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ISSUE 12
AUGUST 2026

NED JOURNAL

Cardiometabolic Health

the latest evidence on nutrition and lifestyle strategies aiding prevention and shaping cardiovascular care

The effect of Daily Avocado Intake on Cardiovascular Health and Outcomes

Comparison with Dietary Groups of Various Macronutrient Ratios on Cardiovascular Risk Factors

Wearable Devices for Exercise Prescription and Physical Activity Monitoring in Cardiovascular Conditions

Modern Food Systems and the Rise of Medicalised Weight Loss - The Cardiovascular Consequences

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NED is the UK's first scientific database dedicated to nutrition and lifestyle medicine research. It has been expertly curated to provide you with access to high-quality, human studies, designed to support evidence-based clinical decision making in personalised nutrition practice, and applied scientific-thinking in academic practice.

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WELCOME

Clare Grundel
Managing Editor

WELCOME TO THE NED CARDIOVASCULAR EDITION

Hello NED Journal Readers

The NED Science Forum 2026 is a wrap! The theme this year was “Realising the Vision of Preventative Health - Translating Genetic and Wearable Data”, and we heard from expert academics and clinicians leading the way in this crucial area of healthcare. If you are a BANT member, you can access the recordings in full from the BANT Learning Zone. 4 hours of insightful, ground-breaking presentation.

And we are already planning for the NED Science Forum 2027! **Save the Date - 11 May 2027**. Theme, speakers and venue will be announced over the coming months.

I would like to personally extend my thanks to the NED Science Forum sponsors, which enables us to put on this informative event in a central London venue.

Pure Encapsulations, our premium sponsor
Lifecode Gx, **Doctors Data**, **Microba**, **Metabolics**, **Pharma Nord**

In this 12th edition of the NED Journal, we turn our attention to the latest science on nutrition and lifestyle for cardiovascular health. As well as a range of expert reviews from the NED panel, you can also read an opinion piece from Chloe Steele MSc MBANT, looking into the data relating to UPF consumption as a potential driver of cardiovascular disease.

If you don’t have a NED account yet, **set one up here**. With an account, you get valuable extra functionality, including search history, saved searches, search alerts and tagging favourites.

The **British Association of Nutrition and Lifestyle Medicine (BANT)** is a professional membership body for nutrition practitioners, trained in nutrition sciences and the delivery of personalised nutrition services. BANT members are reading and interpreting nutrition and lifestyle sciences such as that found in this NED Journal on a routine basis to inform their clinical decision making. You can find the BANT member practitioner listing **here**.

The **Nutrition Evidence Database** is one of the ways that BANT contributes to the evidence-based practice of precision nutrition. BANT is delighted to make this resource open access for all and encourages all healthcare practitioners interested in personalised healthcare to make use of the resource on a regular basis. You can sign up to an account **here** and subscribe to receive monthly NED alerts **here**.

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NED ALERTS

NUTRITION EVIDENCE DATABASE

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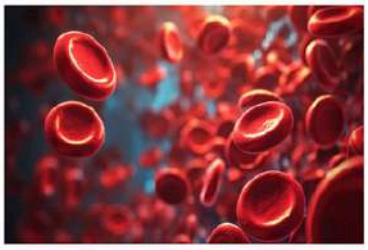
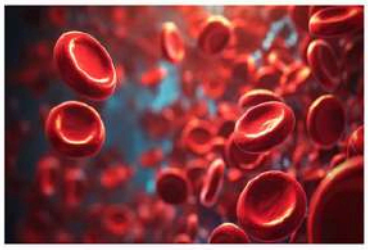
- Each month we publish a dedicated **Nutrition Evidence alert** with our editorial team's pick of the latest research and expert reviews. Sign up at **here** and have the science delivered straight to your inbox. Follow our socials for weekly posts on topics of interest.



Nutrition Evidence Alert – July 2026 – Heart Matters Continued

This month we are continuing the focus on cardiovascular health with our second edition of Heart Matters. Our Expert Reviewers have delved into more research and translated the findings on the role...



Nutrition Evidence Alert – June 2026 – Cardiovascular Health

Despite advances in cardiovascular medicine, rates of disease continue to rise, which may be due to a focus on the management of cardiovascular disease after development rather than the drivers of...

If you have any questions or need support using NED, take a look at About Us and FAQs.
We'd also love to hear from you directly - you can reach us at

info@nutrition-evidence.co.uk

NED ARTICLES

NED Articles feature narrative reviews and other original material aimed at Registered Nutritional Therapists MBANT and healthcare professionals with an interest in nutrition and lifestyle medicine.

Lead by a member of the NED Editorial Board, with contributions from members of the NED Expert Review panel, the narrative reviews aim to summarise the science behind dietary modifications, targeted nutrition interventions and lifestyle factors on a current topic of interest.

Other NED research articles are contributed by academics at the cutting edge of nutrition and lifestyle medicine research.

Browse NED Feature Articles **here**

IN THIS ISSUE

MEET THE NED EDITORIAL BOARD

Dr Justin Roberts, Ph.D, SFHEA, FBANT **EDITOR-IN-CHIEF**

Professor Roberts is a Professor of Nutritional Physiology applied to exercise and functional health within the Cambridge Centre for Sport and Exercise Sciences, Anglia Ruskin University. He has published over 65 peer-reviewed, scientific articles and book chapters, and is a reviewer for numerous academic journals. His research focuses on nutritional strategies to promote metabolic flexibility and adaptive recovery in relation to exercise, including polyphenol and protein-targeted approaches, along with interests in pre-probiotic and food-based strategies to support gastrointestinal function.

Clare Grundel, MSc, BA (Hons), MBANT **MANAGING EDITOR**

Clare is an experienced nutrition practitioner, and a regular speaker on BBC Radio Cambridge. Clare's area of clinical expertise is digestive health and chronic pain. As the NED Managing Editor and as part of the NED Editorial Board, Clare is involved with database development, value-added resource production and regular dissemination of evidence-based material to BANT members and NED subscribers. In this issue, Clare co-authors a feature article on 'Wearables in Nutrition Practice'.

EDITORIAL BOARD

Dr Jessica Rigutto MPharm, MPH, Dr. sc. ETH Zurich, DipION, MBANT

External lecturer at the ETH Zürich, Switzerland. Specialised in micronutrient nutrition and nutrition methodology meta-research. Widely published in the peer-reviewed, scientific press.

Benjamin I. Brown, ND, FBANT

Founder and director of the Nutritional Medicine Institute, an educational, advocacy and research group. An internationally acclaimed lecturer. Editor of the Nutritional Medicine Journal.

Dr Kate Lawrence, BA(Hons), PhD, FHEA

Dr Lawrence is a Senior Lecturer in psychology at St Mary's University. Kate's research specialises in nutritional psychology and neurodiversity. She is widely published in scientific journals.

Dr Michelle Barrow, DProf, MSc, SFHEA, FBANT, RNutr

Dr. Michelle Barrow is the Academic and Clinical Director at CNELM, and supervises PhD students at the Universities of Central Lancaster, Middlesex, and West London.

MEET THE NED EXPERT REVIEWERS

Our Expert Reviewers work within the nutrition industry in academia, research, clinical practice and wider healthcare, and provide unique and invaluable insights on the latest nutrition research to enable practitioners to apply the science to clinical practice.

Knowledge sharing is a key strategic pillar for the NED editorial team. Not only do the expert reviews get directly published on the NED database, they are further communicated via a series of monthly resources and across our BANT social media channels reaching in excess of 25,000 practitioners and followers.

EXPERT REVIEWERS IN THIS ISSUE (In order of appearance)

Chloe Steele, MSc, MBANT
Guest Author of this edition's Feature Article

Chloe has an MSc in Personalised Nutrition from the University of Middlesex, and specialises in cardiovascular disease, type 2 diabetes, and anxiety. Chloe started her career at BANT as a member of the Nutrition Evidence Database research team and now has over 5 years experience of research and writing. She has worked in several countries, and is currently in Australia, where she worked for Nutrition Australia and is currently the principal nutritionist for Heart Research Australia. She has published two papers in the Nutrition Medicine Journal, on gut microbiota and collagen. Chloe is a member of BANT and the Nutrition Society of Australia and sits on the editorial board for the Nutrition Medicine Institute in the UK.

Wilma Kirsten, MSc, INLPTA, MBANT

Wilma has been in clinical practice since 2005. The topic for her MSc dissertation project was "The impact of Coenzyme Q10 deficiency in late-onset Alzheimer's disease in patients who use cholesterol lowering medication". She furthermore obtained two honours science degrees, one in Nutritional Therapy and the other in Molecular Cell Biology and Health Sciences. Wilma specialises in digestive disorders (IBS and IBD), female hormonal well-being (PMS and menopause), and mental health. She has successfully helped hundreds of patients address symptoms of ill health in her clinic. Wilma is also the author of the popular science book, "Ideal Plate Composition - Choose Food to Help You Be Your Best Self".

Gail Brady, MSc, AFMCP, MBANT

Gail is a Registered Nutritional Therapy Practitioner CNHC MBANT. She qualified in 2013 from The Institute for Optimum Nutrition in London and has since furthered her studies and completed a Master's of Science (MSc) degree in Advanced Nutrition (Research and Practice). The topic for her MSc dissertation project was menopause and potential diet and lifestyle interventions that may help to prevent weight gain. In clinical practice, Gail specialises in female health and works 1:1 with clients using a Functional Medicine framework. She also runs an online course providing a tool kit for managing perimenopause and menopause.

Georphie Murphy, MSc ANutr

Georgie is a Registered Nutritional Therapist and BANT member. She studied Nutritional Therapy at the College of Naturopathic Medicine in London. Prior to this she completed her MSc in Nutrition at King's College London and BSc in Biomedical Science from University College Dublin. Georgie brings experience working as the Head of Nutrition at a personalised nutrition start-up. As well this she has experience in supplement development, clinical research, biotech and early-stage clinical trials. Her passion and areas of specialism include gut health and how it affects skin health.

Ana-Paula Agrela, MSc

Ana is a Nutrition Consultant, and Health Coach who graduated with a BSc. (Hons) in Nutritional Science from Middlesex University and holds a Health Coaching certificate from Zest for Life. She completed her Master's degree in Holistic Health and Nutritional Education through Hawthorn University in the United States. Ana has over 20 years' experience in researching and developing health supplements for the nutraceutical industry. She also offers group education programs and private consultations to help clients make healthier food choices and lifestyle habits.

Sarah Cassar, MSc

Sarah is a Registered Nutritional Therapist with a Master's degree in Personalised Nutrition. With a strong background in education, she is committed to bridging the gap between nutrition science and practical application, empowering individuals and families to make informed dietary choices. She delivers educational sessions to children, adolescents, parents, and educators while collaborating with other healthcare professionals to promote holistic health strategies. Passionate about evidence-based nutritional practices, Sarah focuses on their impact on cognitive development, behavioural health, and overall well-being. She actively contributes to the field through research analysis, community engagement, and the indexing of scientific journals, striving to make nutrition education more accessible and impactful.

Miranda Harris, MSc, SFHEA, MBANT

Miranda is a member of BANT and a CNHC Registered Nutritional Therapy Practitioner with over 10 years clinical experience, specialising in endurance sport. She is a senior lecturer (SFHEA) focusing on research methods, dissertation supervision and sports nutrition on the Nutrition and Lifestyle Medicine MSc course at the University of Worcester. She has recently published in the European Journal of Integrated Medicine and the Journal of Nutrition and Health and is working towards a PhD by publication. She is a keen triathlete training for Ironman.

Dr Michelle Weech, MSc, PhD

Michelle is a Research Fellow at the Hugh Sinclair Unit of Human Nutrition, University of Reading and holds a PhD in human nutrition. With over 15 years' experience in nutrition research, she has authored more than 50 scientific publications and conducted over 10 human studies. Her research investigates the impact of individual nutrients (particularly dietary fats), diet quality, dietary patterns, and sustainable diets on cardiometabolic health. Michelle has expertise in dietary assessment methodologies and has developed research tools, including digital technologies, to assess dietary intake and deliver evidence-based personalised nutrition advice.

Creative Editor

Claire Sambolino, MSc, MBANT

Claire is a Registered Nutritional Therapy Practitioner with an MSc in Personalised Nutrition. She specialises in metabolic health and integrative cancer nutrition and is a certified MTIH Terrain Advocate ®, Systems Approach to Cancer ® Practitioner, Metabolic Balance ® Consultant, and ANLP Health Coach. Over the last decade, Claire has increasingly integrated data from client's wearable devices into a clinical framework; supporting a test, assess, address model of nutrition and lifestyle behaviour change, and fostering client agency and automony. In this issue, she co-authors a feature article on 'Wearables in Nutrition Practice'.

In Memory of Heather Rosa - July 2026

The Nutritional therapy profession and research community has lost a passionate, positive, wonderful human being with the sad passing of Heather Rosa, Dean at Institute of Optimum Nutrition (ION).

Heather was a well-deserving BANT Honorary Fellow and passionate advocate of nutrition research and sciences. BANT is grateful for Heather's recent attendance at the NED Science Forum where she proudly showcased posters from ION graduates.

Heather was a strong advocate of nutritional therapy and collaborated with BANT, NTEC and many other organisations to advance the professional recognition and reach of nutrition therapy.
Heather has left a legacy that will continue to positively impact our profession. We will greatly miss her enthusiasm, positivity, and knowledge.

DIET & CARDIO-METABOLIC HEALTH

The effects of extra virgin olive oil or butter on cardiovascular biomarkers in European and Chinese males in the UK:

A pilot randomised crossover trial

JOURNAL: NUTRITION AND HEALTH 2025;31(2):485-498

TAKE HOME MESSAGE

- Replacing butter (saturated fat) with olive oil (monounsaturated fat) may improve cardiovascular risk markers such as ABP and MAP.
- Responses to EVOO may differ by ethnicity

Read the article here

INTRODUCTION

Diets high in consumption of extra virgin olive oil (EVOO) have been associated with better cardiovascular health, attributed to its high oleic acid content and phenolic compounds. However, studies to date have focused on white Caucasian individuals, with very little data from ethnic minority groups. This study aimed to evaluate the effects of an intervention supplementing EVOO or butter on cardiovascular biomarkers in European Caucasians and Chinese males.

METHOD

- This was a two-arm crossover non-blinded randomised control trial.
- 34 healthy male participants were supplemented with either 30 ml/day of EVOO or 30g/day butter for 2 weeks given in a canned soup meal.
- A two-week washout period was given between treatments where participants were asked not to consume butter or olive oil.
- The primary outcome was ambulatory blood pressure (ABP).
- Secondary outcomes were serum total cholesterol, triglycerides, low-density lipoprotein (LDL) cholesterol, and high-density lipoprotein (HDL) cholesterol.

RESULTS

- EVOO consumption was associated with lower 24-hour ambulatory systolic blood pressure (SBP) (−4.3 mmHg; P=0.020), daytime SBP (5.528 mmHg; P = 0.008), night-time diastolic blood pressure (DBP) (−3.784 mmHg; p= 0.008), and night-time mean arterial pressure (ABP) (−3.747 mmHg; P= 0.007).
- Butter but not EVOO consumption was associated with increased total cholesterol (7.9 mg/dL; P= 0.017) and LDL-c (6.5 mg/dL; P= 0.028).
- Ethnic differences in response were also observed with Asian individuals having significantly lower 24-hour SBP (P=0.026) and MAP (P= 0.038), and daytime SBP (P= 0.032) and MAP (P= 0.052). Whilst Europeans showed a lower night-time DBP (p=0.047).

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

CLINICAL PRACTICE APPLICATIONS

- EVOO consumption could be recommended to improve the cardiovascular health of healthy Asians and Caucasians.
- Improvements may be seen in ABP and blood cholesterol levels.
- The consumption of butter may detrimentally affect LDL-c levels.

CONSIDERATIONS FOR FUTURE RESEARCH

- Further research should extend to investigations in women and those who have poor cardiometabolic health.
- Olive oils with differing polyphenol levels could be researched.
- Research could consider clinical outcomes and analyse cardiovascular events and progression of hypertension or atherosclerosis.

