



LJMU Research Online

Davies, IG, Clayton, D, Kirwan, R and Schmidt, MA

Editorial: Body composition and cardiovascular health

<http://researchonline.ljmu.ac.uk/id/eprint/23484/>

Article

Citation (please note it is advisable to refer to the publisher's version if you intend to cite from this work)

Davies, IG, Clayton, D, Kirwan, R and Schmidt, MA (2024) Editorial: Body composition and cardiovascular health. *Frontiers in Nutrition*, 11.

LJMU has developed **LJMU Research Online** for users to access the research output of the University more effectively. Copyright © and Moral Rights for the papers on this site are retained by the individual authors and/or other copyright owners. Users may download and/or print one copy of any article(s) in LJMU Research Online to facilitate their private study or for non-commercial research. You may not engage in further distribution of the material or use it for any profit-making activities or any commercial gain.

The version presented here may differ from the published version or from the version of the record. Please see the repository URL above for details on accessing the published version and note that access may require a subscription.

For more information please contact researchonline@ljmu.ac.uk

<http://researchonline.ljmu.ac.uk/>



OPEN ACCESS

EDITED AND REVIEWED BY
Maurizio Muscaritoli,
Sapienza University of Rome, Italy

*CORRESPONDENCE
Ian G. Davies
✉ i.g.davies@ljamu.ac.uk

RECEIVED 08 April 2024
ACCEPTED 11 April 2024
PUBLISHED 13 May 2024

CITATION
Davies IG, Clayton D, Kirwan R and
Schmidt MA (2024) Editorial: Body
composition and cardiovascular health.
Front. Nutr. 11:1414103.
doi: 10.3389/fnut.2024.1414103

COPYRIGHT
© 2024 Davies, Clayton, Kirwan and Schmidt.
This is an open-access article distributed
under the terms of the [Creative Commons
Attribution License \(CC BY\)](#). The use,
distribution or reproduction in other forums is
permitted, provided the original author(s) and
the copyright owner(s) are credited and that
the original publication in this journal is cited,
in accordance with accepted academic
practice. No use, distribution or reproduction
is permitted which does not comply with
these terms.

Editorial: Body composition and cardiovascular health

Ian G. Davies^{1*}, David Clayton², Richard Kirwan¹ and
Michael A. Schmidt³

¹Research Institute of Sport and Exercise Science, Liverpool John Moores University, Liverpool, United Kingdom, ²School of Science and Technology, Nottingham Trent University, Nottingham, United Kingdom, ³Sovaris Aerospace, Boulder, CO, United States

KEYWORDS

body composition, cardiovascular disease, muscle mass and fat mass, sarcopenia, vitamin D

Editorial on the Research Topic

Body composition and cardiovascular health

Cardiovascular disease (CVD) displays a major global concern, has a strong relationship with obesity and an emerging association with lower levels of muscle mass or sarcopenia, highlighting the importance of measuring body composition in cardiovascular (CV) health research (1, 2). Several methods are available to measure body composition, including gold standards such as Dual-Energy X-ray Absorptiometry (DXA) and Magnetic Resonance Imaging (MRI), and other more accessible methods, such as Bioimpedance (BIA) (3). These measures provide analysis of skeletal muscle and body fat metrics, that influence basal metabolic rate (BMR) and metabolic and CV health. In the absence of sophisticated equipment, and especially for large-scale observational studies, Body Mass Index (BMI) and waist circumference (WC) are useful in CVD prediction models either as an exposure or covariate but novel indices such as the Body Roundness Index (BRI) are also gaining traction. BRI is calculated from height and WC and is proposed to improve determination of total body fat percentage and visceral adipose tissue mass. However, it remains equivalent in predicting CVD related disease (4), highlighting the need for further research.

Gaining a deeper understanding of body composition and its related measures, provides a greater insight of CVD risk and will drive future research innovations, which may lead to preventative strategies. This Research Topic explores the role of body composition in cardiovascular health, with four novel studies investigating cardiovascular endpoints; risk factors such as blood pressure and thrombotic risk; and the relationship of vitamin D with CVD risk.

