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Proper BMI ranges for the elderly in the context of morbidity, mortality and functional status

Prawidłowe zakresy wskaźnika BMI dla osób starszych w kontekście zachorowalności, śmiertelności oraz statusu funkcjonalnego

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Abstract

Introduction. *Recently, a great attention is focused on the issue of aging. One of the great medical challenges is to create a separate BMI range for older people.* ***Aim.*** *The main aim of this research was to present results of recent randomized clinical trials trying to analyze the correctness of using current BMI ranges for the elderly.* ***Material and methods.*** *27 sources were used in this publication, including 18 studies, 4 medical manuals published after 2004 and 5 websites.* ***Results and discussion.*** *The most appropriate BMI range for the elderly was 25-27 kg/m^2 (except for the Asian population), providing the lowest mortality, yet indicating overweight and mild obesity. Higher BMI values (even BMI >30 kg/m^2) were associated with better functional status.* ***Conclusions.*** *Current ranges of the BMI index for the elderly are not the most beneficial, frequently causing misleading interpretations. Therefore, it is necessary to create new, more current ranges. (Gerontol Pol 2016, 24, 114-118)*

Key words: *Body Mass Index, elderly, morbidity, mortality, aging*

Streszczenie

Wstęp. *Ostatnio wielką uwagę poświęca się kwestii starzenia. Jednym z największych wyzwań medycznych jest stworzenie odrębnych wartości wskaźnika BMI dla osób starszych.* ***Cel pracy.*** *Głównym celem publikacji było zaprezentowanie aktualnych badań, analizując poprawność stosowania dotychczasowych zakresów wskaźnika BMI u osób starszych.* ***Materiał i metody.*** *W publikacji zostało wykorzystanych 27 źródeł, w tym 18 publikacji naukowych, 4 podręczniki medyczne opublikowane po 2004 roku oraz 5 stron internetowych.* ***Wyniki i dyskusja.*** *Najkorzystniejszy zakres wskaźnika BMI dla osób starszych wynosił 25–27 kg/m^2 (z wyjątkiem populacji azjatyckiej). Zapewniał on najniższą śmiertelność, mimo że wskazywał na występowanie nadwagi i lekkiej otyłości. Wyższe wartości BMI (nawet >30 kg/m^2) wiązały się z lepszą sprawnością osób w wieku podeszłym.* ***Wnioski.*** *Aktualnie stosowane zakresy wskaźnika BMI dla osób starszych nie są najbardziej optymalne, często bywają błędnie interpretowane. W związku z tym konieczne jest określenie nowych, bardziej aktualnych zakresów. (Gerontol Pol 2016, 24, 114-118)*

Słowa kluczowe: *Body Mass Index, osoby starsze, zachorowalność, śmiertelność, starzenie*

Introduction

According to the World Health Organization old age begins after the sixth decade of human life, however in Poland, in accordance with the United Nations guidelines, this boundary gradually moves to 65 years [1]. Polish society is getting older and the Central Statistical Office in Poland proves this statistics. The number of elderly people increased by 4.7% between 1989-2013, reaching 14.7% of the whole country's population in 2013 [2]. The statistical prognosis for years 2014-2050 predicts an increase in the number of the elderly to about 30.2%, which will be accompanied by the decrease in the total population of the country. In 2050, people aged

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65 and more will constitute almost one-third of the population [3]. Aging leads to many physical, as well as structural changes in the human body. These can include reducing the efficiency of internal organs, muscle weakness or changes in body composition such as increasing body fat along with a loss of muscle mass, shortages of minerals and water loss [4,5]. The most common disorders in old age are cardiovascular disease, diseases of the musculoskeletal system, carbohydrate disorders, loss of hearing and eyesight, urinary incontinence, problems with sleeping and depression [6].

BMI (Body Mass Index) is a standard parameter used for the evaluation of human nutritional status. The BMI ranges are equal for age and gender in the group of adults [7]. However, there are an increasing number of studies, which are intended to prove that there is a need to create a separate BMI range for the elderly.

Aim

The main aim of this research was to present results of recent randomized clinical trials trying to analyze the correctness of using current BMI ranges for the elderly.

Material and methods

A systematic literature search was conducted using the following databases: Science Direct, Springer, Scopus, Medline, and PubMed. Terms included in the search were as follows: "BMI", "elderly", "old age", "mortality", "aging", "morbidity", "mortality", and their Polish translations. These terms were cross-referenced in all possible combinations. Articles written in English and Polish, concerning research involving human patients were included. Articles published before 2004 were excluded from the review. Also, medical literature related to the subject of this research was used. Sixteen publications, one medical manual, and an article from the official WHO website were used to develop results.

