



The Relationship Between Nutrition and Exercise Habits and Biochemical Parameters in Non-Smoking Elderly Individuals

Gokhan Dogukan Akarsu¹, Meral Ekim²

¹Yozgat Bozok University, School of Health Services, Pharmacy Services Program, Yozgat, Türkiye

²Yozgat Bozok University, Faculty of Medicine, Department of Medical Biochemistry, Yozgat, Türkiye

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Abstract

Aim: The aim of this study is to examine the relationship between nutrition, physical activity and biochemical parameters in non-smokers aged 65 and over.

Material and Method: The study was completed with 180 participants in the cardiovascular surgery outpatient clinic of a public hospital located in Central Anatolia, Türkiye. Data were collected using a questionnaire form prepared by the researchers. Independent sample t-test and Pearson correlation test were used in the analysis of the data.

Results: The mean age of the participants was 72.36±5.65 years, 56.7% were illiterate, 60% had less income than expenses, and 73.3% had chronic diseases. It was determined that individuals who consumed at least one serving of fruit/vegetables per day had significantly lower glucose ($p<0.05$) and HDL ($p<0.05$) levels compared to those who consumed more. Participants who exercised for at least 30 minutes three times a week had significantly higher B9 levels ($p<0.05$). Fish consumption was associated with lower glucose, creatinine, cholesterol, HDL and B12 levels ($p<0.05$).

Conclusion: The study emphasizes that regular nutrition and physical activity have a significant effect on biochemical parameters in elderly individuals. It is recommended that social policies be implemented to improve nutrition and exercise habits in order to promote healthy aging, improve quality of life and support better health outcomes among the elderly population.

Keywords: Nutritional status, health services for the aged, diet, healthy, biochemistry, exercise

INTRODUCTION

The number of elderly people worldwide is rapidly increasing. According to the United Nations' 2022 report, the global population aged 60 and over is around 1.1 billion, and this number is expected to reach 2.1 billion by 2050 (United Nations, 2022) (1). A similar increase is observed in Türkiye, as well; according to data from the Turkish Statistical Institute (TÜİK), as of 2023, the population aged 65 and over is approximately 9.5 million, constituting 11.6% of the total population (TÜİK, 2023) (2). These figures indicate that Türkiye has a rapidly aging population, emphasizing the growing importance of efforts to protect the health and improve the quality of life of elderly individuals.

The aging process is influenced by many variables, including biological, environmental, genetic, and socioeconomic factors (3). Lifestyle factors such as dietary habits, level of physical activity, presence of chronic diseases, and use of tobacco and alcohol can determine the pace of aging and the quality of life of individuals (4). Additionally, genetic predisposition and environmental factors also shape the biological processes of aging. For example, healthy dietary habits and regular exercise contribute to healthier aging by reducing inflammation and oxidative stress levels in the body of elderly individuals (5).

With the aging process, individuals' nutrition and physical activity habits play a critical role in determining their health status (6). Regular nutrition and exercise

CITATION

Akarsu GD, Ekim M. The Relationship Between Nutrition and Exercise Habits and Biochemical Parameters in Non-Smoking Elderly Individuals. Med Records. 2025;7(2):299-305. DOI:1037990/medr.1557023

Received: 27.09.2024 Accepted: 20.01.2025 Published: 08.05.2025

Corresponding Author: Gokhan Dogukan Akarsu, Yozgat Bozok University, School of Health Services, Pharmacy Services Program, Yozgat, Türkiye

E-mail: gokhan_dogukan_akarsu@hotmail.com

habits have a significant impact on regulating various biochemical parameters, especially in elderly individuals who do not smoke (7). While smoking can contribute to the development of many diseases by triggering oxidative stress and inflammation processes (8), the impact of nutrition and exercise on the biochemical parameters of non-smoking individuals has not yet been fully understood.

Studies have shown that healthy nutrition and regular physical activity have positive effects on cardiovascular health, metabolic balance, and overall quality of life in elderly individuals (9). Additionally, exercise is known to have beneficial effects on biochemical parameters such as blood glucose, cholesterol, and triglycerides (10). Therefore, examining the relationship between nutrition and exercise habits and biochemical parameters in non-smoking elderly individuals can play an important role in supporting the healthy aging process of this group.

