to evaluate (discard) multicollinearity). SE, standard error; LL, UL, lower and upper limits; CI, confidence interval; z: z-score. BW and BH, bodyweight and height; BMI, body mass index; OM, Omron bioelectrical impedance analysis device; PBF, body fat percentage; PMM, muscle mass percentage; VFL, visceral fat level; PFFM, fat-free mass percentage; FFMI, fat-free mass index; FMI, fat mass index; R, right. L, left; SBP, DBP, systolic and diastolic pressure (suffix: ao: aortic, ba: brachial artery). CCA, CFA, BA; common carotid, common femoral, and brachial artery; DD, diastolic diameter; IMT, intima-media thickness; EM, elastic modulus; cfPWV, crPWV, carotid-femoral and carotid-radial pulse wave velocity; PWV ratio, cfPWV/crPWV ratio; SD, standard deviation; CVD, cardiovascular disease. All anthropometric variables were included in the multiple linear regression. For diabetes, history of CVD, family history of CVD, hypertension: 1: Yes and 0: No. Only significant ($p < 0.05$) independent variables entered in the models (Stepwise) are shown.

devices (**Supplementary File 2**: **Table S7**; **Supplementary File 3**: **Figure S2**). Bland-Altman plots correspond to the mean of the methods considered (x-axis) against their difference (y-axis). Systematic error (bias) was considered present if mean error was significantly different from 0, whereas proportional error was considered present if the slope of the linear regression was statistically significant. Descriptive statistics obtained for the participants evaluated with multi-frequency BIA device (InBody-120) is shown in **Supplementary File 2**: **Table S5**.

Multi-Segmental BIA-Derived Body Composition Indexes: Correlation and Regression Models

Finally, using the information from the multi-segmental BIA device, an analysis similar to the one previously reported was performed. Correlation analyses were implemented to quantify the association between CRFs, classical anthropometric indexes, and multi-segmental BIA-derived indexes obtained for "total body," "trunk," "upper limb," and "lower limb" segments and cardiovascular z-scores (**Supplementary File 2**: **Table S8**; **Supplementary File 3**: **Figures S3–S8**).

Statistical Analysis

According to the central limit theorem, a normal distribution was considered (taking into account Kurtosis and Skewness coefficients distribution and number of studied subjects; sample size >30) (33). The number of the subjects included was much higher than the minimum required sample size, both to construct the reference group to obtain the MV and SD equations (included: 1,688, minimum required sample size: 377), and to perform the agreement and/or association analyses (included: 538 for OM and 110 for IB, a minimum required sample size: 103). Consequently, the number of the subjects studied was higher than the minimum number calculated for: $\alpha = 0.05$, $\beta = 0.20$, anticipated effect size = 0.15 (medium), and a total number of predictors in the multiple linear regression model = 7.

Even in this conservative context, when making associations, we performed Bootstrapping of the samples as a strategy to evaluate whether potential associations observed between cardiovascular z-scores and body composition indexes do maintain even after analyzing different random sampling settings (resampling with replacement from the original sample). In other words, with this mechanism, any initial $p < 0.05$ may no longer be significant after the "fictional random re-sampling" (i.e., bootstrapping). This type of test obligates the investigators to consider only those significant p values that replicate in both statistical scenarios (the actual sample and bootstrapping sampling). To this end, Bootstrap-derived 95% confidence intervals (1,000 samples) were obtained, applying bias-corrected

TABLE 3 | Impact of interindividual variations of body composition indices (independent variables) on cardiovascular properties (dependent variables) (OMRON HBF-514C device).

Dependent variable					Cardiovascular differences attributable to FFMI variations					
Cardiovascular variable	**Age (y)**	**MV (RG)**	**SD RG)**	**Bu**	**5 units**	**10 units**	**15 units**	**20 units**	**Δ (Max-Min)**	**Δ%**
Fat-free Mass Index (FFMI) (kg/m2)[MV: 17.51; SD: 2.72; Range: 7.62 - 25.93]										
L-CCA DD (mm)	10	4.71	0.52	0.16	0.41	0.83	1.24	1.65	1.51	32.05
	30	6.34	0.50		0.40	0.80	1.19	1.59	1.46	22.98
	50	6.72	0.66		0.52	1.04	1.57	2.09	1.91	28.42
	70	7.04	0.65		0.52	1.04	1.56	2.08	1.90	27.07
R-CCA DD (mm)	10	5.77	0.50	0.17	0.43	0.86	1.29	1.72	1.58	27.31
	30	6.45	0.51		0.44	0.88	1.32	1.76	1.61	24.94
	50	6.81	0.64		0.55	1.11	1.66	2.22	2.03	29.80
	70	7.19	0.63		0.54	1.08	1.62	2.15	1.97	27.43
L-FCA DD (mm)	10	5.51	0.68	0.11	0.37	0.73	1.10	1.47	1.34	24.42
	30	7.75	1.13		0.61	1.22	1.83	2.44	2.23	28.82
	50	8.33	1.47		0.79	1.59	2.38	3.18	2.91	34.92
	70	8.59	1.38		0.74	1.49	2.23	2.98	2.72	31.70
R-CFA DD (mm)	10	5.53	0.68	0.14	0.48	0.96	1.45	1.93	1.76	31.87
	30	7.77	1.07		0.75	1.50	2.25	3.00	2.74	35.30
	50	8.32	1.34		0.94	1.88	2.82	3.76	3.44	41.37
	70	8.33	1.35		0.95	1.90	2.85	3.80	3.48	41.74
BA DD (mm)	10	2.71	0.35	0.26	0.45	0.90	1.35	1.80	1.65	60.77
	30	3.70	0.62		0.80	1.60	2.40	3.20	2.93	79.08
	50	4.08	0.78		1.01	2.02	3.03	4.03	3.69	90.39
	70	4.21	0.64		0.82	1.65	2.47	3.30	3.02	71.61
L-CCA IMT (mm)	10	0.43	0.05	0.07	0.02	0.03	0.05	0.07	0.06	14.2
	30	0.55	0.08		0.03	0.06	0.09	0.12	0.11	19.3
	50	0.69	0.10		0.03	0.07	0.10	0.13	0.12	17.8
	70	0.85	0.19		0.06	0.13	0.19	0.26	0.24	27.8
R-CCA IMT (mm)	10	0.44	0.04	0.10	0.02	0.04	0.06	0.08	0.07	16.69
	30	0.54	0.10		0.05	0.10	0.15	0.19	0.18	32.74
	50	0.67	0.08		0.04	0.09	0.13	0.17	0.16	23.67
	70	0.83	0.15		0.08	0.16	0.23	0.31	0.29	34.24
L-CCA Beta	10	4.71	1.83	0.10	0.96	1.92	2.88	3.84	3.51	74.49
	30	7.19	1.90		0.99	1.99	2.98	3.98	3.64	50.64
	50	9.57	2.59		1.36	2.71	4.07	5.42	4.96	51.85
	70	11.79	4.01		2.10	4.20	6.30	8.40	7.68	65.14
z-L-CFA EM (mmHg)	10	829	339	0.07	114	227	341	454	416	50.14
	30	1,235	617		207	413	620	826	756	61.22
	50	1,243	579		194	388	581	775	709	57.09
	70	1,128	529		177	354	531	708	648	57.43
R-CFA EM (mmHg)	10	823	315	0.05	78	156	234	313	286	34
	30	1,185	520		129	258	387	516	472	39
	50	1,116	453		112	225	337	450	411	36
	70	919	329		81	163	245	326	298	32
BA EM (mmHg)	10	943	502	0.15	385	770	1,154	1,539	1,384	147
	30	1,265	690		529	1,059	1,560	2,080	1,904	151
	50	1,385	696		534	1,067	15,73	2,097	1,919	139
	70	1,475	733		562	1,125	1,657	2,210	2,022	137
aoSBP (mmHg)	10	91.7	8.31	0.11	4.4	8.8	13.2	17.7	16.2	17.6
	30	106.1	10.1		5.3	10.7	16.0	21.4	19.6	18.4
	50	109.6	9.3		4.9	9.9	14.8	19.8	18.1	16.5
	70	111.1	11.1		5.9	11.8	17.8	23.7	21.7	19.5

(Continued)

TABLE 3 | Continued

Dependent variable					Cardiovascular differences attributable to FFMI variations					
Cardiovascular variable	**Age (y)**	**MV (RG)**	**SD RG)**	**Bu**	**5 units**	**10 units**	**15 units**	**20 units**	**Δ (Max-Min)**	**Δ%**
Muscle Mass Percentage (PMM) (%)(MV: 32.32; SD: 7.12; Range: 16.9 - 49.2%)										
z-L-CCA EM (mmHg)	10	386	155	0.03	22	44	67	89	143	37
	30	676	179		26	52	77	103	166	25
	50	935	272		39	78	117	156	252	27
	70	1,143	395		57	113	170	227	366	32
z-L-CCA beta (SD)	10	4.71	1.83	0.05	0.49	0.99	1.48	1.97	3.18	68
	30	7.19	1.90		0.51	1.02	1.53	2.04	3.30	46
	50	9.57	2.59		0.70	1.39	2.09	2.79	4.50	47
	70	11.79	4.01		1.08	2.16	3.24	4.31	6.97	59
aoDBP (mmHg)	10	62.1	8.2	−0.03	−1.2	−2.4	−.6	−4.8	−7.8	−12.7
	30	71.1	8.7		−1.2	−2.5	−3.8	−5.1	−8.3	−11.7
	50	75.0	7.5		−1.1	−2.2	−3.3	−4.4	−7.2	−9.6
	70	73.9	7.2		−1.0	−2.1	−3.2	−4.2	−6.9	−9.4
Dependent variable					**Cardiovascular differences attributable to FFMI variations**					
Cardiovascular Variable	**Age (y)**	**MV (RG)**	**SD RG)**	**Bu**	**5 units**	**10 units**	**15 units**	**20 units**	**Δ (Max-Min)**	**Δ%**
Visceral Fat Level (VFL) (MV: 7.18; SD: 4.94; Range: 1-27)										
L-CCA DD (mm)	10	4.71	0.52	0.04	0.09	0.19	0.28	0.38	0.49	10.46
	30	6.34	0.50		0.09	0.18	0.27	0.37	0.48	7.50
	50	6.72	0.66		0.12	0.24	0.36	0.48	0.62	9.27
	70	7.04	0.65		0.12	0.24	0.36	0.48	0.62	8.83
R-CCA EM (mmHg)	10	399	121	0.09	52	104	157	209	271	68
	30	661	166		72	143	215	286	372	56
	50	875	267		115	231	346	461	599	69
	70	1,060	368		159	317	476	635	825	78
z-R-CCA Beta	10	4.91	1.39	0.08	0.55	1.11	1.66	2.21	2.88	58.59
	30	7.06	1.77		0.70	1.40	2.10	2.81	3.65	51.68
	50	9.01	2.62		1.04	2.08	3.12	4.16	5.41	60.04
	70	10.93	3.15		1.25	2.50	3.75	5.00	6.50	59.51
aoDBP (mmHg)	10	62.2	8.2	0.05	2.2	4.5	6.7	9.0	11.7	18.8
	30	71.1	8.7		2.4	4.8	7.1	9.5	12.4	17.4
	50	75.1	7.5		2.1	4.1	6.2	8.2	10.7	14.3
	70	74.0	7.2		2.0	4.0	5.9	7.9	10.3	13.9

*RG, reference group; MV, mean value; SD, standard deviation; CV, cardiovascular; Bu, beta un-standardized; Min, Max, minimum and maximum; R, right; L, left; SBP, DBP, systolic and diastolic pressure (suffix: ao: aortic, ba: brachial artery); CCA, CFA, BA, common carotid, common femoral, and brachial artery. DD; diastolic diameter. IMT, intima-media thickness;. EM, elastic modulus. "Δ (Max-Min)" is expressed as absolute value. Δ% was quantified as: [(Max-Min)/MV]*100.*

and accelerated methods for computing confidence interval limits [lower and upper limits (LL and UL, respectively)]. The association was considered significant only if the 95% confidence interval of Pearson's coefficient, quantified by bootstrapping, did not contain the 0 value.

Evans's empirical classifications of interpreting correlation strength by using r were applied: $r < 0.20$, very weak; r: 0.20–0.39, weak; r: 0.40–0.59, moderate; r: 0.60–0.79, strong; $r \geq 0.80$, very strong (34). Analyses were done using SPSS (IBM-SPSS Inc., Chicago, IL, USA), MedCalc (MedCalc Inc., Ostend, Belgium) and NCSS 2020 (NCSS, Kaysville, UT; www.NCSS.com) software. A $p < 0.05$ was considered statistically significant.

RESULTS

The subjects' characteristics evaluated with mono-segmental BIA are shown in **Table 1**. There was a balanced distribution of sex (47% female), and a wide age range (7–85 years). The levels of CRFs exposure and drug use were similar to general population. There was a wide range of variation in fat mass and fat-free mass indexes. Inter-individual variations in fat mass indexes were for PBF (5.4–68.0%), FMI (0.9–28.6 kg/m^2), VFL (1–27, scale between 1 and 30 levels), while, in fat-free mass, indexes were for PMM% (16.9–49.2%), FFMI (7.6–25.9 kg/m^2), and PFFM (32.−94.6%).

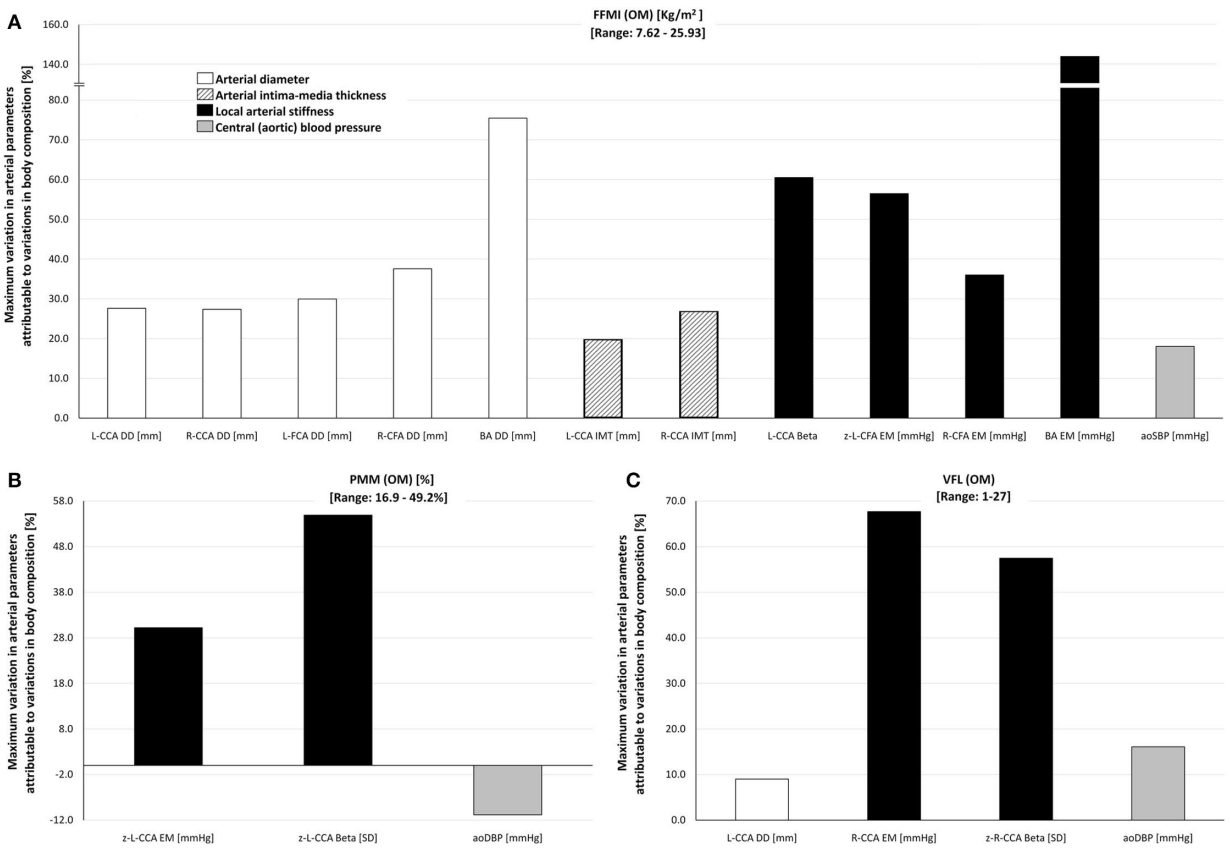

FIGURE 4 | Maximum percentage of variation of cardiovascular variables attributable to inter-individual variations in **(A)** FFMI (range: 7.62–25.95 kg/m^2), **(B)** PMM (range: 16.9–49.2%), and **(C)** VFL (range: 1–27) in the study group (n = 538), obtained by the Omron BIA device (OM). For detailed information, see **Table 3**. Abbreviations as in text.

Additionally, there was a wide inter-individual variation in arterial properties. For instance, while certain subjects presented z-scores lower than −2, others had values higher than +2, or even than +4 (**Supplementary File 2**: **Tables S3, S6**; **Supplementary File 3**: **Figure S1**).

Classical Anthropometric, Body and Visceral Fat, and Fat-Free Mass Indexes (Mono-Segmental BIA-Derived): Association With Arterial Variations (Aim 1)

When comparing classical indexes (BW, BH, BMI, and BMR), those that showed the greatest association with cardiovascular z-scores varied, depending on the arterial parameter and segment, although BH never showed the greatest association with any of the arterial parameters. For BMR, the highest levels of association were obtained for CCA and CFA z-diameters (r: 0.56–0.73), z-R-CCA IMT (r: 0.25) and BA stiffness (r: 0.42–0.46). BMI showed the highest levels of association with z-L-IMT (r: 0.25), CCA stiffness (r: 0.41–0.55), and z-cfPWV (r: 0.21), whereas BW showed the highest level of association with CFA and BA z-stiffness (r: 0.39–0.48), the z-PWV ratio (r: 0.14), and z-baSBP (r: 0.35). Therefore, except for BH, classical indexes had heterogeneous levels of association with arterial z-scores, but never these correlations reached strong association values (**Figure 2**, **Supplementary File 2**: **Table S4**).

Body weight, BMR, and BH showed the highest levels of association with z-diameters, followed by z-local stiffness. BMI showed a heterogeneous distribution, showing different levels of association between z-diameters and z-local stiffness. Regarding regional z-stiffness, the four indexes showed a "very weak" association (the lowest levels observed). Regardless of the classical index evaluated, from highest to lowest, a hierarchical order in the levels of association was observed: diameters or local stiffness > BP (aortic, brachial) > regional stiffness (**Figure 2**, **Supplementary File 2**: **Table S4**).

In general, higher mono-segmental BIA-derived fat mass indexes (i.e., BFM, PBF, FMI, VFL) were associated with (i) higher z-carotid, femoral and brachial local stiffness, and (ii) higher z-aoBP and z-baBP. BFM, FMI, and mainly VFL showed "moderate" levels of associations (r: 0.40–0.60) with cardiovascular z-scores, whereas the lowest levels were obtained for PBF ($r < 0.3$). Furthermore, z-arterial diameters and z-BP were mainly associated with VFL, FMI, and BFM, respectively.

VFL showed the greatest value of association with cardiovascular z-scores (**Figure 2**, **Supplementary File 2**: **Table S4**).

Considering each index individually, both BFM and FMI showed the highest levels of association with z-local stiffness, and only weak associations with z-diameters, whereas the VFL showed strong associations with both z-local stiffness and z-diameters (**Figure 2**, **Supplementary File 2**: **Table S4**). The levels of association with z-regional stiffness were very low. Additionally, considering the body fat mass indexes (BFM and FMI, except for visceral fat), there was the following hierarchical order in associations: local arterial stiffness > BP (aortic, brachial) > arterial diameters > CCA IMT and regional arterial stiffness (**Figure 2**). When considering visceral fat, the following order was shown: diameters and local stiffness > BP > CCA IMT and regional stiffness.

Higher fat-free mass indexes (especially FFM and FFMI) were associated with higher: (i) CCA, CFA, and BA z-diameter, (ii) CCA, CFA, and BA z-stiffness, and (iii) z-BP (aortic, brachial). Like fat mass indexes, the fat-free indexes showed a "very weak" level of association with z-regional stiffness. Both PFFM and PMM reported the lowest levels of association with cardiovascular z-scores ($r < 0.4$). The FFMI, followed by FFM, showed the highest number of associations with cardiovascular z-scores. Both indexes showed (i) "moderate" and "strong" association with z-diameters, followed by (ii) "weak or moderate" association with z-local stiffness. Unlike fat mass indexes, FFM and FFMI showed a marked difference between the levels of association with z-diameters and z-local stiffness (**Figure 2**, **Supplementary File 2**: **Table S4**).

The joint association analysis of fat (BFM, FMI, VFL) and fat-free mass indexes (FFM and FFMI) with cardiovascular z-scores showed that all significant associations were positive; besides, a higher index was associated with a higher cardiovascular z-score (**Supplementary File 2**: **Table S4**).

Comparative Analysis of Classical, Body, and Visceral Fat, and Fat-Free Mass Indexes (Mono-Segmental BIA-Derived) as Explanatory Variables of Arterial Variations (Aim 2)

Bivariate Analysis

The analysis of z-local stiffness was characterized by relatively strong associations with BMI and BMR, in which neither of the indexes of fat mass (especially VFL) nor fat-free mass exceeded these levels of association. Regarding regional stiffness, the associations with fat and fat-free mass indexes were comparatively "very weak," being these values lower than BMI and BMR (**Figure 3**, **Supplementary File 2**: **Table S4**).

Association analyses between z-structural and fat-free mass indexes suggest that FFM and FFMI showed at least a stronger association than BMI and BMR. Conversely, although VFL showed the highest "r" value (a moderate level), BMI and BMR showed stronger associations with z-diameters (**Figure 3**, **Supplementary File 2**: **Table S4**). The associations between fat and fat-free mass indexes and z-IMT were very weak. Same weak associations were observed when considering BMI and BMR.

We found less or similar levels of association between fat and fat-free mass indexes (compared to BMI and BMR) with respect to z-BP (aortic, brachial) (**Figure 3**, **Supplementary File 2**: **Table S4**).

Multivariate Analyses

In general terms, regardless of age, sex, CRFs, and classical anthropometric indexes, variations in cardiovascular z-scores can be explained by variations in FFMI, VFL, and PMM (**Table 2**).

The z-structural variations (diameters, IMT) were mainly explained by variations in FFMI, regardless of the histological type of artery (**Table 2**). Always, (i) higher FFMI was associated with higher arterial z-structure, and, generally, (ii) FFMI was the explanatory variable with the highest relative weight [greatest explanatory ability evidenced by the B standardized (Bs) level]. Classical anthropometric indexes were not included in the explanatory z-structural models.

