



Is there a link between Persian medicine eating habits and the nutritional status of older adults? A cross-sectional study

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ABSTRACT

Background: The physical and physiological changes of shifting into older ages may affect nutritional conditions and lead to malnutrition.

Objectives: This study aimed to assess the possible relationship between eating habits recommended by Persian medicine (PM) and older adults' nutritional status.

Methods: A total of 1259 older adults were included in this study. Data were collected using a three-section questionnaire measuring socio-demographic characteristics, nutritional status according to the short form of the complete Mini Nutritional Assessment (MNA-SF), and nutritional habits (NH) consisting of 31 questions based on PM recommendations.

Results: The mean scores of the subscales of "eating habits" was significantly lower ($p = 0.014$) and "time of meals" was significantly higher ($p = 0.001$), in the well-nourished compared to the malnourished group. Furthermore, while a positive correlation was observed between the MNA-SF score and the subscales of "time of meals" ($p < 0.001$) and "eating and sleeping" ($p = 0.033$), the subscale of "eating habits" showed a negative correlation ($p = 0.019$).

Conclusions: Lifestyle modifications including eating habits and meal timing based on PM recommendations may improve nutritional status in older adults.

Abbreviations: PM, Persian medicine; MNA-SF, Mini Nutritional Assessment Short form; NH, Nutritional habits; TOPS, Tabriz Older People Survey; BMI, Body Mass Index.

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1. Background

The world population is getting older due to health improvements, increased life expectancy, and decreased mortality [1]. The Iranian older adult population (aged 60 and over) increased from 6.6 % in 1996 to 9.2 % in 2016 [2], and it is expected to grow to more than 30 % by 2050 [3].

Aging is one of the causative factors of malnutrition that can place older individuals at an increased risk of adverse outcomes, including functional decline, weakening of the immune system, and mortality [4–7]. According to the World Health Organization, nutritional status is one of the prerequisites for well-being in old age and a modulator of healthy aging [8]. Malnutrition is a risk factor for many clinical disorders that, despite being common in older adults, are usually not diagnosed and therefore not treated. Malnutrition in older people can be attributed to the loss of appetite, use of multiple medications, impaired dentition, and dementia as well as lifestyle factors [9]. Based on Persian medicine (PM), nutrition has a crucial role in human health [10]. Eating and drinking habits have a special place in PM. It is necessary to pay attention to the fact that the occurrence of many diseases is related to the time and manner of eating, the type and amount of food consumed, and the digestive system. In PM, nutritional instructions are stated in parallel with pharmaceutical treatments. In addition to the quality and quantity of nutrition, these orders include various factors such as the time of eating, the duration of eating, the number of meals, and the distance between meals, etc. [11]. It seems that lifestyle modifications, including eating and drinking habits, can improve nutritional status and prevent adverse outcomes in the aging population.

In PM, the individual differences are conceptualized as temperament or the Mizaj which is related to the physical and psychological characteristics of a person [12]. Older adult's temperament, same as the general population, can differ from one person to the other one including all types, however, it tends to become more cold and dry. It has been demonstrated that due to lower core body temperature and physical weakness by getting older, the Mizaj of older adults tends to become cold-dry. Thus, there is a demand for specific alterations which best match their needs. In this case, foods with warm-wet nature are appropriate for them to keep them healthy [13]. Due to the nutritional problems in the older population and their possible association with eating habits, addressing this issue seems to be essential. This study aimed to determine if there is a relationship between these habits based on the PM point of view and the older adults' nutritional status.

