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# Association Between Lifestyle Adherence and Nutritional Status Among Older Adults in Astana, Kazakhstan: A Cross-Sectional Study

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## Abstract

**Background:** This study evaluated the association between healthy lifestyle adherence and nutritional habits, nutritional status, and anthropometric measurements among older citizens of Astana, Kazakhstan, focusing on dietary patterns and physical activity.

**Methods:** A cross-sectional, observational study was carried out among 100 Astana seniors aged 60–74 years, who were grouped according to their adherence to a healthy lifestyle. Dietary intake was assessed using a validated 98–item Food Frequency Questionnaire (FFQ), physical activity was measured by the International Physical Activity Questionnaire (IPAQ), and nutritional status was evaluated using the Mini Nutritional Assessment (MNA), including total score and categories. Anthropometric measurements followed standardized procedures.

**Results:** The results observed significant differences between participants with higher adherence to a healthy lifestyle and those with lower adherence. The group with higher lifestyle adherence was associated with significantly lower BMI (25.08 ± 4.72 kg/m² vs. 30.39 ± 5.70 kg/m², mean difference = 5.31 kg/m², 95% CI: 3.23–7.39, $P < 0.001$) and a smaller waist circumference (82.64 ± 7.37 cm vs. 105.69 ± 8.32 cm, mean difference = 23.05 cm, 95% CI: 19.93–26.17, $P < 0.001$). Hip circumference and waist-to-hip ratio were lower in the higher adherence group (96.60 ± 5.28 vs. 111.45 ± 9.85 cm and 0.88 ± 0.10 vs. 0.96 ± 0.14, respectively; $P < 0.001$). They also consumed more fruits and vegetables per day (56% vs. 30%, $P = 0.009$). MNA scores were higher in the higher adherence group (25.8 ± 2.9 vs. 22.1 ± 3.4), with better nutritional status distribution.

**Conclusion:** Higher lifestyle adherence was associated with more favorable anthropometric indicators and generally healthier dietary practices, although less favorable behaviors related to sugar consumption and salt use were also observed among older adults in Kazakhstan. However, owing to the cross-sectional design, causal relationships cannot be inferred or established.

**Keywords:** Older Adults, Nutritional status, Healthy lifestyle, Physical activity, Anthropometry, Mini Nutritional Assessment, Kazakhstan, Eating habits, Obesity

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## Introduction

Aging represents one of the most important social changes, affecting nearly every aspect of social life, especially social security and healthcare (1). The world demographic trend of population aging justifies the examination of health problems among the older population. For many older people, the quality of life, independence, and functional ability depend largely on their nutritional well-being (2). Given the aging physiology, proper nutrition is especially important. This is due to age-related physiological changes that influence nutrient requirements and metabolic processes (3).

Every country must prepare its social and healthcare systems to embrace the challenges and opportunities stemming from this demographic shift. By the middle of

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***Key Messages:***

***↑What is "already known" in this topic:***

Prior studies in Kazakhstan examined geriatric dietary patterns and nutritional deficiencies in institutionalized older adults or disease-specific risks, largely without integrating physical activity or body composition.

***→What this article adds:***

This study integrates dietary habits, physical activity adherence, and anthropometric outcomes among Astana seniors, providing novel evidence for the association between lifestyle adherence and metabolic health indicators.

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this century, nearly 80% of older adults are predicted to reside in developing and middle-income nations, with the speed of aging much faster than in previous decades. In 2020, individuals over the age of 60 outnumbered those under the age of 5. The proportion of the global population aged 60 and above is expected to nearly double from 12% to 22% between 2015 and 2050 (4).

The WHO and United Nations reports highlight that this demographic transformation will have the greatest impact in Asia and Eastern Europe, where rapid urbanization and limited geriatric infrastructure intensify the challenges related to healthy aging (5-7).

With age, various developments such as loss of muscle mass, decrease in bone density, and reduced metabolism, individually and collectively increase the risk of sarcopenia, osteopenia, and other chronic illnesses such as cardiovascular diseases, diabetes, and osteoporosis (8). Lifestyle factors such as physical inactivity, reduced protein intake, and insufficient micronutrient consumption exacerbate these physiological changes, increasing the risk of malnutrition, frailty, and dependency (9-11).

Changes in nutrition and physical inactivity exacerbate the physiological changes associated with aging, which are detrimental to one's health and increase the chances of suffering malnutrition and its repercussions (12). From the perspective of an older adult, malnutrition brings numerous consequences such as deteriorating health and decreased physical activity, creating a vicious cycle that negatively impacts overall well-being (13). Metabolic disorders are strongly associated with dietary patterns and lifestyle behaviors (14). Public health studies from Kazakhstan highlight the importance of lifestyle factors in shaping population health outcomes (15). Chronic diseases related to nutrition and lifestyle remain a major burden in the region (16). Recent interdisciplinary biomedical and public health research further illustrates the complexity of health challenges affecting aging populations. For example, a cross-sectional study assessing the quality of life of 258 stroke patients using the EQ-5D-5L questionnaire reported generally poor quality of life, particularly in daily activities, while rehabilitation significantly improved patient outcomes, highlighting the importance of functional recovery strategies in older adults with chronic disease (17).

Consequently, the evaluation of pre-existing conditions, especially the risk of malnutrition within this vulnerable age group, is important for early detection and intervention. Assessment of malnutrition and risk for malnutrition in other populations is easily accomplished using frameworks such as the Mini Nutritional Assessment (MNA), which is well documented in both clinical and community settings (18, 19). Recent studies emphasize that combining MNA outcomes with biochemical markers and physical performance tests enhances the prediction of frailty and mortality in older populations (20, 21).

Studies documented in the literature show that the outcomes of the MNA predictive and functional models relate intimately to the integrated set of physical well-being and socioeconomic determinants of diet, nutrition, and geriatric physical activity (22, 23).

In 2023, the population in Kazakhstan aged over 60 surpassed 2.6 million people and represents roughly 13.2% of the total population. In this study, the term "older adults" specifically refers to individuals aged 60–74 years, corresponding to the "young-old" category, who are generally active and independent. This definition is used to ensure clarity and consistency in the study population. There are an increasing proportion of older people who are active, which presents both advantages and disadvantages. Active aging is both an emerging concern and is gaining the attention of the public because of rising participation in fitness and sports activities, diet deficiencies, and emerging metabolic issues (24). National statistics predict that this number will exceed 3.5 million by 2030, positioning Kazakhstan among the fastest-aging nations in Central Asia. This trend poses unique public health challenges related to the balance between nutritional adequacy and increasing physical activity among older adults (24, 25). In order to achieve metabolic health benefits, muscle mass preservation and reduced lingering frail risk, adequate nutrient intake is essential. Active participation is beneficial, but insufficient nutrition is the principal factor (26, 27).

Active older adults who exercise regularly have better nutritional status and optimal body weight, along with decreased chronic disease risk factors. On the contrary, physically inactive people with inadequate food intake suffer from malnutrition and perform poorly in physical activities. Hence, collecting and interpreting food intake, physical activity, and comprehensive clinical data from clients using the triangulation approach helps in formulating effective and individualized nutrition plans (28, 29).

Recent Central Asian data show that integrating physical activity monitoring with dietary assessment improves early identification of malnutrition and supports tailored interventions for maintaining functional independence (30, 31).

Studies show a close connection between income, working capability, age, health status, and access to medical care as well as nutrition myths and realities among older adults (32-34). For example, a study analyzing the association between financial autonomy and body mass index (BMI) demonstrated the protective impact of socioeconomic support structures against malnutrition. Other factors that contribute to the complexity of nutrition are the presence of chronic diseases, such as cardiovascular disease or other components of the metabolic syndrome, which require individualized diet plans based on medical, dietetic, and activity profiles (35, 36). Furthermore, recent evidence suggests that digital dietary tracking, social nutrition programs, and age-friendly policy reforms can mitigate these inequalities and enhance dietary adherence among older adults (37, 38).

Sustaining independence and reducing the burden of illness while enhancing the quality of life makes maintaining optimal nutritional status a critical component of older adults' overall well-being. Incorporating the concepts and tools of routine health assessments, including the MNA, aids in developing prompt and effective strategies for corrective action for nutritional deficiencies. Public health practice needs to begin addressing the promotion of active

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aging together with adequate nutrition to help sustain an aging population. Kazakhstan's public health strategy now increasingly recognizes the role of nutritional literacy, functional fitness, and preventive screening in ensuring successful aging (39, 40).

### *Research objective*

To evaluate the association between lifestyle adherence, nutritional status, and body composition among older adults in Kazakhstan.

### *Research Tasks*

1) To assess dietary intake and nutrient adequacy among physically active and inactive older adults. 2) To compare body composition parameters according to lifestyle adherence status. 3) To evaluate the prevalence of malnutrition and its relationship with lifestyle adherence using the Mini Nutritional Assessment. 4) To provide practical recommendations for nutrition-focused interventions supporting active aging in Kazakhstan.

### *Contribution to Literature*

This study contributes to the growing body of research on geriatric nutrition and lifestyle behaviors in Central Asia through a comprehensive assessment of dietary patterns, physical activity levels, and body composition among the seniors in Kazakhstan. While there are several studies on the nutritional patterns of older adults in the region, the majority of them have concentrated on descriptive studies of dietary consumption or nutrient deficiencies, rather than on lifestyle behaviors that determine the metabolic and anthropometric effects. Unlike previous studies that examined these factors in isolation, this research simultaneously evaluates behavioral (dietary intake and physical activity) and physiological (anthropometric measures) components within a single analytical framework. Therefore, the interplay between nutrition, physical activity, and body composition among older adults in Kazakhstan remains insufficiently explored.