Variations in z-local stiffness were explained (i) by FMI (considering CFA and BA) and (ii) by PMM and VFL (considering CCA). With exception of left z-CCA EM, the BMR, BMI, BW, and BH were not included in local stiffness models. Variations in z-regional stiffness were not explained by anthropometric or body composition indexes (**Table 2**).

Considering aoBP and baBP, the z-BP-related parameters showed meaningful differences. Accordingly, variations in z-aoSBP were mainly explained by FFMI, but also by BMI. Variations in z-aoDBP were explained by VFL and PMM, while z-baBP was explained only by variations in BMI.

Effect Size Analyses: Maximal Inter-Individual Arterial Variations Explained by Mono-Segmental BIA-Derived Body Composition Indexes (Aim 3)

Table 3 shows cardiovascular variations, which could be explained (regardless of other cofactors) by variations in 5, 10, 15, and 20 units of: (i) FFMI, (ii) PMM, and (iii) VFL. The expected variations are presented according to different ages (10, 30, 50, 70 years). Also, **Table 3** shows the maximum cardiovascular variation (absolute and relative) that could be explained by variations in FFMI, PMM, or VFL. **Figure 4** summarizes these findings.

Variations in FFMI explain variations in arterial diameters. Their absolute levels (in mm) gradually increased when considering CCA, CFA, and BA (1.5–2.0, 1.5–3.8, and 1.8–4.0 mm, respectively). Additionally, FFMI levels explain absolute variations of 0.1 to 0.3 mm in CCA IMT (**Table 3**). In relative terms, FFMI variations are able to explain variations in CCA, CFA, and BA diameters (30, 40, and 75%, respectively) and IMT (20–30%).

Besides, FFMI-related variations in local stiffness were different between arterial segments. FFMI-associated variations in CCA and CFA EMs reached levels of 30–60%, while, in BA, EM reached maximum levels of 130–150% (**Figure 4**, **Table 3**). This seems to indicate that there is an arterial segment-dependent "sensitivity" (CCA vs. CFA vs. BA) to changes in FFMI.

Finally, FFMI explained variations in aoSBP, but not in baBP, indicating again an "arterial segment" dependency (central vs. peripheral). Accordingly, FFMI variations explained variations of 16–22 mmHg in aoSBP, representing 17–20% relating to the MV of the reference group (**Figure 4**, **Table 3**).

PMM and VFL variations were associated with structural and stiffness variations in CCA of 25–70% (but not in the CFA or BA), and with aoDBP variations (but not in baBP) of 10–20% (**Figure 4**, **Table 3**).

Mono- (Whole Body) and Multi-Segmental (Total, Trunk, Limbs) Fat and Fat-Free Mass Indexes: Association With Arterial Variations (Aim 4)

Supplementary File 2: **Table S5** shows the subjects' characteristics assessed by multi- and mono-segmental BIA-derived approaches. It can be seen a wide age range (7–75 years), exposure to CRFs, and body composition levels (e.g., BMI: 17.1–44.6 kg/m^2; FMI: 1.9–23.3 kg/m^2, FFMI: 13.4–25.0 kg/m^2). Besides, this subgroup shows wide variation in cardiovascular parameters (e.g., average z-scores between −2.1 and +3.8) (**Supplementary File 2**: **Table S6**; **Supplementary File 3**: **Figure S1**).

High agreement between the two BIA devices (Omron HF-514 vs. InBody-120) was observed in concordance and Bland-Altman analysis when comparing "fat mass" and "fat-free mass" indexes (**Supplementary File 2**: **Table S7**; **Supplementary File 3**: **Figure S2**).

Supplementary File 2: **Table S8** shows correlation analyses between demographic, clinical, anthropometric, body composition, and cardiovascular z-scores characteristics.**Supplementary File 3**: **Figures S3–S8** detail the association ("*r*" ranked from highest to lowest) between (i) cardiovascular z-scores and (i) FMI (**Supplementary File 3**: **Figures S3–S5**) or (ii) FFMI levels (**Supplementary File 3**: **Figures S6–S8**). In addition, information about the comparison of "total" marker [whole body; (IB)] and the five body segments, i.e., trunk (T), left and right arms (LA, RA), and left and right legs (LL, RL), are also provided.

For z-IMT and z-carotid diameters, the T-FMI showed the highest association, while, for z-CFA diameters, the T-FMI had the lowest level of association. The "total" (whole body) FMI achieved neither the highest nor the lowest level of association (**Supplementary File 3**: **Figure S3**). Similarly, the analysis of arterial z-stiffness showed that T-FMI followed by the "total" FMI showed the highest association regardless of the considered arterial segment (CCA, CFA, BA) (**Supplementary File 3**: **Figure S4**). Regarding the z-BP analysis (aoBP, baBP), T-FMI, and the "total" FMI had the strongest associations (**Supplementary File 3**: **Supplementary Figure S5**).

Regarding the CCA, CFA, and BA z-diameters, the "total" (whole body) and "upper limb" FFMI (RA or LA) showed the greatest levels of association ("moderate"), while the "trunk" and lower limb FFMI reached the lowest levels. Considering the z-IMT, upper limb FFMIs achieved the highest degrees of association (**Supplementary File 3**: **Figure S6**). Similarly, regarding z-local stiffness, "total" FFMI showed a greater association with CCA and CFA stiffness, while "upper limb" FFMIs showed greater associations with BA z-stiffness (**Supplementary File 3: Figure S7**). For the z-BP, "total" FFMI (for DBP) and "upper limb" FFMI (for SBP) were found to have the highest association, while lower limb FFMIs showed the lowest levels of association (**Supplementary File 3**: **Figure S8**).

DISCUSSION

To our knowledge, this is the first study to comprehensively evaluate the independent association (and effect size) of (i) mono- and (ii) multi-segmental BIA-derived body composition indexes (e.g., total fat, visceral fat, fat-free mass, and indexes) with the arterial system status. To this end, we have analyzed in a large sample of healthy children, adolescents, and adults (ii) several arterial pathways (elastic, transitional, and muscular; central and peripheral) and (iii) complementary hemodynamic, structural, and functional arterial parameters, using different non-invasive approaches (always considering the "gold standard" if available). The main findings can be summarized in six points, as follows:

- First, non-specific (classical) anthropometric indexes (i.e., BW, BMI, BMR) showed a high level of association with the structural, functional, or hemodynamic cardiovascular characteristics of the subject (z-scores). Furthermore, regardless of the classical index considered, the levels of association showed a specific hierarchy order: diameters and local arterial stiffness > BP (aortic and brachial) > regional arterial stiffness.
- Second, the joint association analysis of fat mass (i.e., BFM, PBF, FMI, VFL) and fat-free mass indexes (i.e., FFM, FFMI) with cardiovascular z-scores showed that all significant associations were positive. In other words, the higher the levels of body composition indexes, the higher levels of z-score (i.e., a greater starting point from the MV that is expected for a subject of similar age, who is not exposed to traditional CRFs).

Our study provides further evidence about the relationship between arterial characteristics (i.e., functional, structural, and hemodynamic properties) and body composition variables (i.e., FM and FFM indexes). Although there are no studies that jointly analyze BIA-derived body composition variables with arterial properties, some studies have analyzed them individually. Our results share similarities with the findings reported by Czernichow et al. (35) who reported an association between CCA IMT and body composition variables (i.e., BMI, PBF, FM, and FFM). Although, in our analysis, the structural arterial characteristics were the ones showing the highest levels of association, functional arterial parameters (mainly regional arterial stiffness) were not significantly explained by anthropometric or composition variables. These findings further support the aforementioned study, as no associations were observed by the authors between both FM and FFM and regional arterial stiffness after adjusting for covariates (35).

When analyzing the PBF and FMI individually, our results show that FMI had a stronger association with the arterial

parameters than PBF. This finding was in line with Ortega et al. (10) and confirms previous studies that reported that FMI was a better predictive index than PBF for both metabolic syndrome and cardiovascular mortality (10, 36). Furthermore, FMI was shown to be strongly associated with high BP and arterial stiffness in children, adolescents (11, 37), and adults (38).

The joint analysis of FM and FFM also showed that these indexes were meaningfully associated with arterial characteristics, and, in turn, increased levels of these indexes could be indicators of elevated cardiovascular risk. Indeed, Ortega et al. showed prospectively that higher levels of FM and FFM were also predictors of greater cardiovascular risk (10). Nevertheless, these findings differ from previous results reported in the literature, showing that higher levels FFM were protective, associated with a decreased mortality risk (39, 40).

- Third, simple correlation analysis showed that fat-free mass indexes exceed the association obtained with BMI and BMR, considering structural arterial z-scores. In contrast, fat mass indexes do not exceed the association with z-scores achieved by BMI and BMR.

This work adds further data to that reported by Ortega et. al (10), demonstrating that FFM and BMI may be complementary parameters. Interestingly, the independent association between both FFM and BMI and cardiovascular z-scores showed that the strength of these associations depended on the cardiovascular parameter considered. For instance, FFM exceeds BMI in z-aoSBP but not in z-baSBP. In addition, the investigators also reached similar conclusions in the sense that BMI increases according to an excess of FM plus FFM (10). This might confirm the strong association shown between BMI and cardiovascular properties, as well as its ability to predict cardiovascular mortality. Obese populations are also characterized by an increased FFM (that might be partially explained by higher blood volume) and might lead to the need of higher stroke volumes and cardiac outputs to match metabolic demands than non-obese peers. Those characteristics might represent an extra burden for the cardiovascular system, increasing the risk of heart disease (41, 42). In fact, not only the excess of FM is considered a CRF, but also FFM (43–45). In this regard, FFM has been considered a significant determinant of BP (44, 46), regional arterial stiffness (46), CCA IMT, and lumen area (35, 47). As previously mentioned, these findings are in contradiction with previous results, which did not show significant associations between FFM and structural parameters (e.g., IMT) and cardiovascular risk (39, 40, 48).

- Fourth, multivariate analysis indicated that, regardless of age, sex, CRFs, and classic anthropometric indexes (i.e., BMI, BMR, BW, BH), variations in cardiovascular z-scores can be explained by levels of FFMI, VFL, and PMM. Independently of both CRFs and classical indexes, FFMI explains mostly the inter-individual variations in (i) CCA IMT, (ii) diameters, and local arterial stiffness regardless of the arterial type and (iii) aoSBP.

It is worth mentioning that, in multiple linear regression models, variations in structural z-scores were mainly explained by either FFMI or z-aoSBP regardless of age, sex, presence of CRFs, and classical anthropometric indexes. In fact, variations in FFMI are able to explain variations in BP levels and CCA, CFA, and BA diameters. Our data point toward an association between FFMI and impaired arterial properties, which is in line with some but not all, recent reports. For instance, FFMI was strongly associated with cardiovascular conditions, such as hypertension, peripheral and coronary artery disease in adults aged 40–69 years (49). Interestingly, in a cross-sectional study of healthy Chinese children and adolescents $n = 1{,}609$, median age and interquartile range: 12.86 and 5.31 years, respectively (57.6% girls)], He et al. found that the effect size of the association between body composition and baBP differed in different age ranges (12). Accordingly, FFMI was positively associated with baSBP in 9–12 years and in 15–16 years age ranges but was not significantly associated with baDBP in any age range. Verma and Sinah. (50) reported similar results as previously mentioned in a randomized cross-sectional study in children and adolescents ($n = 733$; 10–18 years). In this study, FFMI and FMI were both positively correlated with BP, being FFMI the parameter that correlated most strongly with baBP.

Our findings significantly differ from previously published data, which showed a stronger association between FMI and baBP rather than with FFMI (51). It should be noted that, in this study, the anthropometric assessment differed from what was used by other investigators. More specifically, fat percentage, FMI, and FFMI were calculated from skinfolds thickness assessment rather than from bioelectrical impedance analysis (51).

- Fifth, regardless of the body segment considered (trunk, lower and upper limbs), levels of association between FMI and cardiovascular z-scores did not exceed those found with both classic anthropometric and fat-free mass indexes. However, total body fat mass and trunk indexes [T-FMI and FMI (IB)] showed a greater strength of association with cardiovascular z-scores than the FMI of upper and lower limbs.

Our data suggest that variations in total body fat mass or central fat mass (trunk) are associated (albeit weakly) with changes in arterial properties. Evidence has suggested that trunk fat mass as well as abdominal obesity should be considered as real CRFs (35, 37, 52, 53). Indeed, trunk fat mass and abdominal fat have shown a strong correlation between each other in adult women (54). Our results are also in line with previous findings where higher arterial stiffness was associated with high-trunk FMI in children, adolescents, and adults (11, 55, 56). Furthermore, it has been found that adolescents with higher fat trunk levels demonstrated a higher risk of developing cardiovascular disease at 26 and 36 years (57, 58). Considering that arterial stiffness is an early marker of atherosclerotic disease, the distribution of body fat (mainly in trunk and abdomen) becomes relevant in the stratification of cardiovascular risk (35, 52). Indeed, central fatness has been recognized as a primary risk

factor in cardiometabolic dysfunction (37) and an independent determinant of vascular health (55).

- Sixth, total (whole body) and upper limbs FFMI showed a higher level of association with z-diameters, z-IMT, z-local stiffness, and z-BP (surpassing almost all cardiovascular z-scores except for z-crPWV and PWV ratios) than lower limb FFMI indexes.

Although several studies have shown that fat distribution might be as relevant as total fat mass in stratifying the cardiovascular risk (11, 55), to our knowledge, no studies have found differences in FFMI of upper and lower limbs in relation to vascular properties. Accordingly, while increased levels of lower limb fat mass would work as a protective factor of cardiovascular disease in children, adolescents, and adults (53), increased arm fat mass was strongly associated with CRFs in women (59). Further studies, considering segmental body composition characteristics and cardiovascular properties are needed to further clarify these observations.

Importance of Results in Clinical and Epidemiological Settings

From data obtained in healthy children, adolescents and adults, our work provides evidence on which BIA-derived indexes have the highest independent levels of association with inter-subject hemodynamic, structural, and functional arterial variabilities (deviation from expected values). Knowing to what extent BIA-derived indexes are associated with arterial properties, with independence on other subjects' characteristics and exposure to CRFs (e.g., age or sex), would be useful to define the values of arterial properties expected in association with (explained by) data obtained on body composition. This information would be of value in both the research field (e.g., when selecting variables to assess in epidemiological studies aimed at evaluating the relationship between body composition and cardiovascular health) and clinical practice (e.g., to analyze the health impact of certain conditions and/or interventions on body composition). In this regard, it would be particularly important for professionals involved in physical activity and health (e.g., in the field of nutrition, exercise/sports, medicine) to know BIA-derived body-composition indexes and/or parameters with the greatest predictive capacity for cardiovascular status, since that would be useful in terms of assessment, diagnosis, definition of interventions' objectives and strategies (as well as in their evaluation and follow-up). In this regard, the following findings and contributions should be considered.

First, regardless of other subjects' characteristics, in children, adolescents, and adults, FFMI, VFL, and PMM were the BIA-derived indexes independently associated with arterial characteristics. This adds support to the proposal that, in healthy subjects, from the general population, fat-free mass-related indexes would be equally or even more valuable in terms of a predictive capacity when compared to classical anthropometric and fat mass indexes. Then, interventions (e.g., physical training) aimed at modifying (specifically) muscle mass levels and, consequently, FFMI and/or PMM could impact positively and directly (independently) the cardiovascular system. Therefore, being aware of which and to what extent variations in body composition during actions aimed at improving physical fitness (e.g., physical activity and/or dietary programs) are associated with cardiovascular health could contribute to improved professional performance.

Second, structural characteristics of central arteries (i.e., CCA, IMT, and diameters) would be the most sensitive to variations (differences) in BIA-derived indexes (e.g., FFMI). Therefore, analysis of central (e.g., CCA) rather than peripheral (e.g., CFA and BA) arteries would be more valuable for tracking differences in arterial characteristics associated with body composition indexes. In turn, "local" arterial stiffness parameters (e.g., CCA EM) would be more sensitive than the "regional" ones in terms of association with variations in BIA-derived body composition indexes. In this regard, it is noteworthy that we found that regional arterial stiffness assessed (as in several clinical studies) through the cfPWV was not strongly associated with variations in body composition and would not be considered of choice when assessing the association of BIA-derived body composition indexes and cardiovascular status. The above add to the proposal that body composition would not homogeneously impact the arterial system but would differentially affect the arterial territories and properties. Consequently, when analyzing and discussing the impact of body composition on arterial function (e.g., arterial stiffness), it is necessary to specify the territory and parameter evaluated.

Finally, "classic" (e.g., BMI) and "new" indexes (e.g., BIA-derived FFMI) could provide complementary explanatory information. Thus, both types of indexes should not be seen in all cases as "competitors." The above reinforces the value of classical anthropometric measurements and BIA-derived recordings to comprehensively assess the association between body composition and arterial characteristics.

Strengths and Limitations

This work has strengths and limitations that should be considered. First, our study included a comprehensive non-invasive evaluation of arterial properties (including analysis of different histological types of arteries), obtained from a large population sample of children, adolescents, and adults. Second, the number of subjects and the statistical approach (e.g., a bootstrapping technique) were designed to increase the reliability and to analyze the association between BIA-derived body composition indexes and cardiovascular characteristics with independence of other CRFs, classical anthropometric indexes, and regardless of other body composition indexes. However, although we adjusted for several covariates, we cannot rule out the possibility of residual confounding factors that could have influenced our results. Third, having a reference group enabled us to determine through mathematical adjustments the MV, SD, and variations in cardiovascular z-scores. Since the reference group included Uruguayan children, adolescents, and adults non-exposed to CRFs, we avoided using bibliographical data from subjects who do not necessarily present characteristics similar to those of the Uruguayan population. Fourth, body composition data were corroborated using two validated BIA

devices (InBody-120; OMRON-HBF514C), which showed a good concordance correlation (60–62).

We are aware that our research may have limitations: First, it is a cross-sectional study, so the causal relationship between BIA-derived body composition indexes and cardiovascular properties could not be explored. Second, information on the waist-hip ratio and neck circumferences was not included since there was no reliable information for all the subjects. Third, the body composition assessment was performed by BIA devices, a technology which is not considered the "gold standard" method for measuring body composition such as dual-energy X-ray absorptiometry or magnetic resonance imaging. Yet, these advanced imaging modalities are more expensive and operator dependent. Nowadays, BIA devices are a low cost and reliable method widely used in clinical and epidemiological settings to measure FM and FFM parameters (63) (**Supplementary File 1**). Finally, despite the fact that two commercial BIA devices (validated and widely used) were used in the present study, it is worth noting that the equations that allowed BIA-derived indexes to be obtained were not derived from studies in the Uruguayan population. As the other authors have done for specific populations in South America (64, 65), further studies will allow the equations for obtaining BIA-derived indexes to be evaluated and validated in the Uruguayan population.

CONCLUSIONS

First, non-specific (classical) anthropometric indexes (BW, BMI, BMR) showed a high association with cardiovascular z-scores. Furthermore, regardless of the classical index considered, the levels of association showed a specific hierarchy order: diameters and local arterial stiffness > BP (aortic and brachial > regional arterial stiffness.

Second, the joint association analysis between both fat mass and fat-free mass indexes and cardiovascular z-scores showed that all significant associations were positive. The higher the levels of these indexes, the greater the deviation toward positive values of arterial characteristics (e.g., higher CCA IMT, DD, and/or local stiffness).

Third, fat-free mass indexes exceeded the association obtained with BMI and BMR, considering structural arterial z-scores. In contrast, fat mass indexes did not exceed the association with z-scores achieved by BMI and BMR.

Fourth, regardless of age, sex, classical CRFs and anthropometric indexes, variations in arterial z-scores can be mainly explained by levels of (i) FFMI, (ii) VFL, and (iii) PMM. FFMI explains mostly inter-individual variations in (i) CCA IMT, (ii) diameters and local arterial stiffness regardless of the arterial type, and (iii) aoSBP.

Fifth, regardless of the body segment considered (trunk, lower and upper limbs), levels of association between FMI and arterial z-scores did not exceed those found with both classic anthropometric and fat-free mass indexes. However, total body fat mass and trunk indexes showed a greater strength of association with cardiovascular z-scores than the FMI of upper and lower limbs.

Sixth, total and upper limb FFMI showed a higher level of association with z-diameters, z-IMT, z-local stiffness, and z-BP than lower limb FFMI indexes.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Comités de Ética del Hospital de Clínicas, Instituto Superior de Educación Física, and Centro Hospitalario Pereira-Rossell (Universidad de la República; Uruguay). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

MG-G, JT, DB, and YZ contributed to conception and design of the study, performed the anthropometric, body composition, and cardiovascular non-invasive recordings, constructed and organized the database, and performed the statistical analysis. MG-G, JT, MP, DB, and YZ wrote the first draft and final version of the manuscript, contributed to the manuscript revision, read, and approved the submitted version. All authors contributed to the article and approved the submitted version.

FUNDING

This research was funded by Programa Desarrollo de las Ciencias Básicas (PEDECIBA, Ministerio de Educación y Cultura, Universidad de la República), Agencia Nacional de Investigación e Innovación (ANII), grant number PRSCT–008–020; and extra budgetary funds provided by DB, YZ, and CUiiDARTE Centre.

ACKNOWLEDGMENTS

We thank the children, adolescents, and adults, and their families for their participation in the study. To colleagues who integrated the CUiiDARTE Project in different stages, as part of their final degree, master (M.Sc.), and/or doctoral (Ph.D.) projects.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fnut.2022.856198/full#supplementary-material

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frontiers in Sports and Active Living

ORIGINAL RESEARCH
published: 24 February 2022
doi: 10.3389/fspor.2022.799659

Influence of Epoch Length and Recording Site on the Relationship Between Tri-Axial Accelerometry-Derived Physical Activity Levels and Structural, Functional, and Hemodynamic Properties of Central and Peripheral Arteries

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OPEN ACCESS

Edited by:
Eurico N. Wilhelm,
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Reviewed by:
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Western Norway University of Applied Sciences, Norway
Genevieve Healy,
The University of Queensland, Australia

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Specialty section:
This article was submitted to Physical Activity in the Prevention and Management of Disease, a section of the journal Frontiers in Sports and Active Living

Received: 21 October 2021
Accepted: 17 January 2022
Published: 24 February 2022

Citation:
Gómez-García M, Torrado J, Bia D and Zócalo Y (2022) Influence of Epoch Length and Recording Site on the Relationship Between Tri-Axial Accelerometry-Derived Physical Activity Levels and Structural, Functional, and Hemodynamic Properties of Central and Peripheral Arteries.
Front. Sports Act. Living 4:799659.
doi: 10.3389/fspor.2022.799659

Background: It remains to be established to what extent physical activity (PA) levels among individuals are independently associated with deviations from the "optimal" state of the arterial system. Accelerometers have been proposed as means to obtain reliable, objective, and more comprehensive data of PA. Decisions at the time of data collection/processing could influence the association between accelerometry-derived indices and arterial properties.

