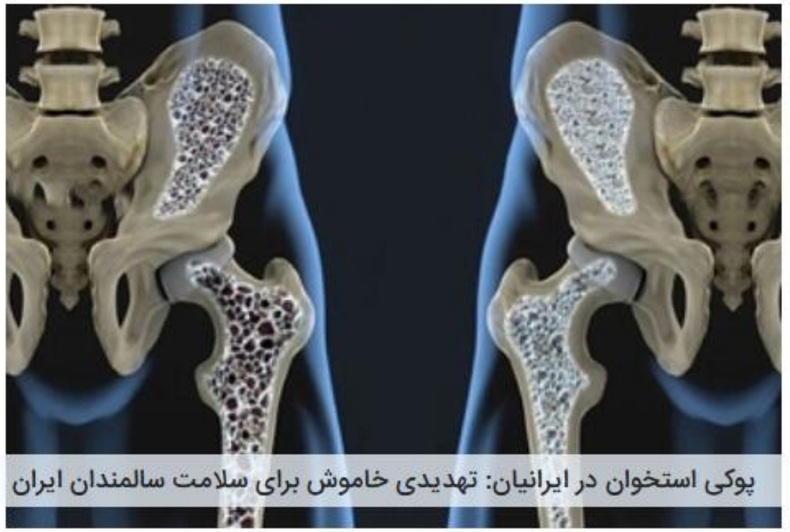
Electromyostimulation (EMS)

italfit EMS

Euphoria of Real Pulse

توتاه و کاربردی

آیا می دانید که ...



پوکی استخوان در ایرانیان: تهدیدی خاموش برای سلامت سالمندان ایران

مصرف ناکافی کلسیم: زنگ

پوکی استخوان در ایرانیان: تهدیدی خاموش برای سلامت سالمندان ایران

استخوان‌های ما، ستون‌های محکم بدنمان، در طول زمان به طور طبیعی ضعیف می‌شوند. اما این ضعف طبیعی می‌تواند به پوکی استخوان تبدیل شود، بیماری ای که استخوان‌ها را شکننده و مستعد شکستگی‌های دردناک و ناتوان‌کننده می‌کند.

مطالعه مرور نظام‌مند جدیدی که در مجله "دیابت و اختلالات متابولیک" منتشر شده، زنگ خطر را در مورد شیوع بالای پوکی استخوان در بین افراد مسن در ایران به صدا در آورده است. بر اساس این مطالعه، تقریباً از هر ۳ زن بالای ۵۰ سال در ایران و از هر ۴ مرد ۱ نفر به این بیماری مبتلا هستند (شیوع ۳۸ درصدی برای زنان و ۲۵ درصدی برای مردان بالای ۵۰ سال). شیوع بالای پوکی استخوان در جمعیت سالمندان نشان‌دهنده یک تهدید جدی برای سلامت عمومی به ویژه در میان افراد مسن است.

پوکی استخوان، که به عنوان "بیماری خاموش" نیز شناخته می‌شود، اغلب بدون علامت باقی می‌ماند تا زمانی که یک شکستگی ناگهانی رخ دهد. این شکستگی‌ها می‌توانند منجر به درد شدید، ناتوانی، از دست دادن استقلال و حتی مرگ شوند.

OPEN ACCESS

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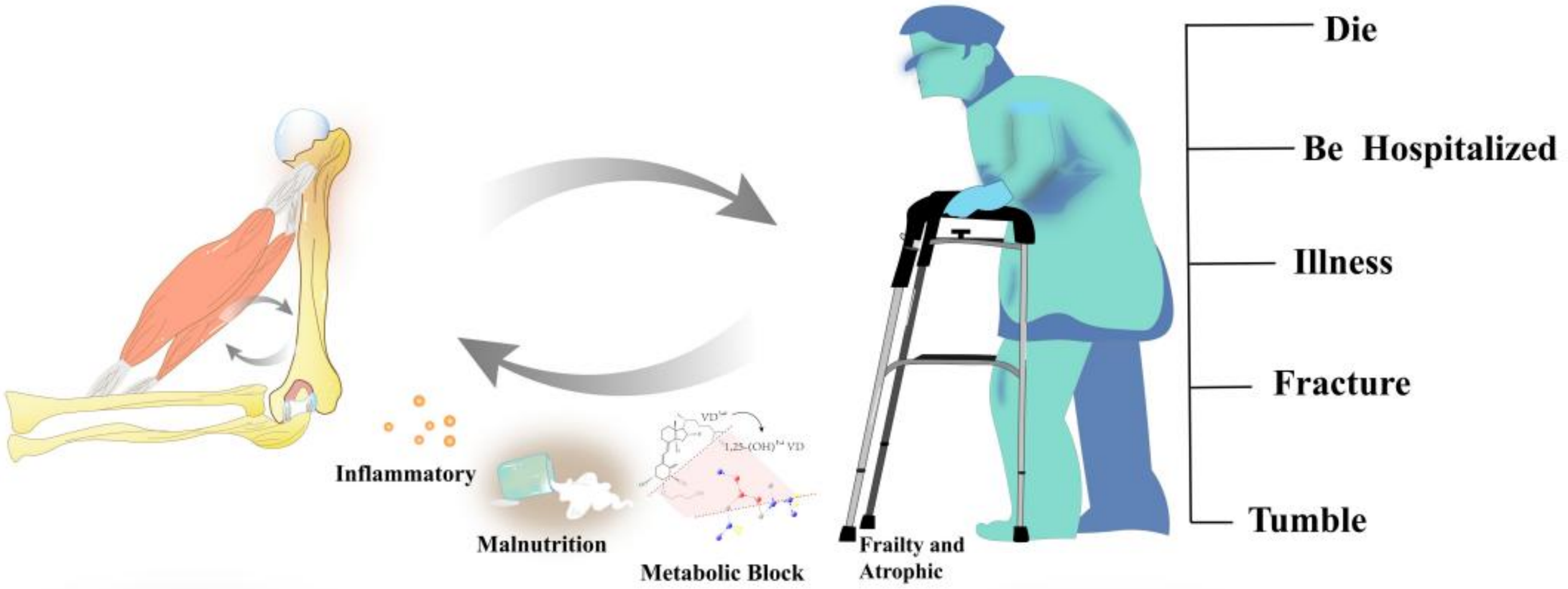
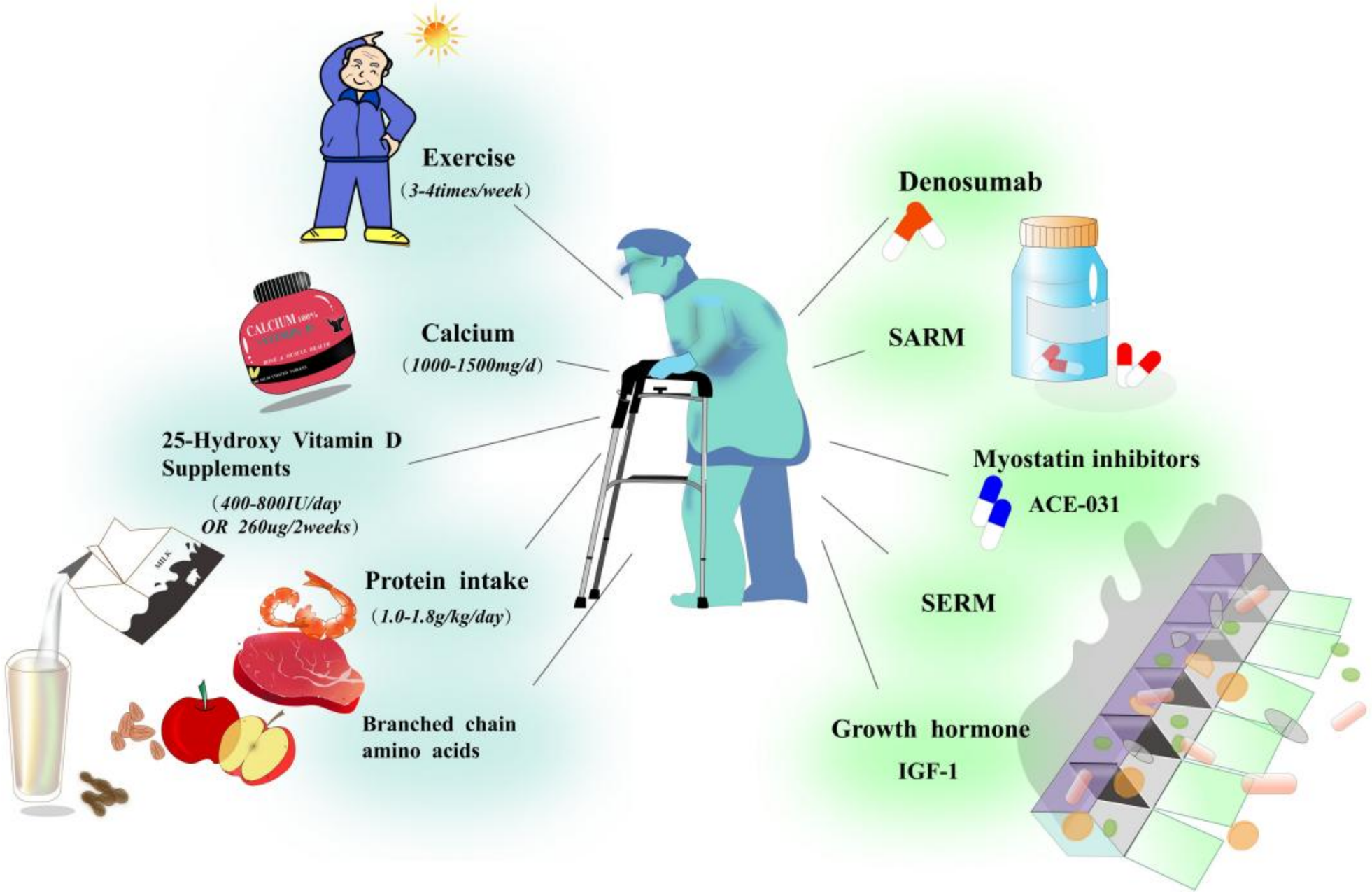
Association between sarcopenia and osteoporosis: the cross-sectional study from NHANES 1999–2020 and a bi-directions Mendelian randomization study

- **Our study identified that it is a positive correlation exists between OP and the prevalence of sarcopenia.**
- **OP and SP may have a strong causal relationship.**
- **OP is more prone to losing Appendicular Lean Mass, and severe loss of ALM may lead to a decrease in LS BMD.**


Die
Be Hospitalized
Illness
Fracture
Tumble
Inflammatory
Malnutrition
Metabolic Block
Frailty and
Atrophic
Osteosarcopenia
Patients with
chronic diseases


Exercise
(3-4times/week)
Calcium
(1000-1500mg/d)
25-Hydroxy Vitamin D
Supplements
(400-800IU/day
OR 260ug/2weeks)
Protein intake
(1.0-1.8g/kg/day)
Branched chain
amino acids
Denosumab
SARM
Myostatin inhibitors
ACE-031
SERM
Growth hormone
IGF-1

Received: 9 May 2024 | Accepted: 17 July 2024

DOI: 10.1113/EP091937

Experimental Physiology WILEY

REVIEW ARTICLE

Mitigating disuse-induced skeletal muscle atrophy in ageing: Resistance exercise as a critical countermeasure

James McKendry | Giulia Coletta | Everson A. Nunes | Char
Stuart M. Phillips

Highlights

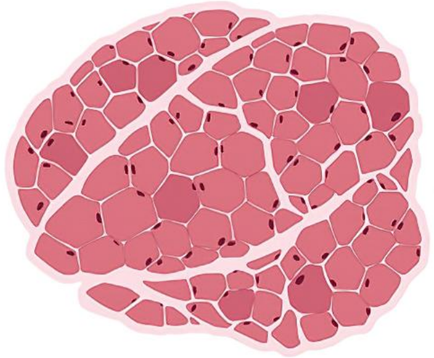
- **What is the topic of this review?**

  Use of resistance exercise training to prevent or mitigate the disuse-induced muscle atrophy in an ageing population.