CONCLUSION

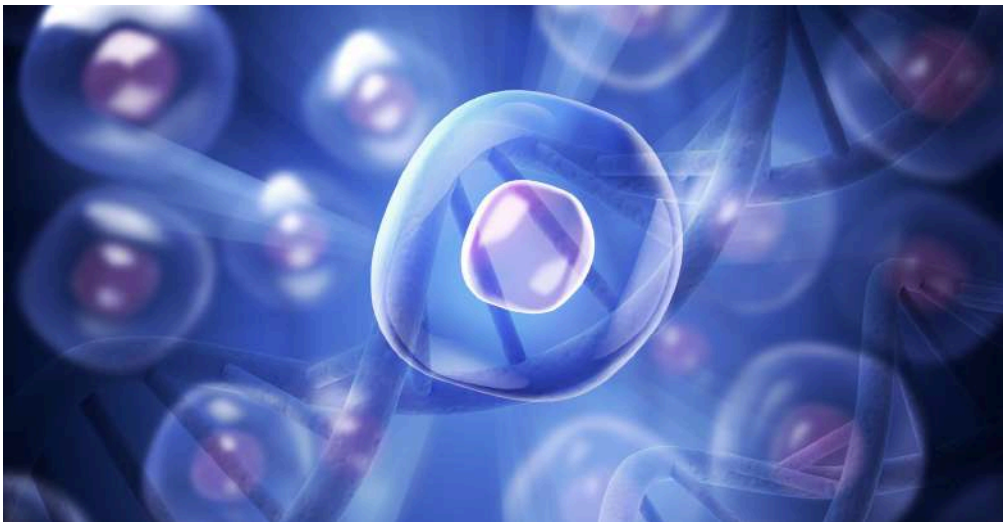
- It was concluded that consumption of EVOO is a healthier fat than butter for cardiovascular health in both Caucasians and East Asians.

EXPERT REVIEWER Chloe Steele

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

Effects of fasting-mimicking diets with low and high protein content on cardiometabolic health and autophagy:

A randomized, parallel group study



SARIR SARMAD, ANTONIO DI MAURO, SCOTT COOPER, ET AL.
JOURNAL: CLINICAL NUTRITION (EDINBURGH, SCOTLAND) 2025;52():299-312

TAKE HOME MESSAGE

FMD's may be of benefit to cardiometabolic health. However, individuals given a FMD with a high protein:fat ratio may see additional benefits to body composition, heart rate variability, lipids, and blood glucose levels. FMD's could be tailored to individual health goals

Read the article here

INTRODUCTION

Fasting Mimicking Diets (FMD) are associated with improved risk factors for cardiovascular disease (CVD) and metabolic syndrome through weight loss, ketogenesis, hepatic fat loss, and improved glucose control. The aim of the study was to investigate the effects of a very low-calorie FMD with differing protein and fat ratios in healthy individuals.

METHOD

A randomised, parallel group, 3 arm study:

1. FMD with low protein/high fat (LP-FMD) n=15
2. FMD with high protein/low fat (HP-FMD) n=15
3. Weight maintaining diet (control) n=16

- FMD meals for 7 days were plant-based, whole foods, with 850 calories.
- LP-FMD had 10% energy from protein and 45% from fat
- HP-FMD had 30% energy from protein and 25% from fat.
- Control had 20% energy from protein and 40% from fat.
- Blood and faecal sampling, DEXA scans, and cardiovascular health tests were performed before and after each 7-day treatment.

RESULTS

- Body weight decreased in both LP-FMD and HP-FMD compared to CONTROL (−2.44; −3.26 to −1.62 kg; P= < 0.0001 and −2.73; −2.01 to −3.44 kg; P= < 0.0001 respectively).
- Visceral adipose tissue decreased in HP-FMD compared to control (−0.09; −0.15 to −0.03 kg, P = 0.006).
- Subcutaneous adipose tissue reduced in both groups compared to control (−0.07; −0.14 to 0.00 kg, P = 0.072, and −0.08; −0.15 to −0.02 kg, P = 0.012, respectively).
- Systolic blood pressure, mean arterial pressure, and heart rate were not affected regardless of treatment compared to control.
- Diastolic blood pressure was reduced in HP-FMD (−6.1; −11.4 to −0.8 mmHg, P = 0.027).
- Heart rate variability, circulating triglycerides, and saturated fatty acids improved in HP-FMD (P= < 0.0001, P=0.003, and P=0.009 respectively).
- Fasting plasma glucose reduced in both groups compared to control LP-FMD: -0.41; −0.80 to −0.02 mmol.L−1, P = 0.038; HP-FMD: -0.46; −0.74 to −0.17 mmol.L−1, P = 0.003).
- Gut microbiome diversity Increased in HP-FMD (P=0.003).

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

CLINICAL PRACTICE APPLICATIONS

- FMDs, regardless of macronutrient content, may improve cardiometabolic health with improvements to blood glucose levels and fat loss.
- FMDs high in protein may improve visceral adipose tissue, diastolic blood pressure, heart rate variability, circulating triglycerides, and saturated fatty acids.
- FMDs with varied macronutrient content can be personalised to individual health goals.

CONSIDERATIONS FOR FUTURE RESEARCH

- Research should focus on the effects of both LP-FMD and HP-FMD on skeletal muscle content, low levels of which may contribute to poorer cardiometabolic outcomes.
- Studies should also look at the effects of both FMD's on individuals with pre-existing poor cardiometabolic health.

CONCLUSION

- Both FMDs improved cardiometabolic health but HP-FMD had additional benefits for body composition, lipid profiles, and heart rate variability.

EXPERT REVIEWER Chloe Steele

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

Effect of Daily Avocado Intake on Cardiovascular Health Assessed by Life's Essential 8: An Ancillary Study of HAT, a Randomized Controlled Trial

JOURNAL OF THE AMERICAN HEART ASSOCIATION 2025;14(5):E039130
PMID: 39968784

INTRODUCTION

Cardiovascular disease remains the leading cause of global mortality. This study aimed to assess the effect of the addition of 1 avocado per day over 26 weeks on the American Heart Association's (AHA) cardiovascular health score, Life's Essential (LE8) in US adults with abdominal obesity. Health factors included in the LE8 are healthy weight, blood pressure, blood lipids and glucose, healthy diet, physical activity, nicotine avoidance, and sleep.

TAKE HOME MESSAGE

- Dietary approach to improve overall nutrient status and achieve healthy body weight should ideally be a first-line approach to minimise cardiovascular disease risk.
- This study showed that the inclusion of 1 avocado per day is a viable option in improving some cardiovascular disease markers.
- Improved physical activity, sleep, blood glucose balance, blood pressure, and reduction of nicotine exposure are additional components that require specific attention to help prevent and address one of the leading causes of death, cardiovascular disease.

Read the article here

METHOD

This 26-week USA based multicentre, investigator-blinded, RCT included participants (n=969) aged ≥25 years, with waist circumference ≥35 inches for women and ≥40 inches for men, and self-reported low intake of avocados (≤2 per month). Data to calculate the LE8 was collected at baseline and 26-weeks using mixed methods of laboratory assessments, self-reported questionnaires and 24-hour dietary recall. The Avocado-Supplemented Diet Group (n=484, 137 M; 347 F; n=400 at 26-wks) was given 1 avocado per day and the Habitual Diet Group (n=485, 126 M; 359 F; n=406 at 26-wks) continued with their regular diet.

RESULTS

No significant between group LE8 score difference for participants with >1 LE8 component was observed from baseline to the 26-week mark (0.79 points [95% CI, −0.41 to 2.00]).

Similar results were obtained for participants who had complete LE8 data points (0.80 points [95% CI, −0.42 to 2.02]). An increase in the LE8 score was noted from baseline to 26 weeks when physical activity scores were omitted (1.34 points [95% CI, 0.29–2.39]) in the avocado-supplemented group.

Primary analysis showed greater LE8 score increases in the supplemented cohort for diet (3.53 points [95% CI, 1.38–5.68]), sleep health (3.20 points [95% CI, 0.38–6.02]), and blood lipids (3.46 points [95% CI, 1.03–5.90]) compared to the habitual diet group.

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

CLINICAL PRACTICE APPLICATIONS

- Dietary intervention is one of many components needed to improve cardiovascular health, both in affected populations and as a preventative strategy.
- Given the potential of notable improvement of three of the eight markers of the American Heart Association's cardiovascular health scores, the addition of 1 avocado in the diet is a relatively small and manageable dietary strategy.

CONSIDERATIONS FOR FUTURE RESEARCH

- Trials with larger, more geographically diverse and cultural representative, equally distributed male to female cohorts, and longer intervention periods are needed to confirm the potential scale of effect of one single food product inclusion on overall cardiovascular health outcomes.
- This study showed that one dietary component is not enough to address all cardiovascular health markers. Therefore, assessment of required minimal intervention combinations needed to improve all - or the majority - of cardiovascular health components remain to be elucidated.

CONCLUSION

This study concluded that the addition of 1 avocado per day in a standard US diet in a cohort with abdominal obesity did not significantly affect the total AHA's cardiovascular health score LE8. However, there was a noted improvement in diet quality, sleep, and blood lipids.

EXPERT REVIEWER Wilma Kirsten

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

Comparison with Dietary Groups of Various Macronutrient Ratios on Body Weight and Cardiovascular Risk Factors in Adults: A Systematic Review and Network Meta-Analysis

JOURNAL: NUTRIENTS 2025;17(16):

INTRODUCTION

The aim of this systematic network meta-analysis was to compare the relative effectiveness of diets with a range of different macronutrient ratios for reducing body weight and cardiovascular risk factors.

METHOD

66 randomised controlled trials (RCTs) were included with study durations of between 1-96 weeks with a total of N=3745 adult participants completing the studies.

• 8 macronutrient dietary groups were analysed based on energy intake ratios for proteins, fats and carbohydrates: very low carbohydrate-low protein (VLCLP), very low carbohydrate-high protein (VLCHP), moderate carbohydrate-high protein (MCHP), moderate carbohydrate-low protein (MCLP), moderate fat-low protein (MFLP), moderate fat-high protein (MFHP), very low fat-low protein (VLFLP), very low fat-high protein (VLFHP).

• Results were reported for their relative effectiveness compared to the MFLP diet group (control), considered the most typical in usual daily life.

• Outcome measures: body weight (BW), blood pressure (systolic and diastolic), total cholesterol (TC), high density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides and blood glucose.

• Sub-groups were analysed for intervention durations of <6 or >6 months. Potential influencing factors considered: physical activity, energy intake, country of study, sample size, intervention duration, funding source and year of publication.

RESULTS

- Compared to a MFLP diet the most significant reductions in BW were found in the following groups; VLCLP, mean difference (MD) -4.10kg, MCHP, MD -1.51kg, and VLCHP, MD -1.35kg (95% credible interval (CrI)). All other dietary types were found to have little or no positive effect on weight loss.
- The greatest reductions in blood glucose were found in the MCLP and VLCLP groups, however, results were not clinically significant.
- The VLCHP was best for lowering systolic BP and the MFHP most effective for reducing diastolic BP, however, findings did not reach clinical significance.
- Cholesterol results showed the MFHP and VLFLP were best for lowering all types of cholesterol, however, results were not statistically significant. The MCLP performed best for lowering triglycerides (95% CrI).
- No substantial differences were found when adjusting for sub-groups or potential influencing factors.

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

- Different dietary macronutrient combinations lead to varying outcomes for managing weight and reducing risk factors associated with cardiovascular disease.
- VLCLP, MCHP and VLCHP dietary types were all significantly associated with greater reductions in body weight compared to the MFLP group.
- MCLP, VLCHP, VLCLP and MFHP were all significantly associated with greater reductions in triglycerides compared to the MFLP group.
- This study therefore supports the need for personalised dietary advice, to meet the diverse needs of individual health and lifestyle requirements. Healthcare practitioners may want to assess the relative effects of different macronutrient profiles depending on their patient weight and cardiovascular markers.

Read the article here

CLINICAL PRACTICE APPLICATIONS

- Dietary guidelines for various countries are most closely aligned with the MFLP diet, as it provides a balanced nutrient profile for general population health. However, this macronutrient dietary type was not found to be the most effective for either blood pressure control or weight management.
- High protein diets may improve insulin and blood glucose levels but have a negative impact on renal and cardiovascular health.
- Dietary advice needs to be personalised to meet an individual's lifestyle and health needs.

CONSIDERATIONS FOR FUTURE RESEARCH

- 2/66 trials were in normal weight adults and 62/66 were in adults with overweight or obesity. Further research is therefore needed in normal weight populations for dietary advice to be generalised for cardiovascular benefits and weight maintenance advice.
- Further research is also needed into optimal macronutrient ratios for reducing blood glucose and blood pressure.
- Heterogeneity between studies may provide only partial comparisons and inconsistent evidence. Further research is therefore needed

CONCLUSION

Different diets performed best for different outcome measures. The VLCLP was best for weight loss and the MCLP best for reducing triglycerides. There were no significant differences between groups for the control of blood pressure, blood glucose or cholesterol levels.

EXPERT REVIEWER Gail Brady

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

Association of drinking water salinity with elevated blood pressure and risk of hypertension among coastal and other populations: a systematic review and meta-analysis of observational studies

RAJAT DAS GUPTA, SETOR K KUNUTSOR, DAVID LOPEZ-SALAMANCA, ET AL.
JOURNAL: BMJ GLOBAL HEALTH 2025;10(12):

INTRODUCTION

While the aetiology of cardiovascular disease can be multifactorial, environmental risk factors like drinking water quality are important to consider, particularly given the effects of climate change, with rising sea levels increasing salinity in groundwater and soils. Previous systemic reviews on this topic were limited by lack of quantitative synthesis, narrow focus and incomplete analysis, which this study aimed to address.

METHOD

- This was a well-run systematic review and meta-analysis following PRISMA guidelines which aimed to assess the association between drinking water salinity and cardiovascular outcomes.
- 27 observational studies, 15 of which included coastal populations, involving a total of 74,063 participants from 7 countries globally were included in the analysis.
- Impacts on hypertension/systolic and diastolic blood pressure (SBP/DBP) (23 studies), coronary heart disease (CHD) and stroke were assessed.

TAKE HOME MESSAGE

- Higher drinking water salinity was found to be significantly associated with elevated blood pressure and hypertension risk - a major disease and risk factor for CHD, stroke and other diseases.
- Tens of millions of individuals depend on saline intruded groundwater and rising sea levels due to global climate change could be rapidly affecting this.
- Sodium intake via drinking water is not recognised as a hypertension risk factor and current prevention strategies focus primarily on behavioural and metabolic factors revealing a gap in guidelines. Healthcare practitioners working with clients with hypertension should take location and water salinity into account when assessing diet diaries.

Read the article here

RESULTS

- Regarding the association between drinking water and BP risk (17 studies; 11 included in the meta-analysis), the pooled mean differences (95% CIs) were 3.22 mm Hg (1.11 to 5.33) for SBP and 2.82 mm Hg (1.44 to 4.20) for DBP.
- 6 studies reported on high versus low water salinity and hypertension risk, with the pooled OR (95% CI) found to be 1.26 (1.07 to 1.48).
- No strong evidence was found in relation to drinking water salinity and risk of gestational hypertension/pre-eclampsia or total CVD events. No study was found which examined the relationship with CHD or stroke risk.

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

RESULTS cont'd

- Further meta-regression analysis showed that high water salinity increased SBP levels in Asian populations only (p = 0.012) and in studies dated from 2000 onwards only (p = 0.002).
- Both SBP and DBP levels were found to be significantly higher in coastal studies (p = <0.05) while higher water salinity increased DBP levels in cross-sectional studies (p = <0.05) and studies published after 2000 showed significantly stronger associations between drinking water salinity and hypertension risk.

CLINICAL PRACTICE APPLICATIONS

- Taking a client's geographical location and drinking water quality into consideration is important, particularly for those with elevated blood pressure/hypertension.
- Dietary sodium exposure comes in different forms including from food and drink which must be fully assessed.
- Mechanistically it is well established that higher sodium intake can affect vascular health via reducing endothelial nitric oxide, increasing vascular stiffness and increasing water retention leading to higher blood volume/cardiac output and kidney function pressure. These mediators must be considered when creating a tailored plan, particularly for those with renal insufficiency.