Objectives: (i) To identify to what extent the strength of association between arterial properties and accelerometer-derived indices depend on the recording site and/or the epoch length; (ii) to determine whether some arterial characteristics (hemodynamic vs. structural vs. functional) or regions (elastic vs. transitional vs. muscular arteries; central vs. peripheral) have higher levels of association with accelerometry-derived indices.

Methods: Physical activity (PA), cardiovascular risk factors (CRFs), and cardiovascular properties were evaluated in 60 volunteers (general population; age: 23–62 years; women: 43%). PA was measured daily for 7 days (free-living situation; triaxial-accelerometers ActiGraph-GT3X+; hip and wrist; "Worn-to-wrist" option) and raw data was converted at epoch lengths of 1, 5, 10, 30, and 60-s. PA-related energy expenditure, daily time in moderate-to-vigorous PA, steps/minute, and counts-per-minute for vector magnitude were calculated. The cardiovascular evaluation included hemodynamic (central and peripheral pressure), structural (diameters and intima-media thickness), and functional (local and regional stiffness) parameters of

carotids, femoral, and brachial arteries, and carotid-femoral and carotid-radial pathways. Arterial z-scores were obtained using age-related equations derived from healthy participants not exposed to CRFs (n = 1,688; age: 2–84 years; female: 51.2%) to evaluate at which degree each parameter deviates from the "optimal" value.

Results: In general, hip recordings outperformed those obtained on the wrist regarding the strength of association with arterial parameters. Accelerometer-derived indices and their association with arterial properties vary depending on the recording site and epoch length. PA indices are stronger associated with functional (local) than structural variables and with central than peripheral arteries.

Conclusions: Regardless of the PA index, there were independent associations with central artery characteristics, which reinforces that these territories would be the most related to PA levels. Differences in data acquisition and processing could lead to differences in conclusions when addressing the association between accelerometer-derived indices and the cardiovascular system.

Keywords: accelerometry, arterial system, cardiovascular, epoch lengths, hip, physical activity, recording site, worn on wrist option (ActiLife software)

INTRODUCTION

Physical activity (PA) is associated with a reduced burden of atherosclerotic cardiovascular disease (CVD). However, it is to note that many of the studies on this topic have shown limitations related to objectively assessing the participants' PA volume (Bertoni et al., 2009). Accelerometers have emerged as useful (now widely used) tools to assess PA as they can provide practical, accurate, and reliable data, allowing ambulatory assessment of usual daily activities (John and Freedson, 2012; O'Driscoll et al., 2020). One of the strengths of the use of accelerometers is that it provides objective and quantitative participant-specific information about PA, critical to a better understanding of the biological links between human activity behavior and the cardiovascular and/or metabolic status (Aadland et al., 2018, 2020). However, methodological issues related to the use of accelerometers remain under debate. In particular, raw data obtained and delivered by the accelerometer is extensive, complex, and subjected to noise, artifacts, and sampling-related issues—reasons why researchers have proposed different data processing and analysis decisions or approaches to simplify the information at the time of creating accelerometer-derived PA estimates (John and Freedson, 2012; Aibar and Chanal, 2015; Banda et al., 2016; Kerr et al., 2016, 2017). Not surprisingly, the above resulted in differences when analyzing accelerometer-derived signals and determining PA (levels and patterns) in different populations (Edwardson and Gorely, 2010; Gabriel et al., 2010; Ojiambo et al., 2011; Sanders et al., 2014; Aibar and Chanal, 2015; Kerr et al., 2016, 2017). The extent to which the methodological approach could impact the capacity of accelerometer-derived indices to predict cardiovascular status is incompletely understood.

One key decision is to define the "epoch length" or "sampling interval" (e.g., 1, 5, 10, 30, 60 s), which refers to the interval of time over which the units of accelerometer measures ("counts") are summed (Aibar and Chanal, 2015; Banda et al., 2016). Previous studies showed that the epoch lengths have a significant impact on the classification of sedentary and moderate-to-vigorous PA (MVPA) time and the observed compliance to MVPA guidelines (Edwardson and Gorely, 2010; Gabriel et al., 2010; Ojiambo et al., 2011; Sanders et al., 2014; Aibar and Chanal, 2015; Quante et al., 2015; Nettlefold et al., 2016; Aadland et al., 2018, 2020). The above would be the result of changes in PA distribution across different intensity levels when different epoch lengths are used (Aibar and Chanal, 2015; Aadland et al., 2018, 2020). In free-living conditions, a "short epoch" is strongly recommended to obtain a "real picture" of PA behavior in children and adolescents as it would avoid the accumulation of counts reflecting the average activity ("smoothing effect") expected when long epochs are used (Edwardson and Gorely, 2010; Aadland et al., 2018, 2020). The above is not in agreement with some authors "findings" (Sanders et al., 2014; Aibar and Chanal, 2015). In addition, the "ideal epoch length" could differ depending on the objective pursued. Altenburg et al. (2021) concluded that whereas 60-s epochs would be of choice to classify sedentary behaviors, shorter epoch lengths would be necessary to capture short bursts of MVPA. Furthermore, the "epoch length" could determine the association between PA levels and markers of the metabolic status as was previously proposed (Aadland

Abbreviations: aoDBP, Aortic diastolic blood pressure; aoSBP, Aortic systolic blood pressure; BA, Brachial artery; baDBP, Brachial artery diastolic blood pressure; baSBP, Brachial artery systolic blood pressure; BH, Body height; BMI, Body mass index; BP, Blood pressure; BW, Body weight; CCA, Common carotid artery; CFA, Common femoral artery; cfPWV, Carotid-femoral pulse wave velocity; CPM, Counts per minute; CRFs, Cardiovascular risk factors; crPWV, Carotid-radial pulse wave velocity; CVD, Cardiovascular disease; DD, End-diastolic arterial diameter; EE, Energy Expenditure; EM, Elastic modulus; IMT, Intima-media thickness; MV, Mean value; MVPA, Moderate-to-vigorous physical activity; PA, Physical activity; PWV Ratio, Pulse wave velocity ratio (cfPWV/crPWV quotient); RG, Reference group; SD, Standard deviation; SysD, Peak systolic arterial diameter; VM, Vector magnitude; z-, Z-score; β, Beta index.

et al., 2018, 2020). About this, for data analyzed using the 60-s epoch, moderate PA intensities and metabolic health markers were associated, but the associations weakened when shorter epoch lengths were considered (Aadland et al., 2020). In this context, it is to note that it remains unknown whether the epoch length impacts the association between accelerometer-derived PA indices and the hemodynamic, structural, or functional arterial properties.

Another important definition is the accelerometer location (e.g., hip, wrist, thigh, ankle, neck). Although a hip-mounted accelerometer has been traditionally used to measure PA, the use of wrist-worn devices has gained popularity (Troiano et al., 2008). Wrist-accelerometer is easy to carry and can be worn for 24 h without removal for sleep, which may improve compliance with wearing patterns (Migueles et al., 2017). However, signals derived from wrist accelerometers could be affected by accelerations related to arm movements not necessarily associated with higher PA-related energy expenditure (EE) (Hildebrand et al., 2014; Ellis et al., 2016). This has led some devices to implement conversion algorithms (equations or filters) that attempt to standardize the levels of accelerometer-derived PA indices (e.g., EE levels), regardless of the recording site (e.g., hip or wrist; McMinn et al., 2013; Mandigout et al., 2019; Mueller et al., 2020; Nuss et al., 2020; ActiGraph, 2021). However, as mentioned for epoch lengths, it remains to be defined whether the accelerometer position (even applying data correction schemes to make different recording sites comparable) determines the strength of the association between PA indices and the arterial status.

Finally, a third decision is the selection of the most appropriate accelerometer-derived PA index to be used. Data processing from accelerometry usually provides a large number of indices, which may not necessarily be related to the arterial state. In this regard, when analyzing the association between PA and the cardiovascular system, the accelerometer-derived index to be selected would be the one with the greatest predictor capacity for cardiovascular status. In addition, it is important to determine whether a given PA index is mainly associated with (i) hemodynamic [e.g., central or peripheral blood pressure (BP)], structural (e.g., diameter, wall thickness), or functional (e.g., stiffness) characteristics, or with the status of (ii) a particular histological arterial type [e.g., elastic (carotid), muscular (femoral), or transitional (brachial)] (Bia et al., 2009). In previous studies, we found that the impact of different cardiovascular risk factors (CRFs) could differ depending on the vascular parameter and territory considered (Zócalo et al., 2017; Zocalo et al., 2018; Garcia-Espinosa et al., 2018; Castro et al., 2019, 2021). Additionally, taking into account the data obtained from PA questionnaires, we found that whereas PA levels were associated with both hemodynamic and structural parameters, PA indices were not independently associated with arterial stiffness (Gómez-García et al., 2021). In this regard, it would be valuable to identify to what extent accelerometer-derived indices are associated with arterial properties, independently of the exposure to other CRFs. Indices showing an independent association would be useful to indicate the expected values of arterial properties, regardless of other participants' characteristics [e.g., body mass index (BMI)].

In this context, working with healthy participants, we set the following aims: (i) to identify whether levels of accelerometer-derived PA indices depend on the recording site (hip vs. wrist) and/or the epoch length; (ii) to identify whether the levels of association between PA indices and arterial properties depend on the recording site or the epoch length; (iii) to assess to what extent the association between arterial properties and PA indices depend on the parameter (hemodynamic vs. structural vs. functional) or territory evaluated (central vs. peripheral, elastic vs. transitional vs. muscular arteries); (iv) to evaluate whether associations between PA indices and arterial properties are independent of other participants' characteristics. We analyzed both (i) the data obtained directly from the participants, and (ii) the data representing the deviation (z-score) of each arterial parameter from the expected value considering the age and sex of the participant (Castro et al., 2019, 2021; Gómez-García et al., 2021). Thus, our analysis focused not only on the levels of association between PA indices and arterial properties but also on the extent to which they would explain the level of deviation of the arterial system with respect to the values considered "ideal or optimal."

METHODS

Study Population

This study was carried out in the context of the Centro Universitario de Investigación, Innovación y Diagnóstico Arterial (CUiiDARTE) project (Bia et al., 2011; Santana et al., 2012a,b; Zócalo et al., 2020; Bia and Zócalo, 2021; Zócalo and Bia, 2021a,b, 2022). In this study, we included two samples. On the one hand, we worked with 60 volunteers who agreed to participate in a study protocol that included (i) recording of PA using accelerometers, (ii) clinical interview, (iii) anthropometric measurements, and (iv) cardiovascular evaluation. The volunteers were the first 60 who agreed to participate in the protocol among people who underwent cardiovascular studies at the CUiiDARTE Center as part of the project "Evaluación integral de la condición física y patrones de conducta sedentaria, actividad física y sueño, mediante ergoespirometría, bioimpedancia segmental multifrecuencia y acelerometría triaxial: asociación con el estado cardiovascular." Only adults without chronic and infectious diseases who were not pregnant and who did not present atheromatosis (assessed by carotid and femoral ultrasound) were invited to participate. On the other hand, the study included a group of 1,688 healthy participants ("Reference group," RG; male: 824, female: 864) without exposure to drugs or CRFs who were submitted to the same evaluation protocol used for the 60 volunteers (with the only exception of accelerometers recordings). This sample of participants was obtained from the CUiiDARTE Project Database (which includes participants from the general population, $n = 3{,}619$) and was allowed to determine, for each cardiovascular variable, the expected value in healthy participants (Zócalo et al., 2020; Bia and Zócalo, 2021; Zócalo and Bia, 2021a,b, 2022). That value represents the "optimal or ideal" based on age and sex. Data from the RG was used to obtain the equations that allowed to typify the cardiovascular parameters of the 60 participants studied with accelerometry

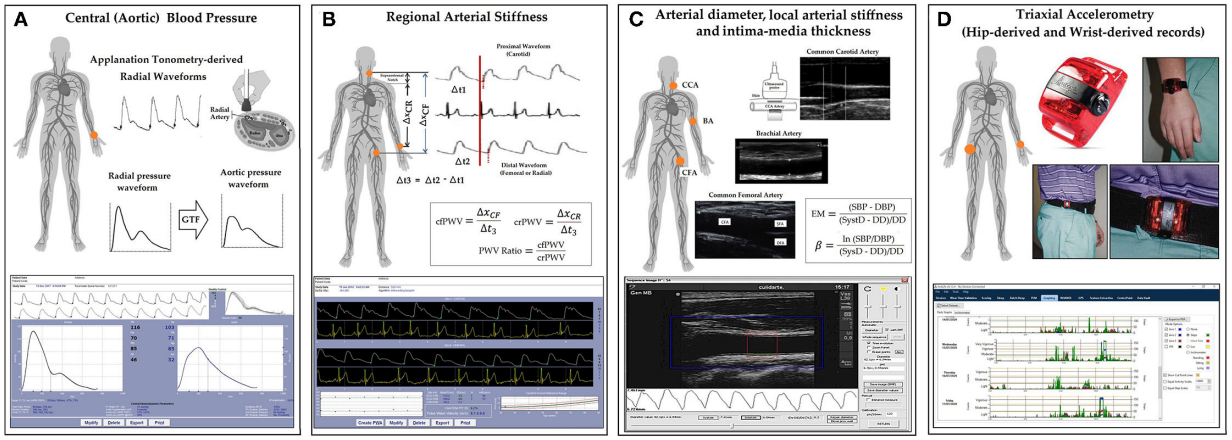


FIGURE 1 | Summary of the non-invasive cardiovascular and accelerometry recordings approach performed on each participant. **(A)** Central aortic pressure measurements using SphygmoCor device and software (Applanation tonometry). GTF, general transfer function. **(B)** Regional arterial stiffness measurements using SphygmoCor device and software (Applanation tonometry). ΔxCR and ΔxCF: carotid-radial and carotid-femoral distances. Δt1 and Δt2: time between R-wave (QRS) and carotid and femoral "foot wave," respectively. crPWV, cfPWV: carotid-radial and carotid-femoral pulse wave velocity. PWV, pulse wave velocity. **(C)** Arterial diameter, local stiffness, and intima-media thickness (IMT) measurements using echography and/or blood pressure measurement using echography and HemoDyn4M software. CCA, CFA, and BA, common carotid artery, common femoral artery, and brachial artery, respectively; EM, elastic modulus; β, beta or stiffness index; SBP and DBP, systolic and diastolic blood pressure; SysD and DD, peak systolic and end-diastolic arterial diameter; **(D)** Diagram of the placement site of the hip and wrist accelerometers (ActiGraph devices, model GT3X+, and ActiLife software).

(z-scores). Procedures were conducted in agreement with the Declaration of Helsinki and the protocol was approved by the Institution's Ethics Committee (Centro Hospitalario Pereira-Rossell, Hospital de Clínicas and Instituto Superior de Educación Física, Universidad de la República). Written informed consent was obtained prior to the evaluations and the use of data in research. The following describes the study protocol used in all participants and the accelerometer records obtained in the sub-sample of 60 volunteers.

Anthropometric and Clinical Evaluation

A clinical interview, together with an anthropometric evaluation, enabled us to assess CRF exposure, defined according to the criteria (cut-off points) described later. A family history of CVD was defined by the presence of at least one first-degree relative with early CVD [<55 years (y) in men; <65 years in women]. Body weight (BW; Omron HBF-514C, Omron Healthcare, Inc., Illinois, USA) and body height (BH; portable stadiometer) were measured with the participants wearing light clothing and no shoes. BMI was calculated as a BW-to-squared BH ratio.

Cardiovascular Evaluation

Participants were asked to avoid exercise, tobacco, alcohol, caffeine, and food intake 4 h prior to evaluation. Measurements were performed in a temperature-controlled environment (21–23°C), with the participant in the supine position and resting for at least 10–15 min. The cardiovascular evaluation included assessing hemodynamic, structural, and functional parameters. In this study, we focused on BP, beat-to-beat arterial diameter and wall thickness, and arterial stiffness parameters.

Peripheral and Central Blood Pressure

Heart rate, peripheral (brachial) systolic BP (baSBP), and diastolic BP (baDBP) were recorded (HEM-433INT; Omron Healthcare Inc., Lake Forest, IL, USA) immediately before, simultaneously, and/or after each non-invasive ultrasonographic and tonometric arterial measurement. Pulse pressure (baPP; baPP = baSBP – baDBP) and mean BP (baMBP, baMBP = baDBP + baPP/3) were calculated.

Central (aortic) systolic and diastolic BP (aoSBP, aoDBP) levels were non-invasively obtained by applanation tonometry (SphygmoCor-CvMS, v.9, AtCor-Medical, Australia) (Zinoveev et al., 2019; Zócalo and Bia, 2022). Briefly, radial BP waveforms were obtained by tonometry and calibrated to baDBP and baMBP levels. Then, aoBP waveforms were derived from the calibrated waves using a radial-to-aortic general transfer function (**Figure 1A**).

Regional Arterial Stiffness and Central-to-Peripheral Arterial Stiffness Gradient

Carotid-radial (crPWV, a marker of upper-arm arteries stiffness) and carotid-femoral pulse wave velocity (cfPWV, a marker of aortic stiffness) were obtained by tonometry (Bia and Zócalo, 2021) (**Figure 1B**). PWV values that were shown correspond to the median of three records. The stiffness gradient (PWV ratio) was quantified using cfPWV/crPWV (Bia and Zócalo, 2021) (**Figure 1B**).

Arterial Diameter, Wall Thickness, and Local Arterial Stiffness

Left (L-) and right (R-) common carotid (CCA), common femoral (CFA), and left brachial (BA) arteries were analyzed

using ultrasound (6–13 MHz, M-Turbo, Sonosite Inc., WA, USA). Sequences of images (30 s, B-Mode, longitudinal views) were stored for offline analysis. Diameter waveforms were obtained using border detection software (HemoDyn4M, Dinap s.r.l., Bs.As., Argentina). Peak systolic diameter (SysD), end-diastolic diameter (DD), and intima-media thickness (IMT; far wall, end diastole) values were obtained by averaging at least 20 beats. CCA diameter and IMT were measured a centimeter proximal to the bulb, CFA diameter was measured in a straight segment in the penultimate centimeter proximal to the bifurcation. BA measurements were acquired at the elbow level in a straight segment of at least one centimeter long (Marin et al., 2020) (**Figure 1C**).

Local stiffness was quantified by the elastic modulus (EM) and Beta Index (β). EM relates BP and diameter changes: EM = (SBP – DBP)/[(SysD – DD)/DD]. To minimize the impact of BP level on arterial stiffness, β was quantified: β = Ln(SBP/DBP)/[(SysD – DD)/DD]. Brachial BP was used to quantify CFA and BA EM and β, while aortic BP was used to quantify CCA EM and β (**Figure 1C**).

Accelerometer Measurements and Data Reduction

Physical activity (PA) raw data was collected by ActiGraph accelerometers (GT3X+, ActiGraph, Pensacola, FL, USA), which measure accelerations in three axes (Y: vertical, X: horizontal, and Z: perpendicular) at a frequency of 100 Hz, with a dynamic range of ±8 units of gravity (ActiGraph, 2019). Participants were asked to wear two accelerometers. One was attached to an adjustable elastic belt with snap buckles and worn in line with the right hip. The other was placed in the non-dominant wrist (Trost et al., 2005) (**Figure 1D**). Participants were required to continue with their usual activities and to wear both accelerometers 24 h/day for at least 7 consecutive days, only taking them off for water activities (e.g., swimming, showering). Raw data were continuously stored in the device.

Anthropomorphic data (BH and BW), body location (hip or wrist), sex, race, and age of the participant were entered into the ActiLife software (v.6.13.4; ActiGraph, Pensacola, FL, USA) (Mueller et al., 2020). Data from the accelerometers was then downloaded and processed. As previously recommended (Migueles et al., 2017), we used the "normal" (default) filter, which was used in the validation study for the cut-off points or algorithms employed in our study (refer below) (Sasaki et al., 2011). In fact, we decided not to use the "Low Frequency Extension" option provided by ActiGraph, since it has been shown to have a large impact on the accelerometer outputs levels and to modify the records obtained at hip and wrist differently, which could have introduced an additional source of data variation (Tudor-Locke et al., 2015). For this study, raw acceleration data was converted into X, Y, Z axis, and vector magnitude (VM) activity counts at epoch lengths of 1, 5, 10, 30, and 60 s. The VM combines information recorded in 3-axes, rather than just the Y-axis [$VM = \sqrt{(X^2+Y^2+Z^2)}$]. To be included in the data analysis, the participant needed to have at least 6 valid days, defined as those with ≥18 h of valid monitoring.

The intervals of use were identified by applying a wear-time validation algorithm described by Choi et al. (2011), which essentially selects flag periods of non-wear and filters them out from the analysis. We selected the default values for the optional criteria [e.g., "Small Window Length" equal to 30 min; "Spike Tolerance" (or motion artifact interval) equal to 2 min, use of VM rather than just the Y-axis] (Choi et al., 2011). Once the wear time data was validated, the following information was derived to score the PA: (i) PA-related Energy Expenditure (EE), (ii) Metabolic Equivalents, (iii) PA Bouts, (iv) PA Levels ("Cut Points") and MVPA, (v) Steps, and (vi) Sedentary Analysis (Bouts and Breaks). Although a large number of PA-related indices were quantified (details of calculations and algorithms can be seen in **Supplementary Material 1**) and presented in the descriptive tables (data available for future comparisons), we focused on the four following indices: (i) EE (kcals/day), (ii) daily time in MVPA (%) (referred to as MVPA%), (iii) average steps/min, and (iv) VM counts-per-minute (CPM). Due to differences in wear time between days and participants, these indices were analyzed and expressed in percentages and/or the average of total daily wear time.

Physical activity (PA)-related EE was determined by the "Freedson VM3 Combination (2011)" algorithm, which combines (i) "Freedson VM3 ('11) formula" with (ii) "Williams Work-Energy ('98) equation" (when VM ≤ 2,453 CPM). "Freedson VM3 ('11)" equation uses all three axes to estimate EE. VM calculation is only valid if the epoch CPM exceeds the Scale ×2,453 CPM. Consequently, if VM > 2,453 CPM, then EE (kcals/min) = 0.001064*VM + 0.087512*BW – 5.500229 where BW is expressed in kg. If this is not achieved (VM ≤ 2,453 CPM), then the "Williams Work-Energy ('98)" formula is applied. The "Williams Work-Energy ('98)" formula utilizes the physics equivalent of energy: EE (kcals) = CPM*0.0000191*BW, where kcals are "total calories for a single epoch." In turn, PA intensity was classified into 4 categories based on VM CPM, according to the "Freedson Adult VM3 (2011)" algorithm (Sasaki et al., 2011). Subsequently, we determined the MVPA% [i.e., the amount of time spent above the "Moderate PA" intensity cut-point level (2,690 CPM)], which indicates "significant" PA (Physical Activity Guidelines for Americans, 2008). ActiGraph uses a proprietary algorithm to count steps; process specifications are not available (Tudor-Locke et al., 2015).

