CLINICAL NUTRITION
DOI: 10.12957/demetra.2026.89368

DEMETRA
Alimentação, Nutrição & Saúde

e-ISSN:2238-913X

Joana Mendes[1,2]
Rita Miranda[3]
Ana Sofia Sousa[1,2,4]

[1] FP-I3ID, FP-BHS, Universidade Fernando Pessoa, Faculdade de Ciências da Saúde. Porto, Portugal.

[2] RISE-Health, Universidade Fernando Pessoa, Fundação Ensino e Cultura Fernando Pessoa. Porto, Portugal.

[3] Universidade Fernando Pessoa, Faculdade de Ciências da Saúde. Porto, Portugal.

[4] Instituto Politécnico de Leiria, Center for Innovative Care and Health Technology (ciTechcare). Leiria, Portugal

Correspondence
Joana Mendes
joanamendes@ufp.edu.pt

Assistant Editor
Fernando Lamarca

Body mass index in older adults and the obesity paradox – a short umbrella review of current evidence

Índice de massa corporal em pessoas idosas e o paradoxo da obesidade – uma breve revisão abrangente da evidência atual

Abstract

The use of body mass index (BMI) to assess nutritional status in older adults may be controversial. According to the obesity paradox, older adults who present overweight may have better outcomes compared to individuals that present a normal weight. Specific BMI cut-offs for older people were proposed by some entities.This short narrative umbrella review aims to realize if it is appropriate to recommend higher BMI values in the elderlyconsidering the most recent evidence about the obesity paradox. Systematic reviews and meta-analyses available in the Pubmed database were identified and selected according to defined criteria, and the main results were presented. In the present review, 27 studies extracted from these reviews were analyzed, but only 12 (44.5%) found significant results regarding the obesity paradox. It was observed that potential benefits of higher BMI values are even less frequent for BMI values ≥ 30 kg/m^2. Therefore, controversy remains regarding the use of BMI in ageing groups. Epidemiological confounding may be linked to better outcomes linked to higher BMI values. It should be ensured that discussion does not involve the promotion of obesity in elderly, which is an indisputable risk factor for the development and worsening of several chronic diseases.

Keywords: Body mass index. Obesity. Obesity paradox. Older adults

Resumo

A utilização do Índice de Massa Corporal (IMC) para avaliar o estado nutricional em adultos mais velhos pode ser controversa. De acordo com o paradoxo da obesidade, as pessoas idosas com excesso de peso podem apresentar melhores resultados em comparação com indivíduos com peso normal. Foram propostos por algumas entidades pontos de corte específicos de IMC para pessoas idosas. Esta breve revisão narrativa do tipo *umbrella* tem como objetivo verificar se é adequado recomendar valores mais elevados de IMC para classificação depessoas idosas, considerando a evidência mais recente sobre o paradoxo da obesidade. Foram identificadas e selecionadas revisões sistemáticas e meta-análises disponíveis na base de dados *PubMed*, de acordo com critérios definidos, tendo sido apresentados os principais resultados. Na presente revisão, foram analisados 27 estudos extraídos dessas revisões, mas apenas 12 (44,5%) apresentaram resultados significativos relativamente ao paradoxo da obesidade. Observou-se que potenciais benefícios de valores mais elevados de IMC são menos frequentes para valores de IMC ≥ 30 kg/m². Assim, permanece a controvérsia quanto à utilização do IMC em grupos etários mais avançados.O efeito de confundimento epidemiológico pode estar associado aos melhores resultados observados com valores mais elevados de IMC. É importante garantir que esta discussão não envolva a promoção da obesidade em pessoas idosas, uma vez que a obesidade é um fator de risco indiscutível para o desenvolvimento e agravamento de várias doenças crónicas.

Palavras-chave: Índice de Massa Corporal. Obesidade. Paradoxo da obesidade. Pessoas idosa.