2. Materials and methods

2.1. Study design and ethics

This study was a part of the Tabriz Older People Survey (TOPS); a representative community-based cross-sectional study [14] that was performed on the nutritional status and nutritional habits (NH) of older adults. Individuals were selected using the probability proportionate to size (PPS) method and sample size formula for quantitative variables in cross-sectional studies [15]. The standard deviation used in the mentioned formula was obtained from Soysal et al. study [16]. Given $(d)^2 = 0.01$, the sample size was 1334 people, and considering 0.05 as the dropout rate led to a total sample size of 1400. The information from the latest national census, which divided Tabriz into 10 municipal districts and urban blocks, was used in sample size selection. This being the case, there was a total of 11,778 city blocks where 140 blocks were designated and 10 older adults from each sample block were randomly selected. Of all 1400 people interviewed and recruited in the study, 1362 filled out study forms where the information of 1259 was reliable for statistical analysis. Informed consent was obtained from participants of the study. Our inclusion criteria were being an older adult (age 60 or older) and a resident of Tabriz. We excluded the individuals with cognitive impairment who were unable to answer the interviewer's questions. This study was conducted under the Declaration of Helsinki

and was approved by the ethical committee of Tabriz University of Medical Sciences (TBZMED.REC.1398.1097). A predesigned questionnaire was used to assess the socio-demographic characteristics, nutritional status, and NH of the participants.

2.2. Socio-demographic data assessment

The first part of the questionnaire was about socio-demographic information, including sex, place of birth, marital status, employment status, education level, cigarette or hookah use, household structure, and hearing and vision status.

2.3. Nutritional status assessment

The second part of the questionnaire was considered for the assessment of nutritional status. The short form of the complete Mini Nutritional Assessment (MNA-SF) was utilized. It is one of the most commonly used screening tools for identifying the risk of malnutrition in older people and includes six items: anthropometric parameters (body mass index [BMI] and weight loss), nutritional parameters (food intake), and general items (mobility, physiological and emotional stress, and cognitive condition). Individuals were classified based on the MNA-SF score as follows: malnutrition (score ≤ 7), risk of malnutrition (score = 8–11), and well-nourished (score = 12–14) [17]. The reliability and validity of the Persian MNA-SF have been previously supported by psychometric research and it has been evaluated as a valid and reliable scale of nutritional status in Iranian older adults [18].

2.4. Nutritional habits assessment

The third part of the questionnaire was based on the PM recommendations regarding NH. The data collection tool to examine eating and drinking habits from the perspective of PM was a researcher-made questionnaire. In this regard, the related traditional manuscripts such as *Al-Qanoun fi al-Tibb* [19], *Alhavi fi al Tibb* [20], and *Zakhireye Kharazmshahi* [21], were evaluated. Later, item generation (31 items) was performed by an expert panel. The content validity of the questionnaire was evaluated by 10 experts to see if each of the items well constitutes content relevance and confirmed after applying their opinions. The reliability of the questionnaire was assessed and confirmed using internal consistency (Cronbach's alpha) with the participation of 90 volunteers ($\alpha = 0.78$).

To evaluate content validity, the items were given to 10 experts in PM and based on their opinions, the content validity index (CVI) and content validity ratio (CVR) were calculated. The CVI shows the clarity, simplicity, and relevance of the items and the CVR determines the importance and necessity of the items. The opinions of the expert panel were applied to the scale. The minimum acceptable value of CVR based on the number of experts and the Lawshe table is ≥ 0.49 [22] and the minimum acceptable value of CVI is ≤ 0.80 [23]. To evaluate face validity, 15 older people were interviewed face to face, and cases related to the ambiguity (possibility of misperceptions) and level of difficulty in understanding expressions were investigated ensuring the questions and answers are meaningful and suggestions for correction were applied in the tool.

This part of the questionnaire consisted of 31 questions (Q); their responses ranged from "always" to "never" on a 5-point scale. Scores from nine subscales (food combinations (5Q), drinking (11Q), eating (7Q), time of meals (3Q), eating and season (1Q), eating and bathing (2Q), eating and physical activity (1Q), and eating and sleeping (1Q)) have been summed to generate a total NH score with a maximum score of 150. A higher score represents a better NH. The subjects of the questions discussed in each subscale are given in Table 4.

2.5. Statistical analysis

Statistical analysis was performed using SPSS statistical software, version 25. Based on their distribution, the percentages and absolute frequencies were used to describe qualitative data and the mean or median for quantitative ones. The data comparison was made using the chi-square test for qualitative and student t-test or ANOVA for quantitative variables. The correlation between NH and MNA-SF scores was also assessed by Pearson correlation analysis. Tukey's post hoc analysis was utilized for comparisons of NH total scores at different educational levels. In all analyzes, $p < 0.05$ was considered significant.