- **What advances does it highlight?**

  The review highlights several potential mechanisms of disuse-induced muscle atrophy and strategies before, during and following disuse to prevent, mitigate and recover lost muscle.

Skeletal Muscle Atrophy in Ageing and Disuse



Eutrophic Adult Skeletal Muscle

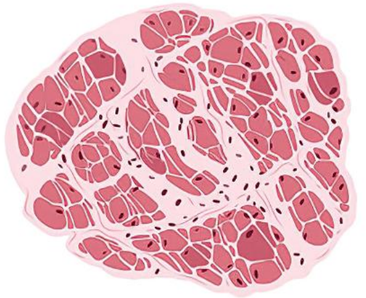
Underlying Causes

Disuse-related: Unloading, Immobilization, Denervation, Reduced Physical Activity.

Age-related: Ageing of Physiological Systems, Insufficient Nutrient Ingestion, Low Grade Inflammation, Reduced Physical Activity.

Consequences and Mechanisms

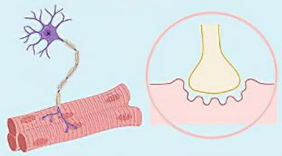
- Reduced Neuromuscular Activation
- Decreased Mechanostimulation
- Neuromuscular Junction Instability
- Modified Immune Cells Activation
- Signs of Inflammation and Fibrosis
- Anabolic Resistance
- Reduced Muscle Protein Synthesis
- Increased Muscle Protein Breakdown
- Altered Proteostasis *(Accumulation of Misfolded or Defective Proteins)*
- Dysregulated Autophagy
- Increased Oxidative and Endoplasmatic Reticulum Stress
- Disturbed Mitochondrial Turnover and Function
- *(Accumulation of Defective and Malfunctional Mitochondria)*



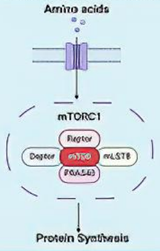
Skeletal Muscle Atrophy resulting from Ageing and Disuse

Atrophy-Priming Mechanisms Incrementing the Effects of Disuse in the Ageing Muscle

Reduced Physical Activity and Mechanical Load

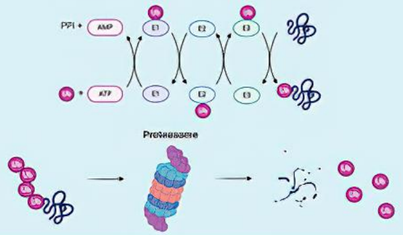


Anabolic Resistance

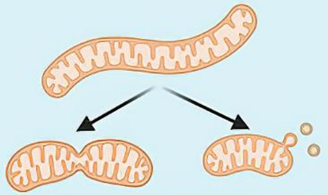


Muscle Pro-Inflammatory environment

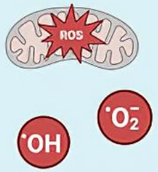
Disturbed Proteostasis

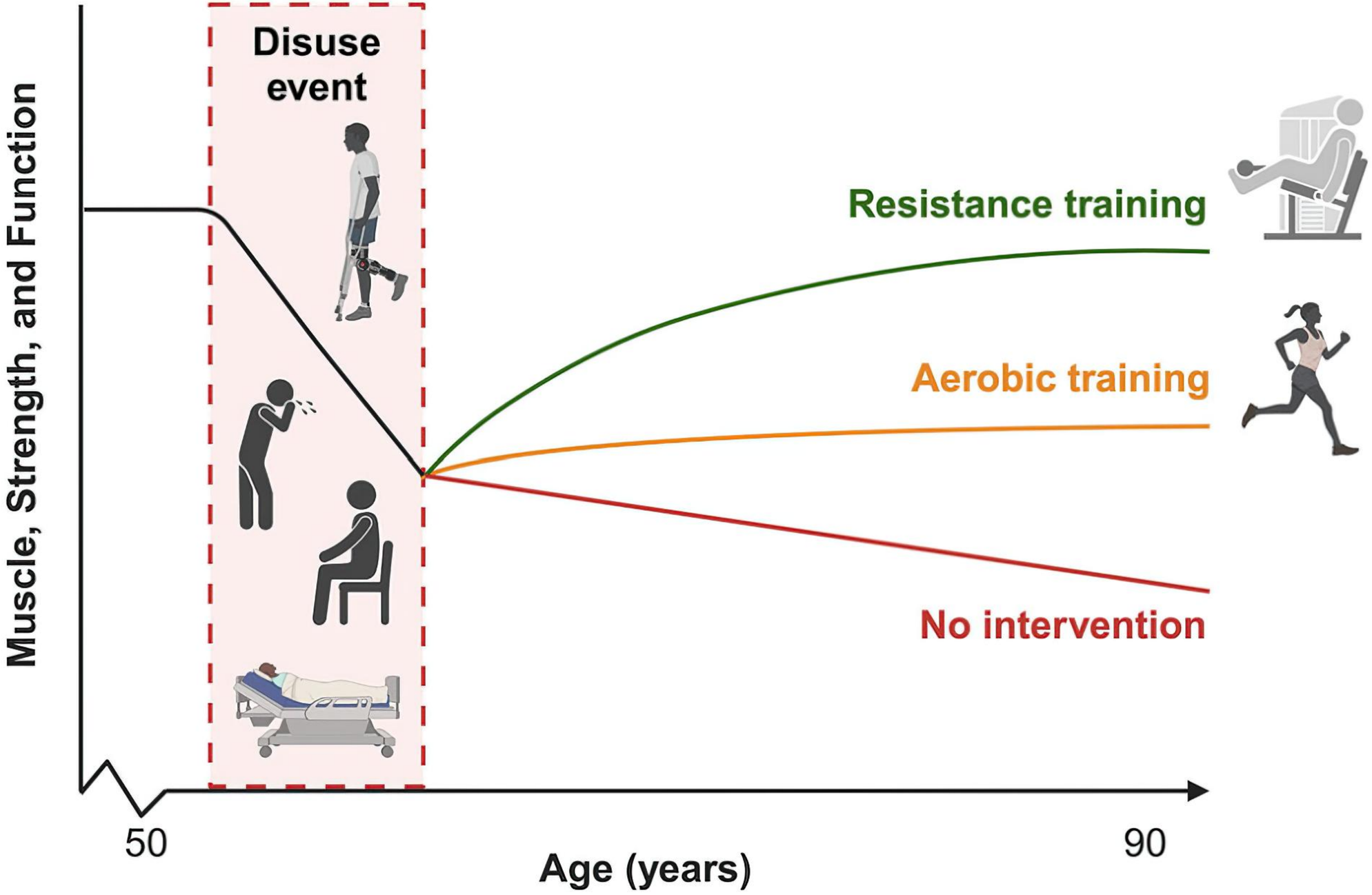


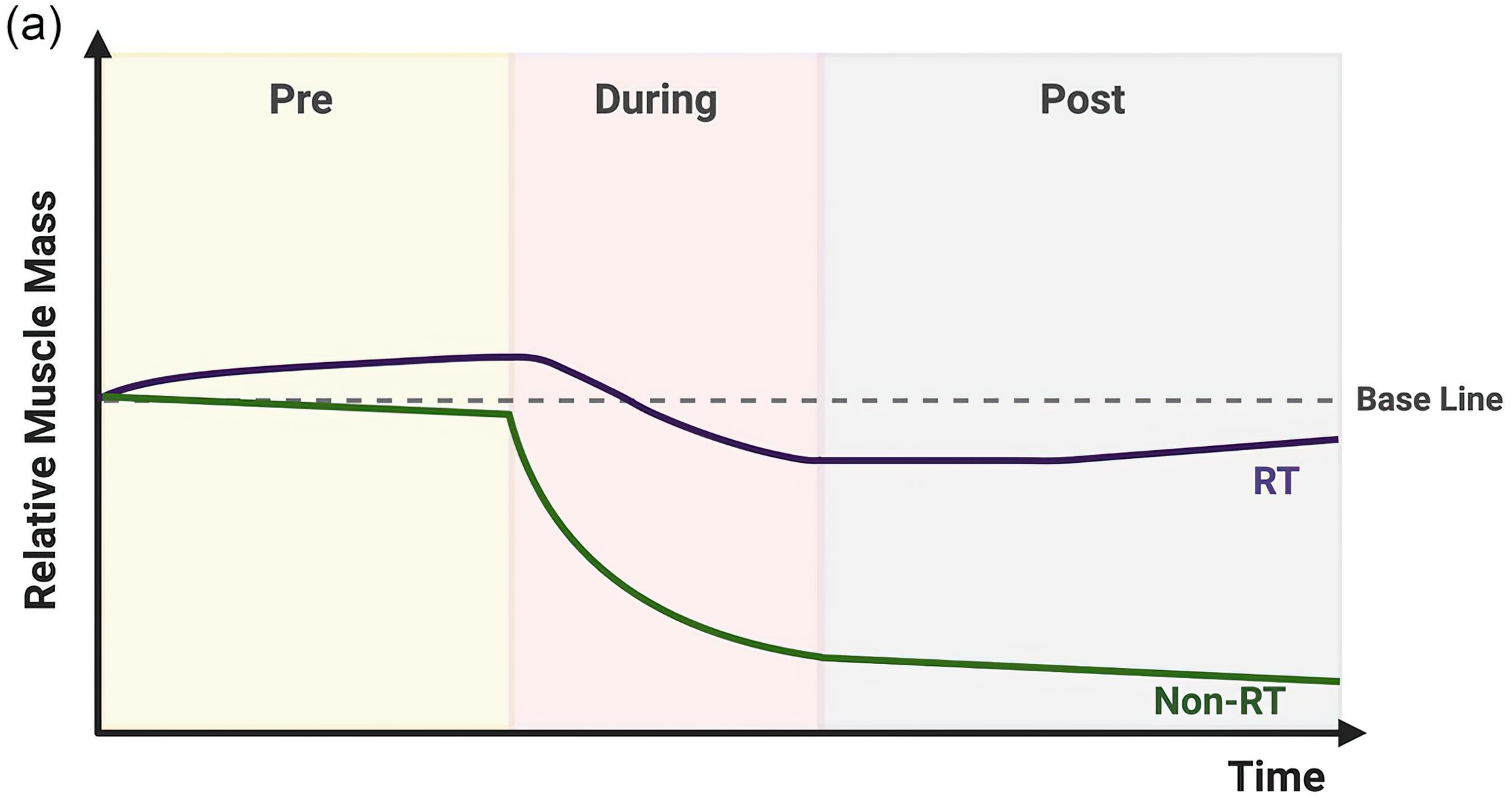
Disturbed Mitochondrial Turnover



Mitochondrial Dysfunction




Disuse event
Muscle, Strength, and Function
Resistance training
Aerobic training
No intervention
50
90
Age (years)


