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Analysis of the level of information, habits and knowledge of university students about the importance and relationship of physical activity and oral health

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ABSTRACT

This study aimed to evaluate university students' awareness, habits, and knowledge concerning the relationship between physical activity and oral health as part of overall well-being. A cross-sectional study was conducted with 345 students from the University of East Sarajevo, comprising 132 males (38.26%) and 213 females (61.74%), aged 19 to 27. The survey included 20 closed-ended questions. Results revealed that 77.69% of participants were non-smokers, with every fifth participant reporting physical inactivity and 64.34% engaging in physical activity one to three times a week. A third of the students exercised for over 60 minutes, while 44.05% exercised for 15-45 minutes. Most respondents (53.91%) brushed their teeth twice daily, with 45.51% brushing for 2-3 minutes. Over half (55.36%) were aware of the positive effects of physical activity on both general and oral health. However, 26.96% were unaware that poor oral health could impact physical activity quality. Some students feared dental procedures (18.85%) or did not use supplementary oral hygiene products (10.72%). A smaller percentage (8.40%) would use performance-enhancing drugs, and 50.44% were unaware of their adverse effects on oral and overall health. Additionally, 28.92% did not know the importance of mouthguards in contact sports. While 42% knew that a knocked-out tooth can be reimplanted, only 30.14% knew how to do it. Most (89.28%) recognized the harmful effects of carbonated drinks on health. Over half (59.13%) changed their toothbrush every three months, and 49.86% visited the dentist only when necessary. The study concludes that students at the University of East Sarajevo

have a commendable level of knowledge regarding the relationship between physical activity and oral health.

KEYWORDS

Physical Activity; Oral Health; Knowledge; Habits; Information

1. INTRODUCTION

Regular physical activity (PA) is a very effective and inexpensive tool for the prevention and treatment of most chronic diseases. PA has been shown to help in the prevention treat non-communicable diseases, such as heart disease, cardiovascular disorders, stroke, diabetes disease. (Mansfild et al., 2017; Nystoriak et al., 2018). It also helps prevent hypertension, overweight and obesity and can improve mental capacity, quality of life and well-being (Lin et al., 2015; Magobe et al., 2017). According to Pavlović et al. (2022), whether it is health status, physical appearance, or a psychological feeling of a better quality of life, a person must perform physical activity regularly, continuously, and under the control of an expert, especially when it involves more complex kinesiology activities.

The benefits of engaging in sports activities in maintaining a person's physical and mental health are numerous. Due to increased caloric consumption, regular PA enables maintaining optimal body mass, preventing obesity, improves the abilities of the cardio-respiratory system, leads to a decrease in blood pressure, and a decrease in the level of fat and sugar in the blood, strengthens muscle strength and muscle endurance, which enables the easier performance of daily physical actions without stress and excessive fatigue. During PA, brain cells release substances (endorphins) that have important, long-term effects on a person's psychological health, increases the level of self-confidence, relieves tension and stress and improves the general mood, increases the ability to concentrate and study, etc. The increasing prevalence of obesity is considered a significant public health problem in most countries, and the primary cause of obesity is the consumption of high-calorie products, diets and low calorie consumption (Idress et al., 2017). In addition, physical inactivity and overweight are the fourth and fifth leading causes of mortality worldwide and are considered a leading risk factor for other systemic diseases such as cardiovascular diseases, musculoskeletal diseases and liver, colon and prostate cancer (Johuar et al., 2021).

Dental caries is an oral disease and is ranked as one of the most common non-communicable diseases in the world. The main reason is the easily available food with a high fat content and a large reduction in the level of PA, allowed the increase of obesity not only in developed countries but also in developing countries around the world. The high prevalence of overweight state in youth is a major public health concern, as it causes short-term and long-term adverse effects on psycho-physical health. Moreover, overweight is associated with poor oral health and irregular tooth brushing among youth in Europe. Poor oral health and obesity have a common background, as they have been shown to be closely related to periodontitis, and periodontitis is associated with diabetes (Janković et al., 2018).