CONSIDERATIONS FOR FUTURE RESEARCH

- There was a lack of evidence found on the association of drinking water salinity and CHD and stroke risk reflecting a gap in available research.
- Long-term drinking water exposure studies are needed as most studies relied on a single assessment of exposure.
- Greater risk was observed for Asian populations which may be explained by differences in exposure levels such as cooking methods. Therefore, research of non-Asian coastal populations, such as sub-Saharan Africa and small island nations, is needed.

CONCLUSION

- Increased drinking water salinity was found to be significantly associated with higher levels of SBP and DBP, and hypertension risk, especially among those in coastal areas.

EXPERT REVIEWER Georgie Murphy

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

Gut microbial metabolism of bile acids modifies the effect of Mediterranean diet interventions on cardiometabolic risk in a randomized controlled trial

OMER KAMER, ZHENDONG MEI, YUXI LIU, ET AL.
JOURNAL: GUT MICROBES 2024;16(1):2426610

INTRODUCTION

A randomised control trial was conducted to investigate the effect of microbiome metabolism of bile acids (BA) of the Mediterranean diet in patients with a high metabolic risk.

METHOD

A total of 284 participants (88% male; range as 31.9 to 82.0 years; mean BMI of 31 kg/m_2, SD 3.9) were randomised into three groups: a healthy guideline group, calorie-restricted Mediterranean diet plus 28g walnuts (MedDiet), and a MedDiet group including 3-4 cups green tea. Faecal bile acids (BAs), microbiome sequencing and serum lipids were assessed at baseline, 6 months, and 18 months.

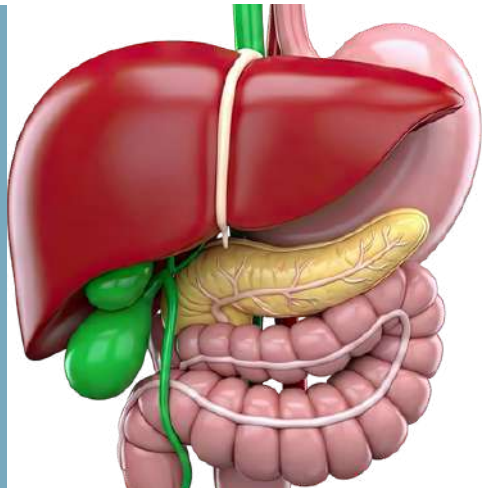
RESULTS

- The MedDiet interventions improved BMI ($p<0.001$), triglycerides ($p=0.046$), and TC/HDLc ratio ($p<0.01$) over 18 months compared to the HDG group
- The BMI-lowering effect of the MedDiet was more pronounced in participants with lower baseline 12-dehydrocholic acid (12-DHCA) ($q<0.001$) taurocholic acid (TCA) ($q=0.003$), taurolithocholic acid 3-sulfate (TLCA-S) ($q=0.009$) and glycocholenoic-sulfate (GCOA-S)($q<0.001$) than the HDG group
- Compared with the HDG group,the MedDiet interventions resulted in a larger reduction in certain fecal bile acids ($p<0.05$)
- Furthermore, the study reported a significant correlation between the abundance and microbial species of the gut microbiome and the secondary bile acid (BA) pool across all participants ($p= 0.001$)
- Higher concentrations of specific BA species families were positively associated with increased triglycerides levels and TC/HDLc ratios across all participants ($p=0.001$)

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

- This RCT identified a correlation between gut microbiome and secondary bile acid in relation to Mediterranean diet interventions.
- Fourteen specific faecal bile acids were associated with higher BMI and triglyceride levels.
- A Mediterranean diet is reported to have a positive effect on BMI and triglycerides, however these results may be influenced by an individual's gut microbial bile acid metabolism.

Read the article here



CLINICAL PRACTICE APPLICATIONS

- This study demonstrates that gut microbiome diversity influences the composition of the secondary bile acids.
- Elevated levels of bile acids were reported to be associated with higher BMI, while UDCA, HCA and LCA were associated with high-density lipoprotein (HDLc) levels.
- Healthcare practitioners may therefore consider assessing a patient's faecal microbiome and bile acid profiles to better understand an individual's response to a recommended dietary intervention.
- These findings may encourage practitioners to consider the Mediterranean diet to optimise the gut microbiome and support bile acid metabolism.

CONSIDERATIONS FOR FUTURE RESEARCH

- This study was limited in that the study population comprised largely males (88%). Future research is needed to include more diverse populations.
- Further in-depth studies are also required to investigate the mechanism through which bile acids influence metabolic health.

CONCLUSION

This RCT demonstrates that Mediterranean diet interventions have an effect on BMI and lipid markers and that these results may differ depending on an individual's baseline fecal profile. Overall the findings highlight the importance of gut microbial bile acid metabolism in shaping personalised responses to dietary interventions.

EXPERT REVIEWER Ana Paula Agrela

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

Dosage exploration of the effects of honey and its derivatives on cardiometabolic outcomes: an overview of systematic reviews and GRADE-assessed updated meta-analysis

MOSTAFA NOROUZZADEH, SANAZ BARAZANDEH, MINOO HASAN RASHEDI, ET AL.
JOURNAL: NUTRITION & DIABETES 2025;15(1):48

INTRODUCTION

A systematic review was conducted to examine the effects of honey, Royal Jelly (RJ) and propolis on cardiometabolic health markers.

METHOD

The analysis included 69 randomised controlled trials (RCTs), involving 3544 male and female participants (50.2%), sourced from PubMed, Scopus, and Web of Science.
The primary outcomes focused on assessment of cardiometabolic biomarkers: glycaemic control, lipid profiles, and blood pressure.

HONEY DOSE & OUTCOMES

- 10g Honey was associated with a reduction in HbA1C (WMD: −0.25, 95% CI: −0.45 to −0.05; I^2: 58.6%).
- Conversely, honey increased triglyceride (TG) levels (WMD: 8.09 mg/dL, 95% CI:1.22 to 14.9; I^2: 7.78%, CoE: Low) and systolic blood pressure (SBP) (WMD:4.24 mmHg, 95% CI: 2.03–6.45; I^2: 0.00%) and diastolic blood pressure (DBP) (WMD: 1.94 mmHg, 95% CI: 0.40 to 3.48; I^2: 0.00%)

Royal Jelly, dose and outcomes

- Royal Jelly demonstrated a lowering effect on insulin (INS) levels (WMD: −3.63 µU/mL, 95% CI: −6.77 to −0.49; I^2: 27.8%) and reduced total cholesterol (WMD: −11.0 mg/dL, 95% CI: −18.0 to −3.96; I^2: 13.4%, CoE: Moderate).

- **Propolis, dose and outcomes**
- Propolis supplementation showed an improvement in glycaemic control by reducing fasting blood glucose (FBG) (WMD: −10.9 mg/dL, 95% CI: −17.3 to −4.51; I^2: 94.4%), Insulin (WMD: −1.55 µU/mL, 95% CI: −2.47 to −0.63; I^2:88.4%), and HbA1C (WMD: −0.49, 95% CI: −0.76 to −0.21; I^2: 85.2%).
- Propolis supplementation improved lipid markers by lowering LDL-C/HDL-C ratio (WMD: −0.20, 95% CI −0.36 to −0.05; I^2: 25.2%, CoE: Very Low)

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

- Replacing simple sugar with 10g of good quality honey per day may positively influence HbA1c levels. However, caution is advised for long-term use due to potential adverse effects lipid profiles, blood pressure and inflammatory markers.

Read the article here

CLINICAL PRACTICE APPLICATIONS

- This review found that a daily intake of 10g of honey significantly reduced HbA1C levels (WMD: −0.37; 95% CI: −0.56 to −0.18). However, these beneficial effects diminished at doses exceeding 50g per day.
- The findings also demonstrated that honey increased blood pressure, highlighting the need for healthcare practitioners to exercise caution when recommending honey to hypertensive patients. In such cases, the anti-hypertensive effects associated with Royal Jelly (RJ) may offer a more suitable alternative.
- A dose-response analysis revealed that approximately 2,200 mg of RJ is required to achieve a minimal clinically important difference (MCID) of 4 mg/dL in LDL-C levels, while a dose of 500 mg daily significantly reduced triglyceride levels beyond the MCID threshold (10.5 vs. 8 mg/dL).
- The greatest reduction in triglyceride levels was observed with a daily
- propolis dose of 500 mg, resulting in a weighted mean difference (WMD) of −10.5 mg/dl (95% CI: −18.7 to−2.37).

CONSIDERATIONS FOR FUTURE RESEARCH

- Given the concerns surrounding honey's effects on blood pressure and inflammatory markers, further high-quality clinical trials are needed to clarify its long-term safety and cardiometabolic impact.
- Although Royal Jelly (RJ) has demonstrated beneficial effects on lipoprotein metabolism, the precise biological mechanisms underlying these effects remain poorly understood and require further investigation.
- Future research exploring combination therapies involving honey, RJ and propolis may reveal synergistic benefits, particularly within high-risk cardiometabolic populations.
- In addition, many commercially available formulations lack quality control, and optimal concentrations of bioactive compounds required to achieve therapeutic efficacy. Future studies should prioritize standardisation, safety and reproducibility across formulations.
- Further investigations focusing on population-specific responses and optimised dosing strategies are also warranted to better guide clinical applications.

CONCLUSION

This review concluded that honey consumption was associated with adverse effects on blood pressure. In contrast, Royal Jelly (RJ) demonstrated beneficial effects on both lipid, and glycaemic profiles, while propolis supplementation improved lipid metabolism, and glycaemic control.

EXPERT REVIEWER Ana Paula Agrela

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

Effects of Increasing Total Fruit Intake With Avocado and Mango on Endothelial Function and Cardiometabolic Risk Factors in Adults With Prediabetes

CHELSEA PREISS, SAMEER TUNIO, LASANTHA KRISHAN HIRIMUTHUGODA, ET AL.
JOURNAL: JOURNAL OF THE AMERICAN HEART ASSOCIATION 2026;15(4):E040933

INTRODUCTION

The study aimed to assess the effect of increasing total and selected fruit intake (avocado and mango) on vascular function and metabolic health in adults with prediabetes.

METHOD

This was an 8-week single-blinded, randomised, 2-arm, partially controlled study. Participants (n=82: 43 men and 39 women) were randomly assigned (1:1) into 1 of 2 dietary interventions: experimental (avocado-mango diet: adding one avocado and one cup of fresh mango daily) vs control intervention (replaced the avocado and mango options with equicaloric carbohydrate food alternatives). Calorie target for female participants was 1500 kcal/d, whereas for males it was 1750 kcal/d.
The primary outcome was flow-mediated vasodilation (FMD). Secondary end points included: central and brachial blood pressure; pulse-wave velocity; metabolic, inflammatory, and kidney function markers; and diet intake.

RESULTS

- Total fruit intake increased in both groups. However, after 8 weeks, the avocado-mango diet significantly increased intake from 0.9 cups/day at baseline to approximately 3 cups/day.
- After 8 weeks, %FMD decreased to 4.6±0.5 in the control group but increased to 6.7±0.6 in the avocado–mango group. This resulted in a significant effect between the control and intervention (−2.11±0.77%, P=0.008).
- In both groups, FMD increased after the breakfast meal (effect of time: P=0.0525, marginally significant) and remained consistently higher in the avocado-mango group compared to the control group (effect of the intervention: P=0.002).
- Increasing avocado-mango improved endothelial function and helped prevent the increase in diastolic blood pressure observed in the control group. They also slightly increased the estimated glomerular filtration rate (P=0.08) and decreased plasma creatinine P=0.06).
- No significant differences were observed between groups for fasting glucose, insulin, systolic blood pressure (P>0.05) and body weight.
- The avocado-mango group showed nonsignificant improvements in lipid profile levels namely reductions in total and low-density lipoprotein cholesterol (P=0.09).

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

TAKE HOME MESSAGE

- Daily intake of one avocado and one mango may help improve cardiovascular health in adults with prediabetes.
- Adding more fruit such as avocado and mango to dietary interventions, may help increase fruit consumption and improve nutrient intake in adults with prediabetes.

Read the article here

CLINICAL PRACTICE APPLICATIONS

- Healthcare professionals may encourage adults with prediabetes to increase their daily whole fruit intake, such as 1 avocado and 1 cup of mango per day, as part of a balanced diet to support cardiovascular health.
- When supporting adults with prediabetes, dietary interventions may benefit from emphasising dietary quality and fruit variety, as improvements in endothelial function were observed despite no significant changes in fasting glucose, insulin, or body weight.

CONSIDERATIONS FOR FUTURE RESEARCH

- Longer trials with larger sample sizes are needed to better understand how different individuals have different responses to dietary interventions and identify challenges in adoption long term.
- Future studies should have specific biomarkers of food intake and nitric oxide bioavailability, as this may help to further strengthen the study results.

CONCLUSION

Increasing fruit intake, specifically 1 avocado and 1 cup of mango per day , into the diet of adults with prediabetes resulted in vascular function changes that are important in cardiovascular health.

EXPERT REVIEWER Sarah Cassar

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

CVD & DIET TAKEAWAYS

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FEATURE ARTICLE

MODERN FOOD SYSTEMS AND THE RISE OF MEDICALISED WEIGHT LOSS:

THE CRADIOVASCULAR CONSEQUENCES

MODERN FOOD SYSTEMS AND THE RISE OF MEDICALISED WEIGHT LOSS:

THE CARDIOVASCULAR CONSEQUENCES

Authors: Chloe Steele MSc MBANT and Dr Justin Roberts Ph.D, SFHEA, FBANT

ABSTRACT

Cardiovascular disease (CVD) remains one of the leading global causes of morbidity and mortality despite advances in medical, nutritional and lifestyle management. Concurrently, ultra-processed food (UPF) consumption has increased, which has been associated with obesity, insulin resistance, dyslipidaemia, hypertension, and cardiovascular events. Glucagon-like peptide-1 receptor agonists (GLP-1RAs) have shown significant reductions in body weight and major adverse cardiovascular events (MACE) in high-risk populations; however, concerns remain regarding their long-term use. This review aimed to evaluate the data surrounding UPF consumption on cardiovascular health and the effect of GLP-1RAs on CVD.

The review highlighted a mismatch between upstream drivers of disease and downstream treatments. Epidemiological evidence reported that the consumption of UPFs was associated with a 50% increased risk of CVD associated mortality and a 12% increased risk of CVD development. Randomised control trials (RCTs) suggested that UPFs may act on the cardiovascular system through gut dysbiosis and impaired cardiovascular function. Cohort studies and RCTs indicated that the displacement of nutrients, with replacement of UPFs, which may benefit the cardiovascular system, such as fibre, polyphenols, and specific micronutrients, may also contribute to CVD risk. However, interpretation should be made with caution as epidemiological studies do not infer causation, and some studies were small and with methodological limitations. The adoption of a minimally processed diet in comparison to an UPF dominated diet may aid weight loss and the improvement of some but not all blood lipid markers associated with cardiovascular risk.

GLP-1RAs were shown in systematic reviews and meta-analyses of RCTs to have clinically meaningful benefits to CVD and reduce the risk of major adverse cardiac events (MACE) by 13% and cardiovascular mortality by 12%. Long-term GLP-1RA use was shown to be associated with side effects such as gastrointestinal (GI) disorders. Nutrient deficiencies were associated with GLP-1RA treatment in observational studies but methodological limitations means that further research is warranted before causation is established. Lean muscle mass reduction was reported in RCTs following GLP-1RA treatment. Weight regain and the reversal of improvements to cardiometabolic risk factors were also reported in RCTs following GLP-1RA treatment cessation.

The Mediterranean diet (MedDiet) was shown in one RCT to be associated with small improvements to systolic blood pressure and endothelial function compared to a typical Western diet, however improvements were likely to be too small to be clinically meaningful. When compared to a low-fat diet, the MedDiet was associated with a 30% decreased risk for cardiovascular events in one large RCT. Despite limitations, the MedDiet and the adoption of minimally processed food diets may provide a nutrition-first upstream solution facilitating lower CVD risk, and may be necessary for individuals who have been medically prescribed GLP-1RA to support nutrient intake. Such diets may also provide a long-term solution to weight loss after GLP-1RA treatment has ceased.