The same PA indices (EE, MVPA%, steps/minute, and VM CPM) were calculated for hip and wrist records. Similar to previous studies, according to the manufacturer's recommendations, for wrist-worm data, the "Worn on wrist" option (ActiLife software) was selected during data scoring (McMinn et al., 2013; Mueller et al., 2020; Nuss et al., 2020; Guediri et al., 2021). When that option is selected, ActiLife software applies "piece-wise scaling" to the collected data, enabling direct comparison between PA indices (e.g., EE) obtained from hip and wrist measurements (ActiGraph, 2021). To this end, the "Worn on wrist" option converts counts obtained at the wrist ["wrist counts," (WC)] into "hip equivalent counts" (HEC), using manufacturer's calibration equations (published on the manufacturer's website): (i) WC range: 0–644, HEC = 0.5341614*WC; (ii) WC range: 645–1,272, HEC =

1.7133758*WC – 759.414013; (iii) WC range: 1,273–3,806, HEC = 0.3997632*WC + 911.501184; and (iv) WC range: 3,807 to infinity, HEC = 0.0128995*WC + 2383.904505 (Mueller et al., 2020; ActiGraph, 2021). The resultant counts (HEC) are then used to calculate EE and MVPA% using equations and cut-off points validated for data obtained at the hip or waist [e.g., Freedson VM3 ('11) formula used to calculate EE was developed from data obtained with waist-worn devices] (Sasaki et al., 2011). The conversion equations, generally used by those using ActiGraph wrist-mounted devices, come from the manufacturer's internal research and developments (ActiGraph, 2021). It is to be noted that, in theory, when the "Worn on wrist" option is selected, EE and MVPA% values obtained from wrist and hip recordings (for a participant in a given period) should be similar. However, this is a controversial issue that is still discussed and under investigation (Mueller et al., 2020; Nuss et al., 2020; Guediri et al., 2021). It is also to note that the "Worn on wrist" option does not modify the step/minute and VM CM data obtained at the wrist (Mueller et al., 2020).

We selected these four accelerometer-derived indices because they are among the most studied and recommended in cardiovascular health studies. For instance, both the American Heart Association (American Heart Association, 2019) and the American College of Sports Medicine (Garber et al., 2011) developed PA guidelines with recommendations related to volumes and intensities of EE. The global "age-specific" PA recommendations of the WHO are based on MVPA% (World Health Organization, 2020). On the other hand, for several years now, different organizations (e.g., U.S. President's Challenge Physical Activity and Fitness Awards Program) have based their recommendations on "step count" (Tudor-Locke et al., 2011). Finally, the VM CPM was analyzed to obtain a continuous variable directly related to the accelerometer recordings, without being determined by modeling or by the participant characteristics. Thus, the PA indices considered included both indices whose calculations depend on the use of the "Worn on wrist" option (EE and MVPA%) and indices that do not depend on the selection of that option (steps/minute and VM CPM) (McMinn et al., 2013; Mueller et al., 2020; Nuss et al., 2020; Guediri et al., 2021).

Statistical Analysis

A stepwise analysis was performed. First, descriptive statistics were obtained for the 60 participants with recordings with accelerometry (**Table 1**; **Figure 2**; **Supplementary Tables 1–10** in **Supplementary Material 2**).

Agreement Between Accelerometry-Derived Data: Body Site and Epoch Length Analysis

Second, we analyzed the degree of agreement between PA indices obtained from different recording sites and considered different epoch lengths. To this end, correlation analysis (**Supplementary Tables 11–14** in **Supplementary Material 2**) and Bland–Altman tests (**Figure 3**; **Supplementary Tables 15–18** in **Supplementary Material 2**) were considered. Although no significant association level was found in 22 of the 324 correlations evaluated, the Bland-Altman tests were performed for all paired comparisons. As in previous studies, Bland-Altman analysis was done using "Krouwer's method" (Krouwer, 2008; Ruiz et al., 2011; Chastin et al., 2018). This method allows, for a given value obtained with a particular method ("reference method"), to know the difference with respect to another method ("alternative method"). The difference between the methods is expressed on the y-axis and the "reference value" on the x-axis [instead of the mean, as in the most widely used (classical) Bland-Altman analysis]. When the described variant is considered, a linear regression equation defining the relationship between the "reference method" (x value; e.g., EE, hip record, epoch: 1 s) and the difference with respect to the "alternative method" (e.g., EE, wrist record, epoch: 1 s) is obtained. The analysis can be applied (as in our article) with the aim of identifying whether there is a proportional error between the methods and determining the expected value for "alternative method" as a function of data obtained with the method considered "reference." The method provides a predictive equation, which allows knowing from a certain recording site and epoch length what would be obtained using another recording site and/or epoch length. Considering the above, in our analyses, the different recording sites (wrist and hip) and epoch lengths were considered as "reference" (and in turn, as "alternative"). This allowed two different simultaneous comparisons: between recording sites (hip vs. wrist), and among epochs lengths (1 vs. 5 vs. 10 vs. 30 vs. 60 s). In each Bland-Altman test, the existence of systematic (mean) and proportional (that varied depending on the "reference" value) errors were evaluated. To this end, the corresponding linear regression equations were obtained (**Supplementary Tables 15–18** in **Supplementary Material 2**).

Standardized Cardiovascular Variables (z-Scores)

Third, cardiovascular variables were expressed as z-scores. As was mentioned, participants to be included in the RG were selected from the CUiiDARTE database (**Supplementary Table 19** in **Supplementary Material 2**). None of the participants included in the RG meet any of the following (exclusion criteria) (Zócalo and Bia, 2021a,b, 2022): history of CVD; use of BP, lipid, or glucose-lowering drugs; arterial hypertension; current smoking; diabetes; dyslipidemia; and/or obesity. None of the participants in the RG had congenital, chronic, or infectious diseases or cardiac arrhythmias.

Once the RG was built, age-related equations for mean value (MV) and SD were obtained. We implemented parametric regression methods based on several models (fractional polynomials, polynomial, and ratios of polynomials) (Zócalo et al., 2020; Bia and Zócalo, 2021; Zócalo and Bia, 2021a,b, 2022). This procedure provides age-related equations for each model. The one with the best-fit was chosen to calculate the z-scores (**Table 1**) for each cardiovascular variable from participants who had accelerometer-derived records ($n = 60$) (**Supplementary Table 20** in **Supplementary Material 2**). A z-score is a dimensionless number obtained by subtracting the observed value from the RG MV and dividing the result by the RG SD. The z-score describes the position of a raw score in terms of its distance from the MV ("expected or optimal" value) when measured in SD units.

TABLE 1 | Characteristics of participants ($n = 60$).

Variables	MV	SD	Min.	P25th	p50th	p75th	Max.
Demographic, anthropometric, and cardiovascular risk factors							
Age (years)	36.72	10.03	23	29	34	43	62
Sex (Female, %)	42.90						
Body height (m)	171.31	9.14	150	164	169	178	189
Body weight (Kg)	76	15	55	66	74	81	115
BMI (Kg/m$^{2)}$	25.84	3.44	20.6	23.55	24.61	28.58	33.97
Current smoker (%)	5.70						
Hypertension (%)	2.90						
Dyslipidemia (%)	8.60						
Obesity (%)	9.00						
Family history of CVD (%)	8.60						
Anti-hypertensive (%)	2.90						
Total cholesterol (mg/dl)	222	37	187	187	217	262	262
HDL cholesterol (mg/dl)	66	12	58	58	59	80	80
LDL cholesterol (mg/dl)	132	48	84	84	132	180	180
Tryglicerides (mg/dl)	121.67	9.02	113	113	121	131	131
Glicaemia (mg/dl)	88	3	86	87	88	91	92
Creatinine (mg/dl)	0.75	0.07	0.7	0.7	0.75	0.8	0.8
Central (aortic) and peripheral (brachial) blood pressure							
aoSBP (mmHg)	106.46	8.96	92	99	107	114	125
z-aoSBP (SD)	−0.08	0.86	−1.78	−0.73	−0.33	0.66	1.41
aoDBP (mmHg)	73.74	7.64	58	68	73	80	85
z-aoDBP (SD)	0.16	0.89	−1.92	−0.46	0.1	0.92	1.63
baSBP (mmHg)	122.21	10.76	100	113	121	130	144
z-baSBP (SD)	0.17	0.96	−2.32	−0.61	0.03	0.86	2.14
baDBP (mmHg)	73.32	7.69	56	70	73.5	78	90
z-baDBP (SD)	0.25	0.94	−2.18	−0.37	0.33	0.79	2.22
Heart rate (beats/minute)	63.74	9.29	47	57	66	69	86
Arterial structural (diameters, wall thickness) parameters							
Left CCA DD (mm)	6.51	0.62	5.47	6.14	6.43	7.11	7.55
z-Left CCA DD (SD)	0.11	1.06	−1.68	−0.43	0.01	1.01	1.75
Left CCA IMT (mm)	0.59	0.12	0.42	0.51	0.58	0.66	0.96
z-Left CCA IMT (SD)	0.08	1.19	−1.7	−0.78	−0.22	0.99	3.49
Right CCA DD (mm)	6.64	0.57	5.37	6.27	6.65	6.92	8.51
z-Right CCA DD (SD)	0.15	0.96	−2.08	−0.47	0.22	0.62	3.21
Right CCA IMT (mm)	0.59	0.11	0.41	0.52	0.56	0.64	0.93
z-Right CCA IMT (SD)	0.09	1.13	−1.65	−0.51	−0.24	0.75	2.73
Left CFA DD (mm)	7.75	1.46	5.74	6.74	7.33	8.72	11.86
z-Left CCA DD (SD)	−0.13	1.16	−1.72	−0.86	−0.43	0.7	2.93
Right CFA DD (mm)	7.63	1.56	5.19	6.53	7.33	8.6	12.79
z-Right CFA DD (SD)	−0.27	1.3	−2.4	−1.07	−0.57	0.43	3.95
Left BA DD (mm)	3.78	0.59	2.9	3.19	3.82	4.29	4.8
z-Left BA DD (SD)	−0.07	0.83	−1.42	−0.77	−0.04	0.73	1.44
Local arterial stiffness (Elastic Modulus and Beta Index)							
Left CCA EM (mmHg)	696.98	173.51	444.38	538.76	695.79	822.11	1086.19
z-Left CCA EM (SD)	−0.22	0.81	−1.49	−0.88	−0.39	0.27	1.84
Left CCA Beta Index	7.15	1.47	4.16	5.98	7	8.48	9.84
z-Left CCA Beta Index (SD)	−0.31	0.65	−1.64	−0.84	−0.33	0.05	0.99
Right CCA EM (mmHg)	702.96	195.3	432.66	585.65	660.1	808.68	1175
z-Right CCA EM (SD)	−0.1	0.91	−1.38	−0.71	−0.09	0.24	2.37

(Continued)

TABLE 1 | Continued

Variables	MV	SD	Min.	P25th	p50th	p75th	Max.
Right CCA Beta Index	7.22	1.77	4.52	5.86	7.1	7.93	11.55
z-Right CCA Beta Index (SD)	−0.2	0.76	−1.26	−0.82	−0.07	0.25	1.65
Left CFA EM (mmHg)	1096.3	428.23	433.02	693.58	1079.19	1377.39	2134.8
z-Left CFA EM (SD)	−0.24	0.71	−1.28	−0.9	−0.24	0.22	1.43
Left CFA Beta Index	11.37	4.19	4.72	7.91	11.16	14.19	22.36
z-Left CFA Beta Index (SD)	−0.31	0.66	−1.31	−0.89	−0.35	0.14	1.44
Right CFA EM (mmHg)	1024.88	397.76	376.27	713.3	1047.14	1185.78	2337.89
z-Right CFA EM (SD)	−0.27	0.81	−1.49	−0.97	−0.16	0.01	2.42
Right CFA Beta Index	10.53	3.7	4.23	7.96	10.56	11.77	23.1
z-Right CFA Beta Index (SD)	−0.33	0.73	−1.41	−0.81	−0.36	−0.07	2.15
Left BA EM (mmHg)	1503.8	1036.75	345.58	702	1067.29	2280	3759.43
z-Left BA EM (SD)	0.29	1.49	−1.35	−0.8	−0.33	1.44	3.61
Left BA Beta Index	15.42	10.24	3.75	8.19	10.35	21.31	40.01
z-Left BA Beta Index (SD)	0.2	1.41	−1.41	−0.78	−0.5	1.03	3.66
Regional arterial stiffness (Pulse Wave Velocity)							
cfPWVcf "real" (m/s)	7.63	1.41	5.72	6.43	7.52	8.13	12.27
z-cfPWV "real" (SD)	0.13	1.04	−2.04	−0.72	0.16	0.93	2.39
crPWV (m/s)	10.38	1.46	7.7	8.9	10.3	11.75	13
z-crPWV (SD)	0.41	1.2	−1.75	−0.41	0.36	1.58	2.62
Arterial stiffness central-peripheral gradient (cfPWV/crPWV)							
PWV Ratio	0.74	0.16	0.48	0.62	0.7	0.8	1.13
z-PWV Ratio (SD)	−0.22	1.3	−2.69	−1.2	−0.3	0.44	2.68

MV, mean value; SD, standard deviation; P25th, p50th, p75th, percentile 25, 50, and 75, respectively; Min., minimal value; Max, maximal value; BMI, body mass index; CVD, cardiovascular disease; Z-, z-score; aoSBP, aoDBP, aortic systolic and diastolic blood pressure; CCA, CFA, BA, common carotid, common femoral, and brachial artery, respectively; DD, arterial end-diastolic diameter; IMT, intima-media thickness; EM, elastic modulus; cfPWV and crPWV, carotid-femoral and carotid-radial pulse wave velocity; PWV, pulse wave velocity.

Accelerometry-Derived Indexes: Association With Arterial Characteristics

Simple bivariate and partial correlations (adjusting for confounders including sex, age, BMI, hypertension, current smoke, dyslipidemia, and family history of CVD) analyses were done to quantify the association between accelerometry-derived indices and cardiovascular parameters, expressed both as un-standardized and standardized (z-scores) variables (**Figure 4**; **Supplementary Tables 21–28** in **Supplementary Material 2**). Evans's Empirical Classification ("correlation strength") was used for r interpretation: <0.20, very weak; 0.20–0.39, weak; 0.40–0.59, moderate; 0.60–0.79, strong; ≥0.80, very strong (Evans, 1996).

Sample Size and Statistical Package

According to the central limit theorem, a normal distribution was considered (considering Kurtosis and Skewness coefficients and number of studied participants, with sample size >30) (Lumley et al., 2002). Considering an $\alpha = 0.05$ (type I error), $\beta = 0.20$ (type II error), and $r = 0.35$–0.50 (effect size for correlation analysis), the number of participants included was higher than the minimum sample size required, both to construct the RG (sample size required: 377), and to perform agreement and association analyses (sample size required: 29–60). Analyses were done using SPSS Software (v.26, IBM-SPSS Inc., Chicago, IL, USA), MedCalc (v.14.8.1, MedCalc Inc., Ostend, Belgium), and NCSS 2020 (NCSS, Kaysville, UT; www.NCSS.com). A $p < 0.05$ was considered statistically significant.

RESULTS

Participants' Characteristics

Table 1 shows the characteristics of the participants who had accelerometers-derived measurements. Note the balanced sex distribution and low exposure to CRFs. There were no participants with diabetes, use of anti-hyperlipidemic, or anti-diabetic agents. In addition, considering the exclusion and inclusion criteria none of the participants had CVD. Cardiovascular variables showed the expected distributions and trends. For example, aoSBP levels were lower than baSBP levels and CCA arteries stiffness was lower than that of peripheral arteries (CFA and BA) (**Table 1**).

Agreement Between Accelerometry-Derived Data: Recording Site and Epoch Length

Data from hip records were lower than those obtained with wrist-based accelerometers (**Figure 2**; **Supplementary Tables 1–10** in **Supplementary Material 2**).

Steps/min and VM CPM data obtained with hip and wrist devices did not vary with the epoch length considered. However, as the epoch length increased, EE and MVPA% levels

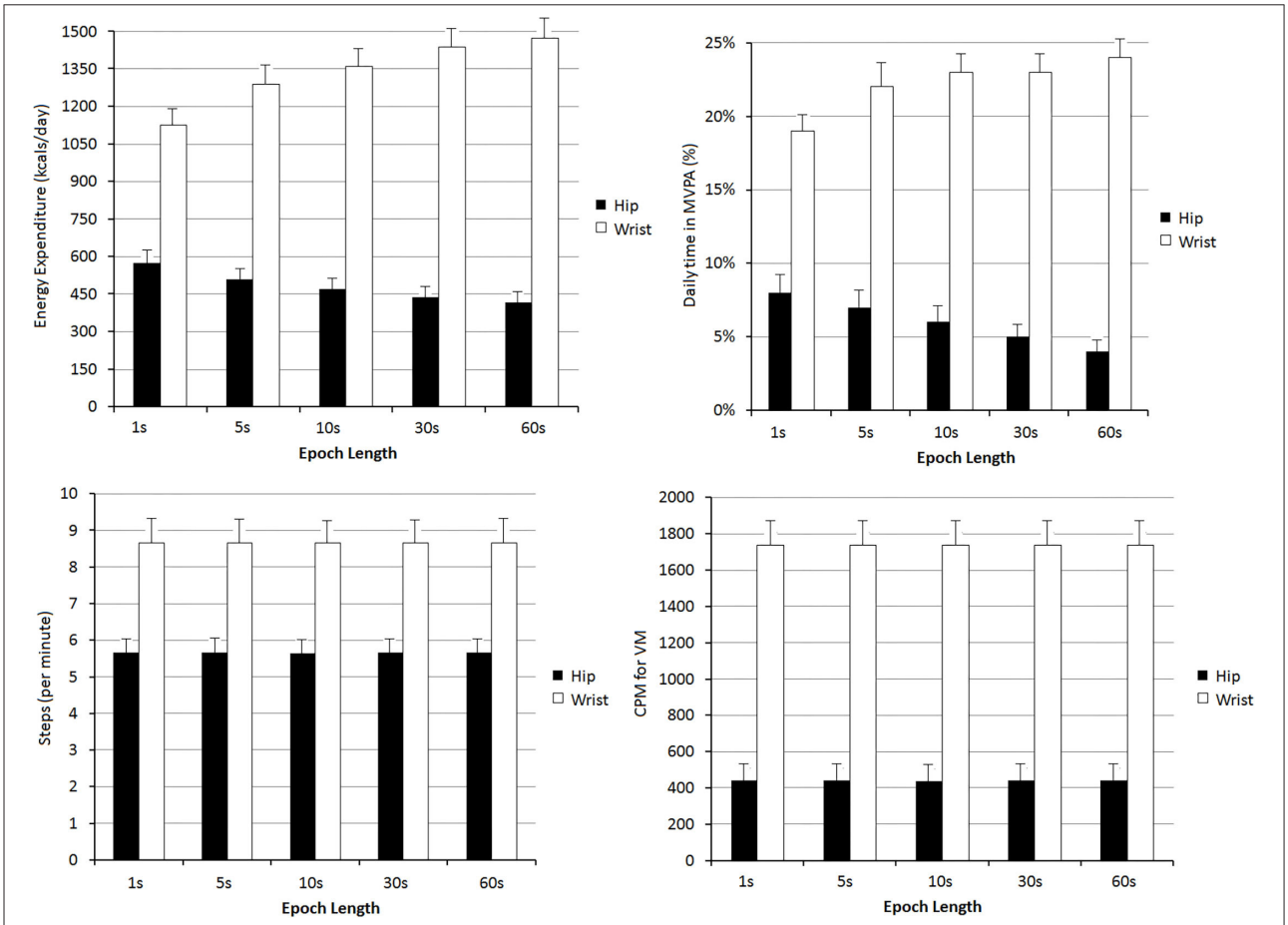


FIGURE 2 | Levels of energy expenditure, daily time in moderate-to-vigorous physical activity (MVPA%), steps per minute and vector magnitude (VM) counts per minute (CPM), found depending on the registration site (hip or wrist) and the epoch length: 1, 5, 10, 30, and 60 s. All comparisons between hip and wrist records were statistically significant ($p < 0.05$). For the same recording site (hip or wrist), the levels of Energy Expenditure and daily time in MVPA% were different ($p < 0.05$) when comparing the values obtained with different epoch lengths.

obtained with hip-accelerometers decreased. The opposite was observed when analyzing wrist-accelerometer data (**Figure 2**; **Supplementary Tables 1–10** in **Supplementary Material 2**).

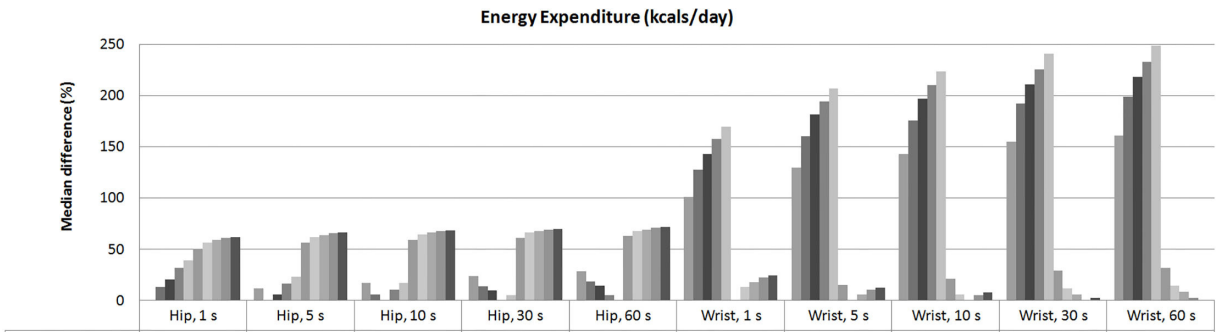
For any of the PA indices, the differences observed when comparing recording sites were greater than the obtained when considering different epoch lengths (**Figure 3**). In fact, regardless of the epoch length analyzed, the differences between data obtained from a given recording site considering different lengths (e.g., 39% between hip EE data when comparing epoch lengths of 1 and 60 s) were never as high as those observed when comparing data from different recording sites. A more extensive quantitative analysis can be found in **Supplementary Tables 11–18** in **Supplementary Material 2**.

Bland-Altman tests showed statistical significance for systematic errors, both when considering data from different locations or when comparing epoch lengths. In addition, with some exceptions, there were also proportional errors both when comparing epoch lengths or different recording sites. Consequently, besides the differences between the recording sites and epoch lengths, the differences varied depending on the levels of the variables measured (**Supplementary Tables 15–18** in **Supplementary Material 2**).