Numerous studies (Heikkala et al., 2014; Carson et al., 2017; Chen et al., 2018; Riad et al., 2022) indicate that a hypokinetic lifestyle, sedentary behavior, poor eating habits and lack of effective oral hygiene practices are associated with overweight and obesity. Liu (2017) suggests that an unhealthy lifestyle not only leads to numerous and major health problems, but can also negatively affect the effectiveness of medical treatments. Low level of physical activity, consumption of tobacco and alcohol, poor daily hygiene habits and diet are the main risk factors for poor general and oral health. Although there are no specific oral lesions associated with diabetes, there are a number of oral manifestations associated with the presence of prolonged hyperglycemia. These are the most common periodontal diseases, dry mouth, delayed healing, loose teeth, premature tooth loss, taste problems and burning mouth syndrome, acute and recurrent oral infections, salivary gland dysfunction, dental caries and the potential for early tooth loss.

Chapple & Genco (2013) present consistent and solid evidence of the correlation of periodontitis with uncontrolled blood glucose level, which is related to the body mass index as the basic criterion for the classification of obesity. Many health-related habits are adopted early in childhood and adolescence, and most of them last throughout life. Gender, parental factors (eg. family relationships, education, socioeconomic status), and lifestyle factors influence adolescent general health and oral health as well as other related behaviors (Virtanen et al., 2018).

The results of the study by Bramantoro et al. (2020) suggest a significant correlation between the state of the teeth and oral cavity and physical condition, body balance, cardiorespiratory function, as well as cognitive functions. Dental health can play a significant role in sports performance, so adequate prevention could enable athletes to maintain their training and competition routine, without interference in sports planning due to the appearance of some dental problems. Athletes have a noticeable tendency to increase many oral problems (frequent intake of carbohydrates, various acidic

sports drinks, dry mouth and little knowledge about oral health), these are just some of the reasons that explain the high prevalence of oral diseases in this group (Needleman et al., 2015).

Daily consumption of non-carbonated sweetened sports energy drinks is very popular among adolescents, students and athletes worldwide, because it is believed that consumption prevents or reduces fatigue and replenishes the body during exercise, thus improving cognitive and physical performance (Larson et al., 2014). A statistically significant result was found regarding the connection between increased consumption of dietary supplements, poor oral health and insufficient oral hygiene (Al Saffan et al., 2020). Sports success depends on several factors that combine to achieve optimal effects and neglecting any aspect involved in the training process leads to sports failure (Ashley et al., 2015). Maintaining proper oral hygiene is considered an important variable in maintaining general health status. The study by de la Parte et al. (2021) analyzes the correlation between oral health and habits of elite athletes by sport type. Results show that individual athletes have worse oral conditions. Endurance sports pose the greatest risk due to high carbohydrate intake needed for glycogen breakdown during exercise. The condition of the oral cavity is influenced by lifestyle, hygiene and eating habits, possible intake of various illegal substances (drugs) and sports activities. It seems that the oral health of athletes is poor in many sports activities and various diseases can limit sports skills, both during training and during competition. Previous studies (Kragt et al., 2019; Kunrath et al., 2020) indicate the existence of several mechanisms by which oral problems can have a negative impact on athletic performance, such as dental malocclusion and bruxism. Dental caries, periodontal diseases and periapical infections can also act as infectious foci for local oral tissues. If left untreated, these conditions can cause a systemic inflammatory response and thus affect athletes' physical fitness, performance and well-being. Caries and periodontal disease can be infectious foci and can degenerate into heart problems due to the huge number of bacteria that are at the level of the gingiva and can access the bloodstream, affecting other parts of the body. In this regard, many joint and muscle injuries are the result of dental foci and/or periapical infection.

Athletes often focus more on maintaining and/or improving physical condition and health, ignoring the high risk of injuries without using mouthguards, especially in contact sports, thus affecting physical performance and physical fitness (Gallagher et al., 2018). Peltzer & Pengpid (2014) in their study showed that 67.2% of students brush their teeth twice or more a day, 28.8% once a day and 4% never brush their teeth. Regarding visits to the dentist, 16.3% reported visiting twice a year, 25.6% once a year, 33.9% rarely and 24.3% never. The use of illegal drugs, tobacco, low physical activity and low daily frequency of snacks, skipping breakfast and inadequate