Results

Body Mass Index and aging changes

The body mass index (BMI) is a simple, generally used and widely accepted method for empirically determining an individual's correct body weight. It is applied worldwide as an independent indicator of weight, and is also a component of many nutritional screening tools, such as NRS 2002 (Nutritional Risk Screening 2002), MNA® (Mini Nutritional Assessment) and MUST (Malnutrition Universal Screening Tool) [8,9].

The BMI value reflects the ratio of an individual's weight in kilograms and square height in meters (kg/m^2). Its proper range for adults is 18.5-24.99 kg/m^2, indicating a healthy weight [10]. Because of its inexpensiveness, simplicity, and noninvasiveness, it is widely used. Research and clinical practice have shown that BMI ranges can predict an individual's future health condition and functional status [8,9,11]. Despite many advantages, in some cases, this empirical method should not be used. A BMI calculation may improperly include excess weight, without identifying the mass of particular body components (water, muscles, fat, bones) and fat distribution. Therefore, using BMI among athletes, pregnant women, and patients suffering from edema is not appropriate. Additionally, a body mass index value does not show a subject's real nutritional status; for example, protein malnutrition often observed among obese individuals is overlooked [12]. Other limitations of using the BMI value as an empirical unit include its inability to factor in other highly individualistic and conditional parameters, such as age, sex and ethnicity [13].

Aging is one example of how these parameters may affect the BMI value because during this process loss of lean body mass and changes in the amount and distribution of fat tissue are very common [14]. Occurring progressive sarcopenia especially in the form of visceral fat is particularly important for the BMI values, together with simultaneous body fat mass increase [15,16]. Due to these differences, for the elderly population, the official BMI ranges may be inappropriate and their prognostic value may be insignificant. Various alterations are within the digestive system as well. It is necessary to mention the reduction in salivary secretion, atrophic changes of the mucous membrane throughout the length of the digestive system, reduced stomach and intestines' mobility, reduced production of digestive enzymes, gastric juice as well as dentition deterioration. Furthermore, sense of smell and taste are disturbed with the loss of taste buds. All of these changes significantly disturb food consumption and preclude the realization of metabolic needs of the organism [17,18]. Additionally, faulty glucose metabolism, which is progressing, increases the risk of morbidity from diabetes type 2, which remains in close interdependence with obesity and inappropriate nutrition [19].

Morbidity and functional status

In adults' population, there are numerous studies describing the dependence between BMI, risk of develo-

ping many diseases (cardiovascular disease, hypertension, type 2 diabetes, cancer) and mortality rate. In contrast, there are few studies conducted on old populations. Changes in the body composition resulting from aging contribute to an increased risk of these diseases, and thus, also decrease an individual's quality of life [8,9,11]. An increased amount of adipose tissue and its redistribution result from these changes. Adipocytes endocrine effect results in the secretion of inflammatory and immune mediators. Because of this, visceral fat growth is more dangerous for health than overall fatness. It contributes to the development of many diseases, such as cardiovascular diseases (CVD), insulin resistance, type 2 diabetes, metabolic syndrome (MS) and cancer. Fat tissue proinflammatory effect and ease of transition of the secreted compounds to the portal vein are strongly associated with the occurrence of these illnesses. Free fatty acids, cytokines, proinflammatory hormones and other immunologically active substances, especially interleukin 6 and TNF-alfa (Tumor Necrosis Factor alfa), are excreted by the adipose tissue and reach the liver. This mechanism increases CVD risk by promoting insulin resistance and chronic inflammation. Visceral fat can also impact blood pressure and blood clotting [11]. Various studies have attempted to assess the relationship between the BMI values and the aforementioned diseases in the elderly population. A study published by Janssen et al. (2007) conducted on 4,968 elderly patients (≥ 65 years old), evaluated the risk of many diseases according to the BMI value. Depending on the BMI value, participants were assigned to three groups: normal weight (20-24.9 km/m^2), overweight (25-29.9 kg/m^2), and obese (≥ 30 kg/m^2). There was no difference in the participants' susceptibility to myocardial infarction, stroke, sleep apnea, urinary incontinence, cancer, and osteoporosis between overweight and normal weight groups. However, a significant increase of type 2 diabetes, hips or knees arthritis and physical disability were noted in the overweight group. In the obese group, the risk of these diseases increased, especially with type 2 diabetes and a significantly higher risk of sleep apnea was also demonstrated. Furthermore, researchers found that the obese group had relatively lower morbidity risk from osteoporosis in comparison to the normal weight participants [20]. Another study, conducted on 287,760 men (age 50-71), evaluated the relationship between adiposity and prostate cancer. Higher baseline BMI values were associated with significantly fewer instances of prostate cancer. However, it should be taken into account, that the study involved men under 60 years of age. Thus, the use of these results for the elderly population may be limited [21]. Ramsay et al. investigated 4,252 participants (60-79 years old) in a study that illustrated a strong correlation between BMI, ill health, and disability. An increased morbidity from hypertension, CVD, insulin resistance, and type 2 diabetes, in correlation with an evaluated BMI value, was noticed. Moreover, significantly higher mobility limitations and problems with usual activities were noticed in a group of subjects with a BMI > 30 [22].