(a)
Pre
During
Post
Relative Muscle Mass
Base Line
RT
Non-RT
Time

- **Sarcopenic obesity is considered to be a combination of sarcopenia (decreased muscle mass and function) and obesity (excess body fat mass).**

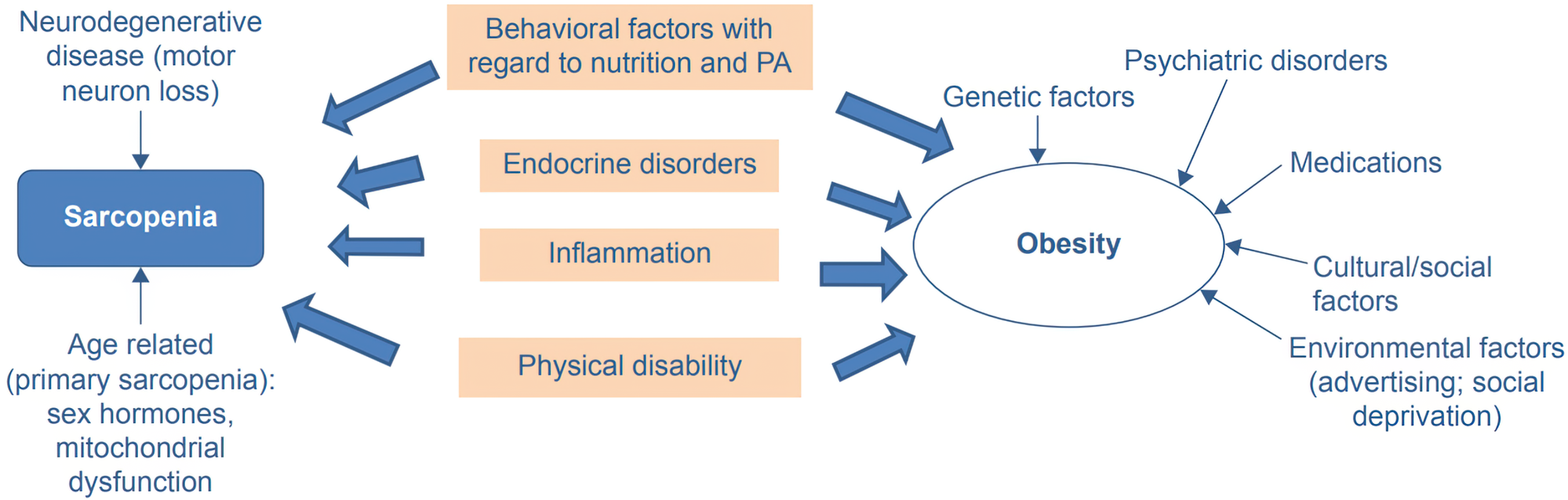
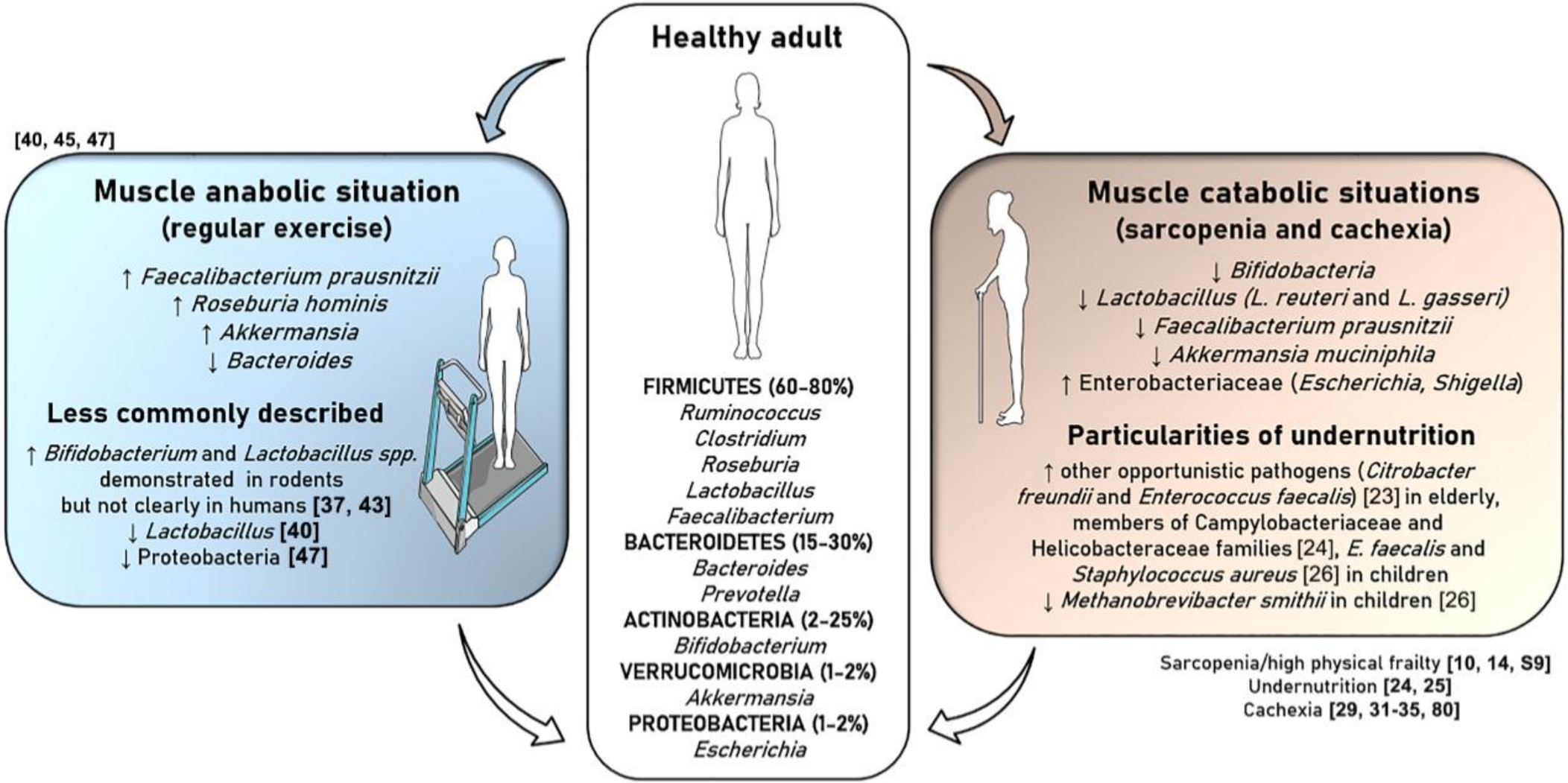


Figure 1 Contributing factors for sarcopenia and obesity.
Abbreviation: PA, physical activity.

microbiota–gut–muscle axis



Protective effects of exercise and nutrition interventions in sarcopenia

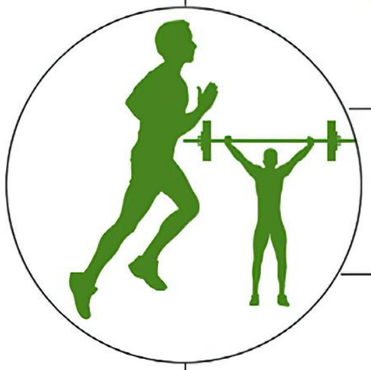
Exercise Intervention

- Resistance Exercise
- Aerobic Exercise
- High Intensity Interval Training
- Whole Body Vibration
- Electromyostimulation

+

Nutrition Intervention

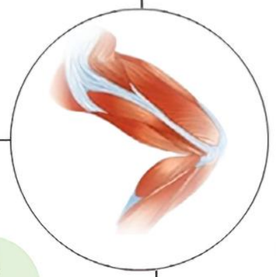
- Macronutrients
- Micronutrients



- **Alleviated oxidative stress:** AMPK/PGC-1α and Akt/mTOR↑ mitochondrial function↑ ROS↓ CAT, GSH-Px and SOD↑
- **Ameliorated inflammation:** AMPK/PGC-1α and VEGF↑ anti-inflammatory capacity↑ pro-inflammatory factors↓
- **Reduced cells apoptosis:** AMPK/ PGC-1 α and PI3K/Akt↑ oxidative stress and inflammation↓ anti-apoptosis proteins↑ cells apoptosis↓

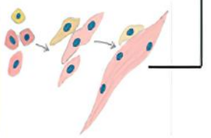
- **Increased muscular perfusion:** VEGF and NO↑ angiogenesis and endothelial function↑ blood circulation↑ muscular perfusion↑

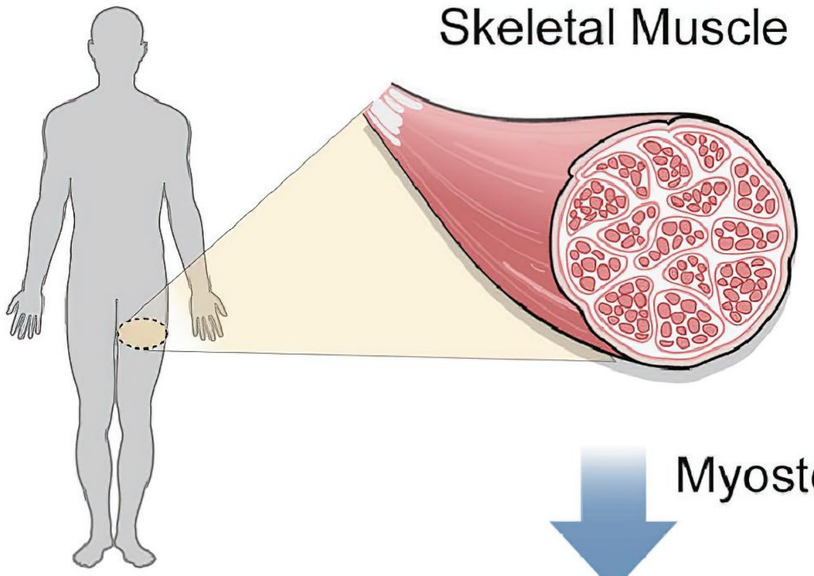
- **Maintained balance of protein synthesis and degradation:** protein synthesis↑ PGC-1 α and mTORC1 pathways↑ UPS and downstream↓ protein degradation↓



- **Cytokines protective effects:** IGF-1 ↑ PGC-1α and Irisin↑ angiogenesis and mitochondrial function↑ anti-oxidant and anti-inflammatory capacities↑ cells apoptosis↓. GDF15 and TNF-α↓ oxidative stress and inflammation↓ muscle fibers injury↓