It was concluded that under medical guidance, GLP-1RA therapy may provide CVD benefits but long-term CVD prevention is unlikely to be achieved through pharmacological intervention alone. Greater emphasis on reducing UPF consumption and the adoption of whole-food diets such as the MedDiet may be necessary to address upstream drivers of disease and improve long-term cardiovascular and cardiometabolic outcomes.

THE BURDEN OF CARDIOVASCULAR DISEASE

INTRODUCTION

In 2019 global burden of CVD was more than 523 million individuals worldwide, with prevalence expected to increase by 90% over the coming decades (1,2). Although risk factors such as hypertension, dyslipidaemia, obesity, smoking, and type 2 diabetes (T2D) have been long recognised for CVD, growing evidence suggests that changes within modern food environments may act as upstream contributors to CVD (3).

Modern dietary patterns have shifted towards increased consumption of UPFs, which now contribute a substantial proportion of energy intake in many countries including the UK, which reported that between 2008-2016 UPFs accounted for 54.3% of energy intake amongst adults (4). Mechanistic evidence suggests that associations with CVD may extend beyond poor nutrient composition, with marketing and UPF ingredients contributing to hyper-palatability, disruption of the gut microbiota, inflammation, and endothelial dysfunction (5–8). In addition to these intrinsic properties, displacement of nutrient-dense foods containing fibre, polyphenols, vitamins, minerals, and other bioactives with cardioprotective effects may be contributing to CVD risk. Suboptimal diet has been shown to be responsible for 4.06 million ischaemic heart disease (IHD) deaths in 2023 (95% uncertainty interval: 0.74-6.22), with low intakes of nuts, seeds, low whole-grains, low fruits and high sodium all shown to be primary contributors (9).

With increasing CVD and obesity, management strategies have become more medicalised. Statins, antihypertensives, and more recently GLP-1RAs are used to reduce cardiometabolic risk. GLP-1RAs have demonstrated clinically meaningful reductions in body weight and cardiovascular events in high-risk populations (10–12). However, concerns have been highlighted regarding long-term sustainability, weight regain, nutrient adequacy, side effects, and whether GLP-1RA administration is only targeting the downstream consequences of modern food environments rather than addressing underlying causes of disease.

With growing rates of CVD despite medicalisation there may be a disconnect between upstream causes not being addressed and a shift towards treating downstream symptoms. This narrative review therefore aimed to evaluate current evidence on the effects of UPF consumption on cardiovascular health, whilst evaluating the efficacy of GLP-1RAs in CVD and their long-term administration.

UPFS AND CARDIOMETABOLIC DISEASE

UPFS AND DIETARY PREVALENCE

Foods purchased in the supermarket have undergone processing to get them to the shop floor. The NOVA food-processing spectrum is the most widely used classification system, which categorises foods depending on the nature and extent of processing they have undergone (13). The scale ranges from minimally processed foods, which have been cleaned, ground, dried or cooled, to the ultra-processed, which have been extensively modified through chemical processing (14).

The ultra-processed category contains foods, which are recognised as so-called “junk foods”, but also contain foods marketed as healthy, such as protein bars, flavoured and low-fat yoghurts, and mass-produced wholegrain breads. These foods are hyperpalatable, convenient, and highly profitable (13). Common additives in UPFs include colours, flavour enhancers, preservatives, and emulsifiers, which are rarely used in home cooked foods. Food additives in particular have been associated with negative disruption of the gut microbiota and the development of chronic diseases (15,16).

The consumption of UPFs is increasing and becoming a large part of the diet at a young age. In the UK, UPFs have been shown in one systematic review to consistently account for around half of total dietary intake between 2008-2016, with an estimated 51-57% of overall energy intake across adults and children (4). This systematic review of 55 papers spanning 32 countries on the sociodemographic determinants behind UPF consumption also reported that higher UPF intakes were associated with younger people, urbanisation, and being unmarried, single, or divorced (4). Sociodemographic status, education, and income all showed varying associations with UPFs depending on the country.

UPFs AND CVD

Epidemiological studies have indicated that the consumption of UPFs is associated with an increased risk for the development of CVD. One umbrella review of 45 epidemiological meta-analyses has reported direct associations between higher UPF consumption and a 50% higher risk for CVD related mortality (risk ratio 1.50, 95% confidence interval (CI) 1.37 to 1.63), a 12% higher risk for T2D (dose-response risk ratio 1.12, CI: 1.11 to 1.13), and increased risk for obesity (odds ratio 1.55, CI: 1.36 to 1.77) (17). Similarly, in the landmark prospective NutriNet-Santé cohort study of 105,159 individuals, which assessed the usual consumption of 3300 food items classified according to the NOVA scale, it was found that higher UPF intake was associated with a 12% increased risk of CVD (hazard ratio (HR) 1.12 (95% CI: 1.05 to 1.20); P= <0.001), an increased coronary heart disease risk (HR 1.13; CI: 1.02 to 1.24; P=0.02), and increased cerebrovascular disease risk (HR 1.11; CI:1.01 to 1.21; P=0.02) (18).

In addition to being associated with CVD development, UPF consumption has been associated with an increased risk of death due to CVD. In the multicentre prospective cohort analysis of over 428,000 individuals known as the European Prospective Investigation into Cancer and Nutrition (EPIC) study, UPF intake was positively associated with all-cause mortality (HRs per 1-SD: 1.04; 95% CI: 1.02 to 1.05) and mortality from ischaemic heart disease (IHD) (HR:1.10; 95% CI: 1.06 to 1.15) (19). This prospective cohort analysis also identified that replacing processed and UPFs with unprocessed/minimally processed foods was associated with a 6% lower mortality risk. Additionally, a meta-analysis of 10 studies highlighted that a 31% increased likelihood of death due to CVD was associated with the consumption of UPFs s (20).

MECHANISTIC LINKS BETWEEN UPF CONSUMPTION AND CVD

INTRINSIC FACTORS

Recent mechanistic research has shown that food processing may independently contribute to CVD risk. Additives commonly found in UPFs, particularly emulsifiers, may contribute to gut dysbiosis and intestinal permeability, however conclusions should be conservative as research has only been carried out in small numbers of individuals. Gut dysbiosis and impaired intestinal barrier integrity have both been associated with chronic low-grade inflammation, which may be a predictor for future cardiovascular events (21–23). One small randomised control trial (RCT) of 16 individuals given an emulsifier free diet or one containing the synthetic emulsifier commonly found in UPFs, carboxymethylcellulose (CMC), has shown that compared to control, CMC consumption for 14 days (15g/day) was associated with altered gut microbiota composition (P=0.002) (16). Reduced microbial richness, which may be an indicator of disease, was also observed in the CMC group as well as reductions in the beneficial bacterial taxa Faecalibacterium prausnitzii and Ruminococcus species, which have physiological roles in gut barrier integrity, short-chain fatty acid production, and anti-inflammatory activity (7).

Consumption of CMC was also associated with altered faecal metabolomes indicating disrupted metabolic activity of the gut (P=0.001). Upon resampling one month after CMC cessation, changes in metabolic activity of the gut microbiome had resolved, suggesting possible transient effects experienced only whilst CMC is in the diet.

In contrast, other research has reported significant effects on intestinal barrier integrity as well as alteration in lipid metabolism, which may further contribute to the development of UPF consumption associated with CVD. In one 2-week RCT of 60 healthy individuals, impaired intestinal function has been reported following a diet containing emulsifiers (Polysorbate-80, CMC, and Carrageenan) compared to an emulsifier free diet (EFD) (P=0.04) (8). Reduced total cholesterol (P=0.00006) and low-density lipoprotein cholesterol (LDL-c) (P=0.002) and minimal but significant weight loss (0.3 kg; P=0.02) was reported following an EFD diet which could have further CVD implications. However, high-density lipoprotein cholesterol (HDL-c) was also shown to decrease (P=0.002), although no changes were seen in metabolic health markers. An EFD diet was followed by all participants with the delivery of the emulsifiers in a chocolate muffin eaten three times per day, which was replaced with a placebo muffin in the control group. Results should be interpreted with caution as dietary adherence was not formally assessed throughout the trial and could account for the observations.

Impaired endothelial function and altered cardiovascular responses have also been shown after the consumption of UPFs. It was shown in one RCT of 14 healthy males that even after a single UPF meal, myocardial blood flow and myocardial flow reserve were increased (1.62 vs. 1.22 mL/min/g, P = 0.015, and 2.43 vs. 1.88, P = 0.012, respectively) (5). This highlights the potential for UPFs to acutely alter cardiovascular function, which if sustained could result in endothelial injury in individuals with existing coronary arterial plaques (24).

UPFs are engineered to maximise consumer appeal with attractive packaging and advertising. Increased levels of sugar and salt makes UPFs hyperpalatable, which could promote excessive energy intake leading to the development of obesity, one of the risk factors associated with CVD. One observational study of 215 University students who were shown 64 pictures of UPFs reported that the pictures prompted a desire to eat the foods because of the

rewarding properties associated with their sugar, fat, and salt content (25). One RCT of 42 individuals with obesity given a breakfast of one of two test meals matched for energy density, macronutrients, sodium, and fibre, but differing in NOVA classification has shown that when individuals were given the UPF meal, rate of food intake increased, with less chewing and bites (07:52 ± 3:00 vs. 11:07 ± 03:16 min; P<0.01), and a greater capacity to eat (39.68 ± 22.69 vs. 23.95 ± 18.92 mm; P<0.02) compared to the non-UPF meal (6).

DISPLACEMENT THEORY AND THE IMPORTANCE OF NUTRIENTS

The detrimental effects of UPF components may not be the only contributors to CVD risk. In addition, UPFs are low in fibre and micronutrient density, and high in total fat, sugar, and salt posing the question as to whether adverse health outcomes may also be due to the displacement of more nutrient dense foods, which may have protective benefits to the cardiovascular system. This “displacement theory” proposes that reductions in fibre, polyphenols, and micronutrients found in whole foods due to the addition of UPFs may promote inflammatory and metabolic mechanisms increasing CVD risk.

The reduced risk of CVD with nutrient dense foods has been attributed to the component parts they contain. Nutrients such as fibre, which is found exclusively in plant-foods, wholegrains, and cereals has been shown to be inversely associated with risk for CVD (risk ratio (RR) 0.91 per 7 g/day; 95% CI: 0.88 to 0.94) and coronary heart disease (RR:0.91; CI: 0.87 to 0.94) in a previous meta-analysis of 22 cohort studies (26). Fibre has been reported to act through improvements to glycaemic control, heart rate, and non-HDL-c (27–29).

Polyphenols are naturally occurring plant-based antioxidants and have been shown in one systematic review and meta-analysis of 16 studies to be associated with significantly improved systolic (mean difference (MD) −1.01, 95% CI: −2.04; 0.02, P = 0.005) and diastolic blood pressure (mean difference −1.32 mmHg, 95% CI: −2.37, −0.27 mmHg; P = 0.001), HDL-c (MD 2.68 mg/dL, 95% CI: 2.43, 2.92 mg/dL, P < 0.001), LDL-c (MD −4.39 mg/dL, 95%CI: −7.66, −1.11 mg/dL, P = 0.009), and endothelial function (MD 0.89%, 95% CI: 0.40, 1.38%, P < 0.001), all of which may reduce CVD risk (30).

Supplementation of selenium and coenzyme Q10, which are naturally found in fruits, vegetables, nuts, and seeds has been shown in one RCT to decrease CVD mortality through modulation of thyroid function, thyroid-stimulating hormone (TSH) (< median: n = 34 out of 103 vs. > median: n = 47 out of 100; P = 0.042) and thyroxine (T4) (> median: n = 47 out of 101 vs < median: n = 33 out of 102, P = 0.039) (31). Reductions in oxidative stress implicated in CVD mortality have also been observed following supplementation with selenium and coenzyme Q10, further supporting the potential cardioprotective role of nutrients derived from whole foods (32).

Zinc, which is found in both animal and plant-based foods has been shown in one systematic review and meta-analysis of 27 studies that when supplemented at low-doses (LD) (<25 mg/day), and for long durations (LDu) results in improvements to several CVD risk factors compared to placebo including fasting blood glucose (LD MD:-19.69; 95% CI: -33.64, -5.75, P=0.006, LDu MD: -18.18, 95% CI: -27.74, -8.61, P= 0.0002), triglycerides (LD MD: -19.65, 95% CI: -27.83, -11.47, P= <0.00001 and LDu MD -25.68, 95% CI: -47.83, -3.54), total cholesterol (LD MD: -11.05, 95% CI : -17.49, -4.60, P= 0.0008 and LDu MD: -12.88, 95% CI: -23.89, -1.86, P=0.02), and LDL-c (LD MD: -11.14, 95% CI: -21.61, -0.67, P= 0.04 and LDu MD: -8.49, 95% CI: -15.82, -1.16; P=0.02) (33).

The intrinsic properties of UPFs may directly contribute to inflammation, metabolic dysfunction, and gut dysbiosis and their addition to the diet, displacing more nutrient dense foods, may act synergistically to increase the risk for CVD. It is important that practitioners consider not only the reduction of UPF intake, but also the adoption of a whole-food dietary pattern such as the MD, rich in fibre and polyphenols, to help prevent CVD.

MEDICAL MANAGEMENT OF CVD

The Global Burden of Disease study put CVD prevalence in 2019 at 523 million (1). This is projected to increase to 1.14 billion in 2050 (2). In addition to biological and genetic factors driving CVD risk, socioeconomic, psychological, and commercial factors may be involved. Adherence to nutrient dense foods can be challenging with the food environment being dominated by inexpensive, highly palatable UPFs which may contribute to the development of CVD risk factors and comorbidities (34). Perceived time and money to cook healthy food may also factor into the challenges surrounding healthy diets and drive food choices towards convenient UPFs (35). As a result medical management of CVD through statins, antihypertensives, anti-inflammatories and more recently GLP-1RAs, has become common practice (36).

GLP-1RAS, TYPE 2 DIABETES AND CARDIOVASCULAR DISEASE

GLP-1RAs should only be initiated under guidance from a doctor or qualified medical professional. They mimic the endogenous incretin hormone glucagon-like peptide-1, which may act to regulate appetite, insulin secretion, satiety, and delayed gastric emptying resulting in weight loss (37).

Increased usage of GLP-1RAs for cardiovascular health may have resulted from early cardiovascular outcome trials demonstrating modest but significant reductions in MACE, which includes cardiovascular death, stroke, or myocardial infarction (MI), in individuals with T2D.

One systematic review and meta-analysis of seven RCTs with 56,006 participants with T2D has shown that compared to placebo, GLP-1RA administration led to a low-moderate 12% relative risk reduction (RRR) of MACE (HR 0.88; 95% CI: 0.82, 0.94; P<0.001) (10). The number needed to treat (NNT) was relatively high at 75, however given the severity of the outcome prevented, this could be considered clinically significant.

When assessing the components of MACE, GLP-1RA use led to a reduction in risk from cardiovascular causes (HR 0.88; 95% CI: 0.81, 0.96; P=0.001), fatal- or non-fatal stroke (HR 0.84; 95% CI 0.76, 0.93; P<0.001), and fatal or non-fatal MI (HR 0.91; 95% CI 0.84, 1.00; P=0.043).

More recently a systematic review and meta-analysis of 13 RCTs in 65,878 individuals with T2D has shown that compared to placebo, GLP-1RA use led to a reduced risk of MACE of 13% (OR: 0.87; 95% CI: 0.81–0.94; P < 0.01; I2 = 37%), and cardiovascular mortality of 12% (OR: 0.88; 95% CI: 0.80–0.96; P < 0.01; I2 = 14%) (12). The odds of stroke, in particular ischaemic stroke were also reduced (OR: 0.74; 95%CI:0.61-0.91; P<0.01; I2=0%).