Previous studies carried out in Kazakhstan have examined the geriatric population, especially the older adults living in institutions. For example, Zhuldyz Satayeva and her co-authors studied the nutritional intake and food preferences of the older adults in social service centers of major cities of Kazakhstan. While the study pointed out some dietary patterns and the prevalent deficiencies, it did not consider the lifestyle elements, such as the level of physical activity and the body composition (41). This highlights a key limitation in existing research, where important behavioral and physiological factors are not examined together. As a result, the possible association of eating patterns with other aspects of health related to lifestyle was not studied.

A related study conducted by Gulmira Zhanalina and colleagues in Central Kazakhstan, who studied the nutritional status of the older population with diet-related diseases, found nutritional imbalances and their associations with chronic diseases such as hypertension, diabetes, and metabolic syndrome. This study, however, concentrated on dietary and some anthropometric measures and did not examine the relationship between nutrition, physical activity, and metabolic health (42). This fragmented approach limits a comprehensive understanding of how combined lifestyle factors influence health outcomes in aging populations.

In Kazakhstan, other studies have focused on the intersection of nutrition and aging, particularly on osteoporosis and deficiencies in micronutrients. These studies focused on the role of nutrients and body mass index in osteoporosis but overlooked the behavioral aspects of obesity, particularly the dietary and physical activity patterns and their combined effect on the metabolic health of seniors (43, 44). As a result, existing evidence tends to address nutritional or disease-specific factors separately rather than through an integrated lifestyle perspective.

Although researchers have acknowledged the impact of lifestyle factors on health aging, literature on this topic in Central Asia is still developing. Existing literature on the region focuses on dietary patterns, disease-specific nutritional risk factors, or community readiness for health promotion initiatives, and tends to study them in isolation, rather than as part of an integrated assessment of lifestyle factors and metabolic components (45). This indicates a clear gap and the need for studies that simultaneously evaluate multiple lifestyle determinants of health in aging populations.

The present study addresses this gap by adopting a multidimensional approach that integrates nutritional assessment (including the Mini Nutritional Assessment), physical activity evaluation, and anthropometric analysis. This study is among the first in Kazakhstan to simultaneously evaluate dietary intake patterns (98-item FFQ), physical activity levels (IPAQ), and direct anthropometric measures in community-dwelling older adults aged 60-74 years. This comprehensive perspective provides stronger evidence on the interaction between lifestyle behaviors and metabolic health outcomes.

Furthermore, this study is among the first in the Central Asian context to specifically examine the "young-old" population (60–74 years) using an integrated lifestyle-health framework, thereby offering context-specific insights relevant for early intervention strategies.

By addressing these interconnected dimensions simultaneously, the study provides robust and contextually relevant empirical evidence on lifestyle-related determinants of metabolic health among older adults in Kazakhstan. The results play a significant role in designing focused public health initiatives for healthy aging and for the control of lifestyle-related metabolic disorders in the region's fast-increasing aging population.

## Methods

### *Study Design*

The study was conducted at the Astana Active Longevity Center, a municipal public institution in the city of Astana, Kazakhstan. The research employed an observational, cross-sectional study design. Participants were explicitly classified into two groups "lower lifestyle adherence" and "higher lifestyle adherence" based on prede-

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fined healthy lifestyle criteria to ensure consistency with the study objectives. Group assignment was based on the overall indicator of the population's dedication to a healthy lifestyle. Those with a high or satisfactory dedication level were assigned to the higher lifestyle adherence group.

### Study Population

The initial sample consisted of 120 older adults aged 60–74 years who were active participants in physical activity and wellness programs in Astana. The World Health Organization defines older adults as people aged 60 years and above. Therefore, this study focused on participants within the 60-74 age range.

According to the inclusion and exclusion criteria, 100 participants were included in the final analysis, consisting of 50 participants in the lower lifestyle adherence (control) group and 50 in the higher lifestyle adherence (study) group. Participants of the higher lifestyle adherence group continued to engage in wellness and physical exercise programming on a regular basis, participating at least three times per week.

### Sample Size Calculation

The sample size was calculated using the comparison of two independent means, with body mass index (BMI) selected as the primary outcome variable, as it is the most frequently reported and sensitive anthropometric indicator in lifestyle intervention studies.

The calculation assumed a two-sided significance level of $\alpha = 0.05$ and a statistical power of 80% ($\beta = 0.20$). Based on previously published lifestyle and obesity-related studies, the expected mean difference in BMI between higher and lower lifestyle adherence groups was assumed to be approximately 1.5–2.0 kg/m², with a pooled standard deviation of approximately 3.5–4.5 kg/m² (46, 47).

The sample size was estimated using a standard formula for comparison of two independent means (48). Under these assumptions, the minimum required sample size was calculated to be 48 participants per group (total = 96 participants).

To compensate for potential non-response and incomplete data, the sample size was increased by approximately 20–25%, resulting in a target sample size of 120 participants. Ultimately, 100 participants completed the study, with 50 participants in each group (lower and higher lifestyle adherence groups).

### Grouping and Assessment

Participants were categorized into two groups based on their level of adherence to healthy lifestyle criteria:

- Lower Lifestyle Adherence Group
- Higher Lifestyle Adherence Group

Adherence was assessed according to the following criteria:

- Non-smoking status
- Daily intake of ≥400 g of fruits and vegetables
- Adequate physical activity (≥150 minutes of moderate or ≥75 minutes of vigorous activity per week)
- Salt intake ≤5 g per day
- Alcohol consumption ≤168 g of pure ethanol per week for men and ≤84 g for women

Participants were classified into the higher lifestyle adherence (study) group if they met all criteria (high adherence) or demonstrated satisfactory adherence (non-smoking plus meeting at least three additional criteria). Participants who did not meet these thresholds were classified into the lower lifestyle adherence (control) group. This approach ensured a clear and consistent grouping framework aligned with the study design.

Nutritional and Lifestyle Assessment

A structured questionnaire was used to evaluate nutritional status, focusing on:

- Dietary habits and meal frequency;
- Consumption of fats, grains, vegetables, and fruits;
- Presence of unhealthy eating patterns (e.g., late meals);
- Awareness of nutritional information (fat, sugar, and salt content).

Nutritional intake was assessed using a 98-item Food Frequency Questionnaire (FFQ), a method with demonstrated validity for assessing habitual dietary intake in nutritional epidemiological studies (49). The 98-item Food Frequency Questionnaire (FFQ) was used to assess habitual dietary intake based on frequency of consumption. No nutrient-level analysis or diet quality index was calculated. The FFQ data were used exclusively for descriptive comparison of food group consumption patterns between lifestyle adherence groups. Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ). Responses were converted into MET-minutes per week according to IPAQ scoring guidelines. Participants were categorized into low, moderate, and high physical activity levels based on standard IPAQ classification criteria (50) a globally validated instrument for assessing physical activity levels. Data collection was conducted through a standardized face-to-face interview process. Participants initially completed the questionnaires independently under the supervision of trained researchers. For individuals with visual or literacy limitations, trained interviewers administered the questionnaires using a structured interview format to ensure accuracy and completeness. All data collection procedures followed a uniform protocol to enhance reliability and minimize reporting bias. Both instruments (FFQ and IPAQ) have established validity and reliability in diverse populations, as reported in previous studies (46, 47). Additionally, the questionnaires were pilot-tested on ten participants prior to the main study to assess clarity, comprehension, and internal consistency.

### Anthropometric Measurements

All anthropometric measurements were performed by one trained specialist in the morning on an empty stomach to minimize diurnal variation. Certified medical measuring instruments, regularly calculated in accordance with the institution's standards, were used.

Physical parameters were measured using standardized procedures and included:



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• Height (cm) and weight (kg) recorded with certified medical scales and stadiometers calibrated regularly and having an accuracy of 0.1 cm and 0.1 kg.

• Waist and hip circumferences (cm) measured with a non-elastic tape according to a single institutional protocol with an accuracy of 0.1 cm. Waist circumference was measured at the midpoint between the lowest rib and the iliac crest, while hip circumference was measured at the widest portion of the buttocks using a non-elastic measuring tape.

• Waist-to-hip ratio (WHR) was calculated as the ratio of waist to hip circumference.

All measurements followed a unified protocol approved by the institution to ensure reproducibility and accuracy.

### Inclusion and Exclusion Criteria

#### Inclusion criteria

1.Aged 60–74 years.

2.Participants classified into either higher (satisfactory or high) or lower adherence groups based on predefined lifestyle criteria.

3.No acute illnesses.

4.Willingness to complete anthropometric measurements, questionnaires, and testing.

5.Signed informed consent.

#### Exclusion criteria

6.Aged <60 or >74 years.

7.Severe inability to classify lifestyle adherence due to incomplete or unreliable responses.

8.Cognitive impairments affecting informed participation.

9.Acute illnesses or chronic disease exacerbations.

### Statistical Analysis

Data was analyzed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Quantitative variables were tested for normality using the Shapiro–Wilk test. Normally distributed variables (e.g., BMI, waist circumference, hip circumference) were presented as mean ± standard deviation (M ± SD) and compared between groups using the Student's t-test. Non-normally distributed variables (e.g., waist-to-hip ratio, frequency of meals) were summarized as median (Me) and interquartile range ($Q_1$–$Q_3$) and compared using the Mann–Whitney U test.