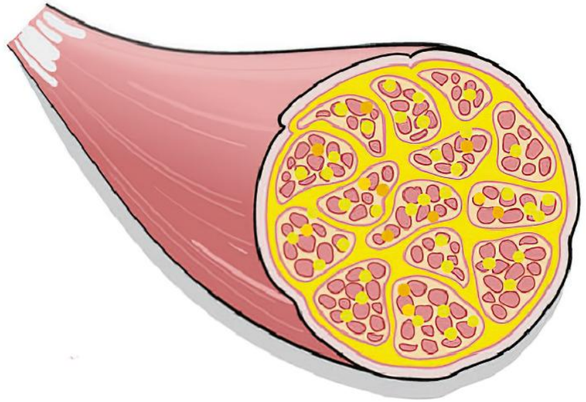
- **Activate satellite cells:** Wnt/β-catenin and and PI3K/Akt↑ Pax7 ↑ Myf5 and MyoD↑ satellite cells proliferation and differentiation↑ excessive activation of PI3K/Akt/mTOR↓ SCs excessive activation and injury↓ cells regenerative potentials ↑





Asian Ethnicity

Myosteatosis



Skeletal Insulin Resistance ↑

- Muscle Glucose Uptake ↓
- Glycogen Synthesis ↓

Systemic Insulin Resistance ↑

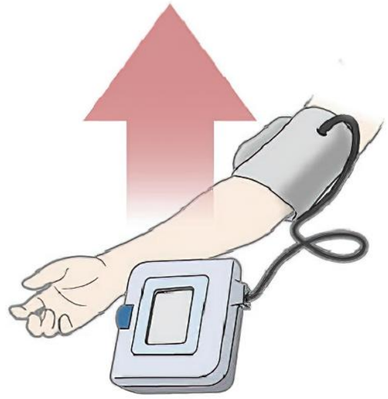
Carbohydrate away from skeletal muscle storage

Hepatic do novo lipogenesis ↑

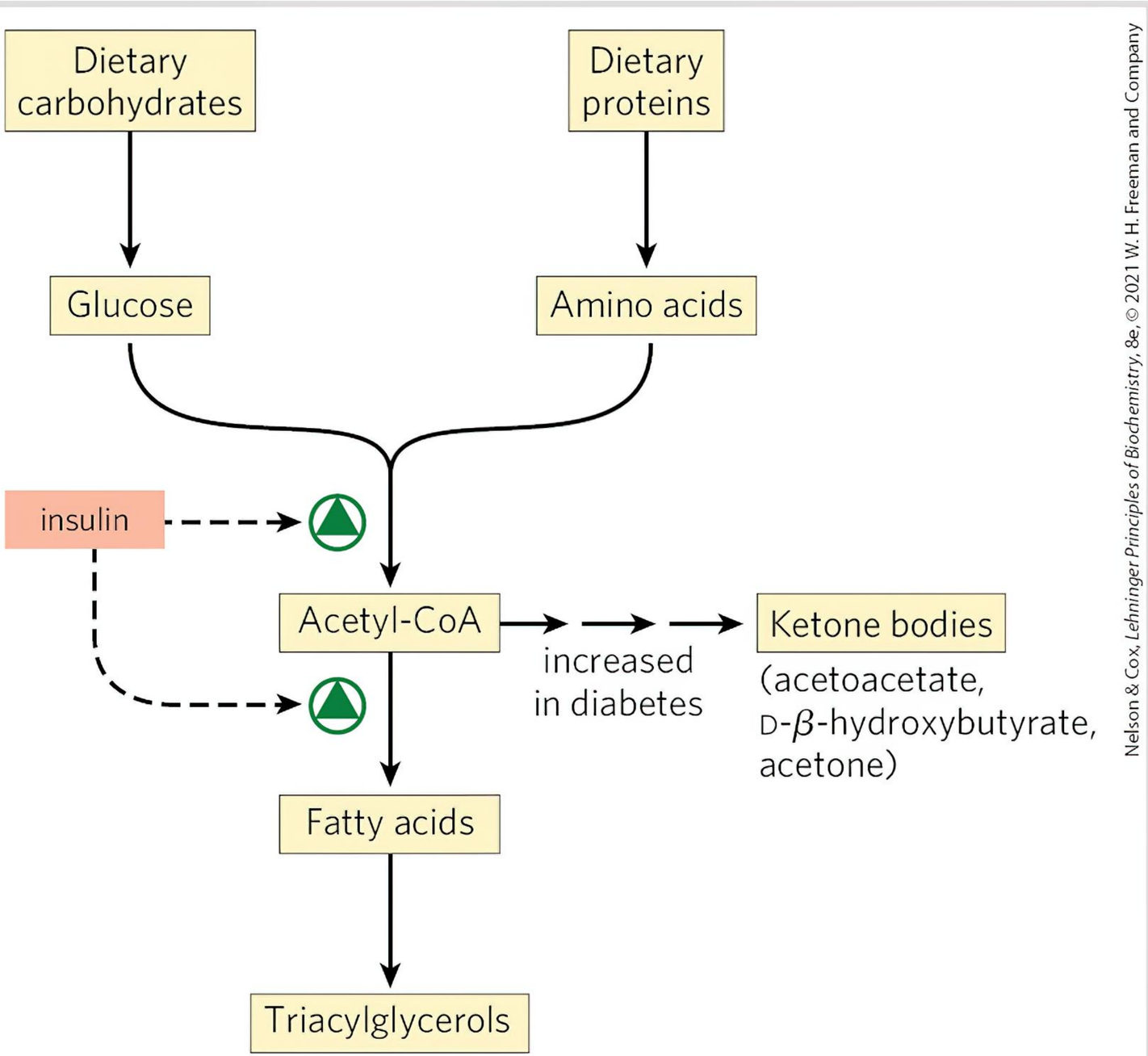
Blood triglyceride ↑ & HDL-C ↓

Atherogenic lipid abnormalities

Endothelial dysfunction with impaired vasodilation



Hypertension



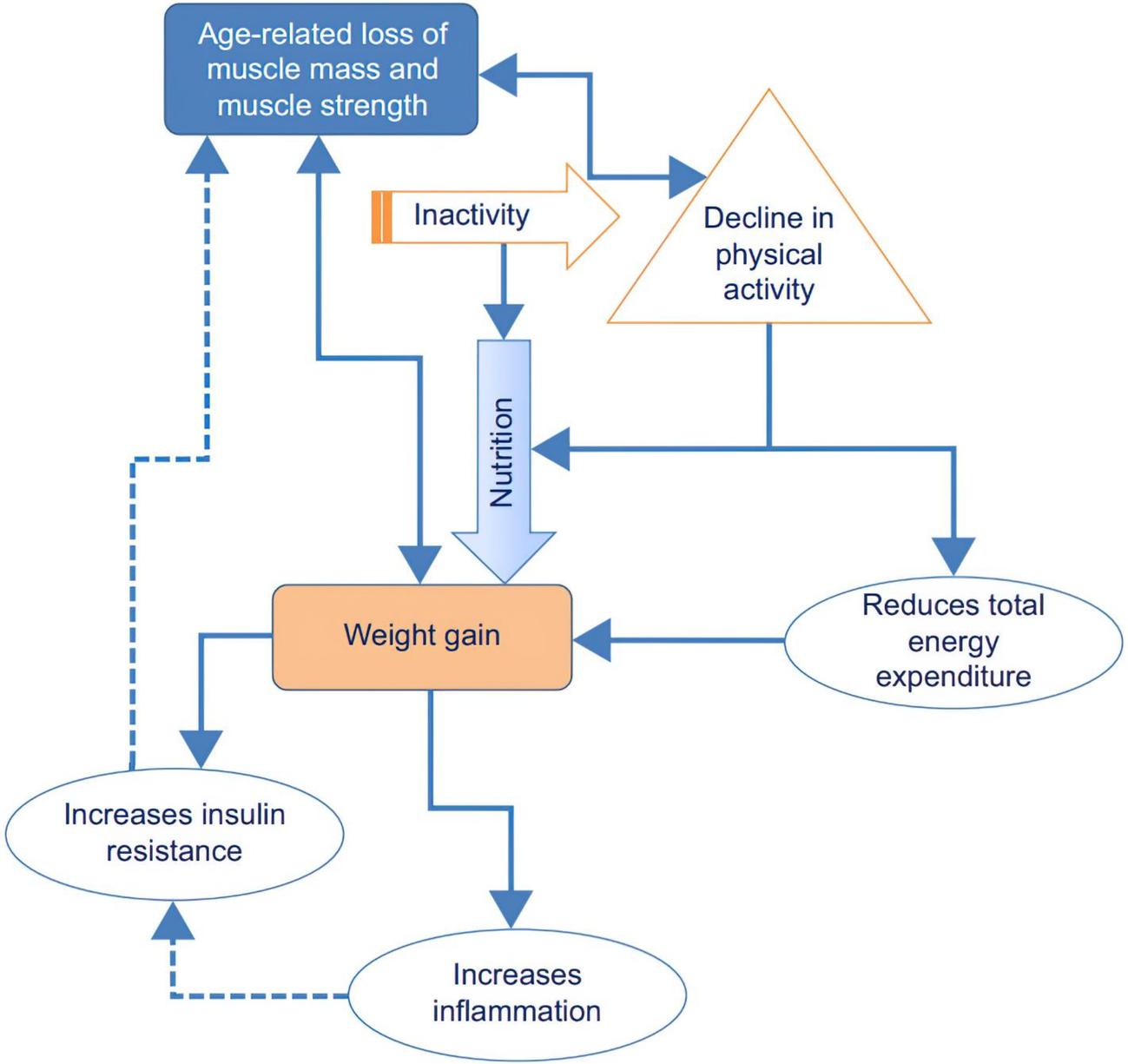
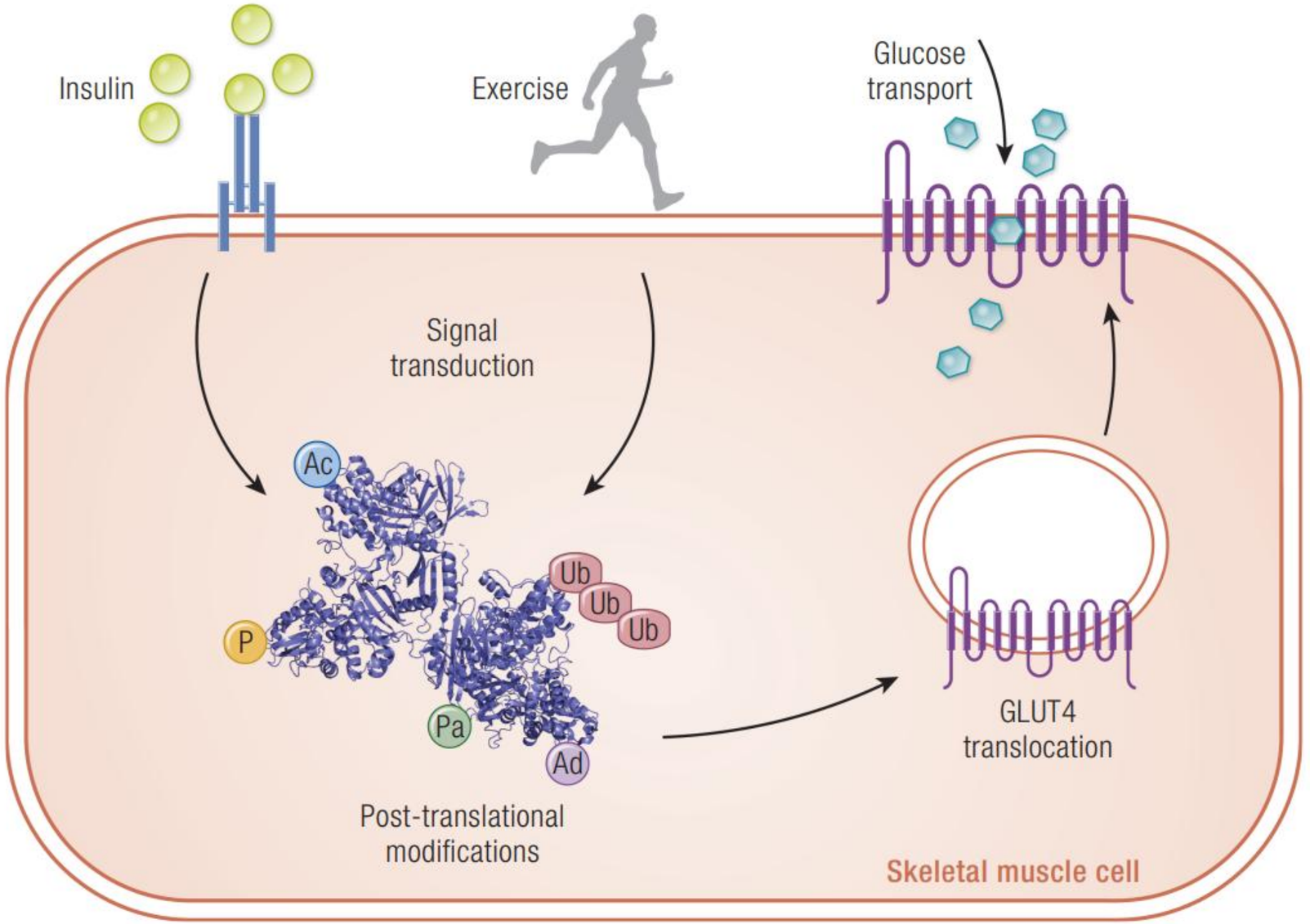