In this study, the aim is to investigate the relationship between nutrition and exercise habits and certain biochemical parameters in non-smoking elderly individuals, in order to obtain scientific data that will support strategies for improving the quality of life and healthy aging of elderly individuals.

MATERIAL AND METHOD

Study Desing and Ethical Considerations

This research is a cross-sectional study.

The study protocol was approved by the clinical ethics committee of the hospital where the research was conducted (Yozgat Bozok University Clinical Research Ethics Committee date: 22/09/2022, number: 2017-KAEK-189_2022.09.22_02). Informed voluntary consent was obtained from all participants (prepared in 24-point Times New Roman font for the elderly to read, read slowly and in an understandable manner by the researcher accompanied by the participants) and the rules of the Declaration of Helsinki were followed.

Population and Sample

The study population consisted of elderly individuals who visited the cardiovascular surgery outpatient clinic of a research and practice hospital in Central Anatolia between January and March 2024. In this cross-sectional study, 240 elderly patients visited the clinic during the specified period. The study sample included all patients (n=180) who met the inclusion criteria and agreed to participate in the research. Patients were enrolled in the study based on the order of their outpatient clinic visits.

Data Collection

Data were collected between January and March 2024 using a two-stage process. The first stage involved a questionnaire on sociodemographic characteristics, nutrition, and exercise habits, conducted face-to-face by the researcher. Participants were asked survey questions, and

their responses were recorded. Their height and weight were measured, and their Body Mass Index (BMI) was calculated. To ensure clarity for elderly participants, questionnaires were prepared in 24-point Times New Roman font and read aloud slowly. Individuals with any food intolerance, those using medications affecting vitamin absorption (e.g., Methotrexate, Carbamazepine, Sulfonamides), those taking medications for gastrointestinal conditions (e.g., Crohn's Disease, Ulcerative Colitis, and Proton Pump Inhibitors), and individuals with conditions such as cancer or rheumatic diseases were excluded from the study. In the second stage, blood samples were taken, and biochemical parameters such as glucose, cholesterol, creatinine, HDL, B9, and B12 were analyzed. Blood samples were collected by nurses in the hospital's blood collection unit and analyzed by the primary researcher in the hospital's laboratory.

Data Collection Forms

The data collection forms included questionnaires that gathered sociodemographic information (such as age, education level, income, chronic disease status, etc.) as well as details about participants' nutritional and exercise habits. Nutrition habits and physical activity levels were assessed through self-reported questionnaires. Participants were asked to provide information on the foods they consumed and the exercises they performed over a specific period. The data related to nutrition and physical activity were collected in a way that accurately reflects the participants' habits (Daily portions of fruits and vegetables consumed, pasta consumption, regular weekly fish consumption, breakfast habits, and weekly exercise duration). In addition, blood values were analyzed to measure biochemical parameters.

Data Analysis

Data were analyzed using SPSS 25. Descriptive statistics (frequency, percentage, mean, standard deviation) were used. Normality was tested using the Shapiro-Wilk test, and comparisons between nutrition/exercise habits and biochemical parameters were made with an independent sample t-test. Pearson correlation was applied for continuous variables, with statistical significance set at $p < 0.05$.

RESULTS

The demographic characteristics of non-smoking elderly individuals are presented in Table 1. The average age of the participants is 72.36 ± 5.65 years, and the average BMI is 28.68 ± 4.62 . 56.7% of the individuals are illiterate and live in the city center, 83.2% are not employed, 60% have an income less than their expenses, and 73.3% have a chronic illness. Among the elderly with chronic illnesses, 45.4% have both hypertension and diabetes (Table 1).

Table 2 presents the comparison of certain health behaviors of the participants with their blood parameters. Individuals who regularly consume at least one portion

of fruit per day have statistically significantly lower blood glucose, cholesterol, and HDL levels compared to those who consume more fruit ($p<0.05$). The frequency of consuming at least one portion or more of fruit daily does not affect the blood creatinine, B9, and B12 levels of the participants ($p>0.05$).

