ORIGINAL RESEARCH ARTICLE

Healthy lifestyle beliefs, nutritional behaviors, and physical activity of adolescents: A mediation analysis

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Abstract

Although the Covid-19 pandemic has ended, its negative impacts on adolescents' physical activity levels, nutritional behaviors, and healthy lifestyle beliefs persist. This study aimed to examine whether physical activity (PAS) mediates the relationship between healthy lifestyle beliefs (HLB) and nutritional behaviors (NBS) among adolescents. This study was a quantitative study, with a cross-sectional survey design. It was conducted during the 2022–2023 academic year in Anatolian high schools in Turkey, and it involved 686 high school students aged 14–17 who voluntarily participated. Data were collected using a personal information form, the Healthy Lifestyle Beliefs Scale, the Physical Activity Scale (PAS), and the Nutrition Behavior Scale (NBS). Descriptive statistics (mean ± SD) and regression analysis were performed using SPSS 22.0 and the PROCESS macro v3.5 (Model 4) with a bootstrap resampling method (5000 samples). Results indicated that adolescents exhibited high levels of HLB, while PAS and NBS were at moderate levels. A moderate positive correlation was found between HLB and NBS (r=0.665, p=0.000), while low positive correlations existed between HLB and PAS (r=0.366, p=0.000), and PAS and NBS (r=0.330, p=0.000). Physical activity was found to partially mediate the relationship between HLB and NBS (0.049, 95% CI [0.0237, 0.0784]). These findings highlight the importance of promoting physical activity to support better nutritional behaviors, which may lead to healthier lifestyles and improved long-term health outcomes for adolescents. *(Afr J Reprod Health 2025; 29 [8s]: 83-93).*

Keywords: Healthy Life, Belief, Physical Activity, Nutrition, Adolescents

Résumé

Bien que la pandémie de Covid-19 soit terminée, ses effets négatifs sur le niveau d'activité physique, les comportements alimentaires et les croyances en matière de mode de vie sain chez les adolescents persistent. Cette étude visait à examiner si l'activité physique (PAS) joue un rôle médiateur dans la relation entre les croyances en matière de mode de vie sain (HLB) et les comportements alimentaires (NBS) chez les adolescents. Réalisée au cours de l'année scolaire 2022-2023 dans des lycées anatoliens en Turquie, l'étude a porté sur 686 lycéens âgés de 14 à 17 ans qui ont participé volontairement. Il s'agit d'une étude quantitative, avec un plan d'enquête transversal. Les données ont été recueillies à l'aide d'un formulaire d'informations personnelles, de l'échelle des croyances en matière de mode de vie sain, de l'échelle d'activité physique (PAS) et de l'échelle des comportements nutritionnels. Des statistiques descriptives (moyenne ± écart-type) et une analyse de régression ont été réalisées à l'aide du logiciel SPSS 22.0 et de la macro PROCESS v3.5 (modèle 4) avec une méthode de rééchantillonnage bootstrap (5000 échantillons). Les résultats ont indiqué que les adolescents affichaient des niveaux élevés de croyances en matière de mode de vie sain (HLB), tandis que l'échelle d'activité physique (PAS) et l'échelle des comportements nutritionnels (NBS) se situaient à des niveaux modérés. Une corrélation positive modérée a été observée entre les HLB et les NBS (r = 0.665, p = 0.000), tandis que de faibles corrélations positives existaient entre les HLB et les PAS (r = 0.366, p = 0.000) et entre les PAS et les NBS (r = 0.330, p = 0.000). L'activité physique s'est avérée être un facteur partiellement médiateur de la relation entre le HLB et le NBS (0.049, IC à 95 % [0.0237, 0.0784]). Ces résultats soulignent l'importance de promouvoir l'activité physique afin de favoriser de meilleurs comportements nutritionnels, qui peuvent conduire à des modes de vie plus sains et à une amélioration des résultats à long terme en matière de santé chez les adolescents. *(Afr J Reprod Health 2025; 29 [8s]: 83-93).*