consumption of fruits and vegetables were associated with inadequate tooth brushing (less than twice a day). Virtanen et al. (2018) confirm that physically active adolescents (more than 4 hours or more per day) have better oral health than less active adolescents, while obesity and smoking were associated with infrequent tooth brushing. Alam et al. (2022) suggest a significant role of excessive diet and sugar consumption in causing obesity and dental caries, identifying a significant relationship between BMI levels with oral hygiene, eating habits and physical activity. Abu-Gharbieh et al. (2019) proved that knowledge about the correlation between oral health and PA is statistically significant, surpassing other factors such as age, gender, and smoking. The study by Jouhar et al. (2021) highlights the role of nutrition in obesity and dental caries, showing a correlation with BMI and PA in male students. A low BMI correlates with fewer carious lesions, while a high BMI is associated with more carious lesions.

Despite the fact that students of University East Sarajevo, they have enough enthusiasm for studying, knowledge about good habits of oral hygiene and PA are still questionable. According to our knowledge, so far no studies have been recorded in Bosnia and Herzegovina, Republic of Srpska, and not even at the University of East Sarajevo, which dealt with information, assessment of the connection between PA and oral health, that is, physical exercise and oral habits of the student population. Therefore, this study aims to examine, analyze and determine the level of information, habits and knowledge of students about the importance and connection of physical activity and oral health as a segment of the general health of an individual.

2. METHODS

2.1. Study design and participants

This cross-sectional study was conducted through a survey with students on a voluntary basis during the period from November to December 2022/2023, in accordance with the principles of the Declaration of Helsinki. The study included 345 registered students of the University of East Sarajevo, representing five faculties (Physical Education and Sports, Law, Economics, Philosophy, and Medicine), aged 19-27. Among the participants, 132 (38.26%) were male and 213 (61.74%) were female. Slightly more than half of the students, 174 (50.43%), were studying at faculties of social sciences and humanities, while 171 (49.57%) were at the faculties of medicine.

2.2. Instrument

As a way of collecting data and information, a descriptive approach and a questionnaire that correspond to the nature and objectives of the study were used. The questionnaire in the form of a survey was designed to include 20 questions about information, habits and knowledge of students about the connection between physical activity (exercise), oral health, and overall human health (Table 1). Secondary questions are related to age, gender and cigarette smoking. The questions were of the closed type with provided answers. Neutral judges were asked to give their opinion on the suitability of the survey questionnaire, to adapt, add or delete any items they considered appropriate. After that, the answers of the judges were deposited, where all the additions, deletions and corrections suggested by the judges were taken into account. Therefore, the content validity of the study questionnaire was high. Questionnaires of respondents who were not completely filled in were excluded from the study, and their results were not taken into consideration. All the data from the study participants were processed using frequencies and percentages.

3. RESULTS

All the data from the study participants were processed using frequencies and percentages, and qualitative conclusions were drawn based on this analysis, regardless of the participants' gender. All the obtained results are presented in Table 1. Out of a total of 345 students included in the research, 77.69% declared themselves as non-smokers, and 22.31% as consuming tobacco products (cigarettes). When it comes to physical activity, which is extremely important for the current study, every fifth student was physically inactive, which in the entire sample defines 22.31% respondents, in contrast to 13.33% who through different forms of exercise were physically active every day. The majority of respondents (64.34%) do physical activity from one to three or more times a week. A third of students (33.63%) declared that their physical activity lasts longer than 60 minutes. The remaining part of the sample (44.05%) was physically less active (15-45min).

In general, they all believe that physical activity and taking care of oral health are very important for the overall health of each individual. Most respondents, (53.91%) brush their teeth twice a day, and the largest number (45.51%) brush their teeth for 2-3 minutes. More than half of the students (59.13%) change their toothbrush every three months. Only a small number, (10.72%) stated that during oral hygiene, they never use additional accessories. Most of the participants (68.12%) use additional accessories every day, and 21.15% respondents use them only sometimes. The developed awareness of regular control and check-ups is partial, because 49.86% of the surveyed students visit a

dentist when necessary, while 18.85% of the students have a present fear of dental interventions (Table 1).