Categorical variables (e.g., smoking status, fat consumption, and dietary awareness indicators) were analyzed using the Chi-square ($\chi^2$) test. Assumptions of the Chi-square test were evaluated by examining expected cell counts. When expected cell counts were less than 5, Fisher's exact test or Monte Carlo exact tests were applied as appropriate. In cases of sparse distributions, variables were additionally collapsed into clinically meaningful categories to ensure statistical validity.

All dietary categorical comparisons were treated as exploratory analyses due to the item-level nature of the Food Frequency Questionnaire (FFQ). No validated composite dietary or fat-consumption scoring system was available for these variables; therefore, these results are presented as descriptive exploratory comparisons. A significance level of $\alpha = 0.05$ was adopted for all analyses.

No multivariable adjustment was performed in this study; therefore, all reported results represent crude (unadjusted) between-group comparisons. Given the exploratory cross-sectional design and limited sample size, adjustment for potential confounders was not applied to avoid model instability and overfitting.

### Primary and Secondary Outcomes

The primary outcomes of this study were anthropometric indicators, including BMI, waist circumference, hip circumference, and waist-to-hip ratio, as these variables directly reflect body composition and metabolic risk in older adults.

The secondary outcomes included nutritional status assessed using the MNA, dietary intake patterns measured by the FFQ, physical activity levels assessed using the IPAQ, and descriptive dietary behaviors and nutritional awareness indicators.

### Ethical Considerations

The study protocol was approved by the Local Ethics Committee of the Astana Medical University (Protocol No. 3, October 21, 2024). All participants provided written informed consent prior to participation.

## Results

### Anthropometric Characteristics

The primary outcomes of this study were anthropometric indicators. Participants in the higher lifestyle adherence group demonstrated significantly lower BMI, waist circumference, hip circumference, and waist-to-hip ratio compared with participants in the lower lifestyle adherence group. The lower lifestyle adherence group mean BMI was 30.39 ± 5.70 kg/m² while the higher lifestyle adherence group mean BMI was 25.08 ± 4.72 kg/m² and was markedly lower (mean difference = 5.31 kg/m², 95% CI: 3.23–7.39; t = 4.96, $P < 0.001$). The effect size for BMI (Cohen's d = 1.02) indicates a large effect.

The waist circumference in the higher lifestyle adherence group was also a similar case which was 82.64 ± 7.37 cm and was significantly lower than the lower lifestyle adherence group 105.69 ± 8.32 cm (mean difference = 23.05 cm, 95% CI: 19.93–26.17; t = 14.3, $P < 0.001$). The effect size for waist circumference (Cohen's d = 2.93) indicates a very large effect.

Hip circumference values were also lower in the higher lifestyle adherence group (96.60 ± 5.28 cm) compared with the lower lifestyle adherence group (111.45 ± 9.85 cm) (mean difference = 14.85 cm, 95% CI: 11.71–17.99; $P < 0.001$). The effect size for hip circumference (r = 0.33) indicates a medium effect.

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*Table 1.* Baseline characteristics and anthropometric indicators by lifestyle adherence

| Variable | Lower lifestyle adherence (n=50) | Higher lifestyle adherence (n=50) | *P*-value | Effect size | Mean difference (95% CI) |
|---|---|---|---|---|---|
| Age (years) | 67.00 ± 5.93 | 67.00 ± 5.19 | 0.782 | r = 0.03 | 0.00 (−2.21 to 2.21) |
| BMI (kg/m²) | 30.39 ± 5.70 | 25.08 ± 4.72 | < 0.001 | d = 1.02 | 5.31 (3.23–7.39) |
| Waist circumference (cm) | 105.69 ± 8.32 | 82.64 ± 7.37 | < 0.001 | d = 2.93 | 23.05 (19.93–26.17) |
| Hip circumference (cm) | 111.45 ± 9.85 | 96.60 ± 5.28 | < 0.001 | r = 0.33 | 14.85 (11.71 to 17.99) |
| Waist-to-hip ratio | 0.96 ± 0.14 | 0.88 ± 0.10 | < 0.001 | r = 0.33 | 0.08 (0.03 to 0.13) |

Note: Data are presented as mean ± standard deviation (SD). Mean differences with 95% confidence intervals (95% CIs) are reported where applicable. Statistical comparisons were performed using independent samples t-test for normally distributed variables and Mann–Whitney U test for non-normally distributed variables. Effect sizes were calculated using Cohen's d for parametric comparisons and rank-biserial correlation (r) for non-parametric comparisons. Interpretation thresholds for Cohen's d were small (0.20), medium (0.50), and large (0.80), whereas thresholds for rank-biserial correlation (r) were small (0.10), medium (0.30), and large (0.50).

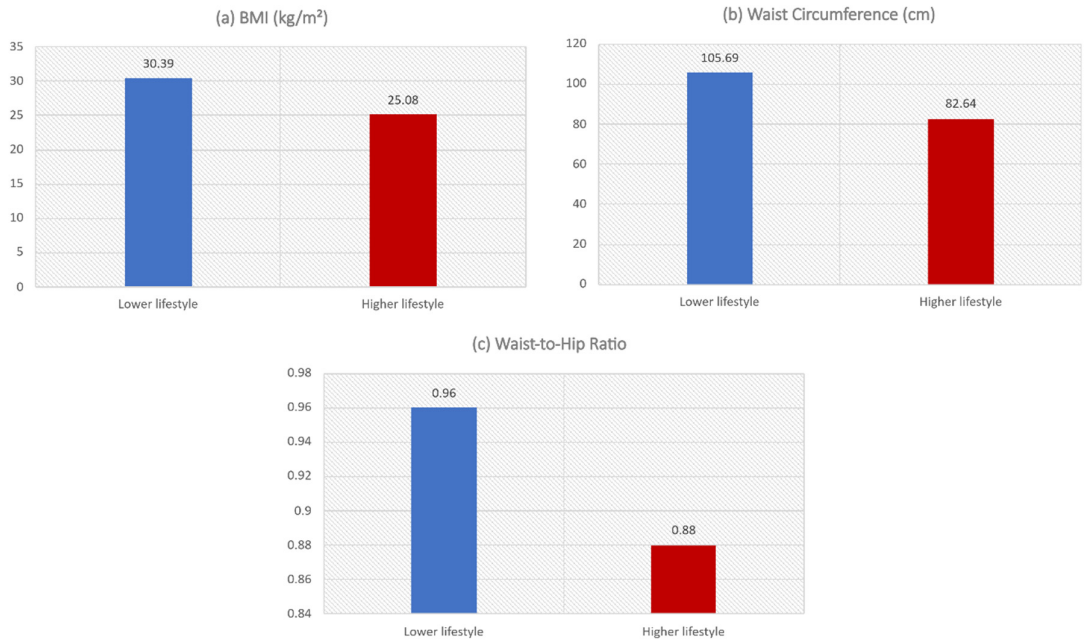



*Figure 1.* Comparison of anthropometric indicators between lower and higher lifestyle adherence groups. (a) Body mass index (BMI), (b) waist circumference, and (c) waist-to-hip ratio. Values are presented as mean ± standard deviation, and each variable is displayed in a separate panel with independent scaling to ensure accurate interpretation of group differences. Abbreviations: BMI – body mass index. Statistical test: Independent samples t-test was used for BMI and waist circumference, whereas the Mann–Whitney U test was used for waist-to-hip ratio. A two-sided *P* value < 0.05 was considered statistically significant).

The waist-to-hip ratio was also significantly lower in the higher lifestyle adherence group (0.88 ± 0.10) compared with the lower lifestyle adherence group (0.96 ± 0.14) (mean difference = 0.08, 95% CI: 0.03–0.13; $P < 0.001$). The effect size for waist-to-hip ratio (r = 0.33) indicates a medium effect. These findings are fully consistent with the data presented in Table 1. These findings indicate that higher lifestyle adherence was associated with more favorable anthropometric profiles. However, due to the cross-sectional design, causal relationships cannot be inferred.

As shown in Figure 1, both groups, the lower and the higher lifestyle adherence group participants, indicated mean values for BMI, waist circumference, and waist-to-hip ratio. The participants in the higher lifestyle adherence group, when compared to the lower lifestyle adherence group, exhibited significantly lower waist and BMI measurements, suggesting a reduction in central adiposity and enhancement in overall body composition ($P < 0.001$).

### Eating Habits and Meal Frequency

The variables presented in Table 2 describe dietary and meal-related behaviors among participants according to lifestyle adherence classification. These findings are intended to characterize group profiles and should not be interpreted as independent evidence of lifestyle-related differences because several of these characteristics were closely related to the criteria used for group assignment. Accordingly, all comparisons are presented as descriptive profiles, and p-values are reported for exploratory purposes only and were not adjusted for multiple testing. The number of meals eaten per day was reportedly the same for both groups, with most respondents from both groups indicating they had 3–4 meals ($P = 0.487$).

However, there was a marked difference in the timing of the last meal, with 92% of participants from the higher lifestyle adherence group having their final meal more than 2 hours before sleep, as opposed to 72% in the lower lifestyle adherence group ($P = 0.017$).