Mots-clés: Vie saine, croyances, activité physique, nutrition, adolescents

Introduction

COVID-19, an infectious disease caused by the coronavirus, became a global pandemic, adversely impacting and causing a socio-economic downturn in over 200 countries, with millions of individuals and families affected and over two million fatalities.[1,2] Following the declaration of COVID-19 as a pandemic by World Health Organization, Turkey, like many national governments have introduced countermeasures to counteract the disease and avoid infections, including social distancing policies, closure of schools, shops and leisure opportunities, contact restrictions, and curfews.[3-5] While the COVID-19 restrictions during lockdown helped with reducing the spread of the virus, it has resulted in negative effects by limiting daily physical activities that people were used to like travelling and some forms of exercising.[3-5] As it is known, these restrictive measures were a very dangerous situation for everyone in society, from the young to the old, and negatively affected people's quality of life.[2,3] Lifestyle is all behaviors that are under the control of individuals and affect their health risks. According to the holistic health approach, health protection (risk reduction and prevention) and health promotion behaviors are an integral part of a healthy lifestyle. Health promotion is an important strategy for improving the overall health status of society and providing basic care services.[6] In order to develop healthy living behaviors in individuals, their beliefs in that area must first be determined.[7] The Health Belief Model (HBM) which examines the association between cognitive beliefs and health behaviors,[8] has been continuously developed and improved for decades as a widely used health behavior theory to examine the barriers and formation of a person's participation in programs which focus on prevention of disease or promotion of a healthy lifestyle.[9] This model is based on the health belief theory that asserts that health behavior is determined by personal beliefs or perception about a disease and the strategies available to decrease its occurrence.[10] Accordingly, with this theory, the accurate perception of overweight or obesity will be a prerequisite for individuals to perceive this disease as a threat with medical and social consequences and therefore engage in healthy lifestyle behaviors. However, several studies have shown that weight underestimation of overweight or obesity could also be associated with healthy lifestyle behaviors.[11-13]

Therefore, nutrition, nutrition behaviors and nutrition perceptions are very important factors in individuals. Nutrition is the ability of the body to use macro and micronutrients obtained from food for metabolic and physiological activities.[14] Healthy nutrition is crucial for good health, whereas unhealthy nutritional behavior and sedentary behavior are associated with a significant risk of developing overweight or obesity.[15] Nutritious foods and standard daily activity is necessary for physical and mental health development and wellbeing among children and teenagers. Therefore, improving nutrition and physical activity among young people could be preventive against non-communicable diseases, including the occurrence of chronic diseases in their older ages.[16-18] Health habits and behaviors such as physical activity are acquired at an early age and developed in later ages. Therefore, environments that encourage physical activity from a young age should be provided to support a healthy life.[19,20]

Although physical activity is defined in various ways in the literature, it is any body movement that uses skeletal muscles and results in energy consumption.[21,22] There are WHO guidelines on physical activity and sedentary behavior that highlight the importance of regular exercise, including aerobic exercise on the one hand, and muscle strengthening exercise on the other.[23,24] Many empirical studies suggest that physical activity can prevent chronic diseases (for example, cardiovascular disease, diabetes, and obesity), improve brain health and conditions, promote mental health (for example, reduced depression and anxiety).[25,26] It is known that the reduction of physical activity could also lead to decreased physical fitness. In order to reduce the negative impact of the pandemic process on people's health, it becomes important for health authorities to develop strategies to encourage people to participate in physical activity. It has been determined that after the COVID-19 pandemic process, physical inactivity levels in individuals have increased at an alarming level and the nutritional pattern has been disrupted along with the frequency of food consumption.[27] One population group that has been struck especially hard by the restrictive measures is children and adolescents. This confinement could have adverse effects on children's physical and

mental health as they did not get to play with their friends, be active in their sports groups, or have regular exercise in school physical education classes.[28]

The habits acquired during childhood form the foundation of adult behaviors. Therefore establishing exercise and movement habits in individuals from childhood is important for these individuals to live a healthier life in the future.[29-33] Additionally, It is considered crucial to instill correct habits regarding physical activity and nutrition in new generations starting from childhood.[34-36] Several studies have examined the levels and the inter-relationship of healthy lifestyles,[37-40] nutritional behaviors[41-44] and physical activity[45-48] levels of people from all age groups, especially during the pandemic restrictions. Physical activity is associated with healthy lifestyle behaviors and is known to be one of the strongest predictors of lifestyle behaviors. Additionally, physical activity and nutrition are two important factors among individuals' healthy lifestyle behaviors.[49-51] Physical activity plays a role in protecting and improving the health of individuals, including extending life span, creating a sense of responsibility, adequate and balanced nutrition, coping with stress, exercise, spiritual development and the development of interpersonal relationships.[19,21,24] In the literature review, no study was found that examined the relationship between healthy lifestyle beliefs and nutritional behaviors or physical activity in adolescents. Additionally, no study was also found that aimed to determine the mediator role of physical activity in the relationship between healthy lifestyle beliefs and nutritional behaviors. This study aimed to fill these gaps. It is anticipated that the results obtained from this study will make a significant contribution to the existing literature.