3. Results

3.1. Socio-demographic characteristics

As shown in Table 1, most participants in this study were female (56.4 %) and single (72.7 %). Most of the subjects were illiterate (48.2 %), housewives (51.5 %), and nonsmokers with normal hearing but impaired vision. The common type (77 %) of household structure was the nuclear family. Cardiovascular disease, diabetes, asthma, and cancer

Table 1
Demographic characteristics.

Characteristics	Number of patients (%)
Gender	
Male	549 (43.6 %)
Female	710 (56.4 %)
Marital status	
Single, separated, widow	915 (72.7 %)
Married, polygamy	344 (27.3 %)
Employment status	
Employed	95 (8.5 %)
Retired	337 (30.1 %)
Unemployed	111 (9.9 %)
Housewife	577 (51.5 %)
Place of birth	
City	618 (49.2 %)
Town	639 (50.8 %)
Education level	
Illiterate	607 (48.2 %)
Less than high school	490 (38.9 %)
High school graduate/diploma	85 (6.8 %)
University	77 (6.1 %)
Tobacco use	
Smoker	125 (9.9 %)
Non smoker	1046 (83.1 %)
Stopped	88 (7.0 %)
Hookah use	
Smoker	27 (2.1 %)
Non smoker	1195 (94.9 %)
Stopped	37 (2.9 %)
Household structure	
Alone	151 (12 %)
Nuclear	970 (77 %)
Extended	110 (8.7 %)
Other	28 (2.2 %)
Chronic diseases	
Healthy	715 (52.52 %)
Cardiovascular disease	293 (21.53 %)
Diabetes	289 (21.23 %)
Asthma	52 (3.83 %)
Cancer	12 (0.89 %)

As there might be missing values, valid percentage is presented.

were reported by 21.53 %, 21.23 %, 3.83 %, and 0.89 % of the participants, respectively.

3.2. Relationship between NH and socio-demographic characteristics

The mean total score of NH for the studied population was 108.66 ± 7.912 , which ranged from 82 to 136. The comparison of the total scores of NH with the characteristics of participants showed that the total score of NH was significantly different based on the employment status ($p = 0.007$) and the level of education ($p = 0.021$). In this regard, the results showed that unemployed individuals had significantly higher NH scores than retired participants ($p = 0.005$). In addition, higher NH scores for individuals with a diploma compared to the participants with primary educational levels ($p = 0.001$) were observed. Moreover, individuals with normal hearing status had significantly higher NH scores than those with impaired hearing status. No significant association was found between NH and other socio-demographic characteristics (Table 2).

3.3. Correlation between NH and nutritional status

Based on the present research findings regarding the nutritional status of the studied population ($N = 1259$), 69.7 % of participants were

Table 2
Relationship between total score of NH and demographic variables.

Characteristics	Total score of NH (Mean $\pm$ SD)	<i>p</i> value
Gender		
Male	108.62 ± 7.725	0.878 ^a
Female	108.69 ± 8.060	
Marital status		
Single, separated, widow	109.17 ± 8.352	0.149 ^a
Married, polygamy	108.46 ± 7.738	
Employment status		
Employed	107.60 ± 6.136	0.007**
Retired	107.15 ± 7.456	
Unemployed	109.68 ± 7.403	
Housewife	108.72 ± 8.147	
Place of birth		
City	108.72 ± 7.992	0.784 ^a
Town	108.60 ± 7.837	
Education level		
Illiterate	108.67 ± 7.938	0.021**
Less than high school	108.13 ± 7.717	
High school graduate/diploma	110.77 ± 8.680	
University	109.48 ± 7.702	
Tobacco use		
Smoker	109.43 ± 8.106	0.050**
Non smoker	108.53 ± 8.200	
Stopped	108.57 ± 7.868	
Hookah use		
Smoker	105.89 ± 9.429	0.064**
Non smoker	106.92 ± 7.961	
Stopped	108.77 ± 7.864	
Hearing status		
Normal	108.99 ± 8.080	0.036 ^a
Impaired	108.00 ± 7.487	
Vision status		
Normal	108.93 ± 8.404	0.363 ^a
Impaired	108.50 ± 7.531	

** Results based on analysis of variances (ANOVA).

NH, Nutritional Habits.