INTRODUCTION

In the last decades, a question that has been often debated is to what extent older persons' body mass index (BMI) influences their health status.[1] According to a recent meta-analysis,the prevalence of obesity in the older adults is high,around 40.4% in elderly South Americans and 33.6% in Europeans.[2] The World Health Organization (WHO) defined BMI cut-off pointsfor adults and older adults as follow: underweight < 18.5 kg/m^2; normal weight: 18.5 – 24.9 kg/m^2; pre-obese ≥ 25 kg/m^2 and obese ≥ 30 kg/m^2.[3] (Figure 1)

However, a number of working groups decided to establish exclusive BMI cut-offs for the elderly. They agree that older adults should be characterized differently than adults due to their physiological specificities and higher vulnerability.[4,5]

The Nutrition Screening Initiative suggested that healthy older people should have a BMI between 24 and 27 kg/m^2.[4] If the individual has a BMI lower than 24 or higher than 27 kg/m^2, or has an involuntary weight loss ≥ 10 kg within a period of 6 months, should be clinically signaled.[4] (Figure 1) In turn, Lipschitz classified older people withunderweight for a BMI < 22 kg/m^2 and with overweight for a BMI > 27 kg/m^2.[6] (Figure 1) In 2002, the Pan-American Health Organization (PAHO) studied older populations from seven countries and proposed other BMI cut-off points: underweight for a BMI < 23 kg/m^2; pre-obesity for a BMI > 28 kg/m^2, and obesity for a BMI > 30 kg/m^2.[7] (Figure 1)

Figure 1. Body mass index cut-off points for older adults, according to different entities recommendations.

Entity recommender	Body mass index cut-off points
World Health Organization, recommendations for adults and older adults [3]	Underweight: BMI < 18.5 kg/m^2 Normal weight: BMI [18.5 - 24.9 kg/m^2] Pre-obesity: BMI [25 to 29.9 kg/m^2] Obesity: BMI ≥ 30 kg/m^2
Nutrition Screening Initiative, recommendations for older adults[4]	Underweight: BMI < 24 kg/m^2 Normal weight: BMI [24 - 27 kg/m^2] Pre-obesity: BMI >27 kg/m^2
Lipschitz, recommendations for older adults [6]	Underweight: BMI < 22 kg/m^2 Normal weight: BMI [22 - 27 kg/m^2] Pre-obesity: BMI >27 kg/m^2
Pan-American Health Organization, recommendations for older adults [7]	Underweight: BMI < 23 kg/m^2 Normal weight: BMI [23 - 28 kg/m^2] Pre-obesity: BMI > 28 kg/m^2 Obesity: BMI > 30 kg/m^2

Legend: BMI, body mass index.

Apparently, some BMI cut-off points were defined to preserve higher BMI values in the elderly.[4-8] In part, this can be justified by the concept of the obesity paradox described in the literature. This concept is based on the hypothesis that older adults who present over weight may have better outcomes compared to individuals who present a normal weight, particularly those with specific pathologies.[9,10]

Therefore, the present review aimed to realize whether it is appropriate to recommend higher BMI values in the elderly considering the most recent evidence about the obesity paradox.

METHODS

To address the purpose of this umbrella review, six steps of methodology were established: 1) identification of the research question; 2) identification of relevant studies on database; 3) study selection, according to predefined criteria; 4) data mapping; 5) summarization of results; 6) presentation of results.[11]

In order to accomplish whether it is appropriate to maintain higher BMI values in the elderly based on the latest evidence about the obesity paradox, the follow question emerged: *"What does the latest scientific evidence say about the obesity paradox in older adults?"* Publications available in the Pubmed database were identified through relevant keywords: "obesity paradox" AND "older adults OR elderly". This research was limited to studies published in recent years, from January 2023 to August 2025, because the objective was to focus on the most recent evidence. Only systematic reviews and meta-analyses were eligible to be analyzed in an effort to present a cohesive overview of a large body of research. Reviews or meta-analyses that were not fully available, those that deviated from the principal topic (obesity paradox in older adults), and others restricted to individuals with another primary diagnosis besides obesity were excluded.

Two independent reviewers (ASS and JM) were nominated among the authors, and they selected the reviews in two phases: title analysis and abstract reading. The selected reviews were read in full, and it was confirmed that studies included in each review/meta-analysis did not overlap. Only community-based studies that utilized BMI to define obesity were included in the current review after being obtained from the chosen reviews/ meta-analyses. Studies conducted in the hospital setting or that involved populations selected according to the presence of a particular medical condition were excluded. Full-text reading and comprehension were conducted for all studies included in the present review. Figure 2 describes the publishing selection process as advised by the Preferred Reporting Items for Systematic reviews and Meta-Analyses (Prisma).[11] The main results of the studies were systematized.