A study by Zhang et al. focused on the relationship of BRI with composite cardiovascular endpoints (CCE), consisting of stroke, myocardial infarction, and CVD death, conducted in rural regions of China ($n = 13,209$). This is an understudied area where the population has a different diet and lifestyle compared to urban areas of China, and there is limited longitudinal research on BRI and CV health. The results revealed both moderate and high BRI trajectories (over a 6-year period) increased CCE risk. While this evidence highlights the potential utility of BRI as a predictive tool, other studies have shown varied results. For example, analysis of the US National Health and Nutrition Examination Survey (NHANES) database ($n = 47,356$) over approximately 8 years, found the relationship with BRI and all-cause and cardiovascular mortality was U-shaped (5). This suggests that both low and high BRI values are associated with increased (cardiovascular) mortality risk, while moderate values are associated with lower risk. Lower BRI values,

are linked with malnutrition and muscle atrophy (5) emphasizing the significance of measuring key metrics of sarcopenia, such as Hand Grip Strength (HGS) and/or muscle mass. However, there is a lack of longitudinal evidence using muscle mass, along with conflicting cross-sectional data, regarding cardiovascular health.

In another of our Research Topic studies, [Bu](#) conducted a longitudinal analysis of middle-aged Korean adults ($n = 2,669$), showing an inverse association between relative skeletal muscle mass (RSM) (as measured by BIA) and incident hypertension over a 16-year follow-up period. The participants were categorized into tertiles (T) of RSM, revealing higher hypertension risk in T1 and T2 compared to T3 (the highest RSM). Notably, a recent meta-analysis demonstrated that sarcopenia is associated with a 1.67 and 1.31-fold increased risk of stroke and cardiovascular disease (CVD), respectively (6), highlighting the potential significance of hypertension and muscle health in CVD.

Mechanistic evidence supports vitamin D's involvement in various metabolic pathways relevant to skeletal muscle atrophy and vascular function respectively (7, 8), which may present a bridge between body composition, vitamin D status, and CVD. A study by [Che et al.](#) in our Research Topic, analyzing the US NHANES database ($n = 17,467$), revealed a non-linear (U-shaped curve) inverse association between vitamin D levels and elevated blood pressure, even after adjusting for BMI in individuals without prior hypertension diagnosis. While epidemiological studies suggest increasing doses of vitamin D have an inverse association with hypertension (9), evidence is uncertain from randomized controlled trials (RCTs) (10). The [Che et al.](#) study suggests an upper ceiling of vitamin D intake, which is consistent with other research when high plasma levels may have a detrimental effect in other areas such as fracture risk (11). There is emerging evidence on the relationship with skeletal muscle, hypertension, and vitamin D, implicating the role of mitogen-activated protein kinase signaling and angiotensin (12), but large-scale dose response and mechanistic studies are needed for a more comprehensive understanding.

Basal metabolic rate (BMR), which is heavily influenced by body composition, is notably higher in obesity, but primarily driven by fat-free mass (13). Recently, it has emerged as a novel factor impacting CVD risk. In our Research Topic, employing Mendelian randomization (MR) methods, [Huang and Xie](#) investigated the novel causal relationship between BMR and venous thromboembolism (VTE) in European populations. Their findings uncovered a significant positive association between elevated BMR levels and heightened VTE risk, encompassing pulmonary embolism (PE) and lower extremity deep vein thrombosis (DVT). Potential mechanisms include increased reactive oxygen species (ROS), a pro-inflammatory state, and enhanced platelet activation and aggregation, fostering a prothrombotic milieu. Obesity alone, and its coexistence with low muscle mass and strength (sarcopenic obesity), correlates with VTE and related outcomes (14, 15),

influencing BMR in a nuanced manner. While lower muscle mass reduces BMR, when coupled with excess adiposity (particularly visceral adipose tissue), a prothrombotic environment may persist. The study in our Research Topic sets the stage for further MR research into VTE and body composition, emphasizing the need to address the nuanced interplay of body composition factors.

In summary, while the results of the above studies showcase novel evidence regarding body composition and CV health, there is clearly more research needed in this area. The Research Topic offers the latest evidence on how novel indices of body composition, skeletal muscle mass, BMR and vitamin D impact health, from cardiovascular risk factors through to cardiovascular endpoint and mortality. The hope is the reader will be engaged not only by the evidence presented but will also be intrigued by how the role of body composition in CV health is nuanced, requiring further research that will potentially lead to preventative strategies.

Author contributions

ID: Writing – original draft, Writing – review & editing, Conceptualization. DC: Writing – review & editing, Conceptualization. RK: Writing – review & editing, Conceptualization. MS: Writing – review & editing, Conceptualization.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Conflict of interest

MS was employed by Advanced Pattern Analysis and Countermeasures Group.