^a Results based on independent sample t-test.

well-nourished, 27.6 % were at risk of malnutrition, and 2.6 % were malnourished. The score of each subscale of NH was compared according to different nutritional statuses. The results demonstrated that in the subscale of "eating habits" the mean NH score was significantly lower ($p = 0.014$) in the well-nourished compared to the malnourished group, while in the subscale of "time of meals" the higher NH score was observed ($p = 0.001$) (Table 3). Detailed analysis of the correlation between the questions regarding NH and MNA-SF scores showed a positive correlation between questions 14, 24, 25, 26, and 31 and the MNA-SF score (Table 4). Furthermore, the subscales of "time of meals" and "eating and sleeping" as a whole were positively correlated with the MNA-SF score ($p < 0.001$ and $p = 0.033$, respectively). On the other hand, a negative correlation was observed between questions 2, 15, and 18 and the MNA-SF score. Moreover, the subscale of "eating habits" as a whole was negatively correlated with this score ($p = 0.019$) (Table 4).

4. Discussion

In the present study, we tried to find any relations between PM nutritional recommendations and nutritional status in older adults. The results of the present study indicated that some NH of PM could affect nutritional status. Among the sub-scales designed in the present study, the sub-scales for "eating habits" and "time of meals" showed significant differences among nutritional status groups. In this regard, individuals who eat their meals at specific times were in better nutritional status. Epidemiological studies have stated an association between meal timing and health status [24]. Additionally, it can control physical hunger and reduce the consumption of snacks with low dietary value [25]. Eating meals irregularly is related to the risk of obesity and diabetes. Thus, it is essential to consider meal timing in order to decrease the risk of negative health outcomes [26]. Moreover, from the PM point of view, nature is adapted to eating meals at a specific time; any alteration in this timetable may negatively affect digestive functions [27], which is in line with our results.

Assessment of the score of the "eating habits" sub-scale among different nutritional status groups showed a significant difference. Surprisingly, older individuals with a high score of eating habits were in worse nutritional status than those who had unhealthy eating habits from the PM point of view. Furthermore, correlation analysis of the "eating habits" sub-scale with the MNA-SF total score revealed a negative correlation. In the next stage, we analyzed seven questions in the "eating habits" sub-scale based on their MNA-SF total scores which showed a significant negative correlation only for the question about stopping eating before feeling full. A more detailed correlation analysis was applied for each question of the MNA-SF questionnaire to find which

Table 3
Relationship between NH and nutritional status.

Habits related to	Malnourished	At risk of malnutrition	Well nourished	<i>p</i> value ^a
Food combinations	15.58 ± 2.610	15.11 ± 2.135	15.25 ± 1.716	0.261
Drinking	40.52 ± 4.178	39.27 ± 4.507	39.51 ± 4.330	0.278
Eating habits	24.84 ± 2.952	24.22 ± 3.136	23.77 ± 2.975	0.014
Time of meals	12.21 ± 2.421	12.35 ± 2.431	12.82 ± 1.974	0.001
Eating and season	3.48 ± 1.034	3.32 ± 0.859	3.41 ± 0.831	0.194
Eating and bathing	6.52 ± 1.326	6.68 ± 1.432	6.57 ± 1.315	0.439
Eating and physical activity	4.55 ± 0.711	4.38 ± 0.932	4.41 ± 0.850	0.553
Eating and sleeping	2.73 ± 0.839	2.69 ± 0.856	2.80 ± 0.913	0.162

NH, Nutritional Habits.

^a Results based on analysis of variances (ANOVA).

Table 4
Correlation between NH questionnaire items with MNA-SF score.