GLP-1RAs and secondary prevention of CVD

While initial cardiovascular outcome trials of GLP-1RAs focused primarily on individuals with T2D, more recent research has expanded into populations with overweight or obesity or at elevated cardiovascular risk. In one RCT known as the SELECT trial, including 17,604 individuals who had pre-existing CVD and a body mass index of 27 kg/m2 or higher, it was shown that the administration of the GLP-1RA (2.4mg), Isemaglutide, led to a 20% reduction in a composite of death from cardiovascular causes, nonfatal MI, or non-fatal stroke, compared to placebo (HR, 0.80; 95% CI:l 0.72 to 0.90; P<0.001) (11). Death from cardiovascular causes occurred in 569 individuals (6.5%) in the semaglutide and 701 (8.0%) in the placebo groups.

INTEGRATED PREVENTION MODEL

NUTRITION-FIRST CVD PREVENTION

A joint advisory group from the American College of Lifestyle Medicine, the American Society for Nutrition and the Obesity Medication Association concluded that to support GLP-1RA therapy, nutritional priorities need to be addressed by practitioners (38). Preventing nutrient deficiencies and preserving bone and muscle mass through diet and exercise should be prioritised. However, what these strategies fail to recognise is the mismatch between upstream causation of CVD, driven by high UPF consumption, and downstream treatment, which may contribute to nutrient deficiencies, muscle loss, and support the need for lifelong therapy. Additionally, concerns remain over side effects with long-term use of GLP-1RAs. The SELECT trial showed that adverse events leading to discontinuation of the trial occurred in significantly more individuals in the GLP-1RA (semaglutide) group than placebo (1461; 16% vs 718; 8.2% P<0.001) (11). Gastrointestinal (880 vs 172, P<0.001) and gall-bladder disorders (246 vs 203, P=0.04) were most commonly reported.

Muscle loss resulting from rapid weight loss may also occur during GLP-1RA treatment and may need to be addressed through dietary and lifestyle changes such as increased dietary protein and strength training. One systematic review and meta-analysis of 38 trials involving 1735 individuals with and without T2D showed that individuals given GLP-1RAs had significantly reduced fat mass (T2D:-3.18 kg, 95% CI: -4.09, -2.28, P < 0.0001 and non T2D: -6.02 kg, 95% CI: -7.53, -4.50, P < 0.0001) (39). This was accompanied by significantly reduced mean muscle mass in individuals without T2D (-1.41 kg, 95% CI: -2.12, -0.71, P = 0.0001), however this was not significant amongst those with T2D.

GLP-1RAs act to decrease nutrient intake and although weight loss may be seen, it should not be assumed that optimal nutritional status is being achieved. Nutrition deficiencies have been reported in one observational trial of 461,382 adults newly prescribed GLP-1RAs (40). Nutrition deficiencies or deficiency complications were

seen in 22.4% of individuals after taking GLP-1RAs for 12 months. Vitamin D deficiency was the most prevalent deficiency at 13.6% after 12 months. A smaller percentage of individuals reported thiamine deficiency (0.1%) and other B vitamin deficiency (2.6%). In a smaller subset (n=9010) comparing individuals taking metformin only and those on GLP-1RAs and metformin, it was shown that there was a significantly higher number of individuals on GLP-1RAs with a vitamin D deficiency (GLP1RA: 489 vs control: 259; P= <0.01) and thiamine deficiency (GLP-1RA: 7 vs control: 5; P=<0.01), although the actual numbers of individuals was incredibly low for thiamine deficiency and may not be a cause for concern.

There are some limitations to this as participants did not undergo routine vitamin testing and diagnosis was based upon health insurance claims data. Individuals may have had existing deficiencies before GLP-1RA initiation or other deficiencies may not have been detected if they weren't tested for. Despite limitations in the research, practitioners should recognise that some individuals may be at increased risk of nutritional compromise as food intakes fall substantially during treatment. Dietary assessment and nutritional monitoring may be of benefit to individuals at an increased risk of inadequate nutrient intake and nutrition related diseases such as sarcopaenia. In addition, more research is warranted on the effects of GLP-1RAs on nutrient levels.

Weight regain following GLP-1RA cessation has been reported, which may partly reflect continued poor diet and failure to implement sustainable long-term maintenance strategies including adherence to healthier dietary and lifestyle patterns during and after treatment (41-43). Without these, a large proportion of the lost weight could be regained. This metabolic rebound has been shown in one systematic review of 18 RCTs with 3771 participants following discontinuation of GLP-1RAs (41). Post-discontinuation follow-up of at least 12 weeks was characterised by a body weight regain of 5.63 kg (95% CI: 3.52–7.73; P <0.0001) and an increase in waist circumference (3.81 cm; 95% CI: 2.15–5.47; P <0.0001), BMI (2.34 kg/m2 ; 95% CI: 1.21–3.46; P <0.0001), systolic blood pressure (4.15 mmHg; 95% CI: 1.87–6.44; P <0.0001), and fasting plasma glucose (0.45 mmol/L, 95% CI: 0.32–0.59 P<0.0001).

The SURMOUNT-4 study, which was a RCT of 783 individuals given the GLP-1RA tirzepatide for 36-weeks and then placebo or tirzepatide continuation for 52 weeks, showed that although GLP-1RA led to weight loss (MD, −19.4%; 95% CI: −21.2%to −17.7%; P< 0.001), switching to placebo led to weight regain, with many of the initial improvements to cardiometabolic risk factors, such as waist circumference, fasting glucose, lipid levels, insulin levels, and blood pressure, observed with GLP-1RA treatment, being reversed (42). Only continuation of treatment ensured weight maintenance or further reductions (mean percentage weight change −6.7% with tirzepatide vs 14.8% with placebo; difference, −21.4%; 95% CI: −22.9% to −20.0%; P< .001). Similar outcomes were seen in the Step 1 Trial extension with two thirds of weight lost, regained and a reversal of cardiometabolic benefits seen during treatment (43).

DIET AND CARDIOVASCULAR DISEASE

Historically, low-fat diets were recommended for CVD prevention based on the Seven Countries Study, which reported associations between saturated fat intake, serum cholesterol, and coronary heart disease risk (44). However, more recently dietary quality has been shown to be important for some cardiovascular disease risk markers. Weight loss, LDL-c levels, blood pressure, and endothelial function have all been shown to be negatively impacted when minimally processed food (MPF) is replaced with UPF (45, 46).

In one crossover RCT of 55 adults with overweight and obesity it was shown that a minimally processed food (MPF) diet for 8-weeks with a 4-week washout and then an UPF diet resulted in weight loss with both diets but MPF diet resulted in significantly greater percentage weight change compared to UPF diet (Δ%WC, −1.01; 95% CI, −1.87, −0.14, P = 0.024) (46). Clinical markers of cardiovascular disease showed mixed outcomes with changes in triglycerides being significantly superior with UPF diet compared to MPF diet (−0.25

mmol l−1(s.e., 0.08);P = 0.004), whereas improvements to LDL-c being greater with MPF (0.25 mmol l−1 (s.e., 0.10); P = 0.016). No differences were seen between the two diets in heart rate and blood pressure.

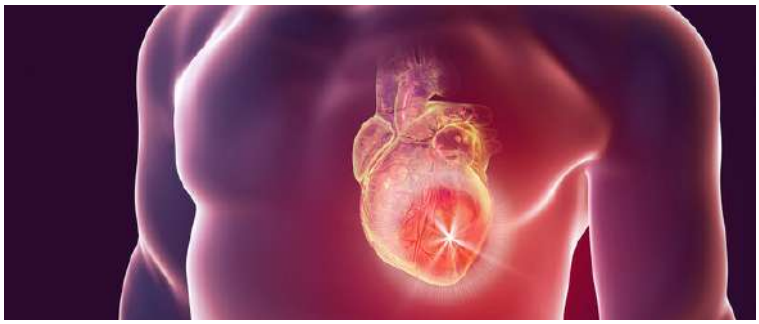
Nutrient dense diets, such as the MedDiet, may be the gold standard diet for managing CVD risk. The landmark Primary Prevention of Cardiovascular Disease with a Mediterranean Diet (PREDIMED) study, which was a multicentre, RCT of 7447 of nearly 5 years, reported that individuals at high risk of CVD had an approximate 30% decrease in risk for the development of cardiovascular events following a MedDiet containing 30g of nuts (HR: 0.72; 95% CI, 0.54 to 0.95) or 4 tablespoons of olive oil (HR 0.69; 95% CI, 0.53 to 0.91) compared to a reduced-fat diet (47).

Subsequently the CORDIOPREV study, which enrolled 1002 individuals showed further reductions in risk for secondary cardiovascular events following the adoption of the MedDiet compared to a low-fat diet (crude rate per 1000 person-years: 28·1 [95% CI 27·9–28·3] in the MedDiet group vs 37·7 [37·5–37·9] in the low-fat group, log-rank P=0·039) (48). In one 6 month RCT study of 85 Australian adults (MedLey Study) consuming either a MedDiet or asked to continue their habitual diet, which was characterised by lower vegetable, fruit, fish, but undisclosed UPF content showed that MedDiet was associated with significant decrease in SBP (−1.1 mm Hg; 95% CI: −2.0, −0.1 mm Hg; P = 0.03) and increased flow mediated dilation (FMD) (1.3%; 95% CI: 0.2%, 2.4%; P=0.026) (45).

Adopting a nutrient dense diet, low in UPFs may improve some risk factors involved in the development of CVD, acting as a preventative measure. GLP-1RA's may be of benefit to individuals at high risk of CVD, and integration with sustainable dietary and lifestyle modifications and long-term maintenance strategies may prevent progression towards a "yo-yo" pattern of weight loss, weight regain, and CVD risk.

IN SUMMARY

CONCLUSION



CVD prevalence continues to rise suggesting that current medicalisation may be more effective at treating the downstream consequences rather than upstream causes. UPF consumption may represent an important route into CVD through several mechanisms including gut dysbiosis, endothelial dysfunction, metabolic disruptions, and displacement of nutrient dense foods, which may be protective against CVD. Conversely the growing use of GLP-1RAs indicates an increased reliance on the medicalised route out of CVD. Whilst GLP-1RAs have shown that they may reduce body weight and cardiovascular events, concerns remain over long-term suitability with side effects, nutrient deficiencies, muscle loss, and weight regain following treatment cessation.

PRACTITIONER RECOMMENDATIONS

CVD prevention should be considered an integrated strategy combining lifestyle changes and where appropriate, pharmacological therapies. For cardiovascular health, practitioners should prioritise improvements to dietary quality through avoidance of UPFs and focusing on vegetables, fruits, legumes, wholegrains, nuts, seeds, and extra virgin olive oil. Although much of the evidence on UPFs in CVD is observational, whole-food dietary patterns such as the MedDiet consistently demonstrate cardiovascular benefits over other dietary patterns.

When clinically indicated and prescribed by a medical professional, GLP-1RAs may aid body weight reductions and decrease the risk of MACE in high-risk populations such as those with obesity and T2D but individual responses may vary. Nutritional assessment should be considered following reports of reduced food intake, possible lean muscle mass loss during rapid

weight reduction, and emerging observational evidence suggesting possible nutrient deficiencies. It should be noted that current evidence remains limited, and direct causal links between GLP-1RA use and nutrient deficiencies have not been determined. Long-term cardiovascular risk reduction is likely to depend on sustainable dietary and behaviour changes given emerging clinical evidence on weight regain and reversal of cardiometabolic benefits following GLP-1RA treatment cessation. Adequate protein intake, resistance exercise, and dietary monitoring may help preserve lean mass and support nutritional status during weight loss.

AUTHOR CONTRIBUTIONS

CS conceived of the review, wrote the initial draft and is responsible for content. JR peer-reviewed and provided editing of content. JR and CG provided final editing. All authors reviewed and accepted the final manuscript.

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References

1. Roth GA, Mensah GA, Johnson CO, et al. Global Burden of Cardiovascular Diseases. J Am Coll Cardiol. 2020;76(25). doi:10.1016/j.jacc.2020.11.010
2. Chong B, Jayabaskaran J, Jauhari SM, et al. Global burden of cardiovascular diseases : projections from 2025 to 2050. Eur J Prev Cardiol. 2025;32(11):1001-1015. doi:10.1093/eurjpc/zwae281
3. Teo KK, Ra T. Cardiovascular Risk Factors and Prevention : A Perspective From Developing Countries. Can J Cardiol. 2021;37:733-743. doi:10.1016/j.cjca.2021.02.009
4. Dicken S, Qamar S, Batterham R. Who consumes ultra-processed food? A systematic review of sociodemographic determinants of ultra-processed food consumption from nationally representative samples. Nutr Res Rev. 2024;37(2):416-456.
5. Lucinian YA, Gagnon C, Latour É, et al. Effect of a single ultra processed meal on myocardial endothelial function , adenosine mediated effects and cognitive performances. Sci Rep. 2025;15.
6. Galdino-silva MB, Maria K, Almeida M, et al. A Meal with Ultra-Processed Foods Leads to a Faster Rate of Intake and to a Lesser Decrease in the Capacity to Eat When Compared to a Similar , Matched Meal Without Ultra-Processed Foods. Nutrients. 2024;16:1-19.
7. Quévrain E, Maubert MA, Michon C, et al. Identification of an anti-inflammatory protein from Faecalibacterium prausnitzii, a commensal bacterium deficient in Crohn's disease. Gut. 2016;65(3):415-425. doi:10.1136/gutjnl-2014-307649.Identification
8. Wellens J, Vanderstappen J, Hoekx S, et al. Effect of Five Dietary Emulsifiers on Inflammation , Permeability , and the Gut Microbiome : A Placebo-controlled Randomized Trial. Clin Gastroenterol Hepatol. 2026;24(4):1092-1101. doi:10.1016/j.cgh.2025.08.005
9. Collaborators G 2023 I& DRF. Global, regional and national burden of ischemic heart disease attributable to suboptimal diet, 1990–2023: a Global Burden of Disease study. Nat Med. 2026;32:1454-1478

References cont.