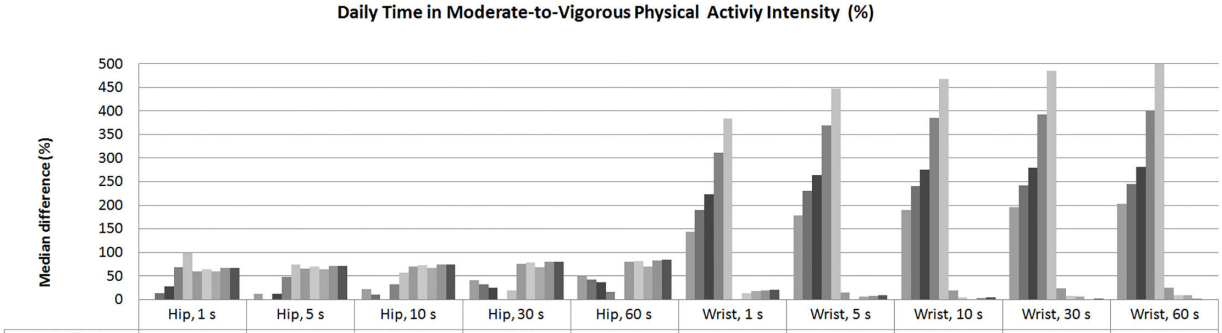
Accelerometry-Derived Indexes and Arterial Properties: Size, Direction, and Nature (Dependent vs. Independent) of the Association

Central and Peripheral Blood Pressure

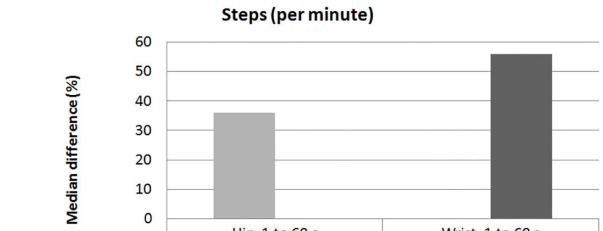
Partial correlations showed "weak to moderate" negative associations between wrist-derived EE data and baDBP (r: −0.384 to −0.413) and z-baDBP (r: −0.405 to −0.439) (**Figure 4**). Similarly, a negative association ("weak to moderate") between MVPA% (wrist recordings) and baDBP (r: −0.353 to −0.373) was observed only after adjustments were made (**Figure 4**; **Supplementary Table 26**



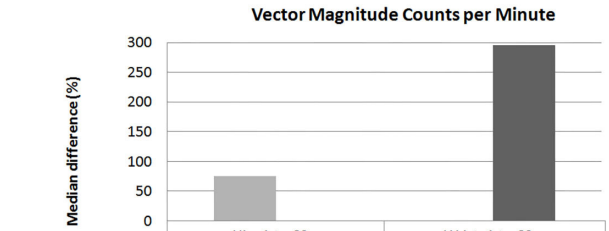
	Hip, 1 s	Hip, 5 s	Hip, 10 s	Hip, 30 s	Hip, 60 s	Wrist, 1 s	Wrist, 5 s	Wrist, 10 s	Wrist, 30 s	Wrist, 60 s
Ref.: Hip, 1 s	0.0	11.4	16.8	24.0	28.2	100.7	129.7	142.9	154.7	161.0
Ref.: Hip, 5 s	12.9	0.0	5.4	13.8	18.6	127.2	160.5	175.4	192.1	199.1
Ref.: Hip, 10 s	20.1	5.7	0.0	9.5	14.5	143.2	181.3	197.0	210.9	218.1
Ref.: Hip, 30 s	31.6	16.0	10.3	0.0	4.9	157.3	194.0	210.4	225.6	232.8
Ref.: Hip, 60 s	39.3	22.9	16.9	5.2	0.0	169.4	207.1	223.7	240.9	248.9
Ref.: Wrist, 1 s	50.2	56.0	58.9	61.1	62.9	0.0	14.8	21.3	28.7	31.7
Ref.: Wrist, 5 s	56.4	61.6	64.5	66.0	67.4	12.9	0.0	5.7	11.5	14.3
Ref.: Wrist, 10 s	58.8	63.7	66.3	67.8	69.1	17.6	5.4	0.0	5.7	8.1
Ref.: Wrist, 30 s	60.7	65.8	67.8	69.3	70.7	22.3	10.3	5.4	0.0	2.5
Ref.: Wrist, 60 s	61.7	66.6	68.6	70.0	71.3	24.1	12.5	7.5	2.5	0.0



	Hip, 1 s	Hip, 5 s	Hip, 10 s	Hip, 30 s	Hip, 60 s	Wrist, 1 s	Wrist, 5 s	Wrist, 10 s	Wrist, 30 s	Wrist, 60 s
Ref.: Hip, 1 s	0.00	12.10	21.53	40.61	49.52	143.93	178.23	190.37	195.15	202.81
Ref.: Hip, 5 s	13.77	0.00	10.33	32.36	42.57	189.16	229.59	239.91	242.27	244.42
Ref.: Hip, 10 s	27.43	11.52	0.00	24.09	36.30	223.58	264.22	275.34	278.99	281.42
Ref.: Hip, 30 s	68.36	47.85	31.73	0.00	15.88	311.69	368.53	385.53	391.63	401.38
Ref.: Hip, 60 s	98.11	74.13	56.98	18.88	0.00	383.09	447.03	467.61	484.93	499.66
Ref.: Wrist, 1 s	58.99	65.41	69.09	75.71	79.30	0.00	14.60	18.84	22.78	24.70
Ref.: Wrist, 5 s	64.06	69.66	72.54	78.66	81.72	12.74	0.00	3.98	7.26	9.32
Ref.: Wrist, 10 s	58.8	63.7	66.3	67.8	69.1	17.6	5.4	0.0	5.7	8.1
Ref.: Wrist, 30 s	66.12	70.77	73.61	79.66	82.90	18.55	6.77	3.01	0.00	1.58
Ref.: Wrist, 60 s	66.97	70.96	73.78	80.05	83.32	19.81	8.52	4.88	1.56	0.00



	Hip, 1 to 60 s	Wrist, 1 to 60 s
Ref.: Wrist, 1 to 60 s	35.85	0.00
Ref.: Hip, 1 to 60 s	0.00	55.89



	Hip, 1 to 60 s	Wrist, 1 to 60 s
Ref.: Wrist, 1 to 60 s	74.75	0.00
Ref.: Hip, 1 to 60 s	0.00	296.02

FIGURE 3 | Relative differences (%), median levels, between Energy Expenditure, daily time in Moderate-to-Vigorous Physical Activity (MVPA, %), steps/min, and VM CPM found depending on the registration site (hip or wrist) and the epoch length: 1, 5, 10, 30, and 60 s. Levels of statistical significance (*p*-values) for each paired comparison are detailed in **Supplementary Tables 15**–**18** in **Supplementary Material 2**.

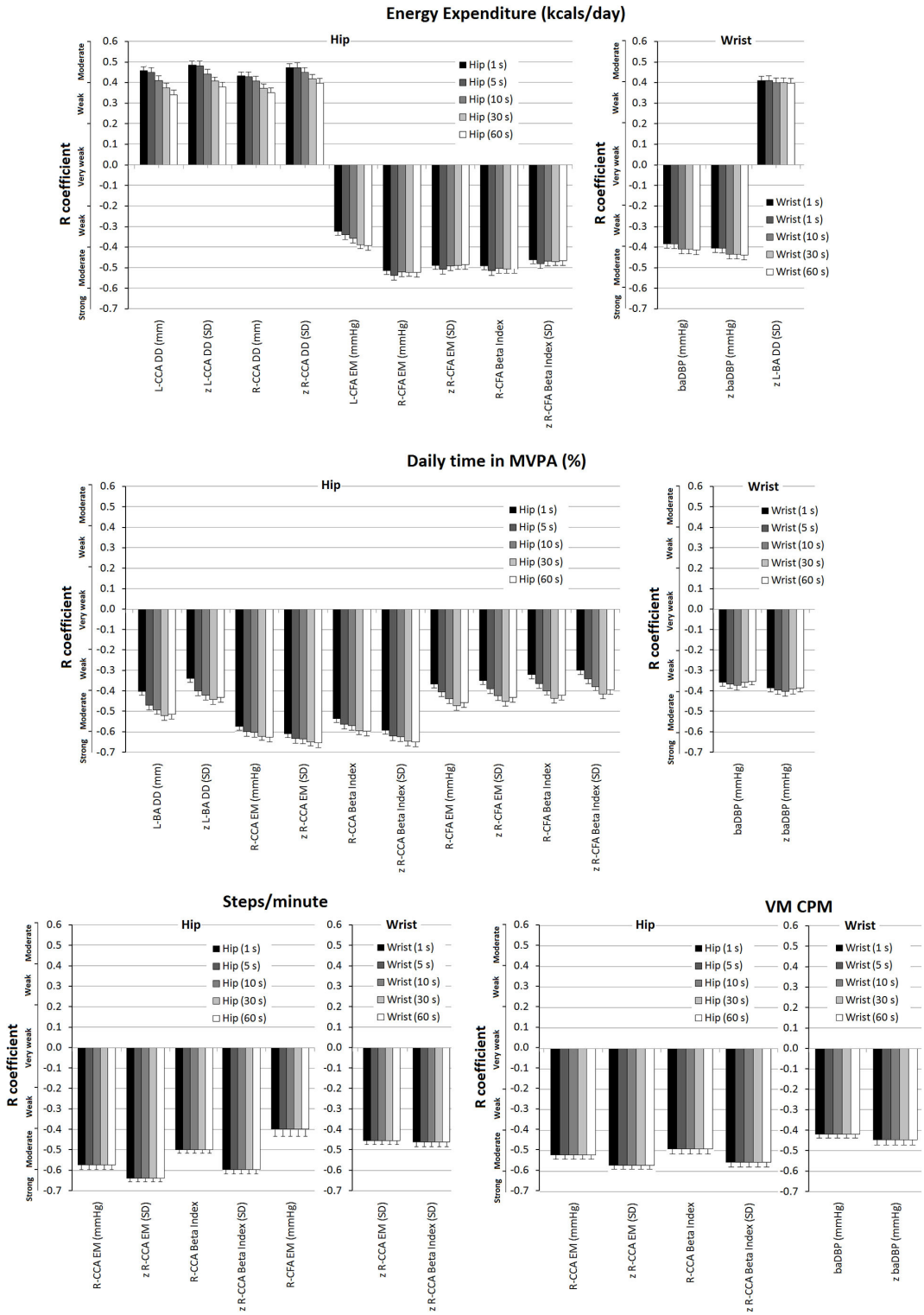


FIGURE 4 | Strength of association (*r* coefficients; partial correlations) between accelerometry-derived physical activity indices and cardiovascular properties (measured levels and/or z-scores), for hip and/or wrist records, as a function of epoch length (1, 5, 10, 30, and 60 s). Only the associations in which statistical significance was reached for at least one epoch are plotted. A more extensive description can be found in **Supplementary Tables 25**–**28** in **Supplementary Material 2**.

in **Supplementary Material 2**). In turn, after adjustment, VM CPM (wrist-recordings) was negatively associated with baDBP (*r*: −0.419) and z-baDBP (*r*: −0.446) (**Figure 4**; **Supplementary Table 28** in **Supplementary Material 2**).

Arterial Structural Parameters

Energy expenditure (EE; hip; and wrist data) showed positive associations (mostly "moderate to strong") with CCA and CFA diameters. In addition, EE from wrist-recordings was positively associated with BA DD (**Supplementary Table 21** in **Supplementary Material 2**). After adjustment, the association ("moderate") between EE (hip-recordings) and Left CCA DD (*r*: 0.341–0.458), z-Left CCA DD (*r*: 0.377–0.486), Right CCA DD (*r*: 0.451–0.434), and z-Right CCA DD (*r*: 0.398–0.472) remained significant (**Figure 4**; **Supplementary Table 25** in **Supplementary Material 2**). On the other hand, after adjustment, the positive association between EE (wrist-data) and diameters was no longer significant, with the only exception of z-left BA DD (**Figure 4**).

Daily time in moderate-to-vigorous physical activity (MVPA%) analysis (hip-recordings) supports the existence of positive independent relationships between PA and central arteries diameters since both before and after adjustment there were trends (*p* between 0.05 and 0.10) for positive associations with Left CCA DD and z-CCA DD (**Supplementary Tables 22**, **26** in **Supplementary Material 2**). MVPA% from wrist-recordings did not show significant association (or a trend to) with CCA, CFA, or BA structural parameters (**Supplementary Tables 22**, **26** in **Supplementary Material 2**).

Neither before nor after adjustment for cofactors the relationship between steps/min and structural parameters reached statistical significance. A similar finding was observed when considering VM CPM obtained from hip and wrist recordings (**Supplementary Tables 23**, **24**, **27**, **28** in **Supplementary Material 2**).

Local Arterial Stiffness

After adjusting for confounders, EE data from wrist-recordings was no longer associated with local stiffness, whereas EE levels (hip-recordings) showed "moderate" negative associations with Right CCA and Right and Left CFA stiffness (**Figure 4**; **Supplementary Table 25** in **Supplementary Material 2**). After adjustment, MVPA% (wrist-recordings) showed no association with local stiffness. On the contrary, MVPA% data obtained from hip-recordings remained negatively associated with CFA and CCA (right hemibody) stiffness ("moderate to strong" association) and kept the trend to be negatively associated with BA stiffness (**Figure 4**; **Supplementary Table 26** in **Supplementary Material 2**). Some associations were no longer significant after adjusting for cofactors; mainly the negative associations of steps/min and VM CPM (hip-records) with CCA stiffness were those that remained significant ("moderate to strong") (**Figure 4**; **Supplementary Tables 27**, **28** in **Supplementary Material 2**).

Regional Arterial Stiffness and Stiffness Gradient

Regional stiffness and PWV ratio showed no independent associations with EE or MVPA% (hip and wrist recordings). Neither before nor after the adjustment for cofactors of the VM CPM data from hip or wrist-recordings were associated with regional stiffness or stiffness gradient (PWV Ratio).

Regardless of the recording site, before adjusting for confounders, there was no association between steps/min and cfPWV, crPWV, or PWV ratio. However, after adjustments, the steps/min data obtained from hip-recordings showed a trend (*p* between 0.05 and 0.10) toward negative associations with z-cfPWV, PWV Ratio, and z-PWV Ratio (**Supplementary Table 27** in **Supplementary Material 2**).

Accelerometer-Derived Indices and Arterial Characteristics: Comparison of Central vs. Peripheral, and Structural vs. Functional vs. Hemodyamic Cardiovascular Parameters

Disregarding the recording site, the arterial variables with the strongest levels of independent association with PA indices were those of the central arteries (i.e., CCA DD and stiffness) (**Figure 5**, **Supplementary Tables 25–28** in **Supplementary Material 2**). Regardless of the recording site or epoch length considered, the highest levels of independent association were observed for functional (e.g., CCA stiffness) rather than hemodynamic or structural parameters (**Figure 5**, **Supplementary Tables 25–28** in **Supplementary Material 2**).

There were accelerometer-derived PA indices associated with arterial parameters of more than one arterial territory. EE and MVPA% recorded at the hip were associated with both CFA and CCA local stiffness. On the contrary, other indices only showed association with functional properties of a single arterial territory (e.g., VM CPM recorded at hip or wrist only showed association with CCA local stiffness parameters) (**Figure 5**; **Supplementary Tables 25–28** in **Supplementary Material 2**).

Association Between Accelerometer-Derived PA Indices and Arterial Characteristics: Influence of the Recording Site (Hip vs. Wrist)

Some PA indices and arterial characteristics were independently associated with disregard of the accelerometer location (e.g., VM CPM and CCA stiffness), whereas other associations depended on the recording site considered (e.g., EE or MVPA% and baDBP were only associated when wrist-data were considered). Compared to indices derived from wrist recordings, those obtained from hip measurements showed a higher number of statistically significant independent associations with arterial parameters (hip vs. wrist: 28 vs. 9 associations, respectively) (**Supplementary Tables 25–28** in **Supplementary Material 2**).

Regardless of the PA index considered, there were always several statistically significant independent associations when hip recordings and central artery parameters were considered. In

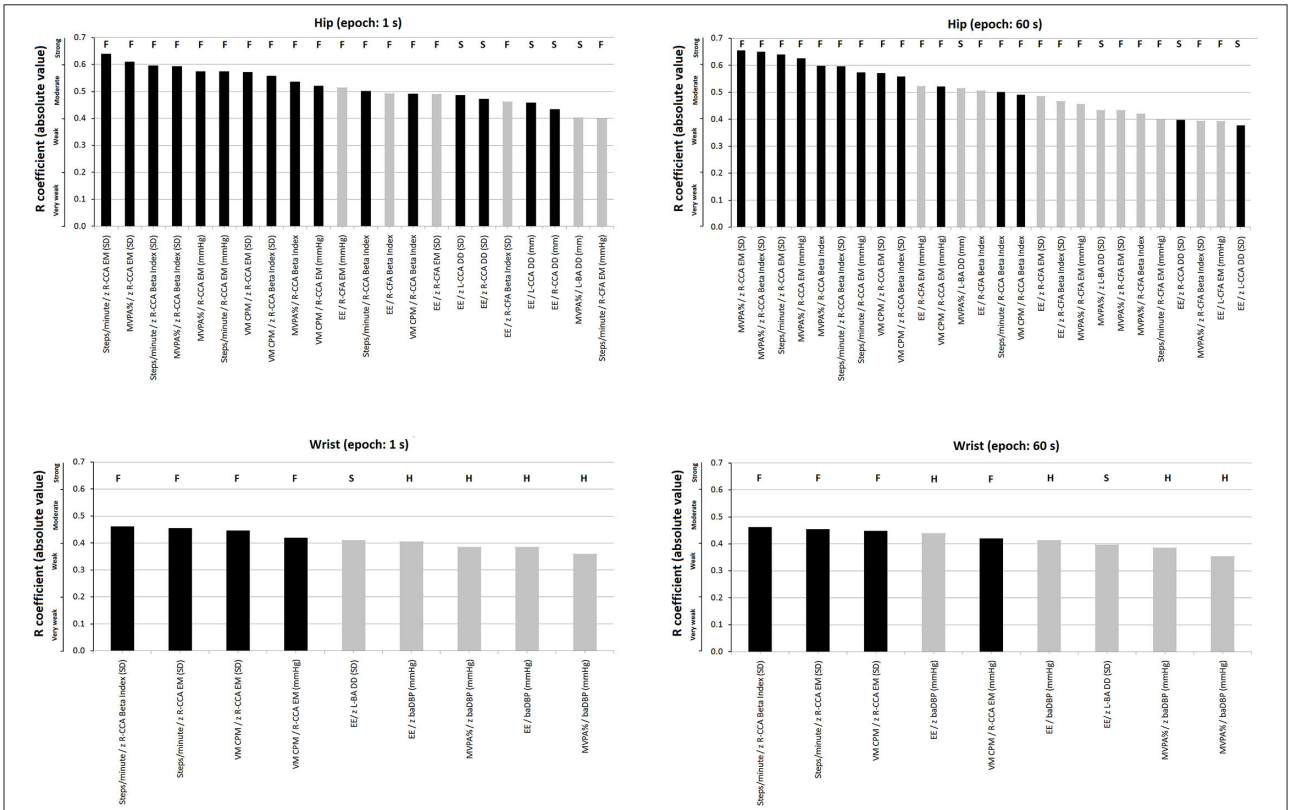


FIGURE 5 | Strength of association (*r* coefficients absolute value; partial correlations), ranked from highest to lowest "r," between accelerometry-derived physical activity indices and cardiovascular properties (measured levels and/or z-scores). Separate charts are presented for wrist and hip, and 1- and 60-s epoch. Only the associations in which statistical significance was reached are plotted. Black and gray bars: central (e.g., common carotid artery, CCA) and peripheral [e.g., common femoral artery (CFA) or brachial artery (BA)] parameters, respectively. The letters above each bar indicate whether it corresponds to a functional (F), structural (S), or hemodynamic (H) parameter. A more extensive description can be found in **Supplementary Tables 25**–**28** in **Supplementary Material 2**.

contrast, wrist recordings only showed associations with CCA when considering steps/min and VM CPM.

Association Between Accelerometry-Derived Indices and Arterial Characteristics: Influence of the Epoch Length

In some cases, the variation in the epoch length resulted in(significant) changes in the levels of association between an accelerometry-derived PA index and an arterial parameter. For instance, in partial correlations, the associations between EE data obtained from hip-recording and Left or Right CCA DD decreased (from "moderate" to "weak") as the epoch length increased (**Figure 4**) (**Supplementary Table 25** in **Supplementary Material 2**). In turn, the opposite was observed when analyzing the association between EE (wrist-recording) and baDBP, or the relationship between MVPA% and local (CCA or CFA) stiffness (**Supplementary Tables 25**, **26** in **Supplementary Material 2**). In fact, the associations between MVPA% (hip-recording) and Right CCA EM increased (from "moderate" to "strong") as the epoch length increased (**Figure 4**; **Supplementary Table 25** in **Supplementary Material 2**).

In contrast, when considering steps/min and VM CPM, the association strengths were shown to be unchanged as epoch length was varied (**Figure 4**; **Supplementary Table 25** in **Supplementary Material 2**).

DISCUSSION

Agreement Between Accelerometry-Derived Data: Recording Site and Epoch Length

Our findings are in agreement with previous studies in which using the same devices (ActiGraph GT3X+) and processing option provided by the software ("Worn-to-wrist"), it was observed that compared to data derived from wrist-recordings, those obtained from hip records showed lower (i) PA-related EE (Guediri et al., 2021), (ii) MVPA% (Kamada et al., 2016), (iii) steps counts (Hildebrand et al., 2014; Tudor-Locke et al., 2015; Kamada et al., 2016; Migueles et al., 2017; Mandigout et al., 2019), and (iv) VM counts (Kamada et al., 2016). Additionally, our data

showed that the differences would depend on the epoch length considered. As the epoch length increased, EE and MVPA% levels decreased when considering hip recordings, while the opposite was observed for wrist-derived data. In turn, steps/min and VM CPM values did not vary in association with variations in the epoch length considered (**Figure 2**). Consequently, for EE and MVPA% levels, the differences (discrepancies) between data from hip and wrist increased when selecting longer epoch lengths. In fact, for a given recording site, variations in the epoch length considered resulted in mean systematic and proportional errors (**Figure 3**).