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*Table 2.* Eating habits and meal patterns among older adults in Astana.

| Indicator | Category | Lower lifestyle adherence n (%) | Higher lifestyle adherence n (%) | *P*-value (exploratory) |
|---|---|---|---|---|
| Meals per day | 3–4 times | 44 (88.0) | 47 (94.0) | 0.487 |
| | ≥5 times | 6 (12.0) | 3 (6.0) | |
| Time of last meal | >2 hours before sleep | 36 (72.0) | 46 (92.0) | 0.017 |
| | ≤2 hours | 14 (28.0) | 4 (8.0) | |
| Sugar intake with tea/coffee | 0 pieces | 0 (0.0) | 2 (4.0) | 0.35 |
| | 1–5 | 44 (88.0) | 43 (86.0) | |
| | 6–9 | 6 (12.0) | 5 (10.0) | |
| Soft drinks consumption | ≤1/week | 42 (84.0) | 47 (94.0) | 0.237 |
| | ≥2–6/week | 8 (16.0) | 3 (6.0) | |
| Added salt after cooking | Never | 44 (88.0) | 46 (92.0) | 0.741 |
| | Sometimes | 6 (12.0) | 4 (8.0) | |
| Salad dressing type | Vegetable oil | 1 (2.0) | 39 (78.0) | <0.001 |
| | Others/none | 49 (98.0) | 11 (22.0) | |
| Eggs/week | 3–4 times | 42 (84.0) | 47 (94.0) | 0.039 |
| | Other | 8 (16.0) | 3 (6.0) | |

Note: Data are expressed as absolute numbers and percentages (n (%)). Where expected cell counts were <5, Fisher's exact test or Monte Carlo simulation was applied instead of Pearson's Chi-square test. Some dietary variables were analyzed as exploratory due to sparse cell distributions. Abbreviations: n – number of participants; $\chi^2$ – Chi-square test. Statistical test: Pearson's Chi-square ($\chi^2$) test. $p < 0.05$ indicates statistical significance.

Regarding salad dressing, 78% of the higher lifestyle adherence group reported using vegetable oil, whereas only 2% of the lower lifestyle adherence group did so ($P < 0.001$).

Also, the number of eggs consumed per week showed a marked difference; 94% of the higher lifestyle adherence group had eggs 3–4 times a week, whereas only 84% of the lower lifestyle adherence group did ($P = 0.039$).

Figure 2 shows the comparison of the eating habits of the lower and the higher lifestyle adherence group. It shows observed differences between groups that are descriptive in nature and should not be interpreted as causal relationships. 92% of the members of the higher lifestyle adherence group had their most recent meal more than two hours before sleeping, while in the lower lifestyle adherence group this number was 72%. Participants in the higher lifestyle adherence group also had higher use of vegetable oil in salad dressings (78%) compared to only 2% in the lower lifestyle adherence group. The consumption of eggs was also higher in the higher lifestyle adherence group, with 94% of respondents reporting consumption of eggs 3–4 times a week compared to 84% in the lower lifestyle adherence group.

The eating habits of lower and higher lifestyle adherence groups show clear descriptive differences in dietary behavior profiles. More respondents in the higher lifestyle adherence group (56%) as compared to the lower lifestyle adherence group (30%) reported consuming at least 400 grams of fruits and vegetables daily. Moreover, 80% of the higher lifestyle adherence group reported checking

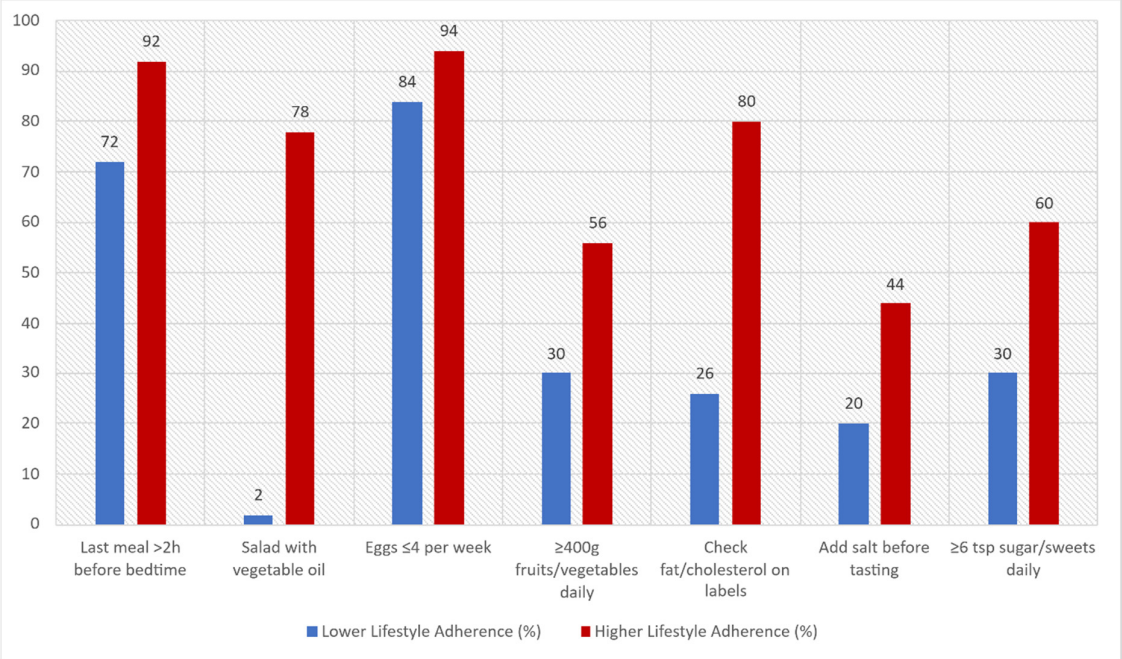



*Figure 2.* Descriptive dietary and nutritional behavior profile by lifestyle adherence.

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food labels for fat and cholesterol, compared to 26% in the lower lifestyle adherence group. More participants in the higher lifestyle adherence group (44%) added salt before tasting food compared to 20% in the lower lifestyle adherence group. Furthermore, 60% of participants in the higher lifestyle adherence group, compared to 30% in the lower lifestyle adherence group, reported consuming at least 6 teaspoons of sugar or sweets daily.

### Fat Consumption Patterns

Table 3 presents descriptive information regarding reported frequencies of fat-rich food consumption among participants classified according to lifestyle adherence. Because dietary habits are conceptually related to the lifestyle adherence construct, these comparisons primarily characterize the dietary profiles of the study groups. Accordingly, all comparisons are presented as descriptive patterns and p-values are reported for exploratory purposes only without adjustment for multiple testing.

According to the analyses, the consumption of foods containing saturated fats was higher in the lower lifestyle adherence group. For example, 44% of the higher lifestyle adherence group reported consuming butter, margarine, and animal fats less than once a month compared with almost universal higher frequency intake in the lower lifestyle adherence group ($P < 0.001$).

In addition, a higher proportion of the higher lifestyle adherence group indicated low-frequency consumption of fatty beef, high-fat dairy products, cream/ice cream, processed meat, and fried foods compared with the lower lifestyle adherence group, in which high-frequency consumption was predominant ($P < 0.001$ for all comparisons).

### Unhealthy Eating Behaviors and Awareness

The variables presented in Table 4 represent descriptive nutritional behaviors and awareness characteristics of participants according to lifestyle adherence classification. Several of these variables, including fruit and vegetable consumption and salt-related behaviors, are closely related to the criteria used to define group membership. Therefore, the findings should be interpreted as descriptive group characteristics rather than independent outcomes. Regular consumption was reported by 56% of the higher lifestyle adherence group, while the lower lifestyle adherence group's reach was only 30% ($\chi^2 = 6.83$, $P = 0.009$).

Even more pronounced were the proportions of the higher lifestyle adherence group (80%) and lower lifestyle adherence group (26%) who reported paying attention to fat and cholesterol content while shopping or cooking ($\chi^2 = 29.4$, $P < 0.001$). However, consistent with Table 4, a higher proportion of participants in the higher lifestyle adherence group reported adding salt before tasting (44% vs. 20%, $P = 0.010$) and consuming ≥6 teaspoons of sugar daily (60% vs. 30%, $P = 0.003$). These findings are reported descriptively to characterize participant behavior patterns and should not be interpreted as independent evidence of differences attributable to lifestyle adherence.

*Table 3.* Fat-rich food consumption patterns among older adults.

| Food item | Frequency | Lower lifestyle adherence n (%) | Higher lifestyle adherence n (%) | *P*-value (exploratory) |
|---|---|---|---|---|
| Butter/margarine/animal fat | <1/month | 0 (0.0) | 22 (44.0) | <0.001 |
| | ≥weekly | 50 (100.0) | 28 (56.0) | |
| Fatty beef | Low frequency | 0 (0.0) | 45 (90.0) | <0.001 |
| | High frequency | 50 (100.0) | 5 (10.0) | |
| High-fat dairy | Low frequency | 0 (0.0) | 45 (90.0) | <0.001 |
| | High frequency | 50 (100.0) | 5 (10.0) | |
| Cream/ice cream | Low frequency | 0 (0.0) | 46 (92.0) | <0.001 |
| | High frequency | 50 (100.0) | 4 (8.0) | |
| Processed meat | Low frequency | 0 (0.0) | 48 (96.0) | <0.001 |
| | High frequency | 50 (100.0) | 2 (4.0) | |
| Fried foods | Low frequency | 0 (0.0) | 47 (94.0) | <0.001 |
| | High frequency | 50 (100.0) | 3 (6.0) | |

Note: Data are expressed as absolute numbers and percentages (n (%)). Where expected cell counts were <5, Fisher's exact test or Monte Carlo simulation was applied instead of Pearson's Chi-square test. Some dietary variables were analyzed as exploratory due to sparse cell distributions. Abbreviations: n – number of participants; $\chi^2$ – Chi-square test. Statistical test: Pearson's Chi-square ($\chi^2$) test. $P < 0.05$ indicates statistical significance.