The selection of adolescents as the sample group is particularly important because the gained attitudes and behaviors of these group would create the future society health profile of Turkey. The negative attitudes and behaviors observed among adolescents may set a detrimental example for the future society health profile of Turkey. After COVID-19 restrictions, determining the current situation regarding adolescents' healthy lifestyle beliefs, nutritional behaviors, and physical activity levels is important for building a healthy society in the future. In order to address these knowledge gaps, the objectives of this study were to: (a) to examine the direct effect of healthy lifestyle beliefs on nutritional behaviors in Turkish adolescents and (b) to explore the mediation role of physical activity on the relationship between healthy lifestyle beliefs and nutritional behaviors in Turkish adolescents. For this purpose, the following hypotheses were tested in the null form.

H_{O1}: Adolescents' healthy lifestyle beliefs have no effect on their physical activity level.

H_{O2}: Adolescents' healthy lifestyle beliefs have no effect on their nutritional behavior

H_{O3}: Adolescents' physical activity has no effect on their nutritional behavior

H_{O4} physical activity has no mediating role on the relationship between healthy lifestyle beliefs and nutritional behaviors.

Methods

Study design

In this study, quantitative research method was used to determine the relationships between adolescents' healthy lifestyle beliefs, nutritional behaviors, and physical activity, and the degree of this relationship.[52] In addition, in this study, the convenience sampling technique was done as the preferred methods among non-probability-based sampling methods. Convenience sampling involves a sample group that is readily available and accessible.[53] In this method, every participant who is accessible and willing to participate in the data collection process is included, and the process continues until the planned sample size is reached within the population.[54]

The research model created to show the mediation role of physical activity (PAS) in the relationship between health lifestyle beliefs (HLB) and nutritional behaviors (NBS) of adolescents' is shown in Figure 1.

Population and sample

This study was conducted on students attending Anatolian high schools in Turkey. Anatolian high schools are public schools that provide education to young people in various regions of Turkey. Successful students are selected for these schools based on an exam conducted throughout Turkey. This study was carried out in the 2022-2023 academic year. A total of 686 high school students (301 female-385 male) aged 14-17 voluntarily participated. This thus formed this study's sample.

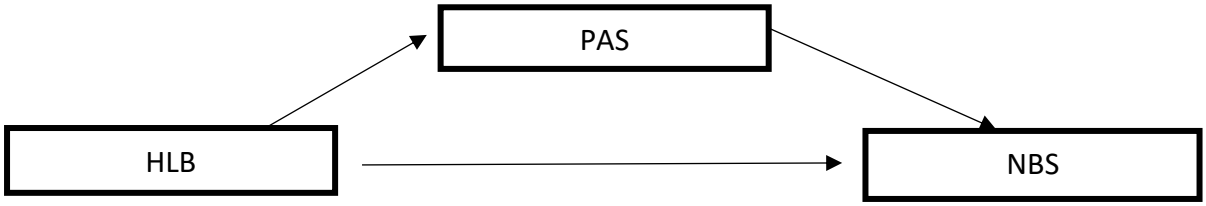

Figure 1: Mediating model of physical activity in the study

Inclusion and exclusion criteria of participants

Specific inclusion and exclusion criteria have been established for participation in this study. In terms of inclusion criteria, participants must be actively enrolled in the 2022-2023 academic year, be enrolled in Anatolian high schools in Turkey, and be between the ages of 14 and 17. Additionally, only individuals who completed the data collection tools used in the study accurately and in full were included in the study. Exclusion criteria include individuals outside the specified age range, those attending schools other than Anatolian high schools, those who have interrupted their education or graduated, and participants who provided incomplete or invalid responses during the data collection process.

Variables and data collection tools

The variables for this study are HLB, NBS and PAS. The personal information form created by the researchers, and the different instruments/scales for HLB, the PAS, and NBS in the literature were used as data collection tools. These tools were applied online using Google form.

Personal Information Form

In this study, a 5-item information form prepared by the researchers and consisting of questions about age, body weight, height, gender and family income was used.