BMI and mortality

Numerous studies focused on the relation between BMI and mortality. Still, this dependence remains unclear, especially for the elderly and cause-specific mortality. In a study conducted on 1,970 Europeans (70-75 years old) the association between BMI and all-cause mortality was not found. However, the relationship between BMI (considered as a continuous variable) and all-cause mortality was determined as significant. The lowest mortality risk was found for BMI = 27.1 kg/m^2 and it significantly increased at values > 31.4 kg/m^2 or < 21.1 kg/m^2. Also was found a correlation between BMI and cause-specific mortality. Cardiovascular disease mortality risk increased notably with BMI > 30 kg/m^2 [14]. A Norwegian study, which included 16,711 participants aged 65 years and older, gave a similar result. In this study, the lowest total mortality risk was found for a BMI range 25-29.9 kg/m^2. CVD mortality risk increased among men with higher BMI values (> 30 kg/m^2) and among women with lower BMI (< 22.5 kg/m^2). Low BMI values had a significant impact on the occurrence of deaths from respiratory diseases [23]. Another study, conducted on 1,282 individuals at the age of 80, showed that people with BMI < 19.5 kg/m^2 had the highest all-cause and respiratory mortality risk, whereas people with BMI 22.5-23.5 kg/m^2 had the lowest all-cause and CVD mortality risk. Furthermore, differences in mortality between genders were also determined. Men with BMI < 19.5 kg/m^2 had high all-cause mortality, as well as from respiratory disease. For women, the same relationship was not found [24]. In a Taiwanese study, the lowest mortality risk was found for the BMI ranges 27-30 kg/m^2 or higher in the elderly, aged 65 years and more. This study also presented that BMI < 21 kg/m^2 was associated with increased mortality [25]. Polish study conducted on 308 elderly patients (age ≥ 65) also proved that BMI lower than 25 kg/m^2 might lead to a higher mortality [8].

Discussion

Analyzed studies, focusing on the relationship between BMI and mortality risk showed that WHO ranges might be incorrect. However, in the case of morbidity risk

in the elderly, higher BMI values were correlated with an increased incidence of diseases. BMI values > 30 kg/m^2 were associated with higher risk of CVD, hypertension, type 2 diabetes, cancer and lower quality of life [20,22]. Only in the case of prostate cancer and osteoporosis, higher BMI values were correlated with a decreased incidence, which may show a protective effect of adipose tissue [20,21].

Elderly people with BMI < 25 kg/m^2, which is considered a proper weight, represent a group with relatively increased mortality [23]. In contrast, the lowest mortality risk for older people was observed for BMI ranges 25-27 kg/m^2, which means that overweight category might be the most appropriate for elderly [14]. Obese patients had only a moderate increase in mortality. This phenomenon was described in numerous studies as the 'obesity paradox' [11,23,25,26]. For the Japanese population, reduced hazard ratio for all-cause and CVD mortality was obtained for BMI in the range of 22.5-23.8 kg/m^2 [24]. These cut-off points indicated slight obesity in the Japanese population. According to the WHO expert consultation that established different associations among BMI, percentage of body fat and health risk, the percentage of body fat is generally higher in Asian population than in European (with the same age, sex, and BMI). Furthermore, in Asian population risk factors for type 2 diabetes and CVD is below the established by WHO BMI cut-off point of 25 kg/m^2 [27]. Differentiation based on gender also appears in the analyzed studies. For men, it is recommended to maintain a slight overweight, and for women even obesity, because of lower mortality risk in these BMI cut-off points. For a better estimation of morbidity and mortality, some researchers suggest using additional indicators such as WHR, WC, lean mass and body fat besides BMI [11].

The presented analysis of miscellaneous studies shows that the optimal BMI range for the elderly, connected with for the lowest mortality, according to the current standards for adults indicated overweight and mild obesity [11]. Therefore, it seems that the most appropriate BMI range for elderly is 25-27 kg/m^2 (besides the Asian population) [14,23]. Higher BMI values (even BMI >30 kg/m2) were associated with a better functional status of the elderly [9].

Conclusions

A higher risk of morbidity was observed in the elderly with increasing BMI values. In the case of mortality, this relationship was opposite. Results of the analyzed studies indicated that individuals characterized by being overweight and obese had a greater chance of survival than people with normal or even lower BMI. Therefore, more studies focusing on the relationship between BMI, mortality and morbidity in the elderly should be carried out, which could contribute to the creation of a new BMI ranges.

Conflict of interest
None

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