*Table 4.* Assessment of unhealthy eating behaviors among active older adults in Astana.

| No. | Indicators | Frequency | Lower lifestyle adherence group N=50 | Higher lifestyle adherence group N=50 | *P*-value |
|---|---|---|---|---|---|
| 1 | Do you consume about 400 grams (or 4-5 servings) of fruits and vegetables (excluding potatoes) every day? | No | 35 (70.0) | 22 (44.0) | 0.009 |
| | | Yes | 15 (30.0) | 28 (56.0) | |
| 2 | Do you pay attention to the fat and cholesterol content in products when shopping (on labels packaging) or when cooking? | No | 37 (74.0) | 10 (20.0) | < 0.001* |
| | | Yes | 13 (26.0) | 40 (80.0) | |
| 3 | Do you have a habit of adding salt to cooked food without tasting it first? | No | 40 (80.0) | 28 (56.0) | 0.010 |
| | | Yes | 10 (20.0) | 22 (44.0) | |
| 4 | Do you consume six or more teaspoons of sugar, jam, honey, or other sweets per day? | No | 35 (70.0) | 20 (40.0) | 0.003 |
| | | Yes | 15 (30.0) | 30 (60.0) | |

Note: Data are expressed as absolute numbers and percentages (n (%)). Abbreviations: n – number of participants; $\chi^2$ – Chi-square test. Statistical test: Pearson's Chi-square ($\chi^2$) test. $P < 0.05$ indicates statistical significance.

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*Table 5.* Mini Nutritional Assessment (MNA) total score and nutritional status

| MNA Category | Lower lifestyle adherence group (n=50) | Higher lifestyle adherence group (n=50) | *P*-value |
|---|---|---|---|
| MNA total score (0–30), Mean ± SD | 22.1 ± 3.4 | 25.8 ± 2.9 | <0.001* (mean difference = 3.70, 95% CI: 2.45–4.95) |
| Normal nutritional status | 18 (36.0%) | 32 (64.0%) | |
| At risk of malnutrition | 28 (56.0%) | 16 (32.0%) | |
| Malnourished | 4 (8.0%) | 2 (4.0%) | |

Note: Data are presented as mean ± SD or n (%). MNA = Mini Nutritional Assessment. Chi-square test and independent t-test used. *$P < 0.05$ significant.

### *Mini Nutritional Assessment*

The Mini Nutritional Assessment (MNA) results, presented in Table 5, showed significant differences in nutritional status between the two lifestyle adherence groups. The mean MNA score was significantly higher in the higher lifestyle adherence group (25.8 ± 2.9) compared with the lower lifestyle adherence group (22.1 ± 3.4, mean difference = 3.70 points, 95% CI: 2.45–4.95; $P < 0.001$).

In terms of nutritional categories, a greater proportion of participants in the higher lifestyle adherence group were classified as having normal nutritional status (64%) compared to the lower lifestyle adherence group (36%). Conversely, the prevalence of "at risk of malnutrition" was higher in the lower lifestyle adherence group (56%) than in the higher adherence group (32%).

## Discussion

This study found that older adults in the higher lifestyle adherence group had significantly lower BMI, waist circumference, and waist-to-hip ratio compared with those in the lower lifestyle adherence group. These findings indicate that higher lifestyle adherence was associated with lower measures of total and abdominal adiposity. However, the cross-sectional design does not permit conclusions regarding causality or directionality of these associations. Importantly, the average BMI of the higher lifestyle adherence group falls within the normal weight range, in contrast to the rest of the sample, which showed evidence of obesity.

These findings suggest that physical activity and healthier dietary habits may be associated with more favorable anthropometric outcomes in older adults. In addition, numerous body composition studies of adults aged 35 to 86 years have linked the level of physical fitness to body composition, with cardiorespiratory and muscular fitness being the best indicators. Previous longitudinal and interventional studies have reported that regular physical activity is associated with lower body fat mass and better preservation of fat-free mass, muscle mass, and overall physical function. Regular physical activity is crucial for attaining and maintaining optimal body composition among older adults. Together, these findings support the observed association between physical activity and favorable body composition in aging populations (51, 52).

In addition, weight reduction strategies in older adults suggest that achieving a modest energy deficit through combined aerobic and resistance training preserves lean mass, enhances physical performance, and reduces metabolic syndrome risk (53). Physically active older adults demonstrate more favorable dietary intake and nutrient density, which protects against both undernutrition and obesity-related complications (54).

Dietary patterns emphasizing plant-based foods, eggs, dairy, and minimal processed meat consumption are associated with favorable metabolic outcomes, supporting the concept that combined diet and physical activity interventions contribute to metabolic control and healthy aging (55, 56). Comparable findings in Chinese adults, demonstrating that balanced dietary patterns and moderate physical activity were inversely related to metabolic obesity phenotypes, indicating consistency between Asian and local data. Such alignment reinforces the international understanding that diet–exercise synergy supports healthy longevity, as advocated under WHO's "Active Aging" framework (55).

Within the study sample, the higher lifestyle adherence group displayed lower BMI and reduced variability in anthropometric measures, indicating an association between higher lifestyle adherence and lower total and abdominal obesity. This finding aligns with previous research emphasizing exercise and diet as central factors in healthy aging (57, 58).

The observed differences in waist circumference and waist-to-hip ratio may indicate lower visceral adiposity among participants with higher lifestyle adherence, which is associated with reduced risk of cardiovascular disease, type 2 diabetes, and metabolic syndrome (59). Additionally, Kassis et al. (2023) highlighted in their international review that balanced nutrition combined with lifestyle management supports the aging process, emphasizing metabolic resilience and functional independence. The consistency between this evidence and the current findings suggests that integrating nutrition with physical activity is widely recognized as a cornerstone of active aging (60).

The current study analysis indicated that participants in the higher lifestyle adherence group displayed significantly healthier eating behaviors compared to those with lower adherence. For example, more of them reported eating dinner two or more hours before bedtime. In addition, participants in the higher lifestyle adherence group reported more frequent consumption of balanced meals, including breakfast, fruits, and fresh vegetables, compared with the lower lifestyle adherence group, reflecting overall healthier dietary habits. Furthermore, the use of vegetable oils for food preparation or dressing was significantly higher in the higher lifestyle adherence group, indicating a preference for healthier fat sources rather than high-fat condiments such as ranch-type dressings.

An analysis of our results also shows that our recommendations regarding adherence to a physically active lifestyle should include multiple food groups. Dietary pat-



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terns in the higher lifestyle adherence group. Thus, older adults should be encouraged to consume a diverse range of food groups to support balanced nutrition and metabolic health. More active participants also followed a structured eating pattern, demonstrating greater adherence to healthier dietary fat choices and meal timing. These findings suggest that participants in the higher lifestyle adherence group reported dietary patterns that were generally more consistent with recommended nutritional practices. Similar dietary habits have been documented among older adults (61).

A further evaluation of the frequency and distribution of eating intervals has shown a positive correlation between the number of main meals eaten and the adoption of healthy eating patterns. Previous studies have reported associations between favorable meal timing patterns, glycemic control, and cardiovascular health. These findings align with the present study in that older active persons seem to have mastered the timing and frequency of meals better than their less active peers and even contemporaries (62).

Regarding fat consumption, data from the current study show that vegetable oil use was predominant among active older people, suggesting intentional fat selection for its positive cardiovascular effects. Unsaturated fats from vegetable oils, while avoiding saturated fats, are an important nutritional criterion for older adults to reduce cardiovascular risks (63).

The study's findings regarding egg consumption showed moderate intake, in line with dietary recommendations that support egg consumption without adverse cardiovascular effects (64). Older adults with higher lifestyle adherence engage in more healthful eating practices, as demonstrated by healthier fat intake, more favorable meal distribution patterns, and improved macronutrient balance, which facilitate better digestion, glycemic control, and cardiovascular health. Appropriate diet reflects positive lifestyle changes that help older adults achieve optimal nutrition (65). These findings indicate intentional dietary choices to reduce cardiovascular risk and improve lipid metabolism (66, 67).

Multiple large cohort studies derived from CLHLS for those aged 60 and older show that exercise lowers BMI, waist circumference, and other obesity outcomes among older adults. One study assessing 2,626 older adults with multimorbidity reported that moderate physical activity reduced mortality risk by 41%, while high waist circumference increased mortality risk (68). Another systematic review in cardiovascular medicine advocates replacing saturated fatty acids with polyunsaturated fatty acids, which is associated with lower coronary heart disease risk and reduced all-cause mortality. These dietary patterns have been globally adopted since the 1970s, coinciding with higher mortality from heart disease when plant oils replaced animal fats. Additionally, one umbrella review indicated that reduced saturated fat intake positively impacts cardiovascular disease in adults, highlighting its importance for older populations (69). Recent controlled reviews regarding carbohydrate intake have shown no clear adverse effects of saturated fats on cardiovascular disease or mortality, suggesting that personalized dietary strategies are needed. Nevertheless, advocating for healthier fats and minimizing processed saturated fats remains important (70). A 2019 review on aged care residents stated: "Not all saturated fats are equally harmful, although these are the most harmful of fats. Dairy fats were shown to positively correlate with HDL cholesterol and total cholesterol/HDL ratio". This supports the need for personalized dietary recommendations while emphasizing healthy fat choices and limiting processed saturated fats (71). Emerging reviews also suggest that minimally processed, full-fat dairy combined with abundant plant oils and overall low saturated-fat intake can be part of a healthy diet (72).