The epoch length-related differences observed in this study are consistent with previous data obtained in children and adolescents using the same accelerometers (hip or waist recordings) (Aadland et al., 2018, 2020; Altenburg et al., 2021). In this regard, the reduction in MVPA% observed in hip-derived data as the epoch length increased agrees with Aadland et al. (2018, 2020) who reported that in children, the daily time in MVPA (minute/day) was reduced from 76 ± 23 to 74 ± 25 and 65 ± 28 when considering 1, 10, and 60-s epoch lengths, respectively. Additionally, the above is also consistent with the findings of Altenburg et al. (2021). These authors analyzed the impact of 5, 15, and 60-s epoch lengths on PA and sedentary behavior data in healthy children (n = 902, 5–12 years). The authors found that light PA, bouts of MVPA, and sedentary behavior increased with longer epochs. Besides, total MVPA decreased using longer epochs (total time: 60, 55, and 44 min/day for 5, 15, and 60-s epochs, respectively) which is in agreement with the findings of this study [total time in MVPA (MV): 67.9, 46.7, and 38.98 min/day for 5, 30, and 60-s epoch length, respectively] (**Supplementary Tables 1–10** in **Supplementary Material 2**). This has further strengthened the hypothesis that epoch length could modify the strength of association between accelerometer-derived indices and cardiovascular variables. Consequently, as stated, differences in data acquisition and processing could lead to significant differences in findings (and conclusions) when addressing PA and cardiovascular system association.

Despite different acceleration patterns expected to be obtained from wrist and hip recordings, some accelerometers (e.g., Actigraph GT3X) are offered, highlighting that the device can be used to evaluate the same parameters (e.g., MVPA%) regardless of the accelerometer location (ActiGraph, 2019). The latter must be entered into the software to define the "filters and algorithm" to be used to estimate the PA indices and to make data obtained from different recording sites comparable and/or well-matched. For instance, to make wrist records compatible with hip records, mathematical options like ActiLife wrist correction ("Worn on wrist" option) are available. If this is omitted (e.g., due to an error in processing data and/or unawareness of the issue), the information recorded at the wrist would be erroneously processed as if it had been recorded at the hip or waist (by default), achieving (generally speaking) higher levels of EE and MVPA%. As expected, this device-dependent processing scheme makes the calculations more complex (and less clear), since, first, the software uses non-linear and activity-dependent "wrist-hip" calibration schemes ("wrist-to-hip transformation") to artificially "reconcile" the acceleration patterns obtained at different locations to finally use scoring methods that were developed using hip accelerometers data in most commercially available devices. To date, no study has evaluated the validity of software data-correction despite its significance in terms of data analysis, validity, and comparability. In addition, in general, the algorithms are not available but are properties of the manufacturer (Mandigout et al., 2019). In this context, it should be noted that since the level of PA is performed regardless of how it is measured, it is clear that in a given individual and condition, the mathematical algorithms should provide the same results for accelerometer-derived indices or outcome of interest (e.g., EE, time in MVPA, steps/min) regardless of the device-location (e.g., allowing the individuals to assess their PA and compliance with the international recommendations) (Guediri et al., 2021).

Given that we used the "Worn to wrist" option (approach recommended by the manufacturer) and found participants to be "more active" based on wrist data, it could be said that wrist correction would not make data from different locations alike. Consequently, it could be proposed that, despite using the "Worn to wrist" option, hip and wrist-derived PA and epoch length-derived indices (with the exception of steps/min and VM CPM) would not provide similar values and would not be equivalent (**Figures 2**, **3**). Hip and wrist recordings should not be used interchangeably, and the epoch length should be selected in advance according to the PA index of interest. Our findings agree with and complement the results of previous works and emphasize that caution is needed when using EE, MVPA%, steps count, and VM CPM values recorded at wrist and hip as outcomes to assess or characterize PA, since different information is obtained. It has been suggested that users may assume that the "Worn on wrist" option in ActiLife would provide more accurate PA estimates (Mueller et al., 2020). However, as was analyzed, our results and those of other authors warn about the accuracy of the estimates (McMinn et al., 2013; Mandigout et al., 2019; Mueller et al., 2020; Nuss et al., 2020). In this context, it is noteworthy that the use of wrist correction factors will likely decrease as new wrist-based algorithms are developed.

In line with the above, when evaluating the association between PA indices and arterial parameters, it was necessary to separately analyze PA data obtained from different locations and epoch lengths. To our knowledge, there are no previous studies analyzing the associations of different arterial parameters, types, and regions with accelerometry-derived parameters.

Accelerometry-Derived Indices and Arterial Properties: Size, Direction, and Nature (Dependent vs. Independent) of the Association

Central and Peripheral Blood Pressure

As was mentioned, statistically significant negative associations between wrist-derived EE data and baDBP and z-baDBP were only observed after adjusting for cofactors. Then, regardless of age, sex, and exposure to CRFs, higher EE (obtained from wrist recordings) was associated with lower baDBP (absolute values, in mmHg) and lower baDBP with respect to the expected (RG value)

for age-matched healthy participants not exposed to CRFs. As was described, EE calculus (kcals/min) considers the relationship between the VM (or CPM) and BW (Kg) of a participant. At least in theory, when adjusting (partial correlations) for participant's characteristics (e.g., BW as BMI determinant), VM (or CPM) would become the variable that governs the relationship between EE and baDBP, making it evident that the higher the PA detected in the wrist, the lower the baDBP (potential beneficial effect of PA on BP associated to reduced peripheral vascular resistances and structural arterial changes). In contrast, when no adjustments are made (simple bivariate correlations), the participant's anthropomorphic characteristics would "hide and reverse" the association, making EE positively associated with aoSBP (e.g., related with the known positive association between aoSBP and BMI) (Garcia-Espinosa et al., 2018) and no longer associated with baDBP. Similarly, a negative association ("weak to moderate") between MVPA% (wrist recordings) and baDBP was observed only after adjustments were made. Thus, regardless of other characteristics of the participant, higher MVPA% (wrist-recordings) was associated with (beneficial) variations in baDBP (values even lower than those expected in the RG). Although it did not reach statistical significance, after the adjustment for cofactors (but not before), the steps/min level showed a tendency (p between 0.05 and 0.10) to be negatively associated with baDBP (wrist and hip recordings) and z-baDBP (wrist recordings). In turn, VM CPM data from wrist-recordings were negatively and independently associated with baDBP and z-baDBP. The above, obtained for steps/min and VM CPM, indices that do not require considering "cut-off values" and/or equations that include variables related to individual characteristics (as is required to calculate MVPA% or EE), reinforces that in healthy participants from the general population, higher "movement" is associated with lower baDBP (largely determined by peripheral vascular resistances; lower resistances, lower baDBP).

The described association suggests that when assessing the association between PA and BP levels, the use of an accelerometry-derived index that, in its calculation, takes into account anthropometric characteristics (e.g., EE) could have the disadvantage of integrating into a single index—variables that have inverse relationships with BP. In this regard, the use of indices whose determinants do not include BW or BMI (e.g., VM CPM) could be more useful for identifying the beneficial negative relationship between PA and BP, minimizing the impact of confounding factors.

Arterial Structural Parameters and Local Arterial Stiffness

The PA-related EE determined from hip-recordings would be positively and independently associated, mainly with central (carotid) arteries diameters (**Figure 4**). Since the associations remained significant after adjustments, they would not be mediated solely by the recognized positive association between arterial diameters and BMI, as might be the case for CFAs (Sandgren et al., 1999; Garcia-Espinosa et al., 2018). Moreover, the MVPA% analysis (hip-records) supports the existence of positive independent relationships between PA and central arteries diameters since there were trends (p between 0.05 and 0.10) in both before and after adjustment for positive relationships with Left CCA DD and z-CCA DD. In contrast, in general terms, after adjustment, the positive association between EE (wrist-records) and arterial diameters was no longer significant. In turn, MVPA% data from wrist measurements did not show significant associations (or trends to) with carotid, femoral, or brachial structural parameters. Therefore, indices from wrist recordings would not be independently associated with characteristics of arteries that are the main determinants of arterial impedance and left ventricular load.

These results show that the structural characteristics of central arteries (i.e., CCA) would be the most sensitive to structural variations associated with variations in the accelerometry-derived indices EE and MVPA%. Therefore, the analysis of central (e.g., CCA) rather than peripheral (e.g., CFA and BA) arteries would be the most valuable for monitoring structural arterial variations associated with PA levels (determined by accelerometry-derived indices).

After adjusting for confounders, EE (wrist-records) was no longer associated with local stiffness, whereas EE levels obtained from hip-recordings showed "moderate" negative associations with CCA and CFA local stiffness (**Figure 4**). In line with the above are findings obtained when analyzing MVPA%. After adjusting for cofactors, MVPA% levels obtained from wrist-recording showed no association with local arterial stiffness. This again suggests that accelerometry-derived indices obtained from wrist-recordings would not be independently associated with the main biomechanical arterial characteristics. On the contrary, after adjustment for confounders, MVPA% data obtained from hip-recordings remained negatively associated with CFA and CCA (right hemibody) stiffness (reaching "moderate to strong" levels of association) and kept the trend to be negatively associated with BA stiffness. Consequently, whatever the participants' characteristics, higher levels of MVPA% (hip-recordings) were associated with lower local arterial stiffness. The described above for EE and MVPA% is similar to the obtained when analyzing steps/min and VM CPM. Although some relationships were no longer significant after adjusting for cofactors, the negative associations between data from hip-recordings and CCA stiffness were, mainly, those that remained significant.

Then higher PA levels obtained from hip-recordings (but not from wrist-measurements) would be (or tend to) independently associated with lower levels of femoral and carotid stiffness (which would certainly indicate a PA-related benefit for the cardiovascular system). The above reinforces the value of hip-recordings to assess the association between PA and arterial characteristics.

Each arterial segment fulfills two different but interrelated "biomechanical" functions: to deliver an adequate blood supply to organs and tissues ("conduit function"), and to smooth the pressure and flow pulsation resulting from the intermittent left ventricular ejection so as to transform the oscillatory (highly pulsatile) hemodynamic into a continuous low-pulsatile one ("buffering or cushioning function"). Both functions are mainly determined by the cross-sectional area of the arterial segment and by the arterial wall stiffness. Arteries with a larger diameter

and lower stiffness interpose less resistance to blood flow (more efficient "conduction function," which is to say, lower local or characteristic impedance) while performing greater filtering (a more efficient "buffering function") of blood flow and pressure pulsatility. In this context, our results showed that accelerometer-derived indices assessed at the hip (but not at the wrist; even though the "Worn on wrist" option was used) would be related to the levels of arterial diameter and stiffness, which would mean that they would be independently associated with the two main determinants of the arterial biomechanical functions.

Regional Arterial Stiffness and Central-Peripheral Stiffness Gradient

Regional stiffness and PWV ratio showed no independent associations with EE, MVPA%, or VM CPM data obtained from hip and wrist recordings. However, after the adjustment for cofactors, steps/min data obtained from hip-recordings showed a trend toward negative associations with z-cfPWV, PWV Ratio, and z-PWV Ratio. Accordingly, higher PA levels measured in terms of steps/min would tend to be associated with lower regional aortic (central) stiffness and "central stiffness/peripheral stiffness" ratio (would gradually move toward values below 1). Reduced aortic stiffness levels would be beneficial to the cardiovascular system as they result in lower levels of ventricular afterload (cardiac effects) and increased buffering capacity. In turn, a reduced PWV ratio would protect the microcirculation and contribute to ensuring an adequate capillary-tissue exchange, reducing the amount of pulsed energy accessing the exchange system (Bia and Zócalo, 2021; Pereira et al., 2021).

In a large cohort sample [n = 2,455, 47 ± 9 years; (53% women)], Andersson et al. (2015) found that higher MVPA% levels were negatively associated with cfPWV and forward pressure wave and positively associated with left ventricular mass. Differences in the PA levels recorded in this study and that in Andersson et al.'s study could contribute to explaining the (relative) dissimilar findings. About this, whereas in this study the mean value of daily MVPA was 46.72 min, the authors reported a mean value equal to 29.9 and 25.5 min for men and women, respectively. In a cross-sectional study in British men, Parsons et al. (2016) found that accelerometer-derived PA indices were associated with arterial stiffness, augmentation index, and CCA IMT. Unfortunately, sample characteristics or methodological differences between studies preclude accurate comparisons.

Finally, as an overall message, from the above four sub-sections, it could be stated that: first, when the associations were evaluated adjusting for co-factors, the number of significant associations was reduced. Then, many associations between PA indices and cardiovascular properties would be mediated or influenced by variations in other factors (mediation/moderation). Whereas, after adjusting for cofactors, BP no longer showed a positive association with some PA indices but became negatively associated (wrist data) with EE and MVPA% (which would be related to the proposed benefits of PA on BP). CCA diameters and stiffness continued to show, respectively, positive and negative associations with PA, reinforcing that the relationship between these variables would not depend on participant's characteristics or exposure to other CRFs (**Figure 4**). Accordingly, it could be said that independent of confounding factors, accelerometry-derived PA indices would be globally associated with an arterial system showing reduced impedance to blood flow (lower stiffness and larger arterial diameter), which in turn could contribute to the trend toward lower BP levels.

Accelerometer-Derived Indices and Arterial Characteristics: Comparison of Central vs. Peripheral and Structural vs. Functional Cardiovascular Parameters

Since accelerometer-derived PA indices showed a major independent association with central elastic (i.e., CCA) than with peripheral arteries (i.e., CFA and BA), the former would be preferentially "affected" or would be more "sensitive" to the PA effects (**Figure 5**; **Supplementary Tables 25–28** in **Supplementary Material 2**). This observation could have important practical implications. First, the assessment of PA impact on the arterial system should focus on central arteries. Identifying that accelerometry-derived PA indices are mostly associated with central artery property levels open the possibility of using them to monitor interventions that are expected to impact on true left ventricular afterload (Zócalo et al., 2013). In turn, peripheral arteries (e.g., BA) could give inaccurate data regarding the impact of PA on the vascular system (Dinenno et al., 2001). In this context, it is noteworthy that exercise training demonstrated beneficial effects on the femoral artery. In this regard, although the impact of exercise on the established peripheral arterial disease would be different, the observed association between PA activity and CFA diameters could contribute to explaining the benefits of PA in the context of vascular adaptations to training and/or disease (Dinenno et al., 2001; Haas et al., 2012). In this regard, our data do not show an independent association between PA indices and CFA DD, but rather a relationship that would depend on other factors (only observed in simple correlations). Prospective interventional studies would be necessary to confirm the above.

On the other hand, after adjustment for cofactors, regardless of the recording site or epoch length considered, the highest levels of association were observed for functional (e.g., CCA local stiffness) rather than hemodynamic or structural arterial parameters (**Figure 5**, black columns; **Supplementary Tables 25–28** in **Supplementary Material 2**). The above is in agreement with Baumgartner et al. (2020) who described that in children and adolescents, accelerometer-derived PA indices had differences in their associations with functional and structural arterial properties, and consequently, not all accelerometer-derived PA indices would have the same ability to identify inter-individual cardiovascular variations.

Regardless of epoch length, there were accelerometer-derived PA indices associated with the arterial parameters of more than one arterial territory. On the contrary, other indices only showed association with functional properties of a single territory. This could have a practical impact on the selection of accelerometry indices to be used in studies (cross-sectional or longitudinal) that attempt to identify associations between PA

levels and the cardiovascular system. The selection of indices associated with more than one characteristic and/or arterial pathway could increase the depth and scope of the study approach, whereas selecting indices without an association could lead to wrong conclusions (e.g., that PA is not associated with "arterial characteristics"). The above reinforces the idea that PA does not impact homogeneously the arterial system, but rather differentially affects the arterial territories and characteristics. Regarding the latter, local stiffness indices (e.g., EM) would be more sensitive than regional parameters (cfPWV or crPWV) in showing associations with accelerometry-derived indices. Consequently, when analyzing and discussing the impact of PA on "arterial stiffness" or "arterial diameter," it is necessary to specify the territory and parameter evaluated.

Association Between Accelerometer-Derived PA Indices and Arterial Characteristics: Influence of the Recording Site (Hip vs. Wrist)

Our results indicated that compared to wrist-derived indices, those obtained from hip measurements showed a greater number of statistically significant associations with arterial parameters. In theory, this could be evidence that the "acceleration" recorded at the hip would be more closely related to PA levels that are biologically linked to structural and functional characteristics of the arterial system. As an example, when walking, running, bending down, or climbing stairs, the aerobic PA associated with benefits on the cardiovascular system could be more accurately recorded with an accelerometer placed on the hip. As discussed, although the software used "counts" measured at the wrist and after converting them to hip equivalents (conversion equations) and calculated PA parameters that attempt to be similar to those from hip-recordings, these clearly did not outperform the data obtained directly from hips in terms of levels of association with arterial characteristics. Anyway, whether the observed differences between hip and wrist data (in terms of association with arterial properties) are such as to recommend the use of hip recordings over wrist should be further analyzed in prospective studies.

Unfortunately, there are no previous studies comparatively analyzing the associations between accelerometer-derived indices (hip and wrist) and arterial variables. We only found one manuscript. In this regard, our findings agree with Cooke et al. who described that the association between step counts and cfPWV was only observed when the accelerometer was attached to the hip (−0.28 m/s, 95% CI −0.58, 0.01) (Cooke et al., 2018).

Association Between Accelerometry-Derived PA Indices and Arterial Characteristics: Influence of the Epoch Length

Our results indicate that although the length of the epoch could determine the levels of association between PA indices and arterial characteristics, it is not possible to make generalizations regarding the appropriateness of using a particular epoch length to increase the overall levels of association between accelerometer-derived PA indices and arterial characteristics. Defining the "best" epoch length is beyond the scope of this work. As mentioned, the results showed that the levels of association between accelerometry-derived indices and cardiovascular variables can both increase and decrease with increasing epoch length, which could depend on the recording site and index considered. This heterogeneity in the impact of epoch length on the strength of association between accelerometry-derived indices and arterial variables underscores the complexity of the issue. In this context, it could be said that the elective methodological approach, parameters to be analyzed, and associations to be assessed would vary and should be individually defined depending on the aim of the study. Further studies should address to what extent systematization or consensus on epoch lengths (defined considering the above) could improve the usefulness of accelerometry-derived variables in the analysis of the relationship between PA and the status of the cardiovascular system.

In practical terms, the selected "epoch length" could determine the association between PA levels and cardiovascular health markers. As was mentioned, Aadland et al. (2018, 2020) found that in children the associations between accelerometer-derived PA levels and metabolic health markers (i.e., a composite metabolic health score) differed among different epoch lengths. About this, the associations between moderate-intensity PA (2,000–4,000 counts/min) and metabolic health markers observed for data analyzed using 60-s epoch were significantly weakened when shorter epoch durations were used (e.g., when considering 1-s epochs, that is, a configuration with sufficient resolution to capture accurately vigorous PA) (Aadland et al., 2020). The authors' findings suggested the associations between moderate-intensity PA and metabolic health could be spuriously high when analyzing data using long epochs. This could be explained by the misclassification of vigorous PA as moderate when averaging PA over longer periods (Aadland et al., 2018). In addition, when considering the 60- vs. 1-s epoch setting, the PA intensity associated with metabolic health was found to be significantly left-skewed; the strongest associations with metabolic health were observed for 7,000–8,000 cpm (rather than for 4,000–5,000 cpm) (Aadland et al., 2020). Then, conscious use of epoch settings would be critical for accurate analysis and understanding of the relationship between PA and health status (Aadland et al., 2018, 2020). The findings of the authors both question and challenge researchers' knowledge on how PA is distributed and accumulated and on how accelerometer data should be managed and analyzed (Aadland et al., 2020). In line with what was described for metabolic health indicators, our findings reinforce the significance of the epoch length considered for adequate analysis and interpretation of data on the association between accelerometer-derived PA indices and the structural, functional, and hemodynamic properties of central and peripheral arteries.

Strengths and Limitations

This study has strengths and limitations that should be considered. First, our study included a comprehensive

non-invasive evaluation of cardiovascular properties. Second, the definition of an RG made it possible to determine inter-individual cardiovascular variations (z-scores). Since the RG included Uruguayan adults non-exposed to CRFs, at the time of identifying in the 60 participants the degree of deviation from the expected or optimal values, we avoided using bibliographic data obtained non-Uruguayan participants who do not necessarily have characteristics similar to those of the Uruguayan population. Third, in this study, central and peripheral SBP and DBP were used to quantify central and peripheral arterial stiffness levels.

We are aware that our research may have limitations. First, it is a cross-sectional study, so participants were not followed and the temporal profiles of the cardiovascular properties and/or the time spent on PA components and subcomponents were unknown. Second, the accelerometers do not allow capturing some PA (e.g., bicycling). Third, an obvious limitation was the lack of a criterion measure, such as direct observation, which precluded comparing and determining which epoch length would be the most accurate to assess PA. It should be noted that in addition to the mentioned (e.g., classification techniques based on accelerometer "intensity cut points") and used in this study, there are other analysis and classification methodologies (e.g., machine learning techniques or algorithms) proposed to determine PA behaviors from tri-axial wrist and hip acceleration raw data which allow the development of models (i.e., classifiers) (Kerr et al., 2016, 2017). However, in the present study, we limited the analysis to the approaches described (i) to focus the scope and limit the extension of the study, (ii) because they are among the most used so far, and (iii) because they are available for data processing using Actigraph GT3X +/ActiLife software. This is not a minor issue since previous studies showed differences in PA behavior estimates across hip and wrist locations, which varied depending on the way data was processed. Similarly, it should be noted that different computational analysis methods had different strengths depending on the type of measure being analyzed (Kate et al., 2016). Fourth, we did not consider thigh location as a wear option. This was simply to facilitate the protocol, as the inclusion of a third recording site would have reduced the project's ability to succeed. The value and eventual superiority of other accelerometer locations in terms of their ability to provide information about PA and its association with cardiovascular status should be analyzed in future studies. Fifth, our results were obtained in healthy participants and may not necessarily correspond to findings that could be obtained in other populations. The approach was selected based on the fact that our motivation was to assess the relationship between PA and vascular properties in participants considered healthy, given that we aimed to identify and analyze the association between PA and the vascular system from a physiological and preventive perspective. Sixth, we did not record ambulatory heart rate in order to obtain a "real" indication of PA intensity. Finally, as in previous studies, Bland-Altman analysis was done using "Krouwer's method" (Krouwer, 2008; Ruiz et al., 2011; Chastin et al., 2018). We are aware of the fact that this approach is not the classic one and although it has strengths, it also has limitations. In this regard, it should be noted that the "reference" method is the one with a smaller measurement error compared to the other measure evaluated, and strictly, this is not the case for data in our study.