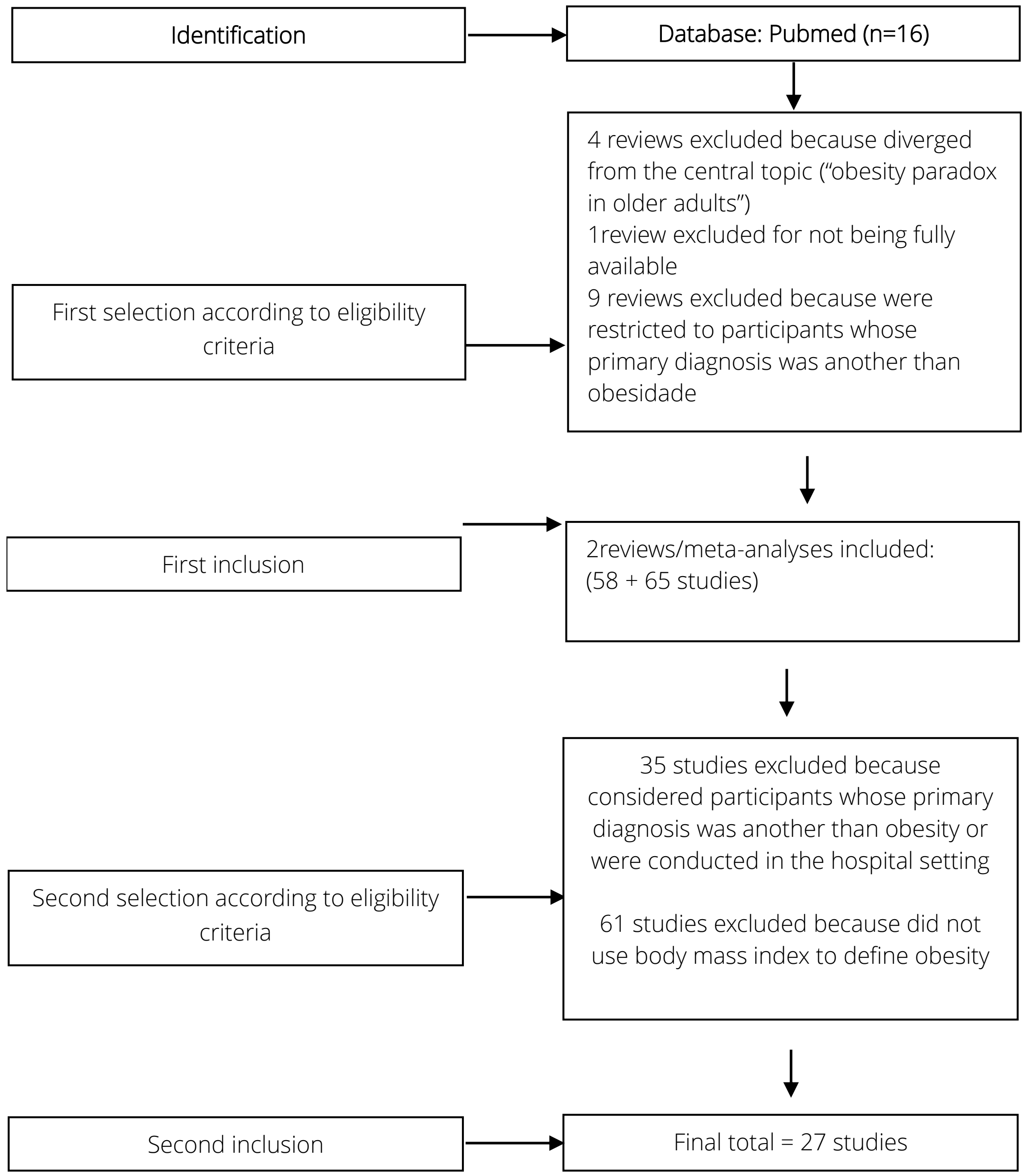
RESULTS

Firstly, two systematic reviews/meta-analyses on the obesity paradox were selected.[12,13] The systematic review by Dramé and Godaert[12] included 58 cohort studies. However,35 cohorts were excluded from the present review because they were conducted in hospital setting or were focused on patients with a particular medical condition, namely cardiovascular disease, diabetes or cancer.[12]

In the meta-analysis conducted by Eitmann et al.,[13] 65 studies were included, but only four studies used BMI to define obesity; the other studies took into account other methods such computer tomography, dual-energy X-ray absorptiometry (DEXA), and bioelectrical impedance analysis.[13]

Therefore, a total of 27 studies were usedfor the present review, after being retrieved from the selected reviews/meta-analyses.(Figure 2)

Figure 2. Flowchart for identification, selection and inclusion of studies.



