Body mass index among elderly population and its association with neurological and musculoskeletal diseases in Aseer, Saudi Arabia

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Abstract

Introduction: An increase in BMI in the elderly may reduce life expectancy and increase the risk of death, cardiovascular disease, and metabolic syndrome. Frailty index, body weight, and pain levels all seem to be linked. Excessively low or high body weight may cause muscle weakness and decrease physical activity, placing the elderly at risk for frailty. Methodology: This was a cross-sectional study to investigate BMI among the elderly and neurological and musculoskeletal diseases in the Aseer region, Saudi Arabia conducted during the period from 5 January, 2020 to 26 February, 2020. The data were collected using a self-administered pre-designed questionnaire, and 503 full forms of eligible subjects were included. Results: A total of 503 participants were included in this study, 61.2% of them were female, with a mean age of 67 ± 9. The mean BMI was 31.1 ± 7.5. Parkinsonism and hemiplegia were significantly associated with BMI (P = 0.003) and (P = 0.027), respectively. Osteoporosis and participants with no musculoskeletal problems were significantly associated with BMI (P = 0.001) and (P = 0.003), respectively. Conclusion: We found a significant association between Parkinsonism and hemiplegia and BMI as these conditions were more common among overweight patients. Moreover, osteoporosis was also significantly associated with BMI, and most of the patients with osteoporosis were underweight.

Keywords: BMI, death, risk, underweight

Introduction

Aging is considered a critical risk factor for multimorbidity,[¹] including hypertension,[²] heart failure,[³] and osteoarthritis.[⁴] These comorbidities may have an impact on the elderly’s quality of life. The risk of cognitive impairment is increased by depression and physical frailty as a dimension of quality of life.[⁵] Besides, as people age, their cognition changes, and their ability to perform cognitive tasks decreases. Furthermore, half of the elderly population is obese. Obesity has become a widespread chronic illness all over the world.[⁶]

According to researchers, an increase in BMI in the elderly may decrease life expectancy and increase the risk of death, cardiovascular disease, and metabolic syndrome.[⁷] Obesity, in fact, plays a key role in atherosclerosis and coronary heart disease. On the other hand, some studies have found that being overweight lowers the risk of dying from any cause.[⁸]

Significant associations have been identified between serious cognitive impairment and increased BMI in older adults.[⁹] Longitudinal studies have reported a markedly increased risk of
dementia in both midlife and later life when BMI is high. While most studies show a link between a high BMI and decreased cognitive ability in older adults, this link’s precise nature is still up for debate. ACCORDING TO SOME ANALYSES, low BMI in later life may be predictive of cognitive decline, whereas high BMI in later life may actually be protective, according to some analyses. Lower BMI in older adults may be due to poor diet, resulting in lower intake of some nutrients like antioxidants, which have improved cognitive dysfunction associated with aging. Furthermore, a longitudinal study found that high BMI has protective effects only when cognitively impaired older adults are included in the sample.

There are several theories about how BMI affects the aging brain. According to previous research, increased BMI may have an additive effect on the aging brain, altering physiological processes by enhancing oxidative stress and systemic inflammation, which may have a negative impact on the brain’s cellular integrity.

Musculoskeletal diseases (such as osteoarthritis and rheumatoid arthritis), diabetic neuropathies and postherpetic neuralgia, cancer and cancer therapy, and advanced stages of chronic conditions cause pain, such as congestive heart failure and end-stage renal disease, which are all common causes of chronic geriatric pain. The frailty index, body weight, and pain levels all appear to be linked. Excessively low or high body weight can lead to muscle weakness and a reduction in physical activity, putting older people at risk for frailty.

This research aimed to cross-sectionally investigate the association between BMI and neurological and musculoskeletal diseases among the elderly in the Aseer region of Saudi Arabia.

Methodology

A cross-sectional study design. The study was conducted during the period from 5 January, 2020 to 26 February, 2020. The study was carried out in the Aseer Region, Saudi Arabia at five primary health care centers administered by the Ministry of Health (MOH).

Individuals who visited primary care during the study duration were eligible to participate if they met the selection criteria.