Physical activity scale

The physical activity questionnaire was developed by Kowalski et al.[58] in the USA in 1997. The physical activity questionnaire, which was adapted into Turkish by Sert & Temel, was tested for validity and reliability and found appropriate.[56,57] It consists of 9 items that aim to determine the frequency of physical activity of the student in the last 7 days. The answers given to the questionnaire are scored between 1 and 5 and a score of '1' corresponds to low intensity physical activity and a score of '5' corresponds to high intensity physical activity. The total score is obtained by calculating the average score of all questions. The minimum score is 9 and the maximum score is 45.[58] Sert & Temel reported that the Cronbach's alpha value was 0.74.[57]

Nutritional behavior scale

The Nutritional Behavior Scale developed by Edmundson et al.[59] and adapted to Turkish children by Öztürk[60] was used to determine nutritional behaviors. The scale consists of 14 illustrated nutrients as high-fat/ salty and low-fat/salty. In these 14 questions, students are asked to choose one of the 2 foods given. In the scale, healthy foods are evaluated as +1 and unhealthy foods as -1. The highest score that can be obtained from the scale is +14, the lowest score is -14, and the high total score indicates healthy nutrition and the low score indicates unhealthy nutrition. The internal consistency reliability coefficient of the original scale was 0.76 and the test-retest reliability r: 0.58.[59]

Healthy lifestyle beliefs scale

The scale developed by Melnyk & Small[61] in 2003 was adapted into Turkish by Kaya[62] and validated as a reliable tool to assess healthy lifestyle beliefs among students aged 14-19. This scale adapted into Turkish consists of 11 items rated on a 5-point Likert scale with possible scores ranging from 11 to 55. Higher scores indicate stronger adherence to healthy lifestyle beliefs. Kaya[62] reported Cronbach's alpha coefficient of 0.89 for the total score of the scale.

Statistical analysis

Since the data were found to be normally distributed in this study, parametric statistical analysis tests were used. SPSS 22.00 statistical package program was used in the analysis. The arithmetic means and standard deviations of the scores obtained by the

participants on the scales are presented as X±SD. To determine the mediating effect of physical activity on the relationship between healthy lifestyle beliefs and dietary behaviors, regression analysis using the process v3.5 macro bootstrap method was employed. The process macro model option 4 was selected to examine the mediating effect. In the analysis, the bootstrap method with 5000 resampling options was used.[63,64].

Results

Table 1 and Table 2 shows the characteristics of the study participants.

According to Table 1, the mean age, height, and weight of the participants were 15.64 ± 0.63 (yrs), 170.15 ± 8.75 (cm) and 62.14 ± 11.39 (kg), respectively.

Table 2 shows that 43.9% of the participants were female and 56.1% were male. Also, 27.7% had a maximum family income of less than 20000 TL, while 40.8% had a family income of 20001-30000 TL, and 31.5% had a family income of greater than 30001 TL.

According to Table 3, the Cronbach's Alpha value of the HLB, PAS and NBS were found to be α=0.90, 0.91 and 0.90 respectively, showing internal consistency of the different data collection instruments.

It is observed that the scores from the scales were at significant levels and skewness and kurtosis values were in the range of ±2. According to George & Mallery[65], values are in the range of ±2 shows no extreme deviations from normality. Table 4

Table 1: Physical characteristics of participants

Variables	N	Minimum	Maximum	X±SD
Age (yrs)	686	14.00	17.00	15.64±0.63
Height (cm)	686	150.00	195.00	170.15 ± 8.75
Weight(kg)	686	40.00	96.00	62.14 ± 11.39

Table 2: Demographic characteristics of the participants

Variables		Frequency (n)	Percentage (%)
Gender	Female	301	43.9
	Male	385	56.1
Total		686	100.0
Family Income status	Less than 20000 TL	190	27.7
	20001 – 30000 TL	280	40.8
	Greater than 30001 TL	216	31.5
Total		686	100.0

Table 3: Cronbach's alpha values of scales

Scales	Cronbach's Alpha Value
Healthy Lifestyle Beliefs (HLB)	0.90
Physical Activity Scale (PAS)	0.91
Nutritional Behavior Scale (NBS)	0.90

According to Table 5, it was found that the total mean score of HLB was 44.510± 6.818, total mean score of PAS was 25.720± 6.929 and the total mean NBS score was 0.960±8.322. It was found that adolescents' HLB have positive low correlation with PAS (r=0.366***, p<0.001), and vice versa, and a positive moderate correlation with NBS (r=0.665***, p<0.001), and vice versa. PAS of participants have a positive low correlation with NBS (r=0.330***, p<0.001), and vice versa.