In the systematic review by Dramé and Godaert[12] that explored the relation between BMI and mortality, 23 cohort studies were considered.[14-36] In eight of these cohorts, an obesity paradox was detected;[14-21] however, in at least four of these, individuals with a BMI ≥ 25 kg/m^2 had a longer survival than those with a normal weight, but not those with a BMI ≥ 30 kg/m^2.[14-16,18] (Table 1) Notably, in 15 cohorts no obesity paradox was observed.[22-36]

Table 1. Summary of studies where an obesity paradox was observed. 2025

Author, year Type of study	n	Age,years (mean ± SD)	Outcome	Results	Adjustment variables
Crotti, 2018[14] Prospective cohort	4970	72 ±5	5.7-years mortality	BMI ≥ 18.5 - < 25: reference BMI ≥ 25 - < 30: ↓ mortality BMI ≥ 30: n.s.	Age, sex, education, household income, smoking status, leisure-time physical activity, CVD, diabetes, hypertension, and caloricintake, hs-CR, INFLA-score, metabolic variables (systolic blood pressure, HDL-cholesterol, triglycerides, blood glucose, creatinine)
Kim, 2018[15] Prospective cohort	170,639	72 ±5	5-years mortality	BMI ≥ 22.5 - < 25: reference BMI ≥ 25 - < 27.5: ↓ mortality (only for women) BMI ≥ 27.5: n.s.	Age, alcohol consumption, smoking habits, physical activity, household income
Lee, 2014[16] Prospective cohort	11,844	73 ±7	3-years mortality	BMI ≥ 18.5 - < 25: reference BMI ≥ 25 - < 30: ↓ mortality BMI ≥ 30: n.s.	Age, sex, marital status, education, household income, comorbidities, cognitive impairment, smoking habits, alcohol consumption, nutritional risk
Wu, 2014[17] Prospective cohort	77,541	73 ±7	5-years mortality	BMI < 18.5 - ↑ mortality BMI ≥ 18.5 - < 25: reference BMI ≥ 25 - < 30: ↓ mortality BMI ≥ 30 - < 35: ↓ mortality BMI ≥ 35: n.s.	Age, sex, marital status, education level, smoking, alcohol consumption, physical activity, high FBS, high SBP, high TG, and high TC.
Dahl, 2013[18] Prospective cohort	882	80 ±6	18-years mortality	BMI < 25: reference BMI ≥ 25 - < 30: ↓ mortality BMI ≥ 30: n.s.	none
Takata, 2007[19] Prospective cohort	697	80 ± 0	4-years mortality	BMI <18.5: ↑ mortality BMI ≥ 18.5 - < 25: reference BMI ≥ 25: ↓ mortality	Sex, current outpatient status, smoking habits, alcohol consumption, weight loss, SBP, physical activity, functional status, marital status, preexisting diseases, place of residence, TC and blood glucose
Cheng, 2016[20] Retrospectivecohort	4565	74 ±5	11-years mortality	BMI < 18.5: ↑ mortality BMI ≥ 18.5 - < 25: reference BMI ≥ 25 - < 30: ↓ mortality BMI ≥ 30 -< 35: ↓ mortality BMI ≥ 35: n.s.	Age, sex, smoking status and alcohol consumption, blood glucose, diabetes medication, TG, HDL cholesterol, LDL cholesterol, hypercholesterolemia medication, SBP, DBP, hypertension medication, diseaseburden

Table 1. Summary of studies where an obesity paradox was observed. 2025.(Continues)