It is evident that more than a quarter of respondents (28.92%) are not aware that they should wear mouthguards during contact sports. If an injury occurs that leads to a complete dislocation of the tooth from its alveolus, 42.02% students know that the knocked-out tooth can be returned to the jaw, and 30.14% know how to do it. The majority of surveyed students (89.28%) are aware of the harmful effects of carbonated beverages on the oral and overall human health, while more than half of the respondents (50.44%) are not aware of the negative impact of doping agents, both on the oral and on the the health of the individual in general. In total, 8.40% of students said that they would use doping agents to achieve results despite knowing that they are endangering their physical and oral health. About a quarter of students (26.96%) are not aware of the fact that poor oral health can affect the quality of physical activity. However, more than half of them (55.36%) have a developed awareness that physical activity has a positive effect on overall health, and therefore on oral health. The largest number of research participants, (93.91%) know how important oral cavity hygiene is, but also the hygiene of the whole body, which is confirmed by the number of (92.17%) surveyed. It is interesting to mention that only 2.31% of young, educated people think that carious front teeth do not impair the physical appearance of an individual, which is negligible in the entire sample (Table 1).

Table 1. Knowledge, habits, awareness and attitudes of students about the connection between physical activity and oral health

	Males	**%**	**Females**	**%**
GENDER	**132**	**38.26**	**213**	**61.74 %**
CONSUMPTION OF TOBACCO PRODUCTS (CIGARETTES)	**Yes**	**%**	**No**	**%**
	77	22.31	268	77.69
A - STUDENT AWARENESS	**Answers**		**N**	**%**
1. Are you aware that when practicing physical activities that involve physical contact with others, you should use mouthguards?	Yes		251	72.75
	No		94	28.92
2. Are you familiar with the on-site procedures in case of tooth eruption?	Yes		104	30,14
	No		241	69.86
3. Are you aware that it is possible to replace a knocked out tooth?	Yes		145	42.02
	No		200	57.98
4. Are you aware of the harmful effect of carbonated beverages on the oral health and therefore the overall health of a person?	Yes		308	89.28
	No		37	10.72
5. Do you know that doping agents can have a harmful effect on the oral and therefore the overall health of a person?	Yes		171	49.56
	No		174	50.44
B - STUDENT HABITS	**Answers**		**N**	**%**

6. How often weekly are you physically active (exercise)?	Never	77	22,31
	Once	61	17.68
	Two times	74	21.45
	Three times and more	87	25,22
	Every day	46	13.33
7. Do you exercise and how long does your physical activity last?	I am not physically active	77	22,31
	15 min.	31	8.98
	30 min.	60	17.39
	45 min.	61	17.69
	60 min. and more	116	33.63
8. How often do you brush your teeth?	Never	0	0
	Once a day	14	4.06
	2 times a day	186	53.91
	Three times and more	145	42.03
9. How long does tooth brushing take?	Less than 1 min.	12	3.48
	1-2 min.	92	26.66
	2-3 min.	157	45,51
	> than 3 min.	84	24,35
10. How often do you change your toothbrush?	Every 3 months	204	59,13
	Every 6 months	63	18,26
	When the fibers are used	76	22.04
	Once a year	2	0.57
11. Except brushes and toothpastes, do you use and additional help for washing teeth (dental floss, mouthwash, toothpicks)?	Yes	253	68,12
	No	37	10.72
	Sometimes	73	21.15
12. How often do you go for check-ups?	Twice a year	92	26.66
	Once a year	81	23.48
	When needed	172	49.86
13. Do you have fear of dental intervention?	Yes	65	18.85
	No	280	81.15

C - STUDENT KNOWLEDGE	**Answers**	**N**	**%**
14. Would you use doping agents despite the fact that they threaten your physical and oral health?	Yes	29	8.40
	No	316	91.60
15. Should a physically active person (who exercises) take care of their oral health in the same way?	Yes	345	100
	No	0	0
16. Does every physical activity have a positive effect on dental health?	Yes	191	55,36
	No	154	44.64
17. Can the bad condition of the oral cavity (teeth) affect the quality of physical activity?	Yes	252	73.04
	No	93	26.96
18. Is physical activity as important for the body as dental hygiene for oral health?	Yes	324	93,91
	No	21	6.09
19. Is showering after every physical activity as important as brushing your teeth after every meal?	Yes	318	92.17
	No	27	7.83
20. Do you think that diseased front teeth (teeth with caries) are disruptive to physical appearance of the individual?	Yes	337	97.69
	No	8	2.31

4. DISCUSSION

All respondents in the current study agreed that physical activity and proper oral health care are crucial for achieving a high quality of life and overall health. This finding aligns with previous research (Virtanen et al., 2018; Abu-Gharbieh et al., 2019; Jouhar et al., 2021; Alam et al., 2022). Namely, the student population, which is defined by the age of the respondents (19-27 years old), largely uses new information technologies and their use implies a hypokinetic (sedentary) lifestyle.