Inclusion criteria
• Age older than 55 years.
• Ability to read and fill the questionnaire independently.
• Saudi nationality.

Exclusion criteria
• Illiterate or unable to fill the questionnaire.
• Not willing to participate in the study.

During the study period, we distributed the questionnaire to the targeted population, and all full forms of eligible subjects were included, resulting in a total of 503 participants. A self-administered questionnaire was used to collect data. It was divided into two parts. The socio-demographic characteristics of the participants (age, gender, marital status, level of education, occupation, residency, and history of chronic diseases) were presented in Section 1. The second section was to be filled by the attending physician according to the patient’s data and history including personal history of chronic diseases.

The researcher distributed the questionnaire to each participant at the selected primary health care centers and explained the purpose of the study as well as the confidentiality of the information given to them. Each participant’s consent was obtained both orally and in writing.

The data were entered and processed using the Statistical Package for Social Sciences (version 26). Descriptive analysis was performed to calculate frequencies and percentages. We used the Mann–Whitney U test for association analyses. To determine the BMI among each chronic disease group, we presented BMI as mean ± standard deviation (SD). A brief introduction was included in the questionnaire to explain the study’s primary objectives to the participants. The participants were made aware that their participation was entirely voluntary. On the questionnaires, no names were written down. All of the questionnaires were kept confidential.

Results

Table 1 showed the socio-demographic characteristics of the participants. A total of 503 elderly participants were included; 61.2% were females, with a mean age of 67 ± 9, and age ranged from 55 to 99 years. More than half of the participants were obese (53.7%), 25.8% were overweight, 19.1% were normal, and 1.4% were underweight. The mean BMI was 31.1 ± 7.5. Most of the participants were married (64%), whereas only a few (1.6%) were single. A total of 45.9% were illiterate regardless of the educational level, 19.1% had a university degree, and only 5.4% had intermediate education.

Table 2 presented the neurological conditions frequencies and their association with BMI. Parkinsonism and hemiplegia were significantly associated with BMI (P = 0.003) and (P = 0.027), respectively. The mean score of BMI among elderly with Parkinsonism was 26.2 ± 4.1, and hemiplegia was 26.8 ± 6.9. No significant association was found between BMI and dementia (P = 0.478) and Alzheimer’s (P = 0.058).

Table 3 presented the musculoskeletal disease frequencies and their association with BMI. Osteoporosis and participants with no musculoskeletal problems were significantly associated with BMI (P = 0.001) and (P = 0.003), respectively. The mean score of BMI among the elderly with osteoporosis was 9.59, and participants with no musculoskeletal problems was 5.00.
### Table 1: Description of Socio-demographic characteristics of the participants (n=503)

| Parameter            | Frequency | Percentage |
|----------------------|-----------|------------|
| Gender               |           |            |
| Female               | 308       | 61.2%      |
| Male                 | 195       | 38.8%      |
| Age                  |           |            |
| <65 years            | 207       | 41.2%      |
| 65 years             | 223       | 44.3%      |
| >75 years            | 73        | 14.5%      |
| Mean±SD (Min-Max)    | 31.1±7.5 (15.2-62.2) | 67±9 (55-99) |
| BMI                  |           |            |
| Underweight          | 7         | 1.4%       |
| Normal               | 96        | 19.1%      |
| Overweight           | 130       | 25.8%      |
| Obese                | 270       | 53.7%      |
| Mean±SD (Min-Max)    | 31.1±7.5 (15.2-62.2) | 3.6%       |
| Marital status       |           |            |
| Widowed              | 159       | 31.6%      |
| Single               | 8         | 1.6%       |
| Married              | 322       | 64.0%      |
| Divorced             | 14        | 2.8%       |
| Educational level    |           |            |
| Illiterate           | 231       | 45.9%      |
| Primary              | 83        | 16.5%      |
| Intermediate         | 27        | 5.4%       |
| Secondary            | 66        | 13.1%      |
| University           | 96        | 19.1%      |