Author, year Type of study	n	Age,years (mean ± SD)	Outcome	Results	Adjustment variables
Grabowski, 2001[21] Retrospectivecohort	7527	77 ±6	96-month mortality	BMI <19.4: ↑ mortality BMI ≥ 19.4 - < 28.5: reference BMI ≥ 28.5: ↓ mortality	Demographic factors, health services utilization, functional status
Stenholm, 2014,[37] Retrospectivecohort	7875	≥ 70	All-cause mortality during 33 years	BMI ≥ 18.5 - <25: reference BMI ≥ 25 - < 30: ↓ mortality BMI ≥ 30:↓ mortality	Age, sex, education, smoking, alcohol use and physical activity, handgrip strength, hypertension, cardiovascular disease, diabetes and cancer
Sanada, 2017[38] Retrospectivecohort	2309	77.6 ± 4.6	All-cause mortality during 24 years	BMI < 25: reference BMI ≥ 25 : ↓ mortality	Age, education, marital status, hypertension, diabetes mellitus, pack-years smoking, alcohol intake, total cholesterol, and physical activity index, cognitive status
Hamer, 2017[39] Prospective cohort	8688	66.2 ± 9.5	All-cause mortality during 8 years	BMI ≥ 18.5 - < 25: reference BMI ≥ 25 - < 30: ↓ mortality BMI ≥ 30: ↓ mortality	Age, sex, physical activity, smoking habits, general health, depressive symptoms and chronic illnesses
Cesari, 2009[40] Prospective cohort	934	74.5 ± 7	All-cause mortality during 6 years	BMI ≥ 18.5 - < 25: reference BMI ≥ 25 - < 30: ↓ mortality BMI ≥ 30: ↓ mortality	Age, sex, education, cognitive status, depression, physical activity, congestive heart failure, coronary artery disease, hypertension, peripheral artery disease, respiratory disease, osteoarthritis, stroke, interleukin-6, C-reactive protein, tumor necrosis factor- α

Abbreviations:BMI: body mass index; CVD: cardiovascular diseases; DBP:diastolic blood pressure; FBS: fasting blood sugar; HDL:high-density lipoprotein; hs-CR:high-sensitivity C-reactive protein; INFLA-score:low-grade inflammation score;LDL: low-density lipoprotein; n.s.: non-significant result; SBP: systolic blood pressure; TC: total cholesterol; TG: triglycerides.

According to a meta-analysis by Eitmann et al.[13] from which four studies were selected,[37-40] older adults with low muscle mass who presented obesity had a 13% lower risk of dying than those who did not present obesity (hazard ratio (HR): 0.87; 95% confidence interval (CI): 0.79-0.96)[13] These results are also in line with the obesity paradox. Among these four studies, three concluded that there was a reduction in mortality risk both when the BMI was between 25-29.9 kg/m^2 and when it was equal or higher than 30kg/m^2, compared to values between 18.5-24.9 kg/m^2. [37,39,40] According to one study, mortality risk was only comparatively low for BMI levels over 25 kg/m^2 as opposed to those under 25kg/m^2.[38] (Table 1)

In summary, 27 studies were analyzed in this review, however, only 12 (44.5%) found relevant results regarding the obesity paradox.[14-21,37-40] Additionally, only five (41.7%) of these 12 studies showed an association between a BMI of ≥ 30 kg/m^2 and a decrease in mortality.[17,20,37,39,40]

DISCUSSION

The obesity paradox suggests that individuals with overweight and obesity may present lower mortality rates from certain diseases. This theory was based on the hypothesis of people who present obesity might have higher metabolic reserves. This might be beneficial in hypermetabolic conditions, such as burn injuries, in which the body presents a significantly increased energy demand to support tissue repair and wound healing processes.[5,41]

For many years, adipose tissue was thought to be little more than a cushion and storage space to shield organs from harm and trauma. However, a number of relevant research results have identified adipose tissue as an endocrine organ that mediates systemic failure.[41] This fact does not always translate into better outcomes, particularly due to chronic low-grade inflammation of adipose tissue that is connected to metabolic disease and organ tissue problems in organisms that present overweight and obesity, according to multiple lines of clinical studies.[42]

A more thorough analysis poses significant queries regarding the obesity paradox's viability. The contradiction might be caused, in part, by BMI's limitations as an indicator of obesity. BMI is not a discriminatory measure of body composition.[43] It is known that an adequate amount of muscle mass induces better outcomes, which is a recognized risk modifier in both healthy and non-healthy individuals.[44] The majority of findings pertaining to the obesity paradox are associated with BMI levels that fall between 25 and 30 kg/m^2, which can also express higher muscle mass.[44] Furthermore, an increase in fat mass may often be proportional to an increase in muscle mass, therefore, it is debatable if this potential protection is due to the presence of adipose tissue or due to muscular tissue.[43,44]