Habits related to	MNA-SF Correlation coefficient (r)	<i>p</i> value ^a
Food combinations Q1: Do you use appetizers such as soups, salads, etc. before meals?	-0.009	0.757
Q2: Do you use salads with food?	0.041	0.145
Q3: Do you use yogurt with food?	-0.056	0.048
Q4: Do you use different kinds of foods in one meal?	-0.031	0.273
Q5: Do you eat desserts, fruits, sweets or other side dishes after meal?	0.013	0.633
	0.013	0.656
Drinking Q6: Do you drink water when you are not thirsty?	0.000	0.990
Q7: Do you usually drink cold drinks such as water, soft drinks, etc. immediately after a meal?	0.017	0.558
Q8: Do you drink water, If you wake up in the middle of the night?	0.055	0.052
Q9: Do you drink water before eating breakfast in the morning?	0.000	0.995
Q10: Do you use water and beverages such as juices and sirups immediately after bathing, swimming and sauna?	-0.018	0.527
Q11: Do you use water and beverages such as juices and sirups during exercise or vigorous physical activity?	0.043	0.129
Q12: Do you drink water immediately after eating fruit?	-0.016	0.576
Q13: Do you drink water immediately after eating high-fat foods?	0.006	0.828
Q14: How many glasses of water do you drink daily in hot seasons, such as summer?	-0.052	0.067
Q15: How many glasses of cold drinks (such as water, soft drinks, etc.) do you drink with food?	0.103	< 0.001
Q16: How do you drink water when you are thirsty?	-0.076	0.007
	-0.051	0.069
Eating habits Q17: Do you chew your food thoroughly?	-0.066	0.019
Q18: Do you stop eating before feeling full?	0.038	0.183
Q19: Do you eat when you are not hungry?	-0.074	0.008
Q20: Do you watch TV while eating?	-0.008	0.789
Q21: Do you talk while eating?	-0.055	0.053
Q22: How long does it take you to eat your meals (breakfast, lunch, dinner)?	-0.010	0.730
Q23: How long does it take you to start eating after feeling hungry?	-0.054	0.058
	-0.008	0.779
Time of meals Q24: Do you eat breakfast at a set time?	0.109	< 0.001
Q25: Do you eat lunch at a set time?	0.111	< 0.001
Q26: Do you eat dinner at a set time?	0.104	< 0.001
	0.100	< 0.001
Eating and season Q27: Do you eat cucumbers (in salads, etc.) in winter?	0.036	0.2
	-0.002	0.949
Eating and bathing Q28: Do you bathe when you are hungry?	0.039	0.171
Q29: Do you bathe immediately after a meal?	-0.039	0.164
	0.000	0.977
Eating and physical activity Q30: Do you do any high intensity physical activity (running, exercise, etc) up to 2 h after a meal?	0.060	0.033
Eating and sleeping Q31: How long do you wait to go to bed after dinner?		

NH, Nutritional Habits; MNA-SF, Short form of the complete Mini Nutritional Assessment.

^a Results based on Pearson correlation.

items were more associated with stopping eating before feeling full. Even though the correlation between the question about stopping eating before feeling full and anthropometric parameters was insignificant, the other four items of the MNA-SF questionnaire were positively correlated with this question. One of the possible explanations for these findings may be attributed to the loss of appetite directly or indirectly (loss of mobility or physiological and emotional stress). It seems that loss of appetite may be a factor for the earlier ending of the meal. Since the target of this question is people with sufficient appetite but with a natural desire to finish eating before feeling full, it can be misleading in participants with a loss of appetite. Therefore, the significant negative correlation observed between the question about stopping eating before feeling full and the MNA-SF score may not reflect an accurate picture for individuals with a higher score for this habit.

Although the assessment of NH based on the nutritional status groups was not significant for other sub-scales, the detailed analysis of each question according to the MNA-SF total score revealed significant correlations for questions related to having salad during meals and drinking sufficient water and time-interval between dinner and sleep. The water in PM references is considered a conveyor of ingested food within the gastrointestinal system and its role in absorption, digestion, and disposal of waste matters of food metabolism has been demonstrated as well [28]. Moreover, the recommendations for drinking beverages, including the amount of daily water consumption, time of drinking, and time intervals between drinking and physical activities, bath/swimming, and meals, are stated in PM manuscripts [27]. A study done by Gazan et al. shows that considerable water consumers have healthier fluid intake and nutritional patterns [29]. In our study, the question about the amount of daily water consumption during hot seasons showed a positive correlation with MNA-SF total score. This point ties well with the view of PM [30]. Since we assessed the daily amount of water consumption in hot seasons in which drinking a higher amount of water best suits the needs of this climate.