The consequences of such a lifestyle are highly correlated with the occurrence of risk factors for many diseases (Mansfild et al., 2017; Chen et al., 2018; Riad et al., 2022). We are of the opinion that our respondents are aware of these consequences and benefits of physical activity, thus their attitude supports the findings of previous studies. The fact that oral health is an inseparable part of overall health, so it is of crucial importance to develop the awareness of young people, in which way, through their behavior and habits, they can contribute to their overall health being at a high level. A significant percentage of surveyed students of the current study are non-smokers, which implies an indirect confirmation of their personal awareness that their bad habits endanger their own health, and corresponds to the knowledge that smoking is strongly associated with caries and periodontal disease.

Ericsson et al. (2016) suggest a mutual connection between oral health and overall health behavior (nicotine abstinence, regular physical exercise), identical to the results of our study, where almost 80% of respondents are physically active, which can be characterized by habits adopted in childhood and adolescence, which is in accordance with some earlier studies (Virtanen et al., 2018; Riad et al., 2022). Students, as a young and healthy population, most often change their lifestyle when they come to university. Due to independence from parents and changes in social interaction, they mostly face difficulties in adopting a healthy lifestyle. In this regard, there is a lack of physical and sports activities in combination with improper nutrition, due to the hectic work schedule and the increased number of study hours. As a result, they often neglect healthy diet, oral hygiene, physical activity and start consuming unhealthy, high-calorie fast food and many tobacco products. A somewhat unexpected result of the current research is that 18.85% of students have some fear of dental interventions, because nowadays dental interventions are mostly painless and safe (Marulanda et al., 2014).

Kapuran et al. (2017) suggest that the fear of dental interventions is one of the main reasons for neglecting oral health care. The opinion of the profession prevails, that despite the appearance of

fear, students should be more afraid of the consequences of avoiding regular check-ups, because this reduces the possibility of timely diagnosis of the disease and an adequate course of treatment. Our results identify that the majority of our respondents (about 90%) regularly or occasionally use additional accessories to maintain oral hygiene, which is a very positive habit, the so-called individual style, which points to the prevention of caries.

A smaller number of students (8%) would use doping agents to achieve their sporting ambitions, even though they know that they can damage their health. Such an attitude in this case is a good and correct perception of a possible problem of addiction to stimulants (doping) among the student population, which does not support the findings of recent research (Al Saffan et al., 2020). Certain studies (Ashley et al., 2015; Young et al., 2015; Gallagher et al., 2018) arguably confirm the existence of a high risk of dental injuries, especially in contact sports without the use of mouthguards. The fact that about 30% of the respondents in our research are not aware of the need for mouthguards in contact sports is concerning. One of the most common and complex dental injuries is the complete dislocation of a tooth from the alveolus. In such cases, the tooth should be promptly returned to its socket (alveolus) and followed by appropriate dental treatment to immobilize it (Tsuchiya et al., 2017; Janković et al., 2018). The overwhelming majority (about 60%) of students in this study were unaware that dislocated teeth can be reinserted into their sockets, a finding that aligns with previous research (Fujita et al., 2014).

The presence of large amounts of sugar in soft drinks, including sports and energy drinks, cause adverse health consequences. It is evident that dehydration during sports activities can also increase the spread of carbohydrates on dental caries and drinks with low pH on tooth erosion (Al Saffan et al., 2020). A study by Mullee et al. (2019), conducted in 10 European countries, reports a significant correlation between sugar-sweetened beverages and all-cause mortality, which also has a negative impact on oral health. It has been reported that increased consumption of all types of proteins and supplements, carbohydrates, plays a significant role in accelerating tooth decay. In this context, some authors (Khan et al., 2022) reported a high prevalence of oral diseases such as dental erosions associated with increased energy consumption and sports drinks, especially among youth and athletes. In our research, nearly 90% of students were aware of the harmful effects of carbonated beverages on health, which is a good result, so that the possible consequences of harmful effects on the body and oral health are reduced to a minimum. Healthy habits, physical activity and good oral hygiene of students, including brushing teeth twice a day, are of key importance for preventing oral diseases as well as maintaining good oral health.