Moreover, the presence and severity of disease have not always been sufficiently considered, even if many data pertaining to the obesity paradox have been adjusted for metabolic factors. People who have lower weight may have worse health outcomes because of the course of a subclinical disease.[45,46] However, this does not imply that obesity is in any way protective, but rather it can reflect reverse causality, in which a disease causes a lower weight.[45,46] Eitmann et al.[13] demonstrated that older adults with low muscle mass who presented obesity had a 13% lower risk of dying than those who did not present obesity. However, it is known that severe obesity may exacerbate the condition of sarcopenic patients (low muscle mass).[47] When obesity and sarcopenia coexist, the medium-term consequences are higher risk of metabolic syndrome and impaired physical function, when compared to sarcopenia alone.[47] Therefore, a potential explanation for Eitmann's results[13] is that sarcopenic obesity appears at an earlier stage of disease process confounding the interpretation of results.

In addition to disease progression, medication use was another factor rarely considered in the studies analyzed.This may be another important confounding factor. For example, individuals with obesity often have higher levels of cholesterol and arterial pressure, therefore they can be exposed to higher dosages of anti-ischemic medications leading to lower mortality rates.[48]

Another aspect is that the location of adipose tissue itself also affects cardiometabolic response and mortality outcomes. Visceral adiposity, through production of pro-inflammatory cytokines, is more associated with adverse outcomes compared to subcutaneous adiposity.[49] The metabolically healthy pre-obese/obese phenotype is recognized as being more associated with the predominance of subcutaneous adipose tissue.[49] This phenotype is represented by individuals with high BMI, but with healthy metabolic profile, such as preserved insulin sensitivity, healthy lipid profile and low levels of pro-inflammatory cytokines in plasma.[49] A metabolically healthy pre-obese/obese phenotype could explain, in part, the lower risk of mortality.[49] However, other authors have also demonstrated that even individuals with this phenotype had significantly higher risk of developing metabolic syndrome over time and then increased by about 60% the odds of suffering major cardiovascular events with higher risk of mortality.[50,51]

Ageing also leads to a decrease in height over time and to a redistribution of body fat, which also contributes to the lack of validity of BMI in this age group. According to some studies, the distribution of body fat, visceral versus ectopic and other phenotypes, may be more important than the amount of total body fat, in terms of morbidity and mortality.[50,52]

In fact, BMI and mortality have been shown in numerous studies to have a U- or J-shaped relation, meaning that higher death rates are linked to both relatively low and high BMI values.[53] In older adults, BMI values > 31-32 kg/m^2 for women and >27-28 kg/m^2 for men, were associated with balance and mobilization disorders, higher risk of falls, reduction in muscle strength, as well as with sarcopenia and under nutrition that can also coexist with obesity.[54] Therefore, older adults who present overweight or obesity and survive longer may be a subset of more resilient individuals who have survived the negative impacts of having a higher BMI at a younger age.[5]

The high methodological heterogeneity of studies about the association between obesity and mortality in older adults was a limitation in the present review. Because different research stratified BMI data in different ways, not all of them utilized the same BMI class as a reference. Additionally, not all studies compared the mortality outcome data across various obesity classes. Moreover, the potentially varying life expectancy between individuals from different world regions included in the studies may have been another limitation.

This review helped to systematize the most recent reports on the obesity paradox, high lighting how the isolated assessment of BMI in elderly people may be associated with controversial results. Consequently, in the geriatric clinical practice, it is of utmost importance to combine BMI with other anthropometric measurements more discriminatory of body composition, such as waist and calf circumferences, waist–hip ratio, skin fold thickness measurements, as well as with measures of functional status, such as handgrip strength and gait speed, or use bioimpedance or absorptiometry when appropriate, to clarify the obesity paradox.[55-57]

Present information represents a relevant contribution to the existing body of evidence by deepening the understanding of the obesity paradox in elderly populations, highlighting the importance of considering potential epidemiological confounding factors and reinforcing educational and behavioral interventions aimed at recognizing obesity as an independent risk factor for multiple chronic diseases.

CONCLUSION

In conclusion, promotion of higher BMI values in the elderly remains controversial given the available data regarding the obesity paradox. Epidemiological confounding effects may be associated with better outcomes linked to higher BMI values. It is essential to continue with behavioral and educational endeavors to face obesity as a relevant and independent risk factor for several chronic diseases.

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Contributors

Mendes J, Miranda R and Sousa AS participated in all stages, from conception of the study until the review of the final version of the article.

Conflict of Interest: The authors declare no conflict of interest.

Received: January 28, 2025
Accepted: March 6, 2026