10. Kristensen, S. L., Rorth R, Jhund PS, et al. Cardiovascular, mortality and kidney outcomes with GLP-1 receptor agonists in patients with type 2 diabetes: a systematic review and meta-analysis of cardiovascular outcome trials. Lancet Diabetes Endocrinol. 2019;7(10):776-785. doi:10.1016/S2213-8587(19)30249-9
11. Lincoff AM, Brown-Frandsen K, Colhoun HM, et al. Semaglutide and Cardiovascular Outcomes in Obesity without Diabetes. N Engl J Med. 2023;389(24):2221-2232. doi:10.1056/NEJMoa2307563
12. Stefanou M, Theodorou A, Malhotra K, et al. Risk of major adverse cardiovascular events and stroke associated with treatment with GLP-1 or the dual GIP / GLP-1 receptor agonist tirzepatide for type 2 diabetes : A systematic review and meta-analysis. Eur Stroke J. 2024;9(3):530-539. doi:10.1177/23969873241234238
13. Monteiro CA, Cannon G, Moubarac J, Levy RB, Louzada MLC, Jaime PC. Commentary The UN Decade of Nutrition , the NOVA food classi fi cation and the trouble with ultra-processing. Public Health Nutr. 2017;21(1):5-17. doi:10.1017/S1368980017000234
14. Juul F, Vaidean G, Parekh N. Ultra-processed Foods and Cardiovascular Diseases : Potential Mechanisms of Action. ASN Rev. 2021;(5):1673-1680.
15. Raoul P, Cintoni M, Palombaro M, et al. Food Additives , a Key Environmental Factor in the Development of IBD through Gut Dysbiosis. Microorgani. 2022;10:167.
16. Chassaing B, Compher C, Bonhomme B, et al. Randomized Controlled-Feeding Study of Dietary Emulsifier Carboxymethylcellulose Reveals Detrimental Impacts on the Gut Microbiota and Metabolome. Gastroenterology. 2022;162(3):743-756. doi:10.1053/j.gastro.2021.11.006.Randomized
17. Lane MM, Gamage E, Du S, et al. Ultra-processed food exposure and adverse health outcomes : umbrella review of epidemiological meta-analyses. Br Med J. 2024;384. doi:10.1136/bmj-2023-077310
18. Srour B, Fezeu LK, Kesse-guyot E, et al. Ultra-processed food intake and risk of cardiovascular disease : prospective cohort study (NutriNet-Santé). Br Med J. 2019;365. doi:10.1136/bmj.l1451
19. González-gil EM, Matta M, Berstein M, et al. Associations between degree of food processing and all-cause and cause-speci fi c mortality : a multicentre prospective cohort analysis in 9 European countries. Lancet Reg Heal - Eur. 2025;50:101208. doi:10.1016/j.lanepe.2024.101208
20. You J, Hou J, Xie X, Xu R. Consumption of ultra-processed foods raises the possibility of cardiovascular disease. Nutr Hosp. 2025;42(1):117-130.
21. Mellai M, Allesina M, Edoardo B, et al. ARandomized, Double-Blind, Placebo-Controlled Trial: Efficacy of Opuntia ficus-indica Prebiotic Supplementation in Subjects with Gut Dysbiosis. Nutrients. 2024;16:586.
22. Karl JP, Margolis LM, Madslien EH, et al. Changes in intestinal microbiota composition and metabolism coincide with increased intestinal permeability in young adults under prolonged physiological stress. Am J Physiol - Gastrointest Liver Physiol. 2017;312(6):G559-G571. doi:10.1152/ajpgi.00066.2017
23. Henein MY, Vancheri S, Longo G, Vancheri F. The Role of Inflammation in Cardiovascular Disease. Int J Mol Sci. 2022;23.
24. Russo G, Pedicino D, Chiastra C, et al. Coronary artery plaque rupture and erosion : Role of wall shear stress profiling and biological patterns in acute coronary syndromes. Int J Cardiol. 2023;370(October 2022):356-365. doi:10.1016/j.ijcard.2022.10.139
25. David IA, Krutman L, Fernández-santaella MC, et al. Appetitive drives for ultra-processed food products and the ability of text warnings to counteract consumption predispositions. Public Health Nutr. 2017;21(3):543-557. doi:10.1017/S1368980017003263
26. Threapleton DE, Greenwood DC, Nykjaer C, Woodhead C, Cade JE. Dietary fibre intake and risk of cardiovascular disease : systematic review and meta-analysis. Br Med J. 2013;6879(December):1-12. doi:10.1136/bmj.f6879
27. Jones D, Kyriakidou A, Cooper L, et al. The effect of high- fibre diets on glycaemic control in women with diabetes in pregnancy : A systematic review analysis. Diabet Med. 2025;(August 2024). doi:10.1111/dme.15435
28. Cicero AFG, Fogacci F, Veronesi M, Strocchi E. A Randomized Placebo-Controlled Clinical Trial to Evaluate the Medium-Term Effects of Oat Fibers on. Nutrients. 2020;12(3):686.
29. Ju Y, Zhang C, Zhang Z, Zhu H, Liu Y, Liu T. Effect of Dietary Fiber (Oat Bran) Supplement in Heart Rate Lowering in Patients with Hypertension : A Randomized. Nutrients. 2022;14(15):3148.
30. Poti F, Santi D, Spaggiari G, Zimetti F. Polyphenol Health Effects on Cardiovascular and Neurodegenerative Disorders : A Review and Meta-Analysis. Int J Mol Sci. 2019:1-26.
31. Alehagen U, Alexander J, Aaseth JO, Larsson A, Opstad TB. Supplementation with selenium and coenzyme Q10 in an elderly Swedish population low in selenium — positive effects on thyroid hormones, cardiovascular mortality, and quality of life. *BMC Med*. 2024;22(1):1-15. doi:10.1186/s12916-024-03411-1
32. Dunning BJ, Bourgonje AR, Bulthuis MLC, et al. Selenium and coenzyme Q 10 improve the systemic redox status while reducing cardiovascular mortality in elderly population-based individuals. *Free Radic Biol Med*. 2023;204(March):207-214. doi:10.1016/j.freeradbiomed.2023.04.024

References cont.

33. Pompano LM, Boy E. Effects of Dose and Duration of Zinc Interventions on Risk Factors for Type 2 Diabetes and Cardiovascular Disease : A Systematic Review and Meta-Analysis. *Adv Nutr*. 2021;12(1):141-160.
34. Chung A, Westerman L, Martin J, Friel S. The commercial determinants of unhealthy diets. *Public Heal Res Pract*. 2022;32(October):1-4.
35. Wolfson JA, Ramsing R, Richardson CR, Palmer A. Barriers to healthy food access : Associations with household income and cooking behavior. *Prev Med Reports*. 2019;13(December 2018):298-305. doi:10.1016/j.pmedr.2019.01.023
36. Mahase E. GLP-1 agonists: US sees 700% increase over four years in number of patients without diabetes starting treatment. *Br Med J*. 2024;386:1645.
37. Müller TD, Finan B, Bloom SR, et al. Glucagon-like peptide 1 (GLP-1). *Mol Metab*. 2019;30(September):72-130. doi:10.1016/j.molmet.2019.09.010
38. Mozaffarian D, Agarwal M, Aggarwal M, et al. Nutritional priorities to support GLP-1 therapy for obesity : A joint Advisory from the American College of Lifestyle Medicine , the American Society for Nutrition , the Obesity Medicine Association , and The Obesity Society. 2025;(May):1475-1503. doi:10.1002/oby.24336
39. Anyiam O, Ardavani A, Panesar A, Idris I, Sofia R, Rashid A. How do glucagon-like Peptide-1 receptor agonists affect measures of muscle mass in individuals with , and without , type 2 diabetes : A systematic review and meta-analysis. *Obes Rev*. 2025;26(7). doi:10.1111/obr.13916
40. Butsch WS, Sulo S, Chang AT, et al. Nutritional deficiencies and muscle loss in adults with type 2 diabetes using GLP-1 receptor agonists : A retrospective observational study. *Obes Pillars*. 2025;15(April):100186. doi:10.1016/j.obpill.2025.100186
41. Tzang C, Wu P, Luo C, et al. Metabolic rebound after GLP-1 receptor agonist discontinuation : a systematic review and meta-analysis. *eClinicalMedicine*. 2025;90(110):103680. doi:10.1016/j.eclinm.2025.103680
42. Aronne LJ, Sattar N, Horn DB, et al. Continued Treatment With Tirzepatide for Maintenance of Weight Reduction in Adults With Obesity The SURMOUNT-4 Randomized Clinical Trial. *J Am Med Assoc*. 2024;331(1):38-48. doi:10.1001/jama.2023.24945
43. Wilding, J.P.H., Batterham, R.L., Davies, M., Gaal, L.F. Van, et al. (2022) Weight regain and cardiometabolic effects after withdrawal of semaglutide : The STEP 1 trial extension. *Diabetes Obesity and Metabolism*. [Online] 24 (February), 1553–1564. Available from: doi:10.1111/dom.14725.
44. Keys A. Coronary heart disease in seven countries. *Circulation*. 1970;41(1):186-195.
45. Davis CR, Hodgson JM, Woodman R, Bryan J, Wilson C, Murphy KJ. A Mediterranean diet lowers blood pressure and improves endothelial function : results from the MedLey randomized intervention trial 1 , 2. *Am J Clin Nutr*. 2017;105(6):1305-1313. doi:10.3945/ajcn.116.146803
46. Dicken (2025) Ultraprocessed or minimally processed diets following healthy dietary guidelines on weight and cardiometabolic health : a randomized , crossover trial. *Nature Medicine*. [Online] 31 (October). Available from: doi:10.1038/s41591-025-03842-0.
47. Estruch R, Ros E, Salvadó JS, et al. Primary Prevention of Cardiovascular Disease with a Mediterranean Diet Supplemented with Extra-Virgin Olive Oil or Nuts. *N Engl J Med*. 2018;34(1):1-14. doi:10.1056/NEJMoa1800389
48. Delgado-Lista J, Alcala-Diaz JF, Torres-Peña JD, et al. Long-term secondary prevention of cardiovascular disease with a Mediterranean diet and a low-fat diet (CORDIOPREV): a randomised controlled trial. *Lancet*. 2022;399(10338):P1876-1885.

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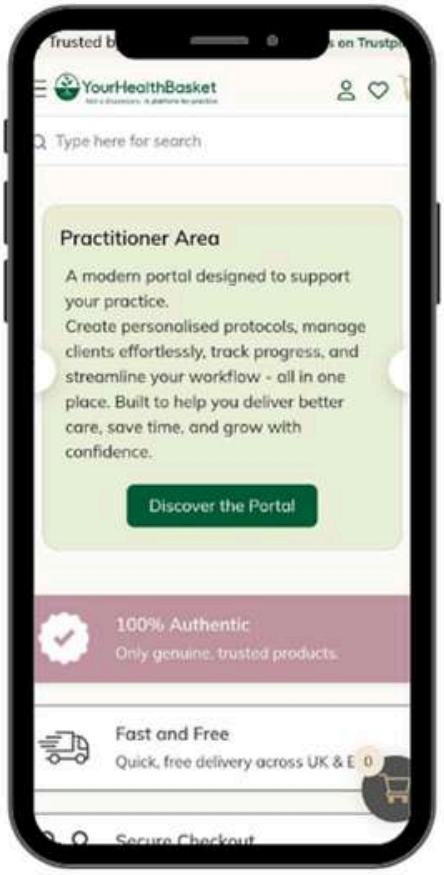

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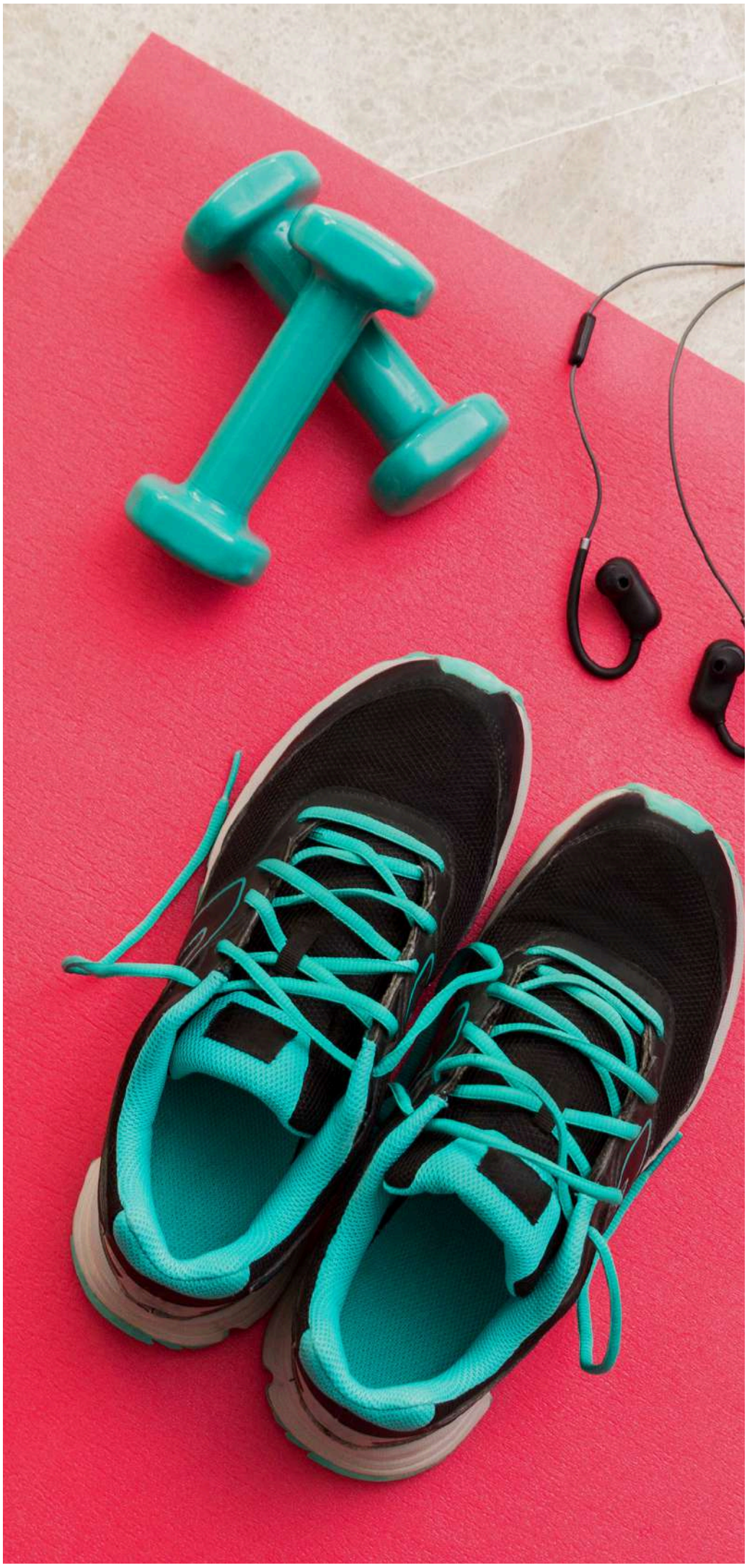
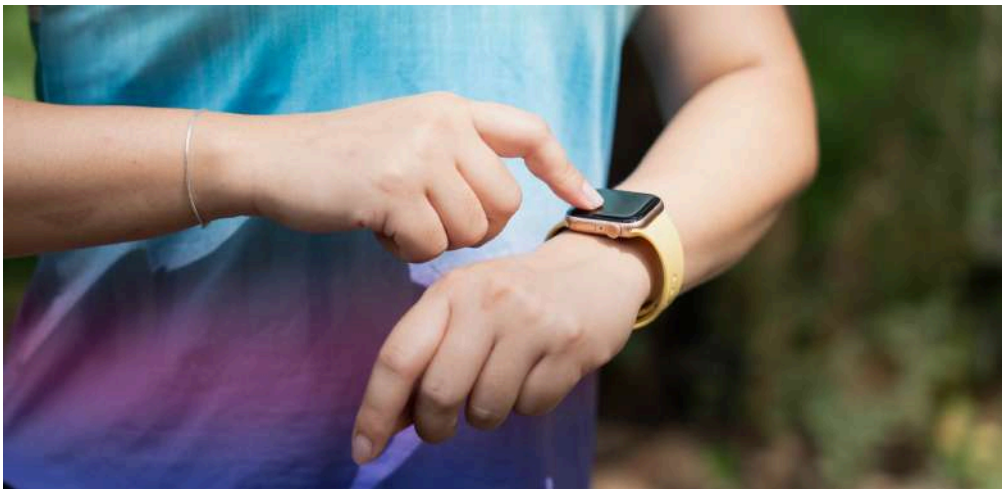
EXERCISE & CARDIO-METABOLIC HEALTH

6 REVIEWS



Wearable device-based health equivalence of different physical activity intensities against mortality, cardiometabolic disease, and cancer



RAAJ KISHORE BISWAS, MATTHEW N AHMADI, ADRIAN BAUMAN ET AL.
JOURNAL: NATURE COMMUNICATIONS 2025;16(1):9581

INTRODUCTION

A dose-response relationship between physical activity (PA) intensity and risk reduction of non-communicable disease and mortality is well-reported. Current recommendations for the amount of PA at different intensities rely on non-empirical data such as self-reports, where each minute of vigorous activity is given twice the weight of moderate intensity activities. With the emergence of wearable device-based data, this study aims to determine the equivalence of different PA intensities and examine them against a range of mortality and health outcomes.

METHOD

- This prospective cohort study included 73,485 UK Biobank adults wearing an accelerometer on their dominant wrist continuously for 7 days, aged 40-69 at baseline, mean age of 61.6.
- 41,420 (56.4%) females and 32,065 (43.6%) males gave informed consent. Ethical approval was granted (Ref:11/NW/0382).
- PA intensities were categorised into light PA (LPA), moderate PA (MPA) and vigorous PA (VPA) using a validated 2-stage machine learning-based classification system. The equivalent of LPA and MPA against VPA was examined against a range of key mortality, cardiometabolic and cancer related outcomes.