### Table 2: Neurological diseases frequencies and association with BMI (n=503)

| Parameter            | No.    | Percent | BMI (Mean±SD) | P*      |
|----------------------|--------|---------|---------------|---------|
| Neurological diseases|         |         |               |         |
| Hemiplegia           | 11     | 2.2%    | 26.8±6.9      | 0.027   |
| Dementia             | 3      | 0.6%    | 33.3±9.8      | 0.478   |
| Alzheimer            | 20     | 4.0%    | 32.7±7.1      | 0.058   |
| Parkinsonism         | 18     | 3.6%    | 26.2±4.1      | 0.003   |
| None                 | 451    | 89.7%   | 31.3±7.6      | 0.141   |

*Mann-Whitney U test was used.*

### Table 3: Musculoskeletal disease frequencies and association with BMI (n=503)

| Parameter            | No.    | Percent | BMI (Mean±SD) | P*      |
|----------------------|--------|---------|---------------|---------|
| Musculoskeletal diseases|       |         |               |         |
| Arthritis            | 155    | 31.62%  | 7.44          | 0.220   |
| Rheumatism           | 98     | 29.86%  | 6.11          | 0.081   |
| Osteoporosis         | 113    | 33.83%  | 9.95          | 0.001   |
| None                 | 137    | 29.00%  | 5.00          | 0.003   |

*Mann-Whitney U test was used.*

However, no significant association was detected between arthritis (P = 0.220) and rheumatism (P = 0.081), and BMI.

### Discussion

In this cross-sectional population-based study of 503 participants in the Aseer region, Saudi Arabia, we investigated the association between neurological and musculoskeletal health problems and BMI. We determined that more than half of the participants were obese (53.7%), 25.8% were overweight, and 1.4% were underweight, with a mean BMI of 31.1 ± 7.5.

Regarding the neurological conditions in this study, Parkinsonism and hemiplegia were significantly associated with BMI (P = 0.003) and (P = 0.027), respectively. Most of the participants with Parkinson's disease were more likely to be overweight and suffering from hemiplegia (26.2 ± 4.1) and (26.8 ± 6.9), respectively.

A cross-sectional study conducted by Hu et al. reported that excess weight (BMI ≥23) was associated with an increased risk of Parkinsonism. However, the exact mechanism behind the relationship between excessive weight and Parkinson's risk is poorly understood. Dopamine, the main neurotransmitter, was reported to have a vital role in food intake regulation.

In contrast, few data have reported the association between Parkinsonism and low BMI, including a meta-analysis by van der Marck et al. who also reported that not all the individual patients were underweight. Weight loss, on the other hand, could be an important predictor of Parkinsonism worsening. Although the link between pesticide exposure and Parkinson’s disease development is still being debated, increased organo-chlorine plasma concentrations after weight loss have been linked to a worsening of symptoms.

Our findings demonstrated a significant association between osteoporosis (P = 0.001) and participants with no musculoskeletal problems (P = 0.003). Most of the participants with osteoporosis were underweight with a mean BMI (9.95). A number of large-scale epidemiological studies showing a positive relationship between BMI (or bodyweight) and bone density have been documented.

A cross-sectional study conducted by Asomaning et al. aimed to investigate the relationship between BMI and osteoporosis in elderly patients. They found that women with a lower BMI have a greater risk of osteoporosis than women of normal weight. To understand how body mass affects osteoporosis and fracture risk, two mechanisms have been suggested. It’s been proposed that body fat protects bones indirectly by acting as a source and depot for androstenedione’s peripheral conversion to the metabolically active estrogen oestrone. When this estrogen depot is depleted, the rate of bone turnover increases, resulting in a quicker rate of bone loss. The second possible mechanism is that heavier people have a higher peak bone mineral density in early adulthood than thinner people because they put more strain on their weight-bearing joints, resulting in higher bone mineral density.

### Conclusion

This study found a significant association between Parkinsonism and hemiplegia and BMI as these conditions were more common. However, no significant association was detected between arthritis and rheumatism, and BMI.
among overweight patients. Moreover, osteoporosis was also significantly associated with BMI, and most of the patients with osteoporosis were underweight. We faced a lack of data investigating the association between these conditions and BMI among the elderly globally or in Saudi Arabia. Further research is required for understanding the detected significant and negative associations.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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