Despite higher awareness, some unhealthy behaviors persisted in the higher lifestyle adherence group, including adding salt before tasting and occasional sweet consumption (73). These patterns may reflect age-related changes in taste perception or cultural dietary practices, indicating the need for more targeted dietary interventions

The current study indicates that members of the higher lifestyle adherence group reported increased awareness of dietary choices and made healthier choices overall. They ate fruits and vegetables daily more often and were more aware of fat and cholesterol content on food labels. However, these individuals were also more likely to add salt before tasting food and to eat sweets more often. These findings suggest that some less-healthy behaviors still persist despite increased knowledge of proper nutrition, possibly due to reduced sensory stimulation or cultural factors, and more systematic dietary interventions are needed.

Older adults with higher lifestyle adherence have better diet and health habits. Physical activity and good dietary intake are positively associated. Evidence shows that a more vigorous exercise regimen is associated with better muscle function and quality of life, which in turn influences healthier eating habits (74). Adults over 40 often lack adequate understanding of macronutrient, fat, and sugar guidelines, indicating insufficient nutrition education. Many adults who understand the importance of home-cooked meals face barriers to healthier dietary patterns, such as limited time and financial resources (75).

The relationship among demographic factors such as age, gender, rest, mental health, and income further defines and influences the nutritional status of older adults. Nurses have observed that older adults with sedentary lifestyles are more prone to malnutrition, indicating that factors beyond nutritional knowledge including self-care behaviors and attitudes toward nutrition play a significant role in maintaining adequate health and well-being (76).

Overall, the study identified positive associations between lifestyle adherence, healthy eating behaviors, and favorable anthropometric indicators among older adults. However, nutritional knowledge alone may be insufficient to ensure fully optimal dietary patterns, highlighting the role of structured interventions.

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### *Limitations of the Study*

First, this was a single-center study conducted exclusively in Astana, limiting the generalizability of findings to other regions of Kazakhstan, where dietary habits and socioeconomic conditions may differ.

Second, the data on dietary intake and physical activity were obtained through self-reported questionnaires, which may be subject to recall bias, central tendency bias, or social desirability bias. Objective measurement tools, such as accelerometers or biochemical markers of nutritional status, were not employed, limiting the precision and reliability of some variables.

Third, the absence of biochemical indicators (e.g., serum albumin, lipid profiles, and micronutrient levels) restricts the depth of interpretation regarding metabolic health and nutritional adequacy.

Fourth, the cross-sectional study design prevents causal inference, restricting conclusions to associations rather than definitive cause-effect relationships between lifestyle behaviors and anthropometric outcomes.

Fifth, the 98-item FFQ was tested on a Pakistani adult population, which is not Kazakhstani older adults, which may bias local dish estimates. Globally, IPAQ is not validated in Central Asia. This can influence the accuracy of measuring diet/physical activity.

Sixth, no multivariable regression analysis was conducted to adjust for potential confounding factors such as age, sex, socioeconomic status, educational level, chronic diseases, and medication use. Therefore, the observed associations between lifestyle adherence and anthropometric outcomes should be interpreted as crude relationships rather than independent effects.

Despite these limitations, the study provides valuable insights into the combined influence of physical activity, dietary practices, and lifestyle adherence on body composition and metabolic health in older adults, offering a foundation for future multicenter and longitudinal studies.

## Conclusion

The findings of this study indicate an association between lifestyle adherence, dietary practices, and anthropometric indicators among older adults in Kazakhstan.

Older adults who were classified in the higher lifestyle adherence group reported greater adherence to recommended dietary practices, including increased intake of fruits, vegetables, whole grains, and moderate amounts of vegetable oil, consistent meal timing (dinner at least two hours before bedtime), and restricted consumption of high-fat foods and processed meats. However, despite these generally healthier dietary patterns, participants in the higher lifestyle adherence group also reported higher consumption of sugar and a greater tendency to add salt to cooked food before tasting, indicating that not all dietary behaviors were uniformly favorable. In contrast, inactive participants showed irregular meal patterns, greater intake of salt, and lower intake of other foods that are considered nutritionally dense. Overall, the higher lifestyle adherence group demonstrated dietary patterns that were generally, but not consistently, aligned with current nutritional recommendations.

Active participants exhibited more favorable anthropometric indicators, including lower BMI, smaller waist circumference, and lower waist-to-hip ratio, which were associated with lower levels of central adiposity. Inactive older adults, on the other hand, were more likely to have central obesity and unbalanced energy intake. However, because of the cross-sectional nature of the study, these findings should be interpreted as associations rather than evidence of causal relationships.

Assessment using the Mini Nutritional Assessment (MNA) revealed a higher prevalence of malnutrition or risk of malnutrition among inactive older adults, suggesting an association between lower lifestyle adherence and poorer nutritional status.

These results highlight the potential value of integration of nutrition education into community health initiatives and Active Longevity Centers focusing on age-appropriate dietary composition, portion size, and nutrient sufficiency. Health care practitioners are encouraged to make use of screening tools like the MNA as standard practice to identify patients who are at risk of malnutrition or other metabolic syndromes. Public health initiatives aimed at enhancing the independence and quality of life of older adults should incorporate regular assessment of health status, promotion of physical activity, and nutrition literacy. Enhanced interdisciplinary collaboration between geriatric specialists, nutritionists, and physiotherapists is recommended to optimize healthy aging outcomes.

Overall, the findings suggest that healthy lifestyle practices, including regular physical activity and healthier dietary behaviors, are associated with more favorable nutritional and anthropometric profiles among older adults in Kazakhstan. Future longitudinal and interventional studies are needed to determine whether these lifestyle factors contribute to improvements in nutritional status, reduction in malnutrition risk, and healthy aging outcomes.

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### *Conflict of Interests*

The authors declare that they have no competing interests.

### *Authors' Contributions*

Conceptualization, S.T and A.A.; methodology, G.B.; software, S.I.; validation, A.A., G.N. and S.I.; formal analysis, S.T.; investigation, G.N.; resources, A.A.; data curation, S.T.; writing—original draft preparation, S.T.; writing—review and editing, G.N.; visualization, S.I.; supervision, G.N.; project administration, S.T.; funding acquisition, A.A. All authors have read and agreed to the published version of the manuscript.

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### Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Local Committee on Bioethics (LCB) of NJSC "Astana Medical University" (Protocol No. 3, dated 21 October 2024). Written informed consent was obtained from all participants prior to enrollment.

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### Data Availability

The data supporting the findings of this study are not publicly available due to privacy restrictions on the participants' information but are available from the corresponding author upon reasonable request.

### AI Use Statement

The authors did not use artificial intelligence or AI-assisted technologies in the preparation of this manuscript.