Figure 2 Influences of physical activity and nutrition on sarcopenic obesity.

insulin-independent glucose uptake



2025

Safety, Adherence and Attractiveness of Whole-Body Electromyostimulation in Non-Athletic Cohorts. A Systematic Review

Wolfgang Kemmler[1,2], Simon von Stengel[1], Michael Uder[1]

[1]*Institute of Radiology, University Hospital Erlangen, Erlangen, Germany*

[2]*Institute of Medical Physics, Friedrich-Alexander-University of Erlangen-Nürnberg, Erlangen, Germany*

Side effects of and contraindications for whole-body electro-myo-stimulation

- Muscular damage by WB-EMS
- WB-EMS in patients with heart failure
- WB-EMS in elderly patients with sarcopenic obesity
- Rhabdomyolysis after WB-EMS
- **WB- EMS is contraindicated in patients with implanted electronic devices such as:**

pacemakers, implanted defibrillators, neuro- stimulators or pain pumps because of potential electrical interference

› Wien Med Wochenschr. 2015 Nov;165(21-22):427-35. doi: 10.1007/s10354-015-0394-1.
Epub 2015 Oct 26.

[(Very) high Creatinkinase concentration after exertional whole-body electromyostimulation application: health risks and longitudinal adaptations]

[Article in German]

Wolfgang Kemmler [1], Marc Teschler [2], Michael Bebenek [2], Simon von Stengel [2]

- Initial high intense WB-EMS application (bipolar, 85 Hz; 350 ms; intermittent, 20 min) led to an increase of the CK-level by the 117fold (28.545 ± 33.611 IU/l) of baseline.

- After 10 weeks of WB-EMS (1 session/week) CK-reaction to intensive WB-EMS-Application was significantly blunted (906 ± 500 IE/l) and averaged in the area of conventional resistance exercise.

- intensity of WB-EMS should be carefully increased during the initial sessions.

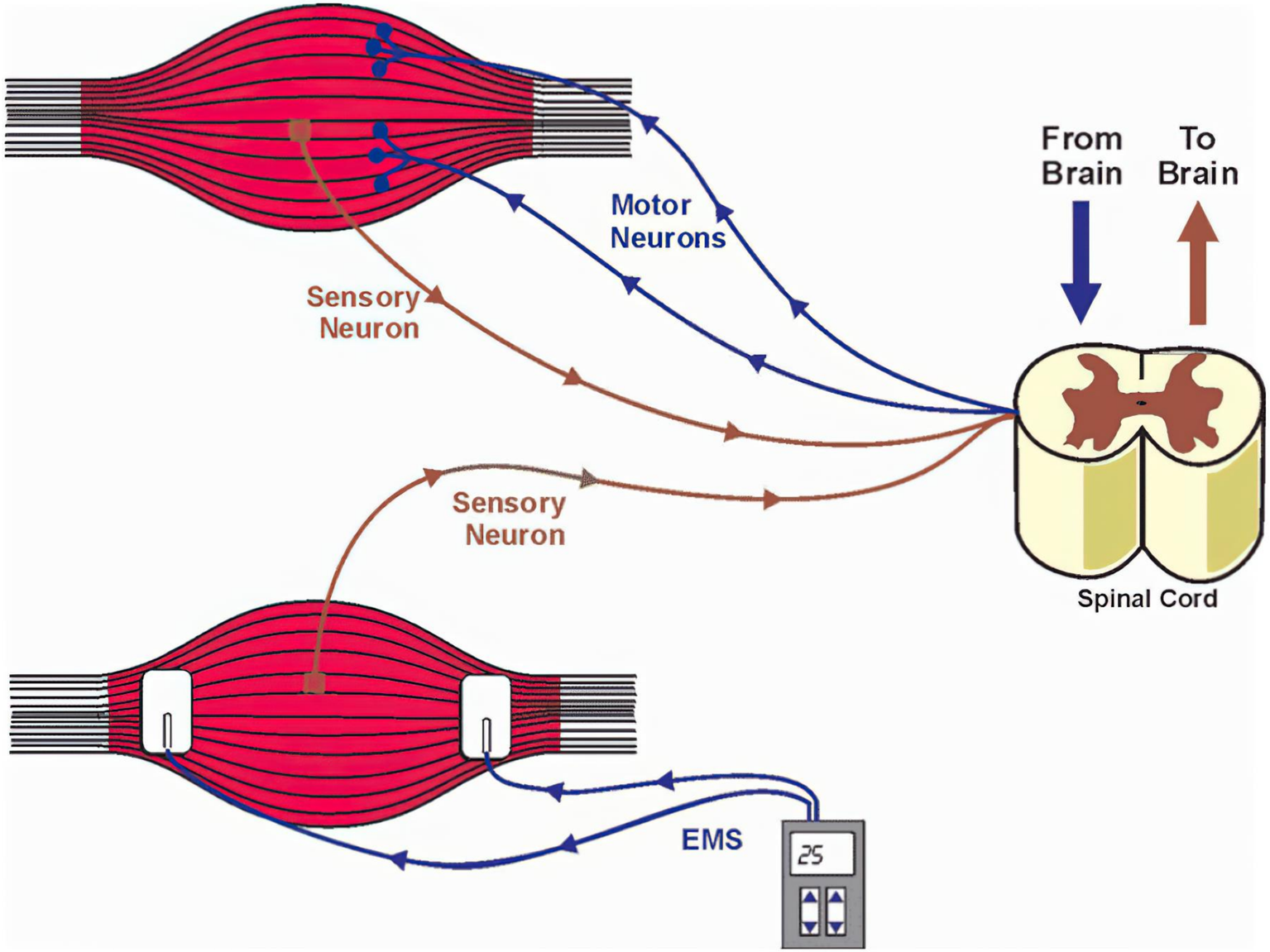


Image 1: Electrical Muscle Stimulation (EMS) contracts muscles forcefully using electrical impulses, in much the same way that our brains do. When used correctly, EMS has the capability to improve our health and well-being.

From a mechanistic perspective

EMS is the same as neuromuscular electrical stimulation (NMES), but in the rehabilitation literature the term NMES is more often used for local devices, whereas in fitness and whole-body suits the terms EMS/WB-EMS are commonly used

EMS Compared with Traditional Resistance Training

- Higher training effect in less time (e.g., ~20-minute sessions with high internal load)
- Preferential recruitment of fast-twitch and deep muscle fibers, even in deconditioned individuals
- Lower joint stress for a given muscle load (useful with pain, obesity, or post-rehab)
- Simultaneous activation of many large muscle groups, increasing energy expenditure per minute
- Usable as a partial alternative to exercise for people with limited mobility

Comparing the effects of 25-minute electrical muscle stimulation vs. 90-minute full-body resistance training on body composition and strength: A 20-week intervention

Süleyman Ulupınar [a,*], Uğur Arı [b], Necip Fazıl Kishalı [c], İzzet İnce [d], Salih Çabuk [a], Cebrail Gençoğlu [a], Serhat Özbay [a]

۱. هر دو گروه (فول‌بادی EMS و تمرین مقاومتی سنتی) در ۲۰ هفته از نظر ترکیب بدن و حداکثر قدرت عضلانی بهبود معنی‌دار داشتند

۲. گروه تمرین مقاومتی سنتی کاهش بیشتر درصد چربی بدن و افزایش بیشتر قدرت حداکثر در bench press، leg press، shoulder press، triceps pushdown و عضلات شکم نشان داد

۳. گروه EMS کاهش بیشتر وزن بدن و BMI را تجربه کرد

novel technology is an effective and safe method to prevent cardiometabolic risk factors and diseases in older women unable or unwilling to exercise conventionally.

Figure 2 WB-EMS application with slight movements in a supine sitting/lying position.
Abbreviation: WB-EMS, whole-body electromyostimulation.