According to data from the literature, the prevalence of brushing teeth (less than twice a day) among students is higher in countries with low and medium gross domestic product-GDP (India 52.2%; Lebanon 35%; Turkey 32%; Yemen 24%), than in countries with high GDP (7.9% Italy; 25% USA). Similarly, the prevalence (less than once) of annual dental examination among students is higher in developing countries (Kenya 84%; Nigeria 92.2%; Turkey 70 As many as 42.7% in India have never visited a dentist, and in Iran this number is higher (48.2%) than in industrialized countries (41% in Finland, 40.1% in Italy). The obtained results of the study show that more than half of the student respondents (53.91%) brush their teeth twice a day, and 42.03% three or more times a day, and change their toothbrush every three months (Peltzer & Pengpid, 2014).

Various factors have been found to be associated with suboptimal tooth brushing among youth, including sociodemographics, smoking and alcohol use, cannabis use, lack of physical activity, poor mental health or psychological stress, and dental anxiety (Marulanda et al., 2014). The lifestyle of an individual, including university students, can be assessed based on their engagement in physical activities, consumption of fruits and vegetables, while oral health maintenance habits can be assessed based on the frequency of brushing teeth, the frequency of flossing and the frequency of visits to the dentist. The results of the current survey of the student population are not encouraging, as almost half of the surveyed participants only visit the dentist when necessary. Certain studies (Ghani et al., 2016; Jamil et al., 2019; Ahmed et al., 2019) show that the presence of dental caries on the front teeth can threaten aesthetics and reduce the level of self-confidence of an individual, while the complications of dental disease (pulpitis) and pain sometimes become unbearable, and can affect the academic success of students, the level of physical activity and on the quality of life in general. More than a quarter of our students are not aware that poor oral health can affect the quality of physical activity.

Nevertheless, the dominant majority of those surveyed (about 93%) have a developed awareness that physical activity has a positive effect on overall health, identifying the same health importance of showering after physical activity and brushing teeth after each meal, which is in line with the findings of earlier similar research (Kragt et al., 2019; Kunrath et al., 2020; Bramantoro et al., 2020). A small percentage (2.31%) of students declared that carious front teeth are not an aesthetic defect for them and that they do not impair physical appearance, which is unusual for the 21st century and such a personal attitude of future members of the academic community.

5. CONCLUSIONS

All study participants consider physical activity and oral health to be very important for overall individual health. Despite being aware of the negative health effects of tobacco nicotine, one in five students is a smoker. Most students are physically active and practice regular oral hygiene using additional accessories, as well as body hygiene after each physical activity. Nearly 90% of students are aware of the harmful effects of carbonated drinks on dental hard tissues. However, more than half of the students (50.44%) are unaware of the negative impact of doping on the body. The majority of respondents understand the need to protect their teeth during contact sports, yet more than half are not aware that dislocated teeth can be returned to their sockets. Additionally, close to 70% of the sample do not know how to restore teeth to their place of injury. Half of the surveyed participants do not regularly visit the dentist for check-ups, but over 70% recognize that poor oral health can affect the quality of physical activity.

6. RECOMMENDATIONS

To address the gaps in knowledge and behavior identified in the study, it is recommended to implement comprehensive educational campaigns and resources focusing on the harmful effects of nicotine, doping, and carbonated drinks, emphasizing their impact on overall health and dental health. Practical workshops on handling dental emergencies and the importance of regular dental check-ups should be conducted, alongside promoting healthier drink alternatives. Enhancing hygiene education and ensuring accessible hygiene resources after physical activity are crucial. Integrating these health topics into the curriculum and establishing peer education programs can further reinforce healthy practices. These initiatives aim to improve students' awareness and behaviors, fostering a healthier student population.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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