Individuals who regularly consume at least one portion of vegetables per day have lower B12 and glucose levels and higher HDL and B9 levels compared to those who consume more vegetables, and this difference is statistically significant ($p<0.05$). The frequency of consuming at least one portion or more of vegetables daily does not affect the creatinine and cholesterol levels of the individuals ($p>0.05$). Participants who consume at least one portion of fish per week have statistically significantly lower glucose, creatinine, cholesterol, HDL, and B12 levels compared to those who do not consume fish ($p<0.05$). The frequency of consuming at least one portion of fish per week does not affect the B9 levels of the participants ($p>0.05$).

Participants who regularly have breakfast have statistically significantly lower HDL and B12 levels compared to those who do not ($p<0.05$). The habit of having breakfast

does not affect the glucose, creatinine, cholesterol, and B9 levels of the participants ($p>0.05$). Participants who engage in physical activity for at least 30 minutes three times a week have statistically significantly higher B9 levels compared to those who do not exercise ($p<0.05$). The regular exercise habit (at least 30 minutes three times a week) does not affect the glucose, creatinine, cholesterol, HDL, and B12 levels of the participants ($p>0.05$) (Table 2).

The correlation of participants' age and BMI with certain biochemical parameters is presented in Table 3. There is a statistically significant weak positive relationship between individuals' ages and cholesterol levels, and a statistically significant weak negative relationship with B9 and B12 levels ($p<0.05$). There is no statistically significant relationship between participants' ages and creatinine or HDL levels ($p>0.05$). A statistically significant weak negative relationship was found between individuals' BMI and creatinine levels, a weak positive relationship with B9 levels, and a moderate positive relationship with cholesterol and HDL levels ($p<0.05$). There is no statistically significant relationship between participants' BMI and B12 levels ($p>0.05$).

Table 1. Distribution of some demographic characteristics of the participants			
Characteristics		n	%
Average age (Min.-Max.)		72.36±5.65 (65-89) years	
Average BMI (Min.-Max.)		28.68±4.62 (20.20-36.74) kg/m ²	
Education	Illiterate	102	56.7
	Primary education	78	43.3
Place of residence	Village/district	78	43.3
	City	102	56.7
Employment status	Yes	30	16.7
	No	150	83.3
Income status	Income less than expenses	108	60.0
	Income equal to expenses	66	36.7
	Income more than expenses	6	3.3
Chronic illness status	Present	132	73.3
	Absent	48	26.7
Chronic diseases*	Heart disease	24	18.2
	Hypertension	30	27.7
	Diabetes	12	9.1
	Hypertension-hypothyroid	6	4.5
	Hypertension-diabetes	60	45.4
*It has been calculated based on n=132			

Table 2. Comparison of certain health behaviors with blood parameters of the participants