CONCLUSIONS

Working with healthy adults in free-living conditions, our study contributes to the knowledge that differences in data acquisition and processing could lead to differences in results when addressing the association between accelerometer-derived PA indices and the cardiovascular system. First, despite using the "Worn to wrist" option provided by the manufacturers of ActiGraph devices, accelerometer-derived PA indices obtained from hip-recordings were lower than those from wrist-measurements. Additionally, these differences varied as a function of the accelerometry-derived PA levels recorded (proportional errors). Second, the EE and MVPA% levels obtained from wrist and hip change in the opposite way when varying the epoch length. As the epoch length increased, EE and MVPA% levels decreased when considering hip recordings, but the opposite was observed for wrist-derived data. Steps/min and VM CPM values did not vary in association with variations in the epoch length considered. Hip and wrist-derived PA indices and indices obtained considering different epoch lengths would not provide similar data and would not be considered equivalent. Then, hip and wrist data should not be used interchangeably. In turn, the epoch length should be selected in advance according to the proposed aims or analysis (e.g., the PA index of interest). Third, mostly central arteries (CCA) characteristics and mainly the functional ones (local stiffness) were associated with accelerometry-derived indices (EE, MVPA%, steps/min, and VM CPM). Then, central territories would be those mainly related to PA levels assessed by accelerometry. Whatever the index considered (EE, MVPA%, steps/minute, or VM CPM), there was an association with central arteries (CCA). Fourth, hip records (with respect to wrist records) showed the highest level of association with arterial characteristics. In general, PA indices obtained by hip recordings outperformed those obtained from wrist measurements in terms of association with arterial parameters. Fifth, variations in the epoch length considered resulted in variations in the strength of association between arterial characteristics and EE and MVPA% levels (but not steps/min and VM CPM), although there was no clear trend enabling to define whether a certain epoch length would be "of choice."

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Comité de Ética del Hospital de Clínicas, Comité de Ética del Centro Hospitalario Pereira-Rossell y Comité de Ética del Instituto Superior de Educación Física. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

MG-G, DB, and YZ contributed to the conception and design of the study, performed the accelerometry and cardiovascular non-invasive recordings, constructed and organized the database, and performed the statistical analysis. MG-G, JT, DB, and YZ wrote the first draft and final version of the manuscript, contributed to manuscript revision, read, and approved the submitted version. All authors contributed to the article and approved the submitted version.

FUNDING

This research was funded by Agencia Nacional de Investigación e Innovación (ANII), grant number PRSCT–008–020 and FSPI_X_2015_1_108484, and extra budgetary funds provided by DB, YZ, and CUiiDARTE Center.

ACKNOWLEDGMENTS

We thank the children, adolescents and adults, and their families for their participation in the study. To colleagues who integrated the CUiiDARTE Project in different stages, as part of their final degree, master (M.Sc.), and/or doctoral (Ph.D.) projects.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fspor.2022.799659/full#supplementary-material

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Contribución personal a las publicaciones

1. **Gómez-García, M., Bia, D., & Zócalo, Y. (2021). Physical activity, sedentary behavior and sleep time: association with cardiovascular hemodynamic parameters, blood pressure and structural and functional arterial properties in childhood.** ***Journal of cardiovascular development and disease*****, *8*(6), 62.**

   El presente trabajo derivó de mis estudios de Maestría realizados en el Programa de Investigación Biomédica (2018-2020). Mi contribución personal se encuentra presente en el desarrollo de toda la publicación. Específicamente realicé el armado y control de calidad de la base de datos, la discusión y definición del abordaje estadístico a realizar, la realización de los test estadísticos (empleando SPSS-IBM Software y Med Calc), el análisis de resultados, así como la definición de la presentación de los mismos. Participé activamente en la escritura de la primera versión del manuscrito, así como de la re-escritura incluyendo modificaciones sugeridas por co-autores. Adicionalmente, participé durante el proceso de respuesta y re-escritura que surgió luego de recibir los comentarios de los revisores. En todo momento estas tareas fueron supervisadas y realizadas conjuntamente con mis directores, Prof. Agdo. Daniel Bia y Prof. Adj. Yanina Zócalo.

2. **Gómez-García, M., Torrado, J., Bia, D., & Zócalo, Y. (2022). Influence of epoch length and recording site on the relationship between tri-axial accelerometry-derived physical activity levels and structural, functional and hemodynamic properties of central and peripheral arteries.** ***Frontiers in sports and active living*****, 26.**
3. **Gómez-García, M., Torrado, J., Pereira, M., Bia, D., & Zócalo, Y. (2022). Fat-Free Mass Index, Visceral Fat Level, and Muscle Mass Percentage Better Explain Deviations From the Expected Value of Aortic Pressure and Structural and Functional Arterial Properties Than Body Fat Indexes.** ***Frontiers in nutrition*****, *9*.**

   Los presentes trabajos derivaron de una muestra de mis estudios de doctorado el cual comencé formalmente en el año 2020, si bien con anterioridad habíamos comenzado los registros del proyecto. En este caso, mi contribución se encontró durante todo el proceso que dio lugar a la publicación. Las actividades realizadas fueron: (i) la discusión y planificación de las series experimentales, (ii) la citación y recepción de las personas evaluadas, (iii) la obtención de datos mediante diversos abordajes no-invasivos que implican el aprendizaje de una variedad de técnicas, (iv) el procesamiento de los datos almacenados mediante diferentes softwares (registros de imágenes [videos y fotos tomados mediante ecografía], de bioimpedancia, de tonometría de aplanamiento, de oscilometría, de cardiografía por impedancia), (v) el armado de la base de datos, (vi) su posterior análisis, post-planificación, mediante softwares de herramientas estadísticas, la discusión de resultados y la escritura de los manuscritos. Estas etapas se hicieron en conjunto con mis directores de tesis, y la discusión de resultados también en conjunto con colegas de instituciones estadounidenses (Juan Torrado y María Pereira).

Título: Evaluación integral de la condición física, conducta sedentaria, actividad física y sueño: asociación con el estado cardiovascular.

Antecedentes

La exposición a factores de riesgo cardiovascular (FRCV) genera apartamientos del punto de trabajo óptimo del sistema cardiovascular (CV), lo que retroalimenta un círculo vicioso que gradualmente favorece desde la propia infancia mayor deterioro estructural y funcional CV, con aumento de riesgo de morbi-mortalidad CV en el adulto [Urbina, 2010; Zócalo, 2015-A]. Por esta razón, se sugiere que la edad óptima para iniciar la prevención y/o detección precoz de alteraciones CVs asociadas es “cuanto antes” [Urbina, 2010; Zócalo, 2015-A]. Por una parte, esto ha llevado a recomendar en diferentes sub-poblaciones intensificar las evaluaciones que permitan conocer el nivel de exposición a FRCV y a conocer directamente el estado estructural y funcional del sistema CV, comenzando en ocasiones en la propia niñez (empleando para esto evaluación arterial no-invasiva) [Urbina, 2010; Zócalo, 2015-B]. Por otra parte, se ha promovido que se profundice en investigación destinada a identificar factores asociados al desarrollo de alteraciones CV y aumento de riesgo CV. En otras palabras, en la búsqueda de reducir el impacto de la enfermedad CV, existe necesidad de identificar características y/o condiciones que podrían estar asociadas a apartamientos del punto óptimo de trabajo y/o a alteraciones CVs tempranas.

Diversos trabajos han evidenciado que el impacto en morbi-mortalidad CV y global de los avances (en las últimas décadas) en herramientas de diagnóstico y tratamiento no ha sido el esperado. Teóricamente, eso se ha explicado principalmente por el concomitante aumento en (i) inactividad física, (ii) conductas sedentarias (CS) y (iii) características nutricionales asociadas a "exceso" (ej. sobrepeso-obesidad), que impactan negativamente en la salud, tanto directa como indirectamente [Joy, 2013].

En la actualidad, si bien los indicadores que intentan caracterizar el "movimiento o capacidad de movimiento humano" (condición física (CF), actividad física (AF), CS y patrón del sueño (PS)) se reconocen como potenciales factores asociados a riesgo de alteración CV, su valoración objetiva en la práctica clínica es un aspecto no resuelto. La valoración subjetiva (auto-reportada por el sujeto y/o sus padres) del "estado físico", la frecuencia, intensidad, tipo y tiempo destinado a la realización de AF (o a dormir) no permite valorar adecuadamente (i) el riesgo asociado a inactividad o sedentarismo, (ii) si el sujeto cumple con la prescripción de ejercicio físico y/o (iii) sustentar intervenciones biomédicas o políticas sanitarias.

Finalmente, un aspecto que cobra cada vez mayor relevancia es el estudio de la asociación entre el nivel de CF del sujeto (o de su sub-componentes) y la salud CV. Clásicamente la aptitud o CF de un sujeto relacionada a la salud, integra diversos sub-componentes: (i) capacidad cardio-respiratoria (ii) condición muscular, (iii) flexibilidad, (iv) composición corporal [ACSM, 2017]. En este contexto, diferentes trabajos han propuesto que la valoración de algunos y/o todos estos componentes podrían ser marcadores del estado de salud CV [Roldão da Silva, 2020; Morikawa, 2018; Baumgartner, 2020].

En este contexto, un área en la que resta profundizar en investigación científica es en abordajes que (i) permitan objetivar de manera sujeto-específica los niveles de CF, AF, CS, PS a la vez que (ii) identificar en qué medida variables asociadas con estas conductas o características se asocian o podrían contribuir a identificar el apartamiento del nivel "óptimo" de trabajo del sistema CV [Gómez-García, 2020-A].

Objetivos

En este contexto, el presente proyecto busca contribuir a:

- Identificar en qué medida, diferentes abordajes empleados para valorar la relación "movimiento, CF y salud permitirían identificar características y/o hábitos que asocien un estado CV normal o alterado.
- Contribuir a identificar fortalezas y/o limitaciones de abordajes, que individual o complementariamente, podrían ser útiles para identificar condiciones que asocien apartamiento del estado óptimo estructural y funcional del sistema CV.

Estrategia metodológica

Para ello se realizarán registros en sujetos sin enfermedad CV previamente conocida, sin limitaciones motoras, con edad ≥5 años. En cada sujeto incluido se realizará: (i) entrevista clínica personal, o a sus tutores legales, con el objetivo de conocer sus antecedentes personales y familiares, nivel de exposición a FRCV, consumo de fármacos, etc. Adicionalmente se realizarán evaluaciones que permitirán caracterizar: (ii) la AF, CS y PS cotidiana, (iii) composición corporal, (iv) la CF, y (v) el estado hemodinámico, estructural y funcional del sistema CV. Todos los protocolos serán aplicados con previo aval de Comité de Ética y siguiendo recomendaciones internacionales [Piepoli, 2006; Urbina, 2010].

Valoración de la actividad física "24/7": Se evaluará mediante acelerometría (registros: ≥7 días continuos, equipo de ATA colocado en muñeca y cintura; GT3X, ActiGraph, U.S.A).

Valoración de la indemnidad y composición corporal: Se registrará talla, peso, composición corporal y otros parámetros derivados mediante BIA, empleando dos abordajes diferentes: (1) sistema monocomponente y monofrecuencia de 50 kHz (Omron HBF-514C; OmronInc, Japón) y (2) sistema de cinco componentes [Miembros superiores e inferiores y tronco] y multifrecuencia: 20 y 100 kHz (InBody-120, InBody Co., Korea).

Valoración de componentes de la condición física asociados con la salud: Se evaluarán la: (i) capacidad cardio-respiratoria, (ii) capacidad músculo-esquelética, (iii) composición corporal y la (iv) flexibilidad. La evaluación de componentes de la CF asociados a la salud permitirá contar con información que posibilite diagnosticar el estado de situación al momento del estudio, así como también clasificar a los sujetos (útil para posteriores sub-análisis).

La valoración arterial no invasiva constará de los siguientes registros: (i) Presión arterial periférica braquial y tibial. Índice tobillo brazo [sistemas oscilométricos HEM-433INT; OmronHealthcare Inc., Illinois, USA], (ii) Presión central aórtica y parámetros derivados de la onda de pulso[SphygmoCor 9.0, AtCorMedical, Australia; Mobil-O-Graph I.E.M. GmbH, Stolberg, Alemania], (iii) Hemodinamia global "latido a latido"[Z-Logic, Exxer, Buenos Aires, Argentina], (iv) Rigidez arterial regional carótido-femoral y carótido-radial [SphygmoCor 9.0, AtCorMedical, Australia], (v) Diámetros, espesor íntima-media y rigidez local carotideo, femoral y braquial [modo B, transductor lineal de 6-13 MHz, sistema M-Turbo, SonoSite Inc., Washington, USA], (vi) Velocidades y flujo sanguíneo carotideo, vertebral, humeral y femoral[modo Doppler, transductor lineal de 6-13 MHz, sistema M-Turbo, SonoSite Inc., Washington, USA] y (vii) Reactividad arterial (función endotelial) [Modo B y Doppler, transductor lineal de 6-13 MHz, sistema M-Turbo, SonoSite Inc., Washington, USA].

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PLAN DE ACTIVIDADES (2023-25): RÉGIMEN DEDICACIÓN TOTAL

Fortalecimiento del área biológica y de las prácticas corporales vinculadas a la salud en el Instituto Superior de Educación Física

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Antecedentes y posición actual

Con gran alegría he preparado la presente postulación para ingresar al Régimen de Dedicación Total (RDT) de la Universidad de la República (UdelaR), ya que acceder al RDT es un objetivo que he perseguido desde que, siendo estudiante de la Licenciatura en Educación Física, decidí desarrollar actividad docente y carrera académica en el Instituto Superior de Educación Física (ISEF) de la UdelaR. Basada en el conocimiento de la institución, en mis ideales y convicciones, y en lo que hemos venido trabajando con diferentes compañeros docentes, es que proyecto el presente Plan de Trabajo a tres años. En el Plan busco describir acciones específicas de enseñanza, investigación, asistencia, extensión, gestión, innovación y desarrollo de capacidades, que contribuyan al crecimiento del ISEF en el marco de su Plan de Desarrollo Institucional 2020-2025 (https://plandesarrollo.isef.edu.uy).

Desde hace 8 años trabajo ininterrumpidamente como docente del ISEF. Simultáneamente a cumplir mis actividades de enseñanza, me he propuesto participar activamente en las restantes funciones docentes sustantivas (investigación y extensión) a la vez que formarme como docente universitaria, en la búsqueda de capacitarme para poder aspirar al RDT. En este contexto, (i) he realizado (2018-2020) estudios de Maestría (Maestría en Ciencias Biomédicas, Escuela de Graduados, Facultad de Medicina, UdelarR), (ii) he realizado pasantías en Laboratorios de la Universidad de Calgary (Canadá), específicamente en cáncer y ejercicio y en la valoración de la respuesta cardiovascular a nivel central y periférica [Financiación MIA-CSIC], (iii) me encuentro finalizando mis estudios de Doctorado en Ciencias Biomédicas (Finalización prevista: Mayo/2023), (iv) lidero como responsable un Proyecto de Investigación financiados por la Comisión Sectorial de Investigación Científica (CSIC; Iniciación a la Investigación 2021-2023), y (v) he sido responsable de la consecución de financiamiento otorgado al ISEF en el marco del llamado ´Programa de Fortalecimiento del Equipamiento de Investigación en los Servicios de la UdelaR´(2022). Sumado a esto, desde el año 2019 participo junto a otros docentes de la UdelaR de la iniciativa de crear un espacio de trabajo interdisciplinario en el área de la Educación Física y la Salud, lo que ha dado lugar a la concreción de la fundación del ´Laboratorio de Investigación y Evaluación Biomédica en Reposo y Ejercicio´ (LIEBRE; https://imagenologiachpr.edu.uy/liebre/) de la UdelaR, del que el ISEF es parte esencial, y en donde venimos desarrollando la totalidad de las funciones universitarias. Basada en lo realizado, en 2021 ingresé al Sistema Nacional de Investigadores (SNI-Agencia Nacional de Investigación [ANII])

Es en este contexto, que el Plan de Trabajo que describo a continuación, se basa en lo que propongo hacer a futuro, sólidamente fundada en lo que hemos venido haciendo y construyendo en el ISEF, y naturalmente, en lo que respecta a investigación se encuentra alineado a mi plan de formación doctoral. Las actividades las realizaré desde mi posición como (i) Asistente Efectiva (Grado 2) del ISEF, y (ii) integrante del nuevo Centro Interdisciplinario “LIEBRE", conformado por docentes del ISEF, del Núcleo Interdisciplinario ´Centro Universitario de Investigación y Diagnóstico Arterial´ (CUiiDARTE-UdelaR), y del Centro Hospitalario Pereira Rossell.

Formación personal: aspectos teórico-prácticos

Durante el propio desarrollo del Plan, continuaré formándome como docente del ISEF. Específicamente continuaré mis estudios de Doctorado, y posteriormente a finalizar los mismos continuaré estudios de Post-Doctorado. En lo teórico, continuaré formándome en aspectos vinculados a los diferentes componentes y sub-componentes de la condición física y relación con la salud general y el estado de bienestar de las personas. En los aspectos prácticos, continuaré adquiriendo destrezas en la utilización de equipamiento de Laboratorio (recientemente financiado por la CSIC, y mucho de ello en proceso de arribo a nuestro país), y de nuevas técnicas de evaluación no-invasiva de la condición física y la salud cardio-respiratoria, metabólica, muscular, etc. que venimos empleando en el LIEBRE. A saber: acelerometría, ergoespirometría, bioimpedancia, ecografía (cardíaca, vascular, musculo-esquelética, de partes blandas), oscilometría, dinamometría, etc. Adquirir destreza en estas técnicas, permitirá no sólo enriquecer las diferentes líneas de investigación en las que se emplean, sino mejorar la información diagnóstica que se le brinda a la persona evaluada como parte de los proyectos de extensión de los que participamos. Adicionalmente, me permitirá ganar en autonomía para emplear los diferentes dispositivos, así como poder enriquecer la docencia en el ISEF en aquellos cursos en los que se incluyen contenidos temáticos relacionados. Por otra parte, la propia formación, me permitirá cuestionar y/o valorar "viejas y/o nuevas" formas de valoración la actividad y condición física de las personas.

Formación de recursos humanos en investigación

Desde mi posición (como docente pudiendo accediendo a ser su Tutora o Co-tutora) estimularé que nuevos docentes del ISEF, estudiantes de posgrado y/o de grado, se incorporen al trabajo de laboratorio, accediendo para ello a becas o financiamiento que permita consolidar su inserción. Para ello, estimularé a que se integren a los grupos de trabajo del ISEF, y que participen de los diferentes llamados para Investigación a Estudiantes de Grado (CSIC-PAIE; ANII; o Espacio Interdisciplinario). Esto permitirá incrementar la participación estudiantil en actividades de investigación y de extensión. Por otra parte, fomentaré y participaré regularmente como docente en cursos y talleres de formación en investigación y extensión, dirigidos a estudiantes, orientados a incrementar la cantidad y calidad de proyectos estudiantiles de investigación y extensión presentados y aprobados. Buscaré en todo momento, que empleen las herramientas que brinda la UdelaR para acceder a financiamiento, en el marco de proyectos de investigación formativos.

En el período del Plan de Trabajo, participaré como Docente en cursos que desde el LIEBRE, se presentarán al ´Programa de Maestría en Educación Física´(ProMEF, ISEF-UdelaR), ´Programa de Investigación Biomédica´ (PROINBIO - Escuela de Graduados, Facultad de Medicina, UdelaR), y en el Programa de Desarrollo de las Ciencias Básicas (PEDECIBA, Facultad de Ciencias, UdelaR), es decir, diferentes programas de formación superior de la UdelaR en las que puede realizarse formación específica en temáticas relacionadas con la educación física y la salud.

Enseñanza - Docencia

Continuaré desarrollando docencia de grado, enriqueciendo la misma con el conocimiento y experiencia adquirida durante el proceso de formación doctoral. Específicamente, esto lo realizaré en los cursos del ISEF en los que integro el equipo docente: ´Fisiología del Ejercicio´ y ´Educación Física Adaptada´. Un aspecto fundamental es que promoveré que se realicen actividades teórico-prácticas, así como rotaciones y pasantías por el LIEBRE. Presentaré y estimularé que se presenten cursos de formación permanente en el marco de la ´Unidad de Apoyo a Posgrados y Educación Permanente´ del ISEF.

A nivel de Posgrado, participaré organizando y co-participando como docente en cursos a realizarse en los programas mencionados (ProMEF, PROINBIO, PEDECIBA).

Extensión Universitaria

En línea con lo definido por la Comisión Sectorial de Extensión y Actividades en el Medio (CSEAM), de la UdelaR, continuaremos trabajando en extensión universitaria entendiendo a la misma como:

´(1) un proceso que contribuye a la producción de conocimiento nuevo, que vincula críticamente el saber científico con el saber popular, (2) un proceso que tiende a promover formas asociativas y grupales que aporten a superar problemáticas significativas a nivel social, (3) una función que permite orientar líneas de investigación y planes de enseñanza; generando compromiso universitario con la sociedad y la resolución de sus problemas, y (4) que en su dimensión pedagógica constituye una metodología de aprendizaje integral y humanizadora´.

En este contexto, continuaremos realizando actividades que indivisiblemente son investigación y docencia, innovación, pero que a la vez son extensión. A saber:

Estimularemos el desarrollo de dos ´Espacio de Formación Integral´(EF) dentro del ISEF, denominados ´Condición física y salud en población general´ y ´Ejercicio físico en oncología pediátrica´. Estos EFI permitirán que estudiantes se formen en un contexto de proyectos de investigación, que incluyen aspectos de diagnóstico y promoción de hábitos saludables, a la vez que el desarrollo de programas de intervención en la búsqueda de mejorar la calidad de vida de las personas evaluadas y la población general.

Adicionalmente, los proyectos de investigación permitirán contribuir a la resolución de problemas locales como, por ejemplo, la creación de valores/intervalos de referencia de diferentes componentes de la condición física, caracterizar la prevalencia o incidencia de diferentes condiciones, proponer e investigar sobre estrategias para reducir o mejorar condiciones que impactan negativamente en la población.

Por otra parte, se realizará la difusión de los resultados mediante artículos de difusión, y participación en Jornadas de ´Puertas abiertas´ tales como las que organiza la UdelaR, la Comisión Honoraria de Salud Cardiovascular, etc.

Innovación y Generación de Capacidades en el ISEF: LIEBRE (Unidad Hospitalaria y Extra-Hospitalaria)

Continuaré trabajando en aras de consolidar el Centro LIEBRE; sitio donde hemos contribuido a que la UR, y el ISEF en particular, cuente con una planta física donde diariamente trabajamos docentes de la UdelaR, formados en diferentes carreras de grado (ej. Educación Física, Biología, Medicina, Psicología), persiguiendo intereses y objetivos comunes. Espacio abierto a otros docentes o profesionales, y que oficia de plataforma científico-tecnológica para la realización de múltiples proyectos de investigación-extensión, en que se requiera un espacio hospitalario y tecnología para valoración no-invasiva. Adicionalmente, continuaré trabajando para profundizar el LIEBRE, sumando al Laboratorio Hospitalario ya creado, un laboratorio extra-hospitalario, que complemente al primero.