RESULTS

- The sample included 2675 all-cause mortality (ACM) events, 545 cardiovascular disease (CVD) mortality events, 2359 major adverse cardiovascular events (MACE), 1836 Type 2 diabetes (T2D) events, 538 PA related cancer mortality events and 2662 PA related cancer incidence events.
- Findings show that, based on evidence from wearable devices, 1 minute of VPA is associated with risk reduction levels comparable to 4-9 minutes of MPA and 53-156 minutes of LPA, dependent on cause of mortality and health outcomes.
- For a standardised 5%–35% risk reduction in mortality and health outcomes measured in this study, the median MPA equivalent per minute of VPA for ACM = 4.1 (95% CI: 4.1–4.2), CVD mortality = 7.8 (7.7-8.0), MACE = 5.4 (5.3–5.5), T2D = 9.4 (9.3-9.6), and cancer mortality = 3.5 (3.4-3.5) and PA related cancer incidence = 1.6 minutes.
- For non-cancer outcomes, the median LPA equivalent per minute of VPA was ACM = 53 minutes, CVD = 72.5 minutes, MACE = 86.1 minutes and T2D = 94 minutes.

TAKE HOME MESSAGE

- Consider the use of wearables to measure physical activity levels and facilitate behaviour change.
- Encourage a variety of physical activity to include vigorous and moderate intensities due to increased risk reduction equivalence per minute compared to light physical activity. One minute of vigorous activity is equivalent to 4-9 minutes of MA and 53-156 minutes of LA.
- Health practitioners may consider recommending lifestyle behaviour change to include vigorous activity to populations who are at high risk.

Read the article here

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

CLINICAL PRACTICE APPLICATIONS

- Using device-based evidence on the health equivalence of different PA intensities, suggests that the current convention of 1 minute of VPA:2 minutes of MPA is low.
- Findings support the use of wearables to monitor physical activity levels, which may help to inform lifestyle interventions and facilitate behaviour change.
- Moderate and vigorous physical activity, where appropriate, may be considered as a more effective and time-saving strategy than light intensity to lower the risk of many lifestyle-related chronic diseases, particularly for those at high risk or those who are time-poor.
- Physical activity can include daily activities such as stair climbing, house maintenance, gardening and walking with short bursts of more intense activity, as well as a wide range of other types of exercise.

CONSIDERATIONS FOR FUTURE RESEARCH

- Randomised controlled trials of physical activity interventions to evaluate the effects of different types and intensity of physical activity on cardiometabolic parameters and other relevant biomarkers in different age categories.
- Interventions using different types of wearables to measure physical activity levels, which may facilitate behaviour change and reduce the risk of a range of key mortality, cardiometabolic and cancer related outcomes.

CONCLUSION

- PA prescription and personalised health initiatives may be supported by wearables and integrating device-based equivalence on PA intensity.

EXPERT REVIEWER Miranda Harris

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: C: Non-randomized trials, observational studies, narrative reviews

Differential benefits of 12-week morning vs. evening aerobic exercise on sleep and cardiometabolic health: a randomized controlled trial

HUIWEN ZHENG, HAIBIN LIU, LIHONG CHEN, BINGYI SHEN, GUANGRUI YANG
JOURNAL: SCIENTIFIC REPORTS 2025;15(1):18298

INTRODUCTION

This study aimed to determine whether morning or evening aerobic exercise affects sleep and cardiometabolic health in sedentary men.

METHOD

This 12-week randomised controlled trial recruited sixty-five sedentary men aged between 18 - 28 years. Participants were randomly assigned to the morning exercise (ME: 6 – 8 a.m.), the evening exercise (EE: 6 – 8 p.m.) or the control (CON) groups. The intervention programme involved at least three sessions of moderate-intensity aerobic exercise with a total of ≥150 minutes every week. Assessments of body composition, sleep, blood metabolic markers, and carotid arterial ultrasound were conducted before and after the intervention.

RESULTS

After the 12-week intervention:

Sleep

The ME group exhibited advanced sleep onset, mid-sleep and sleep end times compared to pre-exercise. Notably, sleep schedules in the ME group were significantly earlier than the EE group (e.g. workday sleep onset ME: 23:36 vs EE: 00:05).

Both ME and EE groups showed reduced sleep latency on workdays and work-free days (ME: ~ 6.70 minutes; EE: ~4.57 minutes) without any significant changes in sleep duration, which aligned with an advanced dim light melatonin onset (DLMO) in the ME group.

Cardiometabolic health

Both ME and EE groups showed significant reductions in body fat mass, visceral fat, subcutaneous fat, and waist-hip ratio, without any significant changes in weight.

ME showed significant reductions in total cholesterol and triglycerides compared to the CON group.

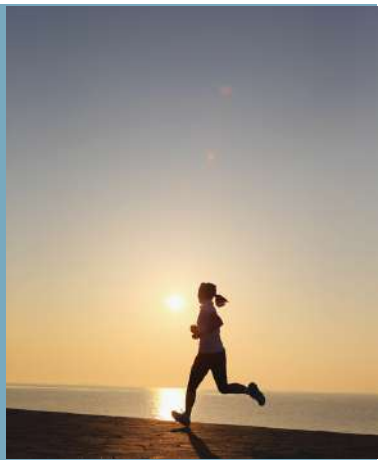
Hemodynamics

Both ME (63.34 ± 1.35 vs. 70.85 ± 1.89) and EE (64.85 ± 2.32 vs. 73.37 ± 2.85) groups showed reductions in resting heart rate (HR), stiffness index and pressure-strain elastic modulus. The ME group showed a lower HR than the CON group (63.34 ± 1.35 vs. 71.53 ± 1.56).

EE group showed increases in maximum and mean arterial diameters, maximum flow velocity, flow rate and pulsatility index. Whereas dynamic resistance and peripheral resistance decreased.

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

Consistent, regular moderate-intensity aerobic exercise causes significant changes in body composition, lipid profile, sleep latency, and artery function, and benefits may vary according to exercise timing.



Read the article here

CLINICAL PRACTICE APPLICATIONS

- Healthcare practitioners should discuss exercise timing, type and intensity when tailoring health interventions especially with clients who have both sleep and cardiometabolic disorders.
- When supporting sedentary male clients presenting with elevated levels of triglycerides or total cholesterol, scheduling morning aerobic exercise sessions may help decrease subcutaneous and visceral body fat content faster, as well as reducing triglyceride and total cholesterol levels.
- For clients with high blood pressure or vascular dysfunction, evening exercising may be better given that the EE cohort showed improvements in systolic blood pressure, carotid blood flow velocity, and arterial dilation.
- Individuals struggling with delayed sleep phase or having difficulty falling asleep may benefit from a morning exercise plan as only the ME cohort was able to show earlier DLMO in addition to shorter sleep-onset latency.

CONSIDERATIONS FOR FUTURE RESEARCH

- The study involved only sedentary adult males thus future studies should aim to also include female and older participants to determine whether there are any differential timing effects of exercise.
- Future research should expand the study range to cover subjects with cardiovascular disease and/or metabolic diseases to better understand the effectiveness of interventions that could benefit people with preexisting illnesses.
- Research could include subjects with disrupted circadian rhythms, such as shift workers and individuals with insomnia, to gain insight into how timed exercise affects sleep disorders.

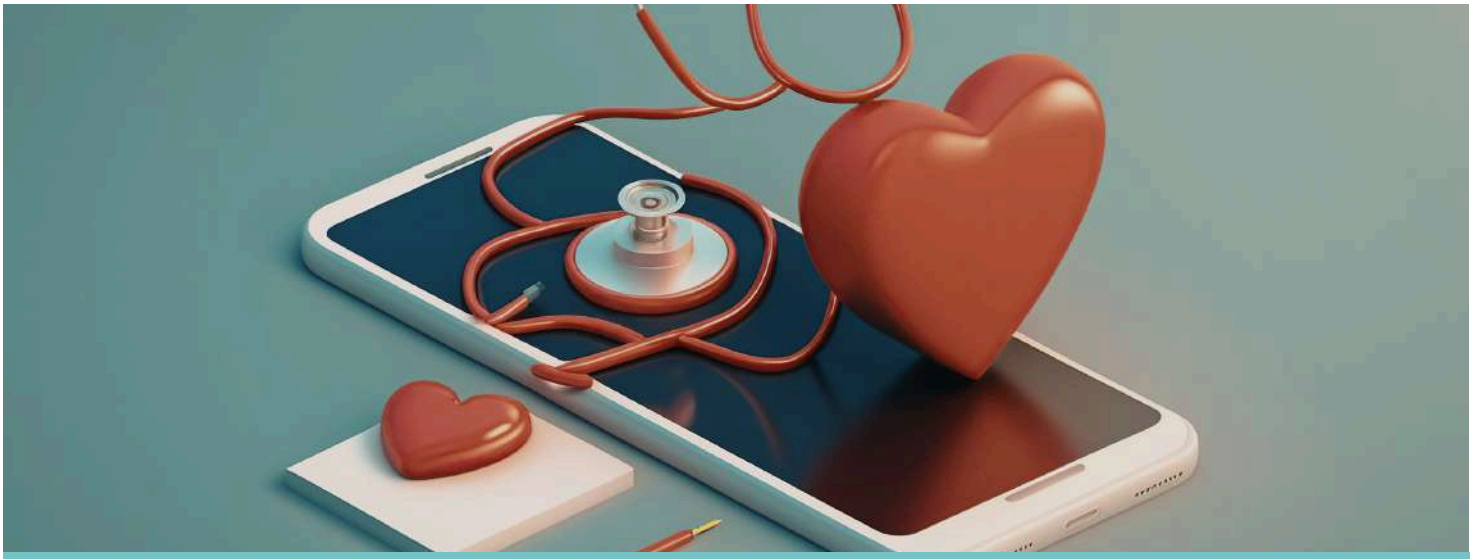
CONCLUSION

- Exercise timing is an important factor when tailoring interventions for sleep and cardiometabolic health.

EXPERT REVIEWER Sarah Cassar

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

Effects of multimodal mobile health interventions on cardiovascular risk factor management in patients with diabetes: a systematic review and meta-analysis



JOURNAL: BMJ OPEN 2025;15(12):E108371
PMID: 41448671

INTRODUCTION

- Mobile health (mHealth) interventions are promising approaches for managing cardiovascular disease (CVD) risk factors.
- Multimodal interventions are defined as incorporating at least three components, e.g. mobile apps, remote biomarker monitoring, wearable devices, video consultations and/or SMS reminders.
- This systematic review and meta-analysis evaluated multimodal mHealth interventions on managing CVD risk factors in adults living with diabetes.

METHOD

- A systematic literature search identified randomised, controlled trials (RCTs) in adults living with diabetes (type unspecified) that compared multimodal mHealth interventions (duration: at least 3 months) with standard care.
- The authors searched MEDLINE, Web of Science, Embase, Cochrane Library, and CINAHL for articles published between January 2010 and December 2024.
- Pooled effect sizes, considering heterogeneity across studies, were expressed as weighted mean differences, or odds ratios (OR) for categorical variables.
- Meta-regression was conducted for haemoglobin A1c (HbA1c), low-density lipoprotein cholesterol (LDL-C), total cholesterol, and physical activity participation against covariates (risk of bias, intervention duration, age, male gender, geographical region).

RESULTS

- The search identified 17 RCTs with 2946 participants.
- Multimodal mHealth interventions significantly reduced HbA1c (−0.38%; p<0.0001), fasting glucose (−14.1 mg/dL; p<0.0001), systolic blood pressure (−1.30 mmHg; p=0.0021), LDL-C (−6.07 mg/dL; p=0.0004), total cholesterol (−5.40 mg/dL; p=0.0177) and triglycerides (−6.50 mg/dL; p=0.0383), and increased physical activity participation (OR=3.41; p=0.0259) versus standard care.
- Body mass index, diastolic blood pressure, high-density lipoprotein cholesterol and smoking cessation did not differ between groups.
- Longer interventions did not appear to produce larger HbA1c reductions.

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

- A robust systematic review and meta-analysis was conducted.
- Findings demonstrated that multimodal mHealth interventions are effective in improving cardiovascular disease risk factors in people living with diabetes compared with standard care.
- Authors concluded that multimodal mHealth interventions are a valuable addition to optimise standard diabetes care in the community.

Read the article here

CLINICAL PRACTICE APPLICATIONS

- Multimodal mHealth interventions, including mobile apps, remote biomarker monitoring, wearable devices, video consultations and/or SMS reminders can be low cost and used at scale, and evidence suggests they are a valuable addition to conventional diabetes care.

CONSIDERATIONS FOR FUTURE RESEARCH

- Since multimodal mHealth interventions typically assume a certain level of digital skills and literacy, the authors acknowledge these findings may not be generalisable to all groups, such as older adults and those with lower literacy. They recommended that equitable access is a focus for future mHealth interventions, such as the inclusion of voice-based apps and simplified wearables, to "bridge the digital divide".

CONCLUSION

- Multimodal mHealth interventions are effective strategies for improving several key CVD risk factors, including glycaemic control, blood pressure, lipid profiles and physical activity levels in people living with diabetes.

EXPERT REVIEWER Dr Michelle Weech

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

Wearable Devices for Exercise Prescription and Physical Activity Monitoring in Patients with Various Cardiovascular Conditions

PAUL DORIAN, KIMBERLEY L WAY, CARLEY D O'NEILL, JENNIFER L REED, ET AL.
JOURNAL: CJC OPEN 2025;7(5):695-706

INTRODUCTION

A review was conducted to discuss the application of wearable devices in patients with coronary artery disease (CAD), heart failure (HF), arterial fibrillation (AF), cardiac implantable electronic devices (CIEDs) and peripheral artery disease (PAD) in different cardiovascular rehabilitation settings.

REPORTED OUTCOMES

CAD

- Systematics reviews were undertaken by Ezekowitz et al. (n = 11 trials, 1356 participants and Hannan (n = 9 studies, 1352 participants) and reported that wrist worn devices and pedometers when combined with established exercise programmes promoted physical activity, which in turn increased peak oxygen consumption (VO_{2peak}) and quality of life (QoL) and reduced the risk by 49% (95% CI: 0.31 to 0.86) of major cardiovascular events in patients with CAD (p=0.004).

HF

- Peng et al. (2018) reported a positive effect when using an instant messaging platform to communicate via text-based, audio, or video calls to support patients with HF who were undergoing exercise telerehabilitation. Compared to the control group, those who received telerehabilitation improved their 6-minute walking test distance (from 407 +/- 12 to 420 +/- 10 minutes vs from 406 +/- 12 to 407+/- 13 minutes, p<0.01) and QoL (from 48.8+/- 12.2 to 49.2+/- 12.4 points vs from 49.4+/- 12.3 to 43.1+/- 8.8 points, p < 0.05).

AF

- Quinn et al. (2024) tested 6 commercial wearables and found a mean absolute difference between ECG-measured HR vs HR as measured by the wearables of 7 -12 bpm at rest and 28 bpm at peak exercise in patients with persistent AF. Additionally, Al-Kaisey et al. (2020) reported that smartwatches underestimate HR in those with persistent AF, particularly at HR ranges that are > 100 bpm; peak HR measured during a treadmill stress test showed greater absolute mean differences (21-36 bpm) between wearables and ECG recordings.This review reported on mean absolute HR differences however, it did not provide p-values or confidence intervals to confirm statistical significance for these differences.

CIEDs

- Smolis-Bak et al. (2015) and Piotrowicz et al. (2020) assessed the safety and efficacy of an 8-week home-based exercise program in patients with CIEDs and demonstrated that the integration of mobile phones into home-based exercise is safe (eg, no adverse events occurred) and feasible (> 90% adherence), and was associated with improvement in VO_{2peak}

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

- Despite the benefits of wearable devices, they have limitations regarding heart rate tracking in AF patients and the potential false-positives signals caused by motion artifacts.
- Successful clinical implementation requires education for both patients and practitioners to ensure safe data interpretation.

Read the article here

(16.1+/- 4.0 vs 18.4 +/- 4.1 mL/kg per minute, p < 0.001), 6MWT distance (428 +/- 93 vs 480 +/- 87 meters,

- p < 0.001), and QoL (79.0 +/- 31.3 vs 70.8 +/- 30.3 points, p< 0.001). 93% of patients reported that the telerehabilitation program stimulated their exercise, and 87% increased their everyday physical activities.

PAD

- Normahani et al. (2018) and Duscha et al. (2018) demonstrated the enhanced benefits of homebased interventions that include wearable devices in maximum walking distance (82 m vs. -5 m) (p=0.009), claudication distance (63m vs. 10m) (p=0.02), steps per day (3492 (95% CI: 2661–4322) to 4502 (95% CI: 3636–5367) , VO_{2peak}, (15.2 ± 4.3 to 18.0 ± 4.8 mL/kg/min) (p<0.05) and QoL (0.9 points vs. 0.2) (p=0.004) in PAD patients compared to those with standard care and/or supervised exercise.