Table 6 The HLB variable was found to have a positive, low, and statistically significant effect on PAS (path a) (a=0.341, p<0.001). In addition, approximately 11.3% of the change in the PAS variable was explained by the independent variable HLB (R^2=0.113, p<0.001). When the effect of the PAS variable on NBS was examined (path b), it was seen that the independent variable had a positive, low, and statistically significant effect on the dependent variable (b=0.144, p<0.001). On the other hand, when the direct effect of HLB on NBS (path c) was examined, it was found that this effect was positive, moderate and statistically significant (c=0.763, p<0.001). Figure 2

When the mediation effect of the PAS variable is examined, the findings show that the indirect effect of the HLB variable on NBS is

Table 4: Normality test results of participants' scale scores

Scales	n	Skewness	Kurtosis	p
Healthy Lifestyle Beliefs (HLB)	686	0.594	-1.208	0.000
Physical Activity Scale (PAS)	686	0.274	-0.590	0.000
Nutritional Behavior Scale (NBS)	686	0.229	-1.089	0.000

Table 5: Descriptive statistics and relationships between results of participants' scale scores

Scales	n	Min	Max	X±SD	1	2	3
1 HLB	686	36.00	55.00	44.510± 6.818	1	0.366**	0.665**
2 PAS	686	10.00	41.00	25.720± 6.929	0.366**	1	0.330**
3 NBS	686	-14.00	+14.00	0.960±8.322	0.665**	0.330**	1

*** p<0.001; 1=Healthy Lifestyle Beliefs (HLB); 2=Physical Activity Scale (PAS); 3=Nutritional Behavior Scale (NBS)

Table 6: Mediator role of PAS in the relationship between HLB and NBS of adolescents

		Result Variables				
		PAS			NBS	
Forecast Variables		*b*	*SE*		*b*	*SE*
HLB	a	0.341	0.037	c	0.763	0.037
PAS	-	-	-	b	0.144	0.036
Constant	i_M	10.537	1.648	i_Y	-36.710	1.597
		R^2=0.113			R^2=0.456	
		F=86.930; p<0.001***			F=285.838; p<0.001***	

*p<0.05, **p<0.01, ***p<0.001; Standard error. Unstandardized beta coefficients (b) are reported.

n=686

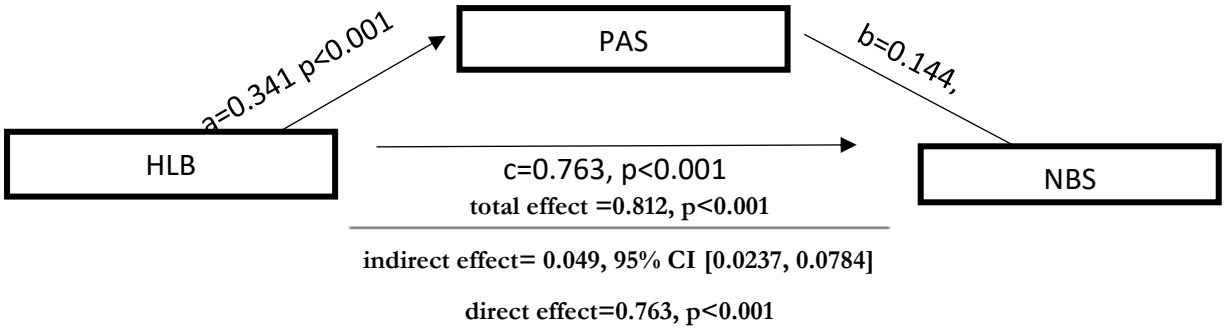

Figure 2: The mediator role of PAS in the relationship between HLB and NBS

significant, thus the PAS variable mediates the relationship between the two variables (*b*=0.049, %95 BCA CI [0.0237, 0.0784]). This is so because, as seen from the result of the bootstrap analysis, the corrected bias and accelerated confidence interval values (BCA CI) did not include the value of zero (0).[63,64].

Discussion

The aim of this study is to examine whether physical activity has a mediating role between healthy lifestyle beliefs and nutritional behaviors in adolescents, together with examining the direct relationship between these variables. From this study's findings, it was shown that an increase in adolescents' healthy lifestyle beliefs will increase physical activity positively. In other words, it shows that strengthening adolescents' beliefs about healthy lifestyles has a positive relationship on their physical activity levels. This can occur through them gaining positive attitudes towards physical activity, which in turn could lead to an increase in physical activity level. Furthermore, the acquisition of healthy lifestyle behaviors and beliefs by individuals in adolescence also contributes to a

healthier lifestyle for the rest of their lives.[66] Similar findings were also obtained by other studies.[67-72] Therefore, the adoption of healthy lifestyle beliefs by adolescents, who are the future of societies, is an important issue that should be emphasized.