De esta manera, busco continuar contribuyendo a generar espacios y capacidades en la UdelaR, donde actuales y futuros estudiantes y docentes puedan encontrar donde formarse o desarrollar su actividad profesional.

Por otra parte, estimularé y participaré activamente en el desarrollo de vínculos interinstitucionales, redes académicas y movilidad académica. El ISEF tiene una importante historia de generación de redes académicas e interinstitucionales, las que les han dado sostén y lo han potenciado. En este contexto, buscaré formalizar vínculos con otros servicios de la UdelaR (como lo hemos hecho al formar el LIEBRE), con otras universidades (nacionales [ej. UTEC], regionales e

internacionales [ej. Universidad de Calgary – Canadá]), el trabajo con instituciones públicas o privadas, y o con organizaciones de la sociedad civil. Esto permitirá cumplir de mejor manera, todas las funciones universitarias y alcanzar objetivos que el ISEF por sí sólo no alcanzaría y/o a un costo muy elevado.

Investigación Científica: aspectos generales

En términos generales, mi plan de actividades busca: (i) contribuir a la producción de conocimiento original, de calidad, en el ISEF, (ii) fomentar la presentación de proyectos de investigación a fondos concursables, (iii) continuar contribuyendo con la formación de jóvenes investigadores, (iv) apoyar la formación científica de estudiantes de grado y la realización de Tesinas de fin de grado, (v) continuar y potenciar las líneas de trabajo con investigadores clínicos, así como la integración con investigadores de diversas disciplinas y (vi) aportar a que otros grupos y servicios puedan desarrollar y aprovechar nuestras capacidades (del LIEBRE).

En lo que respecta a líneas de investigación específicas, trabajaremos en actividades que permitirán desarrollar proyectos de investigación básica, aplicada, clínica y/o epidemiológica, en aspectos vinculados a la condición física y la salud. Esquemáticamente, contribuiré con líneas en dos grandes áreas:

Líneas de Investigación en grandes poblaciones – Bases de Datos Nacionales

Desde la creación del LIEBRE, hemos invertido nuestro tiempo en comenzar un proyecto que involucra grandes poblaciones de personas asintomáticas sin enfermedad cardiovascular, sean estos niños, adolescentes o adultos (“Proyecto LIEBRE 1”). La población estudiada posee edades comprendidas entre 5 y 80 años. En todos los casos los estudios han conllevado la entrega de un informe diagnóstico. Estos registros, están permitiendo conformar una importante base de datos. Durante los estudios se registran una muy importante cantidad de variables cardio-respiratorias, de condición física, de exposición a factores de riesgo, de antecedentes biomédicos, de la historia y antecedentes de vida, y de otras diferentes esferas de la vida del sujeto (existe un grupo de variables fijas, y otras que pueden variar en función del sub-proyecto específico; ej. valoración de la calidad de sueño, etc.). Adicionalmente, se cuenta con información sanguínea de parte importantísima de las personas, así como de su historial médico, sus medidas antropométricas, etc.

La información biológica almacenada en cada estudio es muy amplia (del orden de 1 Tera-byte por cada estudio), y es digitalizada de manera que todo lo obtenido pueda ser visualizado o re-procesado, incluso obteniendo en el futuro información que en el momento actual no nos ha interesado obtener. La consecución de esta base de datos, así como los métodos de muestreo, permite alcanzar conclusiones que son representativas de la población o sub-poblaciones de uruguayos. A la vez, permite contar con importante cantidad de casos, en función de diversas categorizaciones que se pueden hacer de las personas incluidas.

En nuestra área de acción, a diferencia de otras, es muy común que parte de las líneas de trabajo en los centros de referencia sea a partir del empleo de estas grandes bases de datos. Con el empleo de esta base, que además se encuentra en continuo crecimiento será posible el desarrollo de múltiples sub-líneas de trabajo.

Líneas de Investigación específicas

Sumado a lo descrito, mis actividades se dirigirán a darle continuidad a la línea directamente vinculada con mis estudios de Doctorado, relacionada con aspectos del sistema cardio-respiratorio, la condición física, y el movimiento humano. A continuación, se describen las principales características de este proyecto.

Angela Mariana Gómez García Plan de actividades (Régimen Dedicación Total) 2023-2025

El proyecto doctoral busca investigar en la relación entre movimiento y condición física (CF) y la salud cardiovascular (CV) de niños, adolescentes y adultos, empleando para ello registros con tecnología no-invasiva, portable (24/7) y operador-independiente; para caracterizar simultáneamente "en la vida real" múltiples componentes del movimiento. El proyecto permite profundizar en: (1) abordajes tecnológicos específicamente diseñados para caracterizar los niveles de actividad física (AF), conducta sedentaria (CS) y sueño (PS) [Aadland, 2015], la condición física (CF; ej. respuesta cardio-respiratoria al esfuerzo, fuerza/potencia muscular) [Morikawa, 2018; Kolber, 2015; Menzel, 2010] e indemnidad y composición corporal (ICC; % grasa, resistencia extra/intra-celular) [Kuchnia, 2016; Rinninella, 2018; Lukaski, 2017], y (2) en la relación de estos con el estado hemodinámico, estructural y funcional del sistema CV (evaluado no-invasivamente) [Baumgartner, 2020; Gomez-Garcia, 2021].

A partir del estudio de una importante muestra de sujetos sin enfermedad crónica o limitaciones motoras, de amplio rango de edades (5-80 años), buscamos identificar en qué medida:

(1) diversas variables o parámetros empleados para caracterizar el movimiento y CF (ej. consumo de oxígeno, tiempo/día en actividad moderada o intensa), se asocian al estado CV,

(2) permiten estas variables o parámetros (más allá de la existencia de asociación), predecir la existencia de un sistema CV que se aleja de su punto "óptimo de trabajo", con independencia del sexo, la edad y/u otras características co-existentes del sujeto

(3) el nivel de asociación o capacidad predictiva, dependen de aspectos metodológicos del empleo de los dispositivo: (i) sitios corporales de registro (ej. muñeca vs. cintura), (ii) protocolos de registro (test empleados, tiempo de registro con ATA), (iii) algoritmos de adquisición de datos o de pre-acondicionamiento de registros crudos (ej. validación de "tiempo de uso" de ATA, empaquetamiento temporal de datos - longitud de "epochs"), y/o (iv) análisis y/o parámetros empleados (ej. umbrales empleados para clasificar la intensidad de la AF).

El proyecto busca contribuir mediante aportes relacionados con: aspectos fisiológicos/fisiopatológicos de la relación movimiento-salud CV, identificar potenciales biomarcadores del estado "normal o alterado" CV, y aspectos específicos del empleo práctico de la tecnología mencionada.

Se anexa a este plan de actividades un resumen del proyecto doctoral con las principales características metodológicas.

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	Expediente Nro. 008440-000656-22 **Actuación 2**	Oficina: SECCIÓN SECRETARÍA DE COMISIONES ASESORAS - CENTRO MONTEVIDEO - ISEF Fecha Recibido: 01/12/2022 Estado: Cursado

TEXTO

Montevideo, 10 de marzo de 2023

pase a Comisión de Dedicación Total del ISEF a sus efectos.

Gustavo Argibay

Administrativo I

Comisiones ISEF

Firmado electrónicamentemente por GUSTAVO ARGIBAY ALDAMA el 10/03/2023 11:37:01.

	Expediente Nro. 008440-000656-22 **Actuación 3**	Oficina: COMISIÓN DE DEDICACIÓN TOTAL - CENTRO MONTEVIDEO - ISEF Fecha Recibido: 10/03/2023 Estado: Cursado

TEXTO

Montevideo, martes 18 de abril de 2023.

Se adjunta resolución de Comisión de Dedicación Total.

Pase a Comisión Directiva para su consideración.

Gustavo Argibay

Administrativo I

Comisiones ISEF

Firmado electrónicamentemente por GUSTAVO ARGIBAY ALDAMA el 18/04/2023 15:29:52.

Nombre Anexo	Tamaño	Fecha
Informe solicitud DT Mariana Gomez 27.03mas mails.pdf	1462 KB	18/04/2023 15:24:29

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INFORME DE LA COMISIÓN DE DEDICACIÓN TOTAL DEL ISEF
Nº de expediente: 008440-000656-22
Solicitud de ingreso al Régimen de DT de la docente MARIANA GOMEZ

La Comisión de Dedicación Total del ISEF analizó en detalle los antecedentes, así como el plan de trabajo de la Mag. Ángela Mariana Gómez, y considera que reúne condiciones para aspirar al Régimen de Dedicación Total.

Mariana Gómez es Asistente G2 en el Departamento de Educación Física y Salud del ISEF. Licenciada en Educación Física (ISEF 2011-2016) y Magister en Ciencias Biomédicas (Pro.In.Bio, Fac. de Medicina, UdelaR 2018-2020). En el curso de su maestría, obtuvo una beca Pro.In.Bio que se brinda a los mejores estudiantes del programa. Adicionalmente, obtuvo dos financiaciones CSIC: una para presentar un trabajo en un congreso internacional, y otra para hacer una pasantía de tres meses en la Universidad de Calgary (Canadá). Actualmente está desarrollando un doctorado en Ciencias Biomédicas (Pro.In.Bio, Fac. De Medicina, UdelaR, 2020). Su formación incluye dos especializaciones en entrenamiento y deporte conseguidas en España (Instituto Deporte y Vida, 2019-2020) y un título de Técnico Operador de PC (UTU, 2007). Entre el 2007 y el 2019, asistió a 17 cursos de corta duración relacionados con el deporte, la fisiología del ejercicio, salud, bioética y bioestadística.

Con respecto a la actividad de investigación, es investigadora SNI (nivel iniciación) y se encuentra vinculada en un grupo de investigación consolidado y multidisciplinario en el área de educación física y salud: el núcleo interdisciplinario CuiiDARTE-MAS, que recientemente ganó una financiación CSIC para realizar el Laboratorio de Investigación y Evaluación Biomédica en Reposo y Ejercicio (LIEBRE). En este marco lidera un proyecto de investigación financiado por CSIC (Iniciación a la investigación 2021-23). Su actividad se enfoca en dos líneas de estudios: i) Ejercicio físico y cáncer; ii) Movimiento, condición física y salud cardiovascular. Es responsable de 3 proyectos de investigación (1 concluido, 2 en marcha) e integrante de otros 3 proyectos (1 concluido y 2 en marcha). Se trata de una investigadora joven y muy prometedora, con sólidos vínculos nacionales e internacionales.

Su producción científica cuenta con 4 artículos publicados en revistas internacionales arbitradas con buen factor de impacto en el área, 3 como primera autora. Un capítulo de libro publicado por Springer, arbitrado, internacional. Cinco trabajos presentados en congresos nacionales e internacionales. Cuenta con tutorías de estudiantes de grado.

Sus actividades de enseñanza de grado se concentran en las unidades curriculares: Fundamentos Anátomo-Fisiológicos (2015-2020), Fisiología del ejercicio (2015 a la fecha), Educación Física Adaptada (2019 a la fecha), todos en ISEF. Otros cursos: Ejercicio físico en oncología pediátrica (I y II) (2020-2021). Ha realizado la traducción del manual MOON test del portugués y alemán a español e inglés para luego realizar su validación en Uruguay.

En relación su trabajo en extensión y actividades en el medio, ha participado en el

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Programa "Más y mejor vida". Programa de cooperación entre ISEF y VERA+ (2019) y en el Proyecto de Espacio de Formación Integral - Educación física y salud (2019-2020).

A nivel de gestión académica, participo como Asistente de Dirección del Departamento de Educación Física y Salud (2019-2021).

En cuanto a sus actividades de cogobierno, integró por el orden docente la Comisión de Carrera Local de Montevideo (2019 – 2021).

Presenta un plan de actividades vinculado con el *Fortalecimiento del área biológica y de las prácticas corporales vinculadas a la salud en el Instituto Superior de Educación Física* con el que profundizará aspectos relacionados a las tres funciones universitarias que vienen conformado su trabajo desde hace 8 años. En materia de investigación, una vez finalizado su doctorado, se plantea continuar en la misma línea de sus estudios, avanzado hacia un nuevo proyecto (detallado en el plan) con la perspectiva de involucrar estudiantes de grado y posgrado y contribuir de forma sustancial al desarrollo y formación de recursos humanos. Asimismo, continuará con la enseñanza de grado que viene realizando, sumando cursos de posgrado, especialmente en el marco de la maestría ProMEF. En extensión y actividades en el medio, se propone el desarrollo de los espacios EFI “Condición física y salud en población general” y “Ejercicio físico en oncología pediátrica”, que incluyen actividades integradas de investigación, enseñanza y extensión, y el desarrollo de actividades en coordinación con CSEAM.

Su sólida y sistemática formación, su curriculum académico y sus vínculos con laboratorios de investigación pronostican que Mariana Gómez pueda realizar con éxito el plan de actividades que se propone.

Sin otro particular saludan atte.

Dr. Carlo Biancardi Mg.Gonzalo Pérez Monkas Dra. Mariana Sarni

UNIVERSIDAD DE LA REPÚBLICA URUGUAY

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Parque Batlle s/n
24800 102 - 2486 1866

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4225 5326 (telefax)

Rivera CUR
Ituzaingó 667
462 26313

Paysandú CUP
Florida 1065
4723 8342-int 107

CONVOCATORIA: Comisión de Dedicación total ISEF-lunes 27 de marzo, 14:00 hs. por Zoom.

Recibidos

Secretaría Comisiones ISEF <secretariacomisionesisef@gmail.com> 22 mar 2023, 20:44
para Santo, Cecilia, Mariana, Gonzalo, Raumar, Luciano, Carlo

Estimadas y estimados:

Convocamos a reunión de la Comisión de Dedicación Total, para el próximo lunes 27 de marzo a las 14:00 hs. por Zoom (link al final del mensaje). El enlace Zoom es recurrente y a partir de ahora será siempre el mismo.
Se adjunta ODD y documentos correspondientes. Igual que para la sesión anterior, por el peso de los documentos los enviaremos en dos tandas.
Solicitamos confirmar participación.

ISEF - Sala 20 le está invitando a una reunión de Zoom programada.

Tema: Comisión de Dedicación total ISEF-(mensual-recurrente) lunes a las 14:00 hs.
Hora: Este es una reunión recurrente Reunirse en cualquier momento

Unirse a la reunión Zoom
https://salavirtual-udelar.zoom.us/j/81399430788?pwd=dkR2dzE4UnNFMGV4aWZucHVML2FwZz09

ID de reunión: **813 9943 0788**
Código de acceso: **Ste!2u51tc**
Móvil con un toque
+13017158592,,81399430788#,,,,*5241446397# Estados Unidos (Washington DC)
+13052241968,,81399430788#,,,,*5241446397# Estados Unidos

Marcar según su ubicación
+1 301 715 8592 Estados Unidos (Washington DC)
+1 305 224 1968 Estados Unidos
+1 309 205 3325 Estados Unidos
+1 312 626 6799 Estados Unidos (Chicago)
+1 646 931 3860 Estados Unidos
+1 929 205 6099 Estados Unidos (New York)
+1 564 217 2000 Estados Unidos
+1 669 444 9171 Estados Unidos
+1 669 900 6833 Estados Unidos (San Jose)
+1 689 278 1000 Estados Unidos
+1 719 359 4580 Estados Unidos
+1 253 205 0468 Estados Unidos
+1 253 215 8782 Estados Unidos (Tacoma)
+1 346 248 7799 Estados Unidos (Houston)
+1 360 209 5623 Estados Unidos
+1 386 347 5053 Estados Unidos
+1 507 473 4847 Estados Unidos
ID de reunión: 813 9943 0788
Código de acceso: 5241446397
Encuentre su número local: https://salavirtual-udelar.zoom.us/u/kcpDGBA9Kj

Unirse mediante SIP
81399430788@zoomcrc.com

Unirse mediante H.323
162.255.37.11 (EE. UU. oeste)
162.255.36.11 (EE. UU. este)
115.114.131.7 (Mumbay India)
115.114.115.7 (Hyderabad India)
213.19.144.110 (Ámsterdam Países Bajos)
213.244.140.110 (Alemania)
103.122.166.55 (Sídney Australia)
103.122.167.55 (Melbourne Australia)
149.137.40.110 (Singapur)
64.211.144.160 (Brasil)
149.137.68.253 (México)
69.174.57.160 (Toronto Canadá)
65.39.152.160 (Vancouver Canadá)
207.226.132.110 (Tokio Japón)
149.137.24.110 (Osaka Japón)
Código de acceso: 5241446397
ID de reunión: 813 9943 0788

Cordiales saludos,
Gustavo Argibay
Comisiones ISEF

6 archivos adjuntos • Analizado por Gmail


Reseña Comisión…


OD Comisión DT …


Pto. 1a. - Exp. 00…


Pto. 1b. - Informe …


Pto. 2. - Exp. 008…

Secretaría Comisiones ISEF <secretariacomisionesisef@gmail.com> 22 mar 2023, 20:45
para Santo, Cecilia, Mariana, Gonzalo, Raumar, Luciano, Carlo

Enviamos segunda tanda de documentos.

Cordiales saludos,
Gustavo Argibay
Comisiones ISEF

4 archivos adjuntos • Analizado por Gmail

lu jahnecka 24 mar 2023, 11:22
Muchas gracias Gustavo por la información. De mi parte no podré concurrir a la reunión a esa hora como había manifestado anteriormente. Cualquier duda en relaci
Gonzalo Pérez Monkas 24 mar 2023, 11:40
Buenos días. Confirmo participación. No obstante, de acuerdo al mail de Luciano pense que ibamos a encontrarnos el lunes de 08 a 09 (puedo en ese horario) Salud
Secretaría Comisiones ISEF 24 mar 2023, 12:11
Hola a todas y todos. Posiblemente hoy viernes no darán los tiempos, pero se puede coordinar para otro día y hora en cualquier momento. Les compartimos la plani
Mariana Sarni 24 mar 2023, 12:26
Gracias Gustavo Ahí cambie una tarde. Por ahora puedo, no se por cuanto más. De todas formas donde quede la mayoría (si yo no estoy) intentaré adaptarme. La val
Secretaría Comisiones ISEF 24 mar 2023, 12:58
Hola Mariana, muchas gracias por tu respuesta.
Unidad de Apoyo a la Investigación 24 mar 2023, 13:26
Gustavo... el próximo lunes no podré estar en la comisión, tengo médico 14:45 (Cardiólogo), quizá pueda seguirlos en silencio desde el cel. e intervenir en el c
Secretaría Comisiones ISEF 24 mar 2023, 13:45
Hola Santo, entendidos los puntos que señalas. Le enviaremos el borrador de informe a la Comisión para su estudio previo a la reunión, excluyendo a Raumar Rodrí
Unidad de Apoyo a la Investigación 24 mar 2023, 13:45
ok ! El 24/3/23 a las 13:45, Secretaría Comisiones ISEF escribió:
Raumar Rodríguez 24 mar 2023, 13:50
Estimadas/os: espero estén muy bien. Si bien estoy de licencia, no puedo dejar de opinar sobre la solicitud de ingreso al RDT de Virginia Alonso. En primer luga
Mariana Sarni 27 mar 2023, 8:01
Buenos días. Enviamos el informe borrador de la postulación de Mariana Gómez que realizáramos con Carlo. Sobre el planteo de Raumar de la postulación de Virgini
Unidad de Apoyo a la Investigación 27 mar 2023, 10:01
Estimados/as todos/as: sobre este punto, tuve un intercambio con Viqui consultando sobre el particular. me comentó que recibió la devolución y que trabajaría so
cecilia ruegger 27 mar 2023, 13:07
Estimados/as: no podré estar en la sesión de hoy. No confirmé antes porque no sabía si podría arreglar. Hemos estado leyendo el informe de Ceci Seré pero no ten
Gonzalo Pérez Monkas 27 mar 2023, 14:21
para Mariana, Raumar, mí, Santo, Cecilia, Luciano, Carlo

Buenas tardes.
Luego de reunida la comisión, expresamos nuestro acuerdo al punto 3 y el informe elaborado en relación al ingreso de RDT de Mariana Gomez.
Mariana Sarni
Carlo Biancardi
Gonzalo Pérez

Saludos

Carlo Biancardi 27 mar 2023, 14:25
para Gonzalo, Mariana, Raumar, mí, Santo, Cecilia, Luciano

Buenas tardes,
también estoy de acuerdo con el informe elaborado en relación al ingreso de RDT de Mariana Gomez (punto 3).
Saludos,
Carlo Biancardi

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Prof. Agdo. Carlo M. Biancardi Ph.D.
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mobile IT: +39 3342083604
e-mail: cbiancardi@cup.edu.uy
alt.e-mail: carlo.biancardi@gmail.com

Mariana Sarni 27 mar 2023, 14:25
para Gonzalo, Raumar, mí, Santo, Cecilia, Luciano, Carlo

Hago acuerdo con el informe presentado para el ingreso a RDT de la profesora Mariana Gómez
Mariana Sarni

Secretaría Comisiones ISEF 31 mar 2023, 8:07
Hola Gonzalo, hay que agregarle tu nombre al informe del punto 3 ingreso RDT de Mariana Gomez, como Carlo y Mariana figuran como Dr. y Dra. te consulto el trata

Secretaría Comisiones ISEF 12 abr 2023, 19:11 (hace 6 días)
Estimadas, estimados, con las disculpas del caso por la demora, enviamos en adjunto la reseña de la sesión del 27 de marzo.

Mariana Sarni 12 abr 2023, 19:14 (hace 6 días)
Gracias GustavoEl informe de Mariana Gomez (Carlo y Gonzalo corríjanme) ya fue firmado. Sólo queda darle tránsito a CD y sacarlo de la listaSaludos. Mariana

Secretaría Comisiones ISEF 12 abr 2023, 19:32 (hace 6 días)
Hola Mariana, correcto, sucede que la reseña se limita al momento de la reunión. Muchas gracias por tu respuesta.

lu jahnecka 13 abr 2023, 12:01 (hace 5 días)
para mí, Mariana, Raumar, Gonzalo, Carlo, Cecilia, Santo

Gracias Gustavo por el resumen de lo tratado.
El borrador del informe de Ana Torrón ya fue realizado, entiendo que cabería acordar en la reunión si hay modificaciones a realizar y si no las hay, seguir con el trámite.
Agendo el próximo 24 de abril para la reunión.
Saludes.

OK. RECIBIDO. DE ACUERDO.

Responder Responder a todos Reenviar

	Expediente Nro. 008440-000656-22 **Actuación 4**	Oficina: SECCIÓN SECRETARÍA COMISIÓN DIRECTIVA - CENTRO MONTEVIDEO - ISEF Fecha Recibido: 18/04/2023 Estado: Para Actuar

TEXTO