The other question in the "drinking" sub-scale is related to drinking cold beverages with food. Our results demonstrated a higher MNA-SF total score among people with this habit. PM believes that drinking beverages should be avoided during meals and postponed to at least 1 h after a meal [31]. We assume that inconsistencies between our results and the recommendations mentioned above may be related to different Mizaj of organs such as the stomach in each person [32], therefore considering the answers from a personal background of individuals may better clarify this relationship.

Although eating multiple kinds of food throughout one meal due to differences in their digestion time should be avoided from the PM point of view [33], using vegetables with high fiber as a side dish may be effective for the digestive system [34,35].

Our analysis demonstrated a positive correlation between the MNA-SF total score and the time interval between eating dinner and bedtime. Therefore, older individuals who did not immediately sleep after dinner were in better nutritional status. Overall, these findings are under PM recommendations that sleep should be postponed until the passage of food through the stomach [27]. It has also been demonstrated that sleep per se can help digestion [36]. However, a study done by Maw et al. shows that 2 h or shorter between dinner and bedtime did not influence HbA1c changes in middle-aged and elderly Japanese people. Instead, the focus should be on maintaining a normal BMI and abstaining from smoking and consuming alcohol to ensure better health conditions in the long term [37].

The higher NH score of unemployed older people compared to retired ones may be related to the lifestyle of employed people, including lack of time for eating a meal, work-related stress, and unscheduled meals in employed participants. Moreover, the higher NH score of individuals with a diploma compared to those with less than a high school education may arise from better knowledge of educated people regarding healthy lifestyles and dietary habits. A study done by Rippin et al. shows Participants with higher educational status had

better nutritional intakes, particularly within lower GDP countries [38].

The large sample size and questionnaire with a wide range of questions, which cover different aspects of health and life in older individuals, are the strength of our research. However, the main limitations are 1) cross-sectional study design, 2) selection of older adults only from city residents, and 3) using self-reported data for medication use and underlying diseases.

5. Conclusions

Eating meals at specific time points is associated with better nutritional status among older individuals. Therefore, due to the role of NH in determining nutritional status, lifestyle modifications, including dietary habits and meal timing could prevent malnutrition and other related complications in older people.

Statements of

What is already known about the topic?

- Nutritional conditions may be affected by aging and its consideration has been particularly recommended for older individuals.
- The importance of dietary advice of Persian medicine (PM) in improving nutritional status has not been subject to extensive testing.

What does this paper add?

- Following PM advice regarding eating, drinking, and maintaining the time interval between dinners and sleeping may partially improve older adults' nutritional status.

CRedit authorship contribution statement

Conceptualization; Akbar Azizi-Zeinalhajlou. Data curation; Mostafa Araj-khodaei. Formal analysis; Alireza Bagherzadeh Karimi. Funding acquisition; Mostafa Araj-khodaei. Investigation; Zahra Yousefi. Methodology; Morteza Mojahedi. Project administration; Sarvin Sanaie. Resources; Akbar Azizi-Zeinalhajlou. Software; Fatemeh Jahanjoo. Supervision; Mostafa Araj-khodaei, Sarvin Sanaie. Validation; Fatemeh Jahanjoo. Visualization; Saba Nikanfar. Writing – original draft; Saba Nikanfar. Writing – review & editing, Sarvin Sanaie.

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Ethical statement

The study was conducted in accordance with the Declaration of Helsinki (1964) and was approved by the ethical committee of Tabriz University of medical sciences. (TBZMED.REC.1398.1097).

Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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Author contributions

Conceptualization: AAZ, SS, SN, MAK. Data analysis/interpretation: ZYK, ABK, FJ, MM. Writing – original draft: MAK, AAZ. Writing – review & editing: SS, ZYK, ABK, SN, FJ. Final approval: AAZ, SS, ZYK, ABK, SN, FJ, MAK.

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