Our study's findings also showed that an increase in adolescents' healthy lifestyle beliefs will positively increase their nutritional behaviors. This finding is thought to be due to the fact that adolescents' healthy lifestyle beliefs may cause behavioral changes. Individuals' strong beliefs about healthy lifestyle encourage them to adopt healthier eating habits. In addition, the increase in healthy lifestyle beliefs, may contribute positively to adolescents' healthy nutritional preferences, and hence choices. This is of great importance in the periods of identity formation, especially during adolescence. Similar findings were also obtained by other studies.[72,73] In addition, our study's findings showed that an increase in adolescents' physical activity will positively increase their nutritional behaviors. Similar findings were also obtained by other studies.[74-77] Therefore, educating adolescents on healthy life style beliefs is important in improving their nutritional behaviors and physical activity levels.[78-85]

Finally, our study's findings also showed that physical activity mediates the relationship between healthy lifestyle beliefs and nutritional behaviors of adolescents. This result shows that physical activity plays a critical role in adolescents' adoption of healthy lifestyle beliefs and nutritional behaviors. Other studies supporting our research findings were identified. Zhao *et al*.[86] found that health was mediated by nutrition and physical activity in a study conducted with Chinese elderly individuals. Sun *et al*.[87] found that nutrition and lifestyle habits played a mediating role in physical activity. These findings emphasize the importance of physical activity in the acquisition and sustainability of healthy living habits in young people, and also reveal the need to include these factors in both education programs and health policies.

Recommendations

This model can guide the Ministry of National Education and other relevant institutions and organizations in planning awareness-raising campaigns on physical activity and nutrition habits that support adolescents' healthy lifestyles. In addition, seminars and interactive training programs can be organized for families to help them acquire and maintain healthy lifestyle habits during adolescence. These efforts can contribute to raising healthy generations across society and can be an important step to support the long-term health and well-being of young people.

Suggestions for future studies

The tendency for individuals to present their own views in a more positive light may affect the generalizability of the findings. Therefore, experimental and longitudinal studies should be conducted in the future. Examining the effects of healthy lifestyles and nutrition habits on physical activity in larger and different sample groups may increase the generalizability of the findings. Furthermore, conducting this type of study in different cultural contexts may help to identify the influence of cultural factors. By addressing other psychological variables that may influence physical activity, future research could explore more associations about adolescents' healthy living through physical activity, which could increase our understanding.

Limitations

In the study, physical activity was obtained through a self-report questionnaire, which may affect the accuracy of participants' recall of the amount of physical activity and does not provide the opportunity to determine details such as frequency, duration and intensity of physical activity. Furthermore, as the study was designed using a cross-sectional survey design, data were collected within a specific time frame, which limits the ability to establish causal relationships based on the data obtained.

Ethics approval

The study was performed according to the Helsinki Declaration with the approval of the Suleyman Demirel University Health Sciences Ethics Committee (approval code: 89-6 / date: 17/01.2025). The studies were conducted in accordance with the local legislation and institutional requirements.

Informed consent statement

Informed consent was obtained from all participants before data collection. Copies of signed consent forms are available: All authors are prepared to provide them to the journal on request.

Consent for publication

All authors have read and agreed to the published version of the manuscript.

Data availability

The survey data used in this study are retained by the authors. All authors are willing to submit these data to the journal upon request.

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Competing interests

The authors declare that they have no competing interests regarding the publication of this paper.

Author contributions

Conceptualization, K.KA. and G.B.B;
methodology, K.KO., Z.E., M.S.Y., A.A. and K.KA;
formal analysis & Interpretation of Data, K.KO., and G.B.B.;
investigation, Z.E., M.S.Y., K.KA., A.Y.A., E.Ü.A. and G.B.B;
resources, K.KO., E.Ü.A. and M.S.Y.;
writing—original draft preparation, Z.E., A.Y.A. and K.KA.;
writing-review and editing, G.B.B, K.KO., Z.E., A.A., M.S.Y. and K.KA;
supervision, K.KA., Z.E., M.S.Y, K.KO.

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