The remaining 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.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

- Damulji AA, Alfaraidhy M, AlHajri N, Rohant NN, Kumar M, Al Malouf C, et al. Sarcopenia and cardiovascular diseases. *Circulation*. (2023) 147:1534–53. doi: 10.1161/CIRCULATIONAHA.123.064071
- Powell-Wiley TM, Poirier P, Burke LE, Després JP, Gordon-Larsen P, Lavie CJ, et al. Obesity and cardiovascular disease: a scientific statement from the American heart association. *Circulation*. (2021) 143:e984–e1010. doi: 10.1161/CIR.0000000000000973

3. Borga M, West J, Bell JD, Harvey NC, Romu T, Heymsfield SB, et al. Advanced body composition assessment: from body mass index to body composition profiling. *J Investig Med.* (2018) 66:1–9. doi: 10.1136/jim-2018-000722
4. Jayawardena R, Ranasinghe P, Ranathunga T, Mathangasinghe Y, Wasalathanthri S, Hills AP. Novel anthropometric parameters to define obesity and obesity-related disease in adults: a systematic review. *Nutr Rev.* (2020) 78:498–513. doi: 10.1093/nutrit/nuz078
5. Zhou D, Liu X, Huang Y, Feng Y. A nonlinear association between body roundness index and all-cause mortality and cardiovascular mortality in general population. *Public Health Nutr.* (2022) 25:3008–15. doi: 10.1017/S1368980022001768
6. Fang M, Liu C, Liu Y, Tang G, Li C, Guo L. Association between sarcopenia with incident cardio-cerebrovascular disease: a systematic review and meta-analysis. *Biosci Trends.* (2023) 17:293–301. doi: 10.5582/bst.2023.01130
7. Bollen SE, Bass JJ, Fujita S, Wilkinson D, Hewison M, Atherton PJ. The Vitamin D/Vitamin D receptor (VDR) axis in muscle atrophy and sarcopenia. *Cell Signal.* (2022) 96:110355. doi: 10.1016/j.cellsig.2022.110355
8. Jensen NS, Wehland M, Wise PM, Grimm D. Latest knowledge on the role of vitamin D in hypertension. *Int J Mol Sci.* (2023) 24:4679. doi: 10.3390/ijms24054679
9. Mokhtari E, Hajhashemy Z, Saneei P. Serum Vitamin D levels in relation to hypertension and pre-hypertension in adults: a systematic review and dose-response meta-analysis of epidemiologic studies. *Front Nutr.* (2022) 9:829307. doi: 10.3389/fnut.2022.829307
10. Bislev LS, Grove-Laugesen D, Rejnmark L. Vitamin D and muscle health: a systematic review and meta-analysis of randomized placebo-controlled trials. *J Bone Miner Res.* (2021) 36:1651–60. doi: 10.1002/jbmr.4412
11. Anagnostis P, Bosdou JK, Kenanidis E, Potoupnis M, Tsiridis E, Goulis DG. Vitamin D supplementation and fracture risk: evidence for a U-shaped effect. *Maturitas.* (2020) 141:63–70. doi: 10.1016/j.maturitas.2020.06.016
12. Baretic M, Matovinovic M, Vukic T, Ranilovic D. Vitamin D: missing link between hypertension and muscle mass. *J Hum Hypertens.* (2018) 32:1–2. doi: 10.1038/s41371-017-0004-3
13. Argyrakopoulou G, Fountouli N, Dalamaga M, Kokkinos A. Revisiting resting metabolic rate: what is the relation to weight fluctuations? *Curr Obes Rep.* (2023) 27:1–2. doi: 10.1007/s13679-023-00528-x
14. Di Nisio M, Di Iorio A, Porreca E, Abate M, Ferrante N, Bandinelli S, et al. Obesity, poor muscle strength, and venous thromboembolism in older persons: the InCHIANTI study. *J Gerontol A Biol Sci Med Sci.* (2011) 66:320–5. doi: 10.1093/gerona/glq207
15. Shin JM, Hong SJ, Choi KH, Shin SI, Lee DK, Lee SS, et al. Low relative muscle volume: Correlation with prevalence of venous thromboembolism following total knee arthroplasty. *PLoS ONE.* (2019) 14:e0210800. doi: 10.1371/journal.pone.0210800