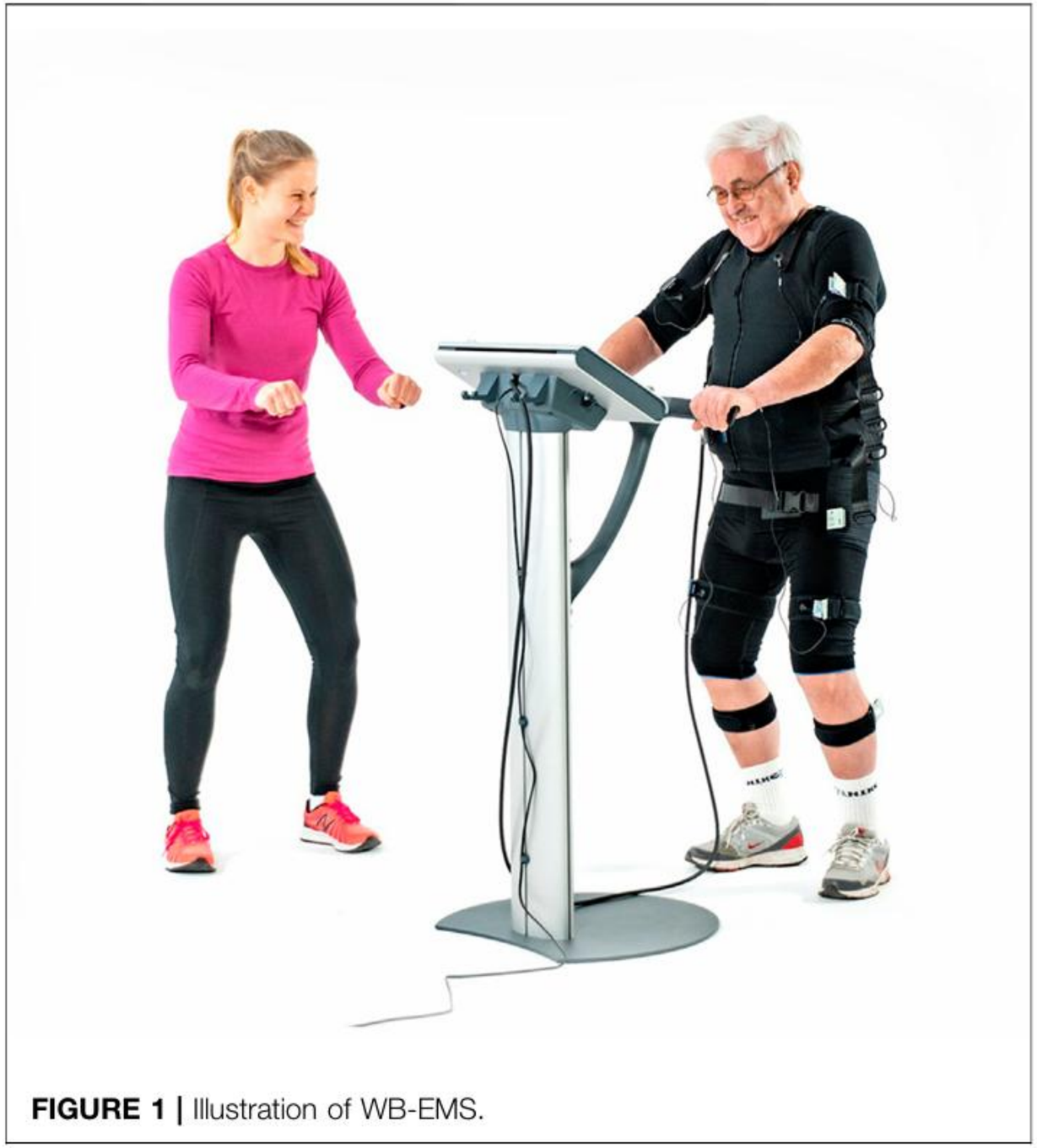


FIGURE 1 | Illustration of WB-EMS.

- frail individuals indicated high training satisfaction with WB-EMS
- safe in respect to the risk of rhabdomyolysis
- We observed CK elevations below the a priori defined threshold of ≥ 5,000 U/l
- no typical clinical signs of exertional rhabdomyolysis (severe muscle pain and weakness, myoglobinuria) were observed

Whole Body-Electric Muscle Stimulation (WB-EMS)

- **EMS known to improve the**

balance of muscles and blood flow
strengthen the heart
relieve pain
increase muscle activity
power
exercise performance
body composition

- WB-EMS can be considered as a feasible and time-efficient exercise option

Efficacy of Whole-Body Electromyostimulation (WB-EMS) on Body Composition and Muscle Strength in Non-athletic Adults. A Systematic Review and Meta-Analysis

- 16 studies with 19 individual WB-EMS groups representing 897 participants were included
- old to older untrained or at least non-athletic cohorts
- moderate to high impulse intensity and low to negligible voluntary workload

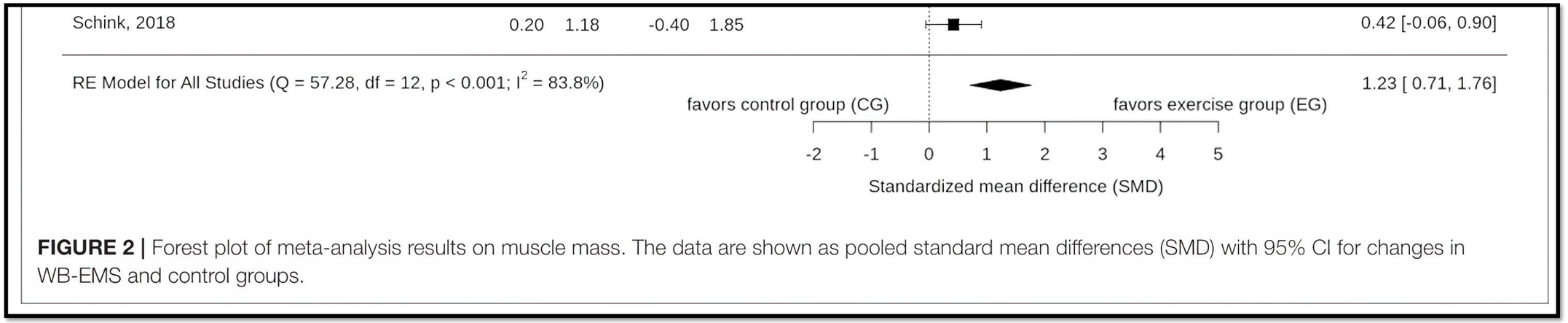


FIGURE 2 | Forest plot of meta-analysis results on muscle mass. The data are shown as pooled standard mean differences (SMD) with 95% CI for changes in WB-EMS and control groups.

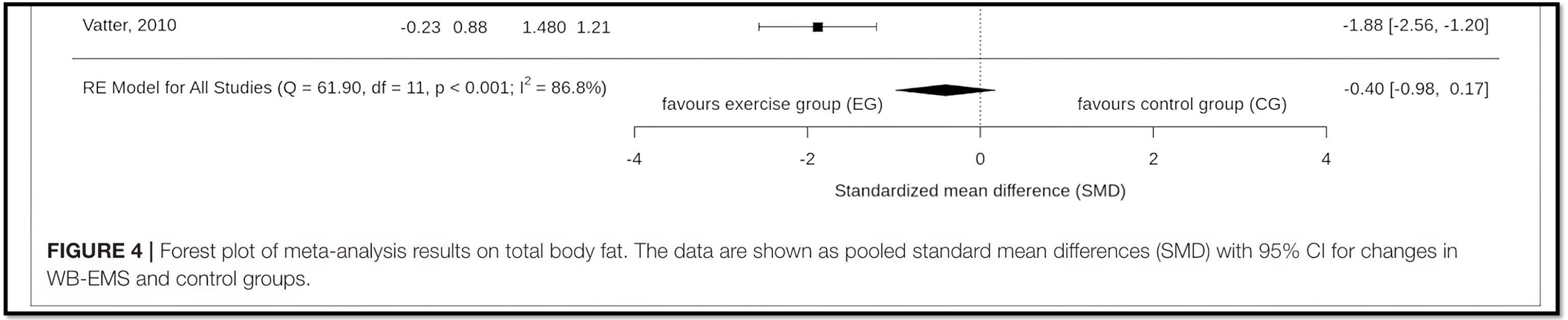


FIGURE 4 | Forest plot of meta-analysis results on total body fat. The data are shown as pooled standard mean differences (SMD) with 95% CI for changes in WB-EMS and control groups.

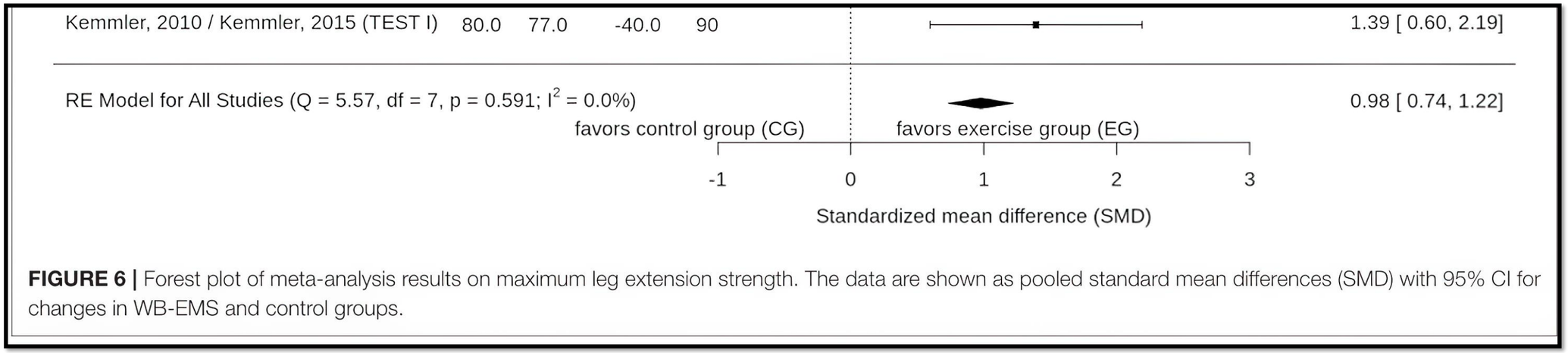


FIGURE 6 | Forest plot of meta-analysis results on maximum leg extension strength. The data are shown as pooled standard mean differences (SMD) with 95% CI for changes in WB-EMS and control groups.

Systematic Review and Meta-Analysis

Medicine

OPEN

The effects of whole-body muscle stimulation on body composition and strength parameters

A PRISMA systematic review and meta-analysis

Luiz Rodrigues-Santana, MSc[a,*], Louro Hugo, PhD[b], Jorge Pérez-Gómez, PhD[c], Miguel A. Hernández-Mocholí, PhD[a], Jorge Carlos-Vivas, PhD[d], Pilar Saldaña-Cortés, PhD[e], Nicolás Contreras-Barraza, PhD[f], José C. Adsuar, PhD[g]

- In total, 26 studies representing 1183 participants were included
- cohorts in terms of age (middle age or older) and level of physical activity (untrained or less trained)
- WB-EMS protocols that focus on moderate to high impulse intensity and low to moderate voluntary workload (functional bodyweight exercises)

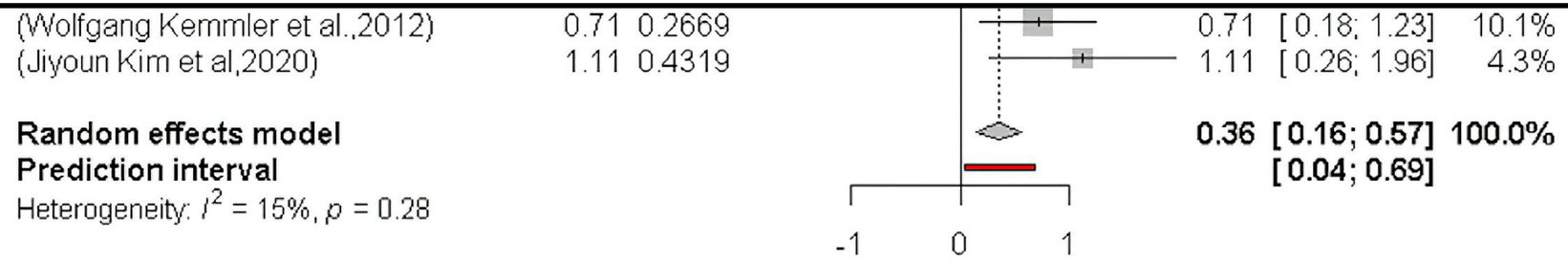


Figure 2. Forest plot of the results of the meta-analysis on muscle mass. Data are shown as pooled standardized mean differences (SMD) with 95% CI for changes in the WB-EMS and non-EMS training groups. CI = confidence interval, WB-EMS = whole-body electromyostimulation.