## References

1. Gianfredi V, Nucci D, Pennisi F, Maggi S, Veronese N, Soysal P. Aging, longevity, and healthy aging: the public health approach. Aging Clin Exp Res. 2025;37(2025):1-12. https://doi.org/10.1007/s40520-025-03021-8
2. Mandal K, Rai A, Kar N. Factors affecting quality of life of an elderly person: a systema tic review and meta-analysis. Malays J Nurs. 2024;16(2):244–55. https://doi.org/10.31674/mjn.2024.v16i02.024
3. Kesari A, Noel JY. Nutritional assessment. StatPearls (Internet). Treasure Island (FL): StatPearls Publishing; 2025 (cited 2026 Apr 12). Available from: https://www.ncbi.nlm.nih.gov/books/NBK580496/
4. World Health Organization. Ageing and health (Internet). Geneva: WHO; 2022 (cited 2026 Apr 12). Available from: https://www.who.int/news-room/fact-sheets/detail/ageing-and-health
5. Priego T, Martín AI, González-Hedström D, Granado M, López-Calderón A. Role of hormones in sarcopenia. Vitam Horm. 2021;115(2021):535–70. https://doi.org/10.1016/bs.vh.2020.12.021
6. Lisco G, Disoteo OE, De Tullio A, De Geronimo V, Giagulli VA, Monzani F, et al. Sarcopenia and diabetes: A detrimental liaison of advancing age. Nutrients. 2023; 16(1):1-27. https://doi.org/10.3390/nu16010063
7. Tu S, Hao X, Xu S, Jin X, Liao W, Xia H, et al. Sarcopenia: Current insights into molecular mechanisms, diagnostics, and emerging interventional approaches. Int J Mol Sci. 2025;26(14):1-33. https://doi.org/10.3390/ijms26146740
8. Razon AH, Haque MI, Ahmed MF, Ahmad T. Assessment of dietary habits, nutritional status and common health complications of older people living in rural areas of Bangladesh. Heliyon. 2022;8(2):e08947. https://doi.org/10.1016/j.heliyon.2022.e08947
9. Zhang L, Liu G, Huang X, He F. Effects of protein supplementation on muscle mass, muscle strength, and physical performance in older adults with physical inactivity: a systematic review and meta-analysis. BMC Geriatr. 2025;25(2025):1-13. https://doi.org/10.1186/s12877-025-05885-x
10. Rautakallio-Järvinen P, Kunvik S, Laaksonen M, Salonoja M, Fogelholm L, Suominen M, et al. Risk of malnutrition and insufficient protein intake among older people living at home: Baseline findings of the power meals study. J Nutr Gerontol Geriatr. 2022;41(4):257–69. https://doi.org/10.1080/21551197.2022.2148803
11. Lourida I, Boer JMA, Teh R, Kerse N, Mendonça N, Rolleston A, et al. Association of daily physical activity and sedentary behaviour with protein intake patterns in older adults: A multi-study analysis across five countries. Nutrients 2021;13(8):1-21. https://doi.org/10.3390/nu13082574
12. Tomasiewicz A, Polański J, Tański W. Advancing the understanding of malnutrition in the elderly population: Current insights and future directions. Nutrients. 2024;16(15):1-11. https://doi.org/10.3390/nu16152502.
13. Kupisz-Urbanska M, Marcinowska-Suchowierska E. Malnutrition in older adults-effect on falls and fractures: A narrative review. Nutrients. 2022;14(15):1-11. https://doi.org/10.3390/nu14153123.
14. Kramarova V, Tyravska Y. Correction of the platelet link of hemostasis in patients with metabolic syndrome through dietary nutrition. Ukraine Nation's Health. 2025;2025(1):77–80. https://doi.org/10.32782/2077-6594/2025.1/15.
15. Kamkhen V, Aidasheva D, Mamyrbekova S, Zhagiparova Z, Auyezova E. Dynamics of Indicators Characterizing the Health of Kazakhstani Youth. Univers J Public Health. 2024;12():218–27. https://doi.org/10.13189/ujph.2024.120205.
16. Balmagambetova SK, Bekmukhambetov YZ, Tulyaeva AB, Iztleuov YM, Smagulova GA, Koyshybaev AK, et al. Gastric Cancer in Aktobe Region of Western Kazakhstan from 2009 to 2018: Incidence Rates, Trends, and Five-Year Survival. Asian Pacific Journal of Cancer Prevention. 2020;21(6):1645–52. https://doi.org/10.31557/APJCP.2020.21.6.1645.
17. Abilova G, Kamkhen V, Kalmatayeva Z. Quality of Life of Patients Who Have Suffered from Acute Cerebrovascular Accident (Investigation Based on EQ-5D-5L). Med J Islam Repub Iran. 2023;37(2023):1-5. https://doi.org/10.47176/mjiri.37.85.
18. Kujawowicz K, Mirończuk-Chodakowska I, Cyuńczyk M, Witkowska AM. Identifying malnutrition risk in the elderly: A single- and multi-parameter approach. Nutrients. 2024;16(15):1-29. https://doi.org/10.3390/nu16152537.
19. Memon DSA, Hafeez SA, Shahroz DIM, Kasi DAK, Amin DS, Azhar DS. Assessment of malnutrition and its determinants among the elderly population of Kemari, Pakistan. J Popul Ther Clin Pharmacol. 2025;32(4):1182–90. https://doi.org/10.53555/r5b13x15.
20. Picca A, Coelho-Junior HJ, Calvani R, Marzetti E, Vetrano DL. Biomarkers shared by frailty and sarcopenia in older adults: A systematic review and meta-analysis. Ageing Res Rev. 2022;73(2022):1-15. https://doi.org/10.1016/j.arr.2021.101530.
21. Li TC, Li CI, Liu CS, Lin CH, Yang SY, Lin CC. Comparison of Mini Nutritional Assessment tool and geriatric nutrition risk index in predicting 12-Y mortality among community-dwelling older persons. J Nutr. 2024;154(7):2215–25. https://doi.org/10.1016/j.tjnut.2024.05.010.
22. Sandri E, Capoferri M, Luciani G, Piredda M. The link between physical activity, nutrition, and health: A cross-sectional study with multivariate analysis in a young and predominantly female Spanish sample. Nutrients. 2025;17(9):1-27. https://doi.org/10.3390/nu17091486.
23. Koehler K, Drenowatz C. Integrated Role of Nutrition and Physical Activity for Lifelong Health. Nutrients. 2019;11(7):1-3. https://doi.org/10.3390/nu11071437.
24. Seilkhanov A. Over 60-year-olds make up 13.2% of Kazakhstan's population (Internet). Inform; 2023 (cited 2026 Apr 12). Available from: https://qazinform.com/news/over-60-year-olds-make-up-132-of-kazkahstans-population-816cfc
25. Kemelova F. Kazakhstan's population projected to reach 26.3 million by 2050 (Internet). Astana Times. 2025 May (cited 2026 Apr 12). Available from: https://astanatimes.com/2025/05/kazakhstans-population-projected-to-reach-26-3-million-by-2050/
26. Ren Y, Lu A, Wang B, Wang C. Nutritional intervention improves muscle mass and physical performance in the elderly in the community: A systematic review and meta-analysis. Life (Basel). 2023;14(1):1-25. https://doi.org/10.3390/life14010070



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[ DOI: 10.47176/mjiri.40.100 ]

27. Laskou F, Dennison E. Interaction of nutrition and exercise on bone and muscle. Eur Endocrinol. 2019;15(1):11–2. https://doi.org/10.17925/EE.2019.15.1.11
28. Kwon D, Roh S-Y, Kwon J. Exploring the association between Older Adults' body mass index and their fall experience, chronic diseases, and exercise frequency: Evidence from Korea. Medicina (Kaunas). 2025;61(9):1-14. https://doi.org/10.3390/medicina61091622
29. Faronbi JO, Awoleye TE, Idowu OA, Olagbegi OM. Association of nutrition, physical activity, and morbidity among older adults. Z Gesundh Wiss. 2025;33(2025):2127–35. https://doi.org/10.1007/s10389-023-02186-8
30. Bragazzi NL, Ibrayeva A, Shoranov M, Muminov T, Ismoldayev Y, Tanabayeva S, et al. Physical Activity Levels in Kazakhstan: A Cross-Sectional Nationwide Study on Demographic, Socioeconomic, and Regional Factors. Medicina. 2025;61(11):1-19. https://doi.org/10.3390/MEDICINA61111913.
31. Zhanalina G, Plyasovskaya S, Mkhitaryan X, Molotov-Luchanskiy V, Hendrixson V, Bolatova Z, et al. The assessment of the nutritional status among the young-old and old-old population with alimentary-dependent diseases. Medicina (Kaunas). 2024;60(6):1-14. https://doi.org/10.3390/medicina60060923
32. Shuremu M, Belachew T, Hassen K. Nutritional status and its associated factors among elderly people in Ilu Aba Bor Zone, Southwest Ethiopia: a community-based cross-sectional study. BMJ Open. 2023;13(2023):e067787. https://doi.org/10.1136/bmjopen-2022-067787.
33. Jian Z, Kun SP, Yun ZL, Ye S, Kai Y, Jing Y, et al. Malnutrition in Relation with Dietary, Geographical, and Socioeconomic Factors among Older Chinese. Biomed Environ Sci. 2021;34(5):337–47. https://doi.org/10.3967/BES2021.045.
34. Aljahdali AA, Na M, Leung CW. Food insecurity and health-related quality of life among a nationally representative sample of older adults: cross-sectional analysis. BMC Geriatr. 2024;24(2024):1-9. https://doi.org/10.1186/s12877-024-04716-9
35. Banerjee K, Sahoo H, Govil D. Financial stress, health and malnourishment among older adults in India. BMC Geriatr. 2023;23(2023):1-12. https://doi.org/10.1186/s12877-023-04532-7
36. Dufe Turkson RK, Ngounda J, Nel R, Walsh CM. The nutritional status of community-dwelling elderly in Lesotho and factors associated with malnutrition. Nutr Health. 2023;29(3):513–22. https://doi.org/10.1177/02601060221082368
37. Low KMY, Ali SH. Advancing dietary behaviour change in older adults through digital technologies: emerging tools and behavioural mechanisms. Curr Opin Clin Nutr Metab Care. 2025;29(1):45-54. https://doi.org/10.1097/MCO.0000000000001156.
38. Aure CF, Kluge A, Moen A. Older adults' engagement in technology-mediated self-monitoring of diet: A mixed-method study. J Nurs Scholarsh. 2021;53(2021):25–34. https://doi.org/10.1111/jnu.12619.
39. Zhylkybekova A, Turlayev A, Grjibovski AM, Koshmaganbetova GK. Measures to support informal care for the older adults in Kazakhstan: a review of the current status. Front Public Health. 2023;11(2023):1-9. https://doi.org/10.3389/fpubh.2023.1247684.
40. WHO Regional Office for Europe. Better nutrition in Kazakhstan: a key to achieving the Sustainable Development Goals (Internet). Copenhagen: WHO Regional Office for Europe; 2019 (cited 2026 Apr 12). Available from: https://iris.who.int/handle/10665/346277
41. Satayeva Z, Tayeva A, Rskeldiyev B, Zhaksylykova G, Akhmetova N. Nutrition of older adults in the Republic of Kazakhstan. Potr S J F Sci. 2022;16(2022):244–57. https://doi.org/10.5219/1747.
42. Zhanalina G, Akhmetova S. Characteristics of the nutritional status of the elderly and senile age with alimentary-dependent diseases. J Clin Med Kaz. 2020;5(59):11–4. https://doi.org/10.23950/1812-2892-jcmk-00772.
43. Abduldayeva A, Doszhanova G, Iskakova S, Bukeyeva Z, Tarjibayeva S, Tolegenova Y, et al. Osteoporosis in the Elderly: A Cross-Sectional Study in Kazakhstan. Int J Environ Res Public Health. 2025;22(11):1-18. https://doi.org/10.3390/ijerph22111694.
44. Izguttinov A, Ainabekova A, Petrescu-Prahova M, Wood SJ. Community Readiness for Increasing Older Adult Physical Activity Levels in Kazakhstan. Cent Asian J Glob Health. 2020;9(1):1-10. https://doi.org/10.5195/cajgh.2020.447.
45. Ji CH, Huang XQ, Li Y, Muheremu A, Luo ZH, Dong ZH. The Relationship between physical activity, nutritional status, and sarcopenia in community- dwelling older adults with type 2 diabetes: a cross-sectional study. BMC Geriatrics. 2024;24(2024):506-15. https://doi.org/10.1186/s12877-024-05038-6.
46. Sadeghi O, Eshaghian N, Keshteli AH, Askari G, Esmaillzadeh A, Adibi P. Association of combined healthy lifestyle with general and abdominal obesity. Front Nutr. 2023;10(2023):1-12. https://doi.org/10.3389/fnut.2023.1332234.
47. Muilwijk M, Loh M, Siddiqui S, Mahmood S, Palaniswamy S, Shahzad K, et al. Effects of a lifestyle intervention programme after 1 year of follow-up among South Asians at high risk of type 2 diabetes: a cluster randomised controlled trial. BMJ Glob Health. 2021;6(11):e006479. https://doi.org/10.1136/BMJGH-2021-006479.
48. Sadiq IZ, Usman A, Muhammad A, Ahmad KH. Sample size calculation in biomedical, clinical and biological sciences research. J Umm Al-Qura Univ Appl Sci. 2025;11:133–41. https://doi.org/10.1007/s43994-024-00153-x.
49. Cui Q, Xia Y, Wu Q, Chang Q, Niu K, Zhao Y. Validity of the food frequency questionnaire for adults in nutritional epidemiological studies: A systematic review and meta-analysis. Crit Rev Food Sci Nutr. 2023;63(12):1670–88. https://doi.org/10.1080/10408398.2021.1966737.
50. Sember V, Meh K, Sorić M, Starc G, Rocha P, Jurak G. Validity and Reliability of International Physical Activity Questionnaires for Adults across EU Countries: Systematic Review and Meta-Analysis. Int J Environ Res Public Health. 2020;17(19):7161. https://doi.org/10.3390/ijerph17197161.
51. Schilling R, Schmidt SCE, Fiedler J, Woll A. Associations between physical activity, physical fitness, and body composition in adults living in Germany: A cross-sectional study. PLoS One. 2023;18(10):e0293555. https://doi.org/10.1371/JOURNAL.PONE.0293555.
52. Kusnir P, Baig S. The Neuropathy as an Adverse Effect of Chemotherapy Diminished After Administration of Dietary Supplement with Iron Citrate - Case Study. Fut Med. 2024;3(3):1-8. https://doi.org/10.57125/FEM.2024.09.30.06.
53. Iftikhar M, Jamal A, Shah MM, Khan SJ. Obesity in the elderly. In: Cases on multimorbidity and its impact on elderly patients. Hershey (PA): IGI Global; 2023. p. 51-70. https://doi.org/10.4018/978-1-6684-2354-7.ch003.
54. Çiftçi S, Erdem M. Comparing nutritional status, quality of life and physical fitness: aging in place versus nursing home residents. BMC Geriatr. 2025;25(2025):102-115. https://doi.org/10.1186/S12877-025-05751-W.
55. Pu F, Lin J, He R, Wei Y, Li J, Liao X, et al. Association between dietary patterns and obesity-related metabolic phenotypes in Chinese middle-aged and older adults: a cross-sectional study. Sci Rep.2025;15(2025):1–12. https://doi.org/10.1038/S41598-025-18446-4.
56. Tazkiyah ND, Suprapti, Wulandari LP, Mansur H, Sunaeni. An Overview of Prospective Brides' Preconceptional Health Using "Elsimil Application." Futurity Medicine. 2024;3(3):1-12. https://doi.org/10.57125/FEM.2024.09.30.05
57. World Health Organization. Physical activity (Internet). Geneva: WHO; 2024 (cited 2026 Apr 12). Available from: https://www.who.int/news-room/fact-sheets/detail/physical-activity
58. Szychowska A, Drygas W. Physical activity as a determinant of successful aging: a narrative review article. Aging Clin Exp Res. 2022;34(6):1209–14. https://pubmed.ncbi.nlm.nih.gov/34873677/
59. Kim HY, Kim JK, Shin GG, Han JA, Kim JW. Association between Abdominal Obesity and Cardiovascular Risk Factors in Adults with Normal Body Mass Index: Based on the Sixth Korea National Health and Nutrition Examination Survey. J Obes Metab Syndr. 2019;28(4):262-270.