Parameters	n	%	Glucose, mg/dL, N (74–109)	Creatinine, mg/dL, N (0.7–1.2)	Cholesterol, mg/dL, N (3–200)	HDL, mg/dL, N (35–55)	VitB9 (ng/ml) N (3–17)	VitB12 (pg/ml) N (200–800)
			Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Regularly consuming at least one portion of fruit per day								
Consumers	102	56.7	119.13±24.88	0.80±0.16	176.83±37.67	49.28±9.45	7.33±3.71	358.99±123.21
Higher consumers	78	43.3	182.51±139.16	0.85±0.18	199.97±22.18	55.74±9.56	7.25±3.39	364.01±133.81
Test/p			-2.924, 0.006	-1.480, 0.141	-3.383, 0.001	-2.984, 0.004	0.138, 0.890	-0.261, 0.794
Regularly consuming at least One portion of vegetables per day								
Consumers	114	63.4	118.67±21.53	0.79±0.16	185.82±36.08	53.22±11.07	8.07±3.56	344.20±113.36
Higher consumers	66	36.6	215.98±153.40	0.85±0.19	177.73±32.31	47.52±4.17	6.35±3.04	394.65±151.82
Test/p			-3.461, 0.002	-1.812, 0.072	0.853, 0.396	3.422, 0.001	3.026, 0.003	-2.473, 0.014
Consuming at least one portion of fish per week								
Consumers	54	30.0	120.01±22.68	0.75±0.11	166.18±37.15	48.30±5.45	6.88±2.93	316.26±116.04
Non-consumers	126	70.0	155.59±111.95	0.85±0.18	195.06±29.18	53.42±11.34	7.46±3.79	380.41±127.87
Test/p			-2.606, 0.011	-4.092, 0.000	-3.617, 0.001	2.787, 0.007	-1.057, 0.293	-3.169, 0.002
Having breakfast								
Breakfast eaters	108	60.0	156.02±116.65	0.82±0.14	178.55±30.25	48.18±4.22	7.19±3.70	344.09±149.13
Non-breakfast eaters	72	40.0	127.44±47.28	0.82±0.20	190.25±39.74	55.00±12.57	7.44±3.41	386.78±80.03
Test/p			1.745, 0.085	0.071, 0.944	-1.473, 0.145	-3.328, 0.002	-0.449, 0.654	-2.486, 0.014
Regular exercise (at least three days a week, at least 30 minutes)								
Exercisers	24	13.3	128.93±22.04	0.84±0.19	182.05±9.97	56.50±7.83	10.22±3.68	381.80±56.30
Non-exercisers	156	86.7	145.02±99.06	0.82±0.17	184.30±38.09	50.77±10.05	6.81±3.32	357.99±135.08
Test/p			-1.416, 0.160	0.527, 0.599	0.409, 0.684	1.876, 0.064	4.593, 0.000	1.508, 0.136

Table 3. Correlation of age and BMI with certain biochemical parameters					
	Creatinine (mg/dL), N (0.7–1.2)	Cholesterol (mg/dL), N (3–200)	HDL (mg/dL), N (35–55)	VitB9 (ng/ml) N (3–17)	VitB12 (pg/ml) N (200–800)
Age (year)	r=0.116	r=0.249	r=0.204	r=-0.217	r=-0.187
	p=0.184	p=0.028	p=0.073	p=0.005	p=0.012
BMI kg/m²	r=-0.262	r=0.588	r=0.346	r=0.165	r=-0.028
	p=0.002	p=0.000	p=0.002	p=0.032	p=0.713
*The relationship between blood glucose levels has not been examined due to some participants having diabetes; **N=normal range					

DISCUSSION

It was determined that elderly individuals who consume at least one serving of fruit per week appear to be healthier in terms of certain biochemical parameters compared to those who consume larger amounts. Studies have shown that fruit consumption plays an important role in regulating blood glucose levels and reducing the risk of cardiovascular diseases (11,12). In particular, antioxidants and flavonoids found in fruits can help control blood sugar levels by increasing insulin sensitivity (13,14). Additionally, the high fiber content of fruits contributes positively to the blood lipid profile by reducing cholesterol absorption. There are also studies indicating that regular consumption of fruits and vegetables lowers LDL cholesterol levels (15,16).

However, some studies have shown that excessive fruit consumption, especially those high in fructose, can lead to an increase in insulin levels and consequently cause fluctuations in blood glucose (17). In our study, elderly individuals who consumed more than one serving of fruit per day were found to have higher levels of HDL, cholesterol, and blood glucose. Therefore, maintaining a balanced and moderate fruit intake is important for the healthy management of blood glucose, HDL, and cholesterol levels.

In our study, consuming one serving of fruit per day or more did not affect B12 and B9 levels. While regular fruit/vegetable consumption has been reported to increase B9 levels in the literature, it does not have a direct impact on B12 levels (18,19). However, in this study, individuals who consumed more than one serving of vegetables per day had higher B12 levels but lower B9 levels. This may be due to the fact that the B9 and B12 levels of the elderly participants were already within normal reference ranges, as well as factors such as the diversity of dietary habits, diet balance, consumption practices, and food sources among elderly individuals.