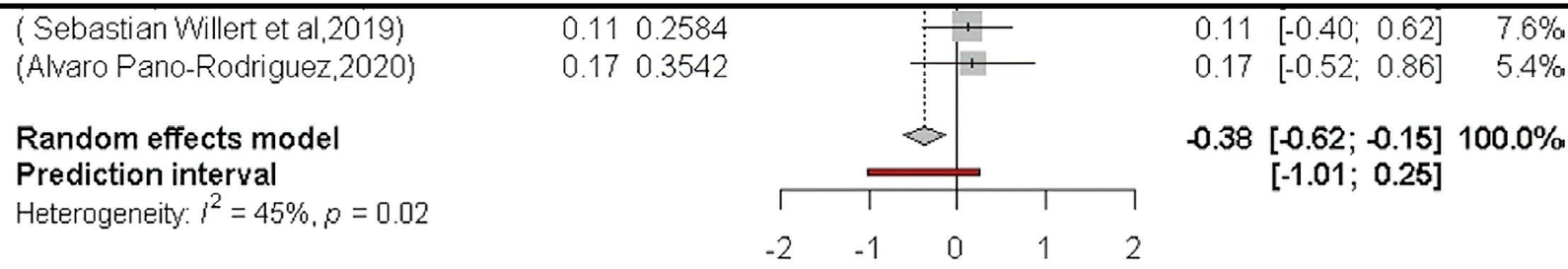


Figure 4. Forest plot of the results of the meta-analysis on body fat. Data are shown as pooled standardized mean differences (SMD) with 95% CI for changes in the WB-EMS and non-EMS training groups. CI = confidence interval, WB-EMS = whole-body electromyostimulation.

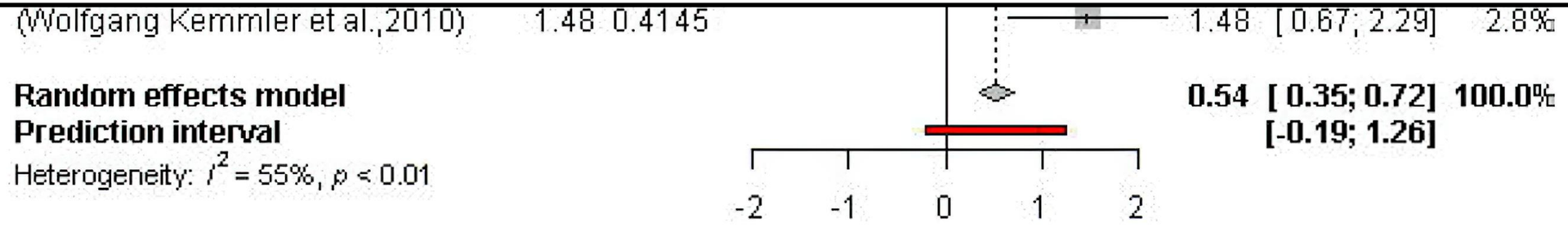


Figure 6. Forest plot of the results of the meta-analysis on strength. Data are shown as pooled standard mean differences (SMD) with 95% CI for changes in the WB-EMS and non-EMS training groups. CI = confidence interval, WB-EMS = whole-body electromyostimulation.

Effects of electromyostimulation on performance parameters in sportive and trained athletes: A systematic review and network meta-analysis

- **Both local EMS and WB-EMS lead to**

adaptations in strength
jumping
and sprinting

- **Neither application appears to be superior**

sensors

MDPI

Systematic Review

Effects of Whole-Body Electromyostimulation on Metabolic Syndrome in Adults at Moderate-to-High Cardiometabolic Risk—A Systematic Review and Meta-Analysis

Ellen Guretzki [1], Matthias Kohl [2], Simon von Stengel [1], Michael Uder [1] and Wolfgang Kemmler [1,3,*]

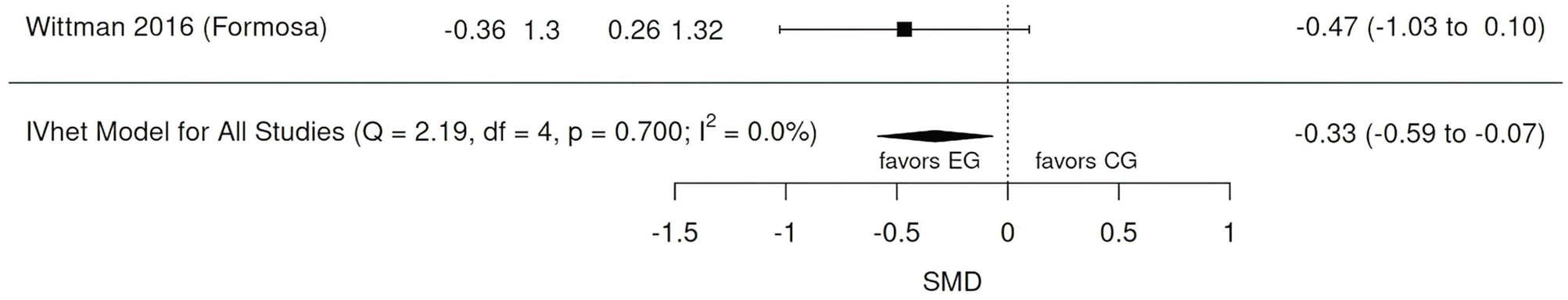


Figure 2. Forest plot showing the meta-analysis results of all the included trials [13,14,22–24] for WB-

FIGURE 1: Alternative training technology whole-body electromyostimulation (WB-EMS).

- **WB-EMS and conventional back-strengthening protocol are comparably effective in reducing nonspecific chronic Low Back Pain (LBP)**

Fig. 1. WB-EMS training session (Written informed consent was obtained from the participants to publish this picture)

- **WB-EMS was found to be effective in relieving knee pain symptoms and improving physical function in individuals with symptomatic knee OA compared to usual care treatment.**

- **WB-EMS could be used as an alternative therapy in the management of knee OA**

- **particularly for patients that cannot be motivated for conventional training**

Neuromuscular exercise with neuromuscular electrical stimulation in knee osteoarthritis: A randomised controlled pilot trial

Jyoti Sabharwal*[A-B,D], Shabnam Joshi[E-F]

Guru Jambheshwar University of Science & Technology, Hisar, India

در این مطالعه، بعد از ۶ هفته

۱. شدت درد زانو بر اساس Visual Analog Scale

۲. تمام زیرمقیاس‌های پرسشنامه Knee injury and Osteoarthritis Outcome Score (شامل درد، علائم، عملکرد در فعالیت‌های روزمره، عملکرد در ورزش و فعالیت بدنی، و کیفیت زندگی مرتبط با زانو)

۳. زمان آزمون Timed Up and Go به‌عنوان شاخص تحرک عملکردی و ریسک سقوط

دامنه حرکتی مفصل زانوی راست بر اساس اندازه‌گیری با گونیامتر

۴. امتیاز Community Balance and Mobility Scale که تعادل و تحرک در فعالیت‌های جامعه‌محور را می‌سنجد

۵. امتیاز Dynamic Gait Index که کیفیت راه‌رفتن پویا و توانایی راه رفتن در شرایط چالشی را ارزیابی می‌کند

Effect of neuromuscular electrical stimulation in postoperative shoulder rehabilitation: A systematic review and meta-analysis

Edmund Jia Xi Zhang [a,*], Gerald Joseph Zeng [b], Denny Tjiauw Tjoen Lie [b]

[a] *Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore*
[b] *Department of Orthopaedic Surgery, Singapore General Hospital, Singapore*

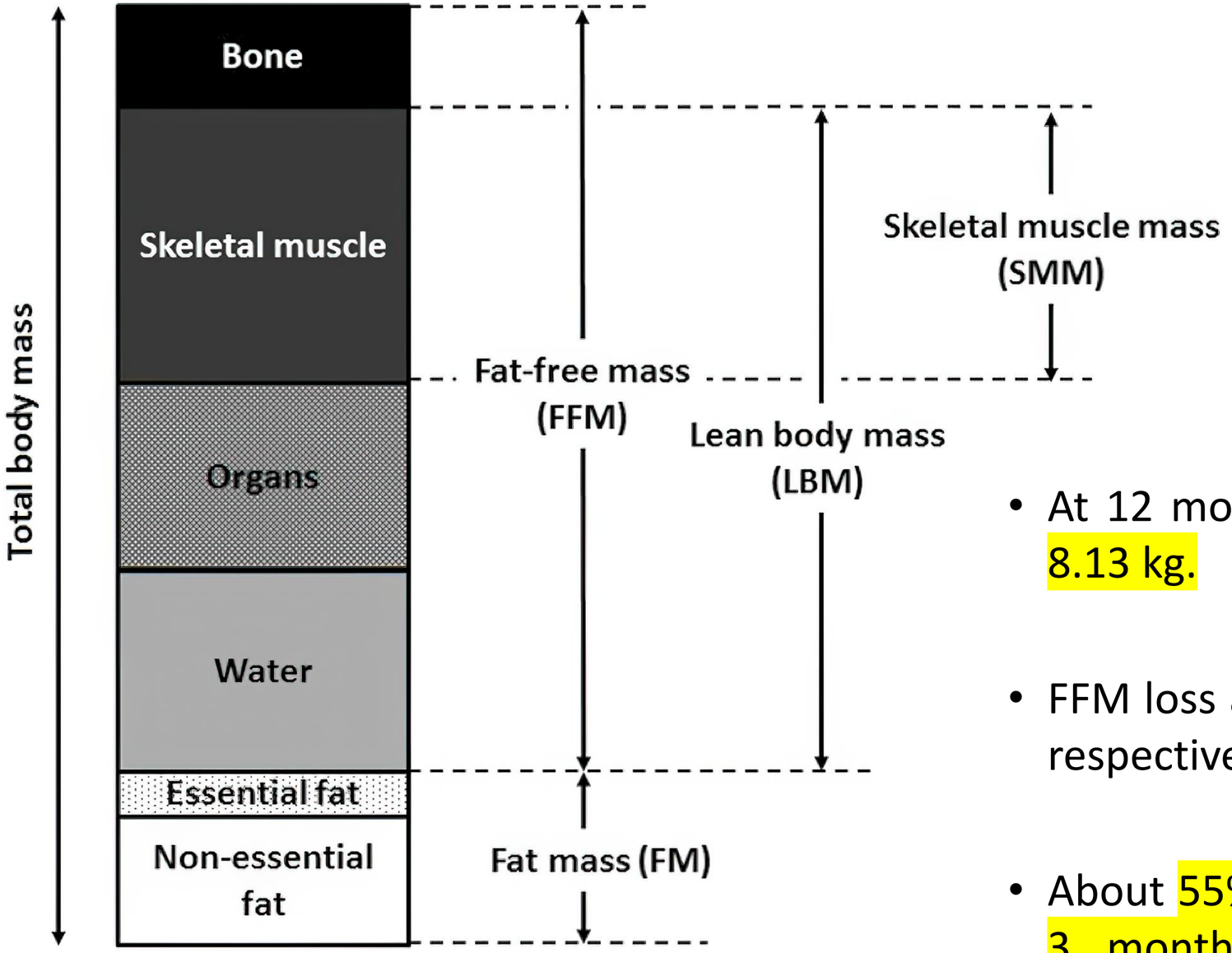
Conclusions: **NMES can be a valuable tool in multimodal rehabilitation for postoperative shoulder surgery patients, particularly for pain management. However, its implementation should be considered within the broader context of the patient's overall rehabilitation plan. Further research is needed to standardize NMES protocols and explore its effects on diverse postoperative outcomes.**