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https://doi.org/10.7570/JOMES.2019.28.4.262.
60. Kassis A, Fichot MC, Horcajada MN, Horstman AMH, Duncan P, Bergonzelli G, et al. Nutritional and lifestyle management of the aging journey: A narrative review. Front Nutr. 2023;9(2023):1-19. https://pmc.ncbi.nlm.nih.gov/articles/PMC9903079/.
61. Latorre JA, Abellán C, López-Moro A, Giménez-Blasi N, Conde-Pipo J, Mariscal-Arcas M. Review of the Nutritional Status in Older Adult Population. OBM Geriatrics.2023;7(1):1–18. https://doi.org/10.21926/OBM.GERIATR.2301224.
62. Park H, Shin D, Lee KW. Association of main meal frequency and skipping with metabolic syndrome in Korean adults: a cross-sectional study. Nutr J. 2023;22(2023):24. https://doi.org/10.1186/S12937-023-00852-X.
63. Visioli F, Poli A. Fatty Acids and Cardiovascular Risk. Evidence, Lack of Evidence, and Diligence. Nutrients. 2020;12(12):1-19. https://doi.org/10.3390/NU12123782.
64. Formisano E, Lopes Neri L de C, Caffa I, Borgarelli C, Ferrando MR, Proietti E, et al. Effect of egg consumption on health outcomes: An updated umbrella review of systematic reviews and meta-analysis of observational and intervention studies. Nutr Metab Cardiovasc Dis. 2025;35(5):1-12. https://doi.org/10.1016/J.NUMECD.2025.103849.
65. Alyafei A, Daley SF. The role of dietary lifestyle modification in chronic disease prevention and management. StatPearls (Internet). Treasure Island (FL): StatPearls Publishing; 2025 (cited 2026 Apr 12). Available from: https://www.ncbi.nlm.nih.gov/books/NBK587401/
66. Yamada S, Shirai T, Inaba S, Inoue G, Torigoe M, Fukuyama N. Saturated Fat Restriction for Cardiovascular Disease Prevention: A Systematic Review and Meta-analysis of Randomized Controlled Trials. JMA J. 2025;8(2):1-13. https://doi.org/10.31662/JMAJ.2024-0324.
67. Mizuno A. There Is More Than Meets the Label: Rethinking Saturated Fat and Cardiovascular Health. JMA J. 2025;8(2):1-3. https://doi.org/10.31662/JMAJ.2025-0120.
68. Fan B, Ren K, Li L. The joint effect of weight-adjusted waist index and physical activity on all-cause mortality in Chinese elderly patients with multimorbidity: A study based on the CLHLS from 2011 to 2018. PLoS One. 2025;20(2025):e0325886. https://doi.org/10.1371/JOURNAL.PONE.0325886.
69. Aramburu A, Dolores-Maldonado G, Curi-Quinto K, Cueva K, Alvarado-Gamarra G, Alcalá-Marcos K, et al. Effect of reducing saturated fat intake on cardiovascular disease in adults: an umbrella review. Front Public Health. 2024;12(2024):1-12. https://doi.org/10.3389/fpubh.2024.1396576.
70. Astrup A, Magkos F, Bier DM, Brenna JT, de Oliveira Otto MC, Hill JO, et al. Saturated Fats and Health: A Reassessment and Proposal for Food-Based Recommendations: JACC State-of-the-Art Review. J Am Coll Cardiol. 2020;76(7):844–57. https://doi.org/10.1016/J.JACC.2020.05.077.
71. Liu Y, Poon S, Seeman E, Hare DL, Bui M, Iuliano S. Fat from dairy foods and 'meat' consumed within recommended levels is associated with favourable serum cholesterol levels in institutionalised older adults. J Nutr Sci. 2019;8(2019):e10. https://doi.org/10.1017/JNS.2019.5.
72. Foster D, Haubrick K. Considering the Impact of Elevated Saturated Fat Intake in the Context of Full Fat Dairy Products and Red Meats on Cardiovascular Health, A Systematic Review. Res Rev. 2024;5(12):2640–62. https://researchreview.in/index.php/rr/article/view/175
73. Sazali A, Shahar S, Haron H, Rajab NF, Mazri FH, Ooi TC, et al. Insights into salt perception and cognitive impairment among middle-aged and older adults: a scoping review. BMC Public Health. 2025;25(2025):1–15. https://doi.org/10.1186/s12889-025-21852-y.
74. Keawalin J, Tatree B, Thanakamon L. Patient awareness on stroke fast track in primary care center. GSC Advanced Research and Reviews. 2020;2(3):018–27. https://doi.org/10.30574/GSCARR.2020.2.3.0017.
75. Juarez-Cedillo T. Nutritional Awareness and Dietary Practices among Adults Aged 40 and Above: A Cross- Sectional Analysis of Knowledge, Behaviour and Barriers. Indian J Nutr Diet. 2025;12(2):1–4. https://www.opensciencepublications.com/wp-content/uploads/IJN-2395-2326-12-323.pdf
76. Usmani M, Amin F, Saeed R, Durrani N, Zaheer MK, Mateen A, et al. Nutritional status and its associated factors among the geriatric population in outpatient clinics of a tertiary care hospital in Karachi, Pakistan. J Family Med Prim Care. 2024;13(1): 271-277. https://doi.org/10.4103/JFMPC.JFMPC_737_23.



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