Participants who consumed at least one serving of fish per week were found to have lower levels of glucose, creatinine, cholesterol, HDL, and B12 compared to those who did not consume fish ($p<0.05$). Fish is rich in omega-3 fatty acids, which have the potential to reduce inflammation and improve heart health. Omega-3 fatty acids lower triglyceride levels, increase HDL levels, and reduce the risk of cardiovascular disease (20). In one study, it was found

that individuals who consumed at least one serving of fish per week had a significantly reduced risk of developing heart disease (21,22). These findings support the positive effects of fish consumption on metabolic health in elderly individuals.

In this study, fish consumption was found not to affect B12 levels. This may be related to the decreased absorption of B12 in elderly individuals. During the aging process, changes in the gastrointestinal system, especially the reduction in stomach acid production and alterations in intestinal motility, can negatively impact B12 absorption (23). Reduced stomach acid makes it more difficult for vitamin B12 to be released from proteins, leading to decreased absorption (24). Additionally, certain health issues common in elderly individuals and the use of certain medications (e.g., proton pump inhibitors) can also adversely affect B12 absorption. Therefore, despite consuming a diet that contains sufficient amounts of vitamin B12 (such as fish), B12 levels may remain below the expected range due to absorption issues (25).

In our study, individuals who regularly had breakfast were found to have significantly lower HDL and B12 levels compared to those who did not have breakfast ($p<0.05$). The reason for the low B12 levels may be due to insufficient consumption of B12-rich foods during breakfast or absorption problems seen in the elderly. Reduced B12 absorption related to stomach acid and intrinsic factor deficiency in elderly individuals may explain this situation (26). The lower HDL levels in those who had breakfast could be due to the consumption of processed carbohydrates or insufficient intake of healthy fats and proteins during breakfast (27). The fact that glucose, creatinine, cholesterol, and B9 levels were not affected by breakfast consumption ($p>0.05$) indicates that breakfast did not have a significant impact on these parameters. Although the literature suggests that breakfast has positive effects on glucose metabolism, this effect was not observed in the elderly participants of this study (28).

In our study, participants who engaged in at least 30 minutes of exercise three times a week had significantly higher B9 levels compared to those who did not exercise ($p<0.05$). This finding suggests that physical activity positively influences folate metabolism and contributes

to maintaining folate levels in an active lifestyle. It is indicated that physical activity may help tissues better absorb essential vitamins like folic acid by increasing blood circulation in the body (29).

However, it was observed that regular exercise did not affect glucose, creatinine, cholesterol, HDL, and B12 levels ($p>0.05$). The effects of physical activity on biochemical parameters, especially in elderly individuals, can be complex. Due to the slower metabolic rate in the elderly and the lower intensity of physical activity compared to younger individuals, it may not have created a significant impact on these biochemical parameters (30). Additionally, the participants' existing dietary and lifestyle habits may have also contributed to these results.

Limitations

This study has some limitations. The research was conducted in a specific region, and the generalizability of the findings may be limited due to the lack of consideration of other demographic variables.

CONCLUSION

This study examined the relationship between health behaviors and biochemical values in elderly individuals, highlighting the positive effects of a balanced diet and regular physical activity on overall health. The findings underscore the critical importance of preventive medicine and health counseling in maintaining and improving the well-being of older adults. In particular, family medicine services play a vital role in helping elderly individuals monitor their health regularly and adopt healthy lifestyle habits. Family physicians not only support individuals in maintaining their health but also contribute to preventing more severe health problems.

Therefore, it is essential to encourage elderly individuals to attend regular medical check-ups and pay attention to their lifestyles. Projects and awareness campaigns that aim to enhance health literacy within the community could be a significant step forward. Our study demonstrates that preventive medicine practices and health counseling are key to ensuring a healthy and high-quality life for older adults.

Financial disclosures: The authors declared that this study has received no financial support.

Conflict of interest: The authors have no conflicts of interest to declare.

Ethical approval: The ethical approval for the study was obtained from the clinical ethics committee of the hospital where the study was conducted (Yozgat Bozok University Clinical Research Ethics Committee date: 22/09/2022, number: 2017-KAEK-189_2022.09.22_02).

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