Effect of Electrical Muscle Stimulation Belt for Abdominal Muscles Activation

Dayeong Choi[a] and Won-Seob Shin[b*]

[a]Department of Physical Therapy, Graduate School, Daejeon University, Republic of Korea
[b]Department of Physical Therapy, College of Health and Medical Science, Daejeon University, Republic of Korea

Conclusions: The results suggest that EMS activates superficial abdominal muscles rectus abdominis and external oblique.



- **The magnitude and progress of lean body mass, fat-free mass, and skeletal muscle mass loss following bariatric surgery: A systematic review and meta-analysis**

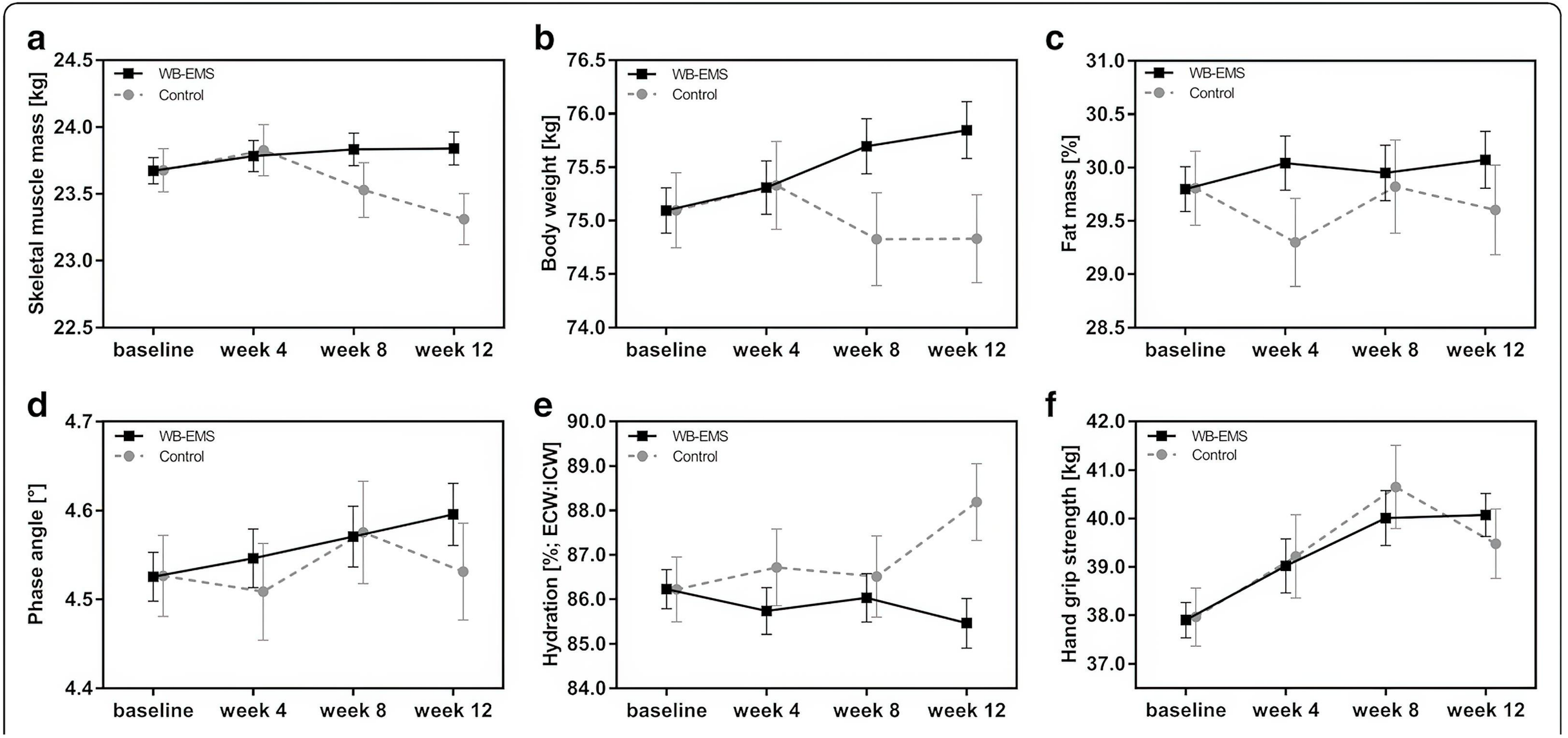
- At 12 months post-surgery, pooled LBM loss was 8.13 kg.
- FFM loss and SMM loss were 8.23 kg and 3.18 kg, respectively.
- About 55% of 12-month LBM loss occurred within 3 months post-surgery, followed by a more gradual decrease up to 12 months.

- **Case report of belt electrode-skeletal muscle electrical stimulation for acute heart failure with severe obesity: a novel therapeutic option for acute phase rehabilitation**

B-SES could be an option for patients with heart failure who have limited mobility and obesity.

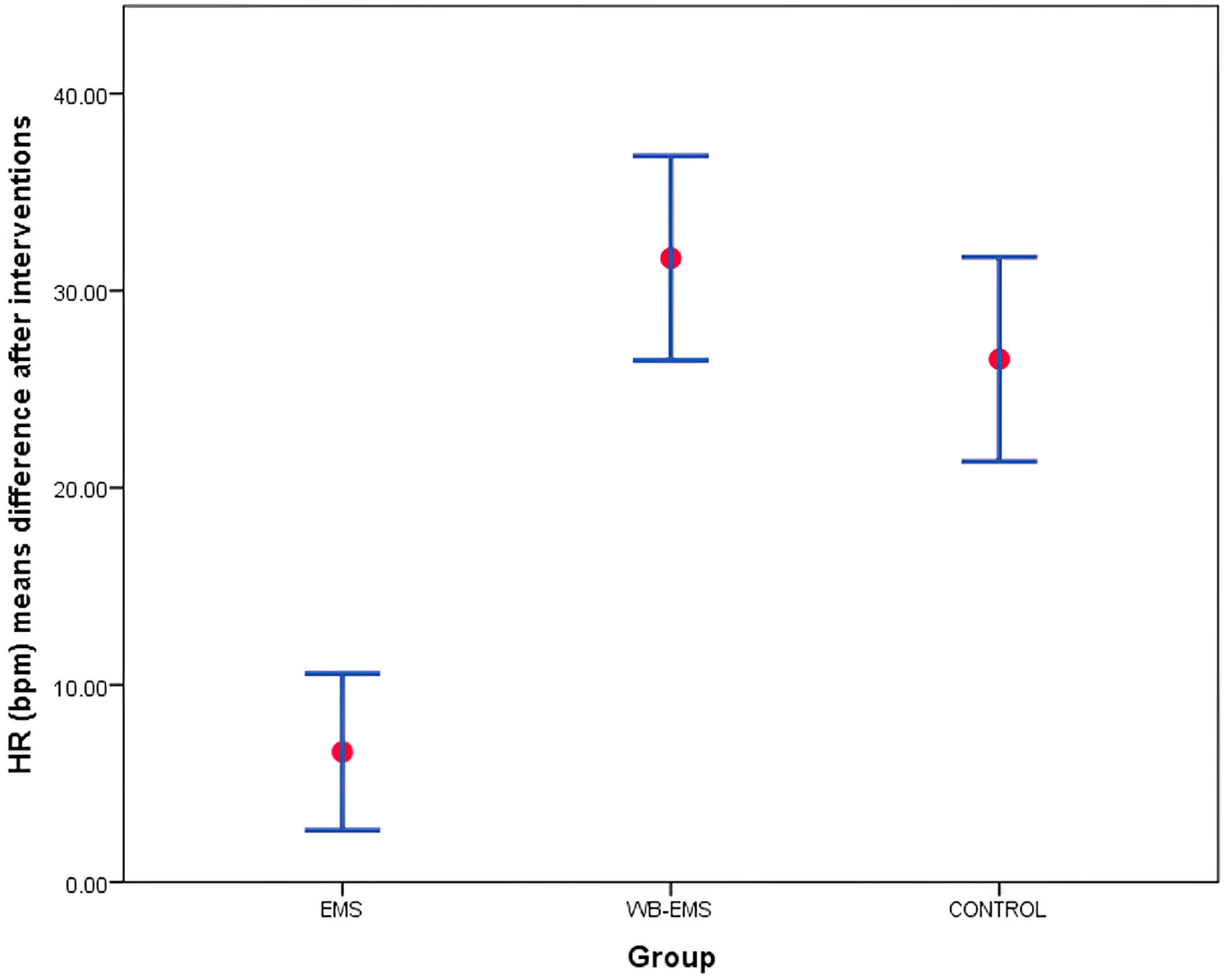
FIGURE 2
Belt electrode-skeletal muscle electrical stimulation. Position was head-up to 10°.

- **Effects of whole-body electromyostimulation combined with individualized nutritional support on body composition in patients with advanced cancer: a controlled pilot trial**



- **Immediate Effects of Whole-Body versus Local Dynamic Electrostimulation of the Abdominal Muscles in Healthy People Assessed by Ultrasound: A Randomized Controlled Trial**

The EMS group showed a smaller increase in posterior HR compared to the WB-EMS and control groups.



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Effects of whole-body electromyostimulation with different impulse intensity on blood pressure changes in hyper- and normotensive overweight people. A pilot study

Wolfgang Kemmler[1,2]*, Matthias Kohl[3], Simon von Stengel[1], Sebastian Willert[1], Stephanie Kast[2] and Michael Uder[1]

[1]Institute of Radiology, University Hospital Nürnberg, Erlangen, Germany, [2]Institute of Medical Physics, Friedrich-Alexander-University of Erlangen-Nürnberg, Erlangen, Germany, [3]Faculty Medical and Life

- **we conclude that treated hypertension should not be considered as a definite barrier for WB-EMS application in moderately old to older cohorts in general.**

THANKS