CLINICAL PRACTICE APPLICATIONS

- Clinicians may consider utilising wearable devices to receive real-time feedback on their patients' physical activity, allowing for the implementation of home-based walking programmes to help improve walking distance and quality of life in those with cardiovascular disease.
- However, clinicians need to assess the wearable device data by considering the patient - device interface, presence or the absence of symptoms and the frequency of irregular occurrences.
- Successful clinical application requires practitioner and patient education to understand the limitations and validity of wearable technology.

CONSIDERATIONS FOR FUTURE RESEARCH

- Wearable-based diagnosis algorithms can be susceptible to false-positive signals; therefore, further research and technological advances are needed to establish quality control standards.
- Further research is needed to investigate effective education methods for practitioners and patients to facilitate effective and long-term use of wearable technology in cardiovascular health.

CONCLUSION

When combined with feedback from healthcare practitioners, wearable devices were reported to improve a range of health measures in patients with cardiovascular diseases, including daily physical activity level, cardiorespiratory fitness, functional capacity, and QoL.

EXPERT REVIEWER Ana Paula Agrela

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: N/A

Impacts of Reducing Sitting Time or Increasing Sit-to-Stand Transitions on Blood Pressure and Glucose Regulation in Postmenopausal Women: Three-Arm Randomized Controlled Trial

DORI E ROSENBERG, LINDSAY DILLON, SIMON SCHENK, ANDREA Z LACROIX, ET AL.
JOURNAL: CIRCULATION 2025;152(8):492-504

INTRODUCTION

The study aimed to evaluate the physiological impact of two intervention arms (reducing sitting time vs increasing sit-to-stand transitions [STST]) on blood pressure and glucose regulation, compared to the control group among overweight/obese sedentary postmenopausal women.

METHOD

This three-arm randomised controlled trial enrolled 407 participants (aged 55 to 91 years) who were randomised (1:1:1) into the sit-less (n=136), increase STST (n=136), or healthy living (n=135) arms. Participants received 7 coaching sessions (5 in person and 2 by phone). The primary outcomes were glucoregulatory (insulin, glucose, HbA1c, and HOMA2-IR) and blood pressure markers assessed at baseline and 3 months.

RESULTS

- The sit less group significantly reduced total daily sitting time by 58 minutes (baseline: 654 minutes/day; 3 months: 579 minutes/day) compared with the healthy living group (baseline: 669 minutes; 3 months: 652 minutes) (95% CI, −82.92 to −33.59; P<0.001).
- The STST group significantly increased daily STST by 26/ day (baseline: 45/day; 3 months: 71/day) compared with the healthy living group (baseline: 43/day; 3 months: 43/day) (95% CI, 17.71 to 33.64; P<0.001).
- At baseline, there were no significant differences between the three groups in blood pressure or glucose regulation outcomes.
- At baseline, HbA1c differed significantly between the three groups (P=0.001) with mean (SD) values of 5.80 (0.76) in the healthy living group; 5.64 (0.53) in the sit-less group and 5.54 (0.36) in the STST group.
- The STST group showed a significant reduction in diastolic blood pressure compared with the healthy living group (-2.24 mm Hg; 95% CI, -4.08 to -0.40; P=0.02). However, although systolic blood pressure decreased (−3.33 mm Hg; 95% CI, −6.32 to −0.33; P=0.03), it did not meet the prespecified statistical significance level.
- No intervention effects on glucoregulatory biomarkers (insulin, glucose, HbA1c, and HOMA2-IR) were observed in either intervention group compared to the healthy living group (P>0.05).

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

TAKE HOME MESSAGE

- Standing up and sitting back down more often throughout the day may help lower diastolic blood pressure in overweight/obese postmenopausal within three months.

Read the article here

CLINICAL PRACTICE APPLICATIONS

- Healthcare practitioners working with overweight/obese postmenopausal women could recommend increasing STST throughout the day to support diastolic blood pressure management.
- When supporting sedentary individuals, it is important to distinguish between total sitting time and STST frequency to better guide targeted health interventions.

CONSIDERATIONS FOR FUTURE RESEARCH

- Future studies with longer follow-up periods are needed to better observe sizeable physiological changes.
- Study population focused on overweight/obese women and lacked racial and ethnic diversity. Thus, future research should enrol ethnically diverse participants, and clinical populations with prehypertension or prediabetes to better identify differences in glucoregulatory outcomes.
- Continuous glucose monitoring may be used to better understand the association between sedentary behaviour and glucoregulatory outcomes.
- Further research should also assess diet and sleep in order to evaluate their potential impact on the study outcomes.

CONCLUSION

Postmenopausal women are at high risk of prolonged sedentary behaviour and cardiovascular disease. Increasing STST reduced diastolic blood pressure within 3 months, supporting the effectiveness of interventions targeting sitting behaviours in this population.

EXPERT REVIEWER Sarah Cassar

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: A: Meta-analyses, position-stands, randomized-controlled trials (RCTs)

Personalisation of the Dutch combined lifestyle intervention SLIMMER improves participant retention and weight loss in people at risk for cardiometabolic disease

JOHANNEKE E OOSTERMAN, DAGMAR J SMID, REGINA J M KAMSTRA, ET AL.
JOURNAL: SCIENTIFIC REPORTS 2025;15(1):44347

INTRODUCTION

This study aimed to evaluate the effects of a personalised SLIMMER programme (the Dutch combined lifestyle intervention) on adherence to lifestyle recommendations using questionnaires assessing lifestyle behaviour, self efficacy and quality of life. Secondary aims included health status measured by: well-being, anthropometrics, clinical metabolic parameters, and inflammation biomarkers.

METHOD

This was a cluster-allocated, controlled, open-label, parallel study with two arms: the intervention (personalised SLIMMER programme, n=61) and control (standard SLIMMER programme, n=60) groups. The study enrolled adult patients at risk of cardiometabolic disease who were allocated to one of the groups depending on their primary care centre and were followed during the first six months of the two-year programme.

RESULTS

- The intervention group demonstrated significant programme adherence, with a dropout rate of 11%. Whereas the control group had a higher dropout rate of 23% ($p < 0.001$).
- Both groups improved their adherence to physical and dietary guidelines at 3 and 6 months compared to baseline ($p < 0.001$). However, the control group showed greater improvement in physical activity adherence ($p < 0.05$).
- Both groups showed improvements in diet quality ($p < 0.05$), with no significant differences between groups at 3 and 6 months.
- Quality of life improved in both groups, however, the control group demonstrated a significantly higher overall improvement ($p < 0.05$) from baseline to 6 months..
- Both groups showed weight loss, with the intervention group achieving greater reductions ($p=0.006$) at 6 months and greater improvements in body fat percentage ($p < 0.001$) and waist-hip ratio ($p = 0.025$).
- Systolic blood pressure decreased in both groups, but only the control group had a significant reduction in diastolic blood pressure ($p < 0.001$).
- Fasting glucose was lower in the intervention group ($p = 0.003$), whereas insulin was lower in the control group ($p = 0.002$).

HOW TO BRING THIS INTO YOUR CLINICAL PRACTICE

- Tailoring programmes to meet the individual needs of the participants may increase engagement, improve retention and yield better results.

Read the article here

- HbA1c levels remained stable in the intervention group, whereas they slightly increased in the control group.
- The intervention group showed favourable changes in several inflammatory biomarkers, namely decreases in leptin, high-sensitive C-reactive protein, alpha-1-antitrypsin, and E-selectin, together with increases in adiponectin.

CLINICAL PRACTICE APPLICATIONS

- A one-size-fits-all approach may not address the diverse needs, preferences and barriers to change of each individual at risk of cardiometabolic diseases. Thus, tailoring lifestyle interventions may improve engagement and programme adherence.
- Regular follow-up and personalised goal setting may help individuals at risk of cardiometabolic disease to achieve greater improvements in weight management and overall cardiometabolic health status.

CONSIDERATIONS FOR FUTURE RESEARCH

- Longer-term follow-up studies are needed to validate the outcomes and ensure they are sustained over a longer period of time.
- Future research designs should use randomised controlled trials with standardised inclusion criteria to minimise the risk of selection bias between healthcare sites.
- Future studies should include compliance tracking criteria to help identify which components of the personalised intervention led to the observed results.

CONCLUSION

These findings suggest that tailoring an already effective combined lifestyle intervention to meet participants' needs may help increase their engagement and also improve their cardiometabolic health status.

EXPERT REVIEWER Sarah Cassar

CONFLICTS OF INTEREST: None
EVIDENCE CATEGORY: C: Non-randomized trials, observational studies, narrative reviews

EXERCISE TAKEAWAYS

NED INFOBITES & CLINICAL RESOURCES

Not yet discovered our one page science summaries? Our NED InfoBites are designed to provide quick overviews of some of the latest research available on particular health issues and nutrition topics. Designed as a one-page clinical handout, the NED InfoBites unite our editorial team's pick of the research and provide a plain-language summary suitable for sharing with nutrition clients. Download the latest InfoBites on **here**.

Additionally, BANT has developed a dedicated range of resources to support practitioners and educate on common symptoms, biological processes, and dietary and lifestyle approaches to health and well-being. These are suitable to share with clients in clinical consultations and group programmes and can be found **here**.

NED INFOBITE

Cardiovascular Health & Exercise

Impacts of Reducing Sitting Time or Increasing Sit-to-Stand Transitions on Blood Pressure and Glucose Regulation in Postmenopausal Women: Three-Arm Randomized Controlled Trial

Sedentary behaviour is a significant risk factor for cardiovascular disease, particularly in postmenopausal women, who often spend more time sitting and experience an increased cardiovascular risk after menopause. Strategies such as reducing overall sitting time and increasing sit to stand transitions have emerged as practical approaches to help minimise sedentary behaviour and support cardiovascular health.

This 3-month randomised control trial of 407 overweight and obese postmenopausal women aimed to determine the behavioural and physiological impacts of two different approaches to changing sedentary behaviour, increasing sit to stand transitions and reducing total sitting time.

The results showed that increasing sit to stand transitions improved systolic blood pressure compared to control.

However, increasing sit to stand transitions was not associated with improvements to diastolic blood pressure or blood sugar control.

Sitting less was not associated with improvements to blood pressure or blood sugar control.

It was concluded that increasing sit to stand transitions improved blood pressure in overweight and obese postmenopausal women.

The effects of 6 wk of resistance training on the gut microbiome and cardiometabolic health in young adults with overweight and obesity.

The gut microbiome is increasingly recognised as being involved in the development of obesity and cardiometabolic disease. Greater microbial diversity has been observed following bariatric surgery-induced weight loss, while disrupted gut microbial patterns are associated with obesity, insulin resistance, and poor metabolic health. Although exercise appears to positively influence the gut microbiome in both lean and obese individuals, research remains limited.

This was a 6-week randomised control trial of 32 obese individuals assigned to either a resistance training programme three times per week or control, which consisted of exercise recommendations but no training programme. The study aimed to examine the impact of resistance training on gut microbial diversity and how this was associated with cardiometabolic outcomes.

The results showed that Roseburia, a short chain fatty acid producer, increased in abundance. Changes in microbial metabolic pathways associated with carbohydrate metabolism and cell motility pathways were also observed. Resistance training was also associated with improvements to diastolic blood pressure and insulin sensitivity. However, no differences in microbial diversity were apparent. It was concluded that resistance training increased Roseburia and induced changes in microbial pathways, which may impact cardiometabolic health.

Read the articles here at www.nutrition-evidence.com

Optimal exercise modalities and doses for improving pro-atherogenic lipid profiles in patients with metabolic syndrome: a systematic review with pairwise, network, and dose-response meta-analyses

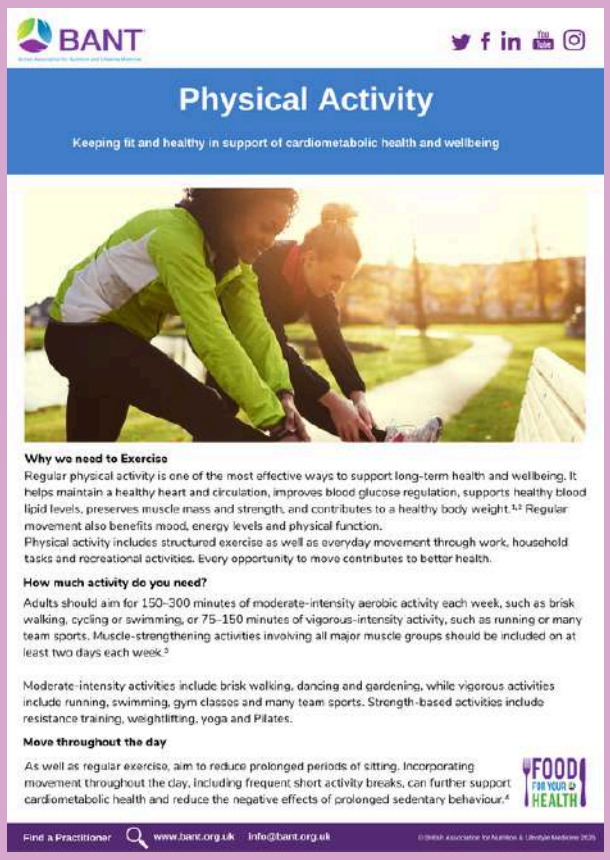
A hallmark feature of metabolic syndrome (MetS) is dyslipidaemia, which has been associated with the development of atherosclerosis through elevated low density lipoprotein cholesterol, triglycerides, and total cholesterol. Exercise has previously been shown to alter lipid profiles, however its effects on pro-atherogenic lipid profiles is less well understood.

This was a systematic review and network meta-analysis of 49 randomised control trials involving 4144 participants to evaluate the effects of multiple exercises on atherogenic lipid profiles. High-intensity interval training, aerobic exercise, resistance training, combined aerobic and resistance training and mind-body exercise were all evaluated.

The results showed that mind-body exercise was the most effective at improving atherogenic lipid profiles. Combined aerobic and resistance training reported clinically meaningful reductions in non-high density lipoprotein cholesterol, triglycerides, and total cholesterol. Separately aerobic and resistance training improved low-density lipoprotein cholesterol and triglycerides. It was concluded that structured exercise may improve pro-atherogenic lipid profiles in individuals with MetS.

CLIENT-FRIENDLY GUIDES:

Providing practitioners with health resources and client-friendly educational materials to support their clinical recommendations.



BANT

Physical Activity

Keeping fit and healthy in support of cardiometabolic health and wellbeing

Why we need to Exercise

Regular physical activity is one of the most effective ways to support long-term health and wellbeing. It helps maintain a healthy heart and circulation, improves blood glucose regulation, supports healthy blood lipid levels, preserves muscle mass and strength, and contributes to a healthy body weight.[1,2] Regular movement also benefits mood, energy levels and physical function.

Physical activity includes structured exercise as well as everyday movement through work, household tasks and recreational activities. Every opportunity to move contributes to better health.

How much activity do you need?

Adults should aim for 150–300 minutes of moderate-intensity aerobic activity each week, such as brisk walking, cycling or swimming, or 75–150 minutes of vigorous-intensity activity, such as running or many team sports. Muscle-strengthening activities involving all major muscle groups should be included on at least two days each week.[3]

Moderate-intensity activities include brisk walking, dancing and gardening, while vigorous activities include running, swimming, gym classes and many team sports. Strength-based activities include resistance training, weightlifting, yoga and Pilates.

Move throughout the day

As well as regular exercise, aim to reduce prolonged periods of sitting. Incorporating movement throughout the day, including frequent short activity breaks, can further support cardiometabolic health and reduce the negative effects of prolonged sedentary behaviour.[4]

FOOD FOR YOUR HEALTH

Find a Practitioner www.bant.org.uk info@bant.org.uk

NED ON SOCIALS

Keep your finger on the pulse by following BANT on socials for weekly NED alerts, nutrition science, and clinical resources.

Tune in on Tuesdays for our weekly pick of the science

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NUTRITION EVIDENCE DATABASE

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