

Original Research Article

Dietary Changes during the Examination Period in Medical Students

Dominika Faixová¹, Zuzana Jurinová², Zita Faixová³, Ján Kyselovič^{4,5}, Andrea Gažová^{2*}¹Department of Pharmaceutical Technology, Pharmacognosy and Botany, University of Veterinary Medicine and Pharmacy in Košice, Komenského 73, 041 81 Košice, Slovakia²Institute of Pharmacology and Clinical Pharmacology, Faculty of Medicine, Comenius University, Špitálska 24, 813 72 Bratislava, Slovakia³Department of Biology and Physiology, University of Veterinary Medicine and Pharmacy in Košice, Komenského 73, 041 81 Košice, Slovakia⁴Department of Pharmacology and Toxicology, University of Veterinary Medicine and Pharmacy in Košice, Komenského 73, 041 81 Košice, Slovakia⁵5th Department of Internal Medicine, Comenius University Faculty of Medicine and University Hospital in Bratislava, Bratislava, Slovakia

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Abstract: Background: University studying is demanding on the mental as well as the physical side of the students. However, studying medicine is even more challenging – the study is six years long, and it is tough to remember more information. The study changed the social life of students, and the students didn't have enough time to relax. The examinations of students are full of stress. Stress harms health, especially in the gastrointestinal tract (autonomic nervous system). **Aims:** The first study evaluated eating habits during and outside an examination period and the effect on the health of medical students in Slovakia. **Methods:** We made the questionnaire and distributed it online to medical students at the Faculty of Medicine in Bratislava, Slovakia. A total of 587 students from the 1st to 6th year completed self-report measures of BMI, academic stress, eating habits and the occurrence or development of digestive problems during the study. **Results:** Our results showed that most respondents were of average range weight and ate a well-balanced diet (90%); more than half of the participants had breakfast regularly, and almost half of the students ate junk food a few times per week. Our participants consumed less food but more junk food and energy drinks during the exam period, which can cause obesity and digestive problems. **Conclusion:** Our findings confirm that subjective academic feelings of stress play an important role in eating habit changes and in the origin of digestive disorders in our medical students.

Keywords: Academic stress, eating habit, gastrointestinal disorders, university students.

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1. INTRODUCTION

Healthy eating habits are essential in preventing non-communicable diseases (NCDs), including diabetes mellitus, cardiovascular diseases, stroke and cancer, in optimal functioning, also on the cognitive and well-being level (Michels *et al.*, 2020). An unhealthy diet and lack of physical activity lead to global health risks. The World Health Organization (WHO) suggests an optimally balanced diet to prevent unhealthy weight gain. Caloric intake should be balanced with its expenditure; total intake of fats should not exceed 30%, and total intake of sugar should not exceed 10% of daily energetic intake, and salts should

be kept to a maximum of 5 g per day to prevent arterial hypertension, cardiovascular diseases and stroke in adults [1]. WHO's member states signed off on reducing salt intake in the global population by 30% by 2025 and agreed to stop growth in the incidence of diabetes mellitus in adults and adolescents and obesity in children by 2025 [2]. Diet is not only affected by social and economic aspects (e.g. income, food prices, individual preferences, cultural traditions and geographical) and environmental factors (including climatic changes) but also by a person's psychological state [3, 4].

*Corresponding Author: Andrea Gažová

Department of Pharmaceutical Technology, Pharmacognosy and Botany, University of Veterinary Medicine and Pharmacy in Košice, Komenského 73, 041 81 Košice, Slovakia

The interaction between stress and eating habits is known. Authors Adam and Epel, (2007) have written about situations when individuals choose unhealthy food under stressful conditions. Stress is also linked with higher consumption of sweets, fats [5], and salts [6], but also with a reduction in a well-balanced diet (e.g., meat, fruits, vegetables) [7]. Students are often exposed to stressful, competitive academic conditions, and exam periods are extremely demanding psychologically [8].

The impact of the examination period on students' eating behaviour has been researched in several countries.

The cross-sectional study evaluated dietary habits among Wrocław Medical University Students. The results showed that improper nutritional habits were observed in most studied students, especially men (Ilow *et al.*, 2017). Balmus *et al.*, (2019) studied the correlation between occupational stress and functional gastrointestinal disturbances in students during examinations in Romania. They reported that more than 40 % of the students declared gastrointestinal disorders during the stressful exam period. Barker *et al.*, (2015) [37] compared students' energy and nutrient intake during and outside an examination period at the University of Sheffield, UK. They reported that most students were dietary resilient, while 10 % had increased energy intake and 25 % had decreased dietary energy intake between baseline and examination period. The results of the questionnaires on health completed by students from Belgian universities and university colleges showed that during the examination period, diet quality decreased (Michels *et al.*, 2020). Based on a Belgian focus group study, most students reported more difficulties eating healthy during exam periods due to time constraints and stress. However, others might try to eat more healthy items such as fruit (Deliens *et al.*, 2014).

Adverse stress effects could lead to the disruption of a healthy lifestyle and the occurrence of non-communicable diseases [9].

1.1 OBJECTIVES

The objectives of this study were to compare the eating habits during an examination period with that outside an examination period among the medical students studying at the Faculty of Medicine in Bratislava. We analysed the students of all six years of the Faculty looking. We hypothesised that eating habits changed during the exam period compared to other parts of the academic year (the exam period vs the holiday or teaching period).

2. MATERIALS AND METHODS

2.1 Participants

A cross-sectional questionnaire study was conducted during the academic year 2019/2020 before

the COVID pandemic began. Five hundred eighty-seven students from all 1948 medical students (137 men (23.3%) and 450 women (76.7%)) from the 1st to the 6th year took part in the study. The response rate was 30 %. The Faculty of Medicine in Bratislava annually has approximately 350 students (1 male to 3 female). We analysed participants' numbers and gender using the R statistics software.

We asked medical students to complete a health survey questionnaire on their eating habits online through social media. The survey was developed based on the Eating Habits Questionnaire [10].

This study was carried out by the Code of Ethics of the World Medical Association, Declaration of Helsinki (WMA Declaration of Helsinki, 2013), and The University Board approved the project in terms of its ethical aspects.

The inclusion criteria were – actual study at the Faculty of Medicine in Bratislava, Slovak students (not the international students – their eating habits are different from the Slovak eating habits) and the willingness to voluntarily answer the questions. The exclusion criteria were the blank answers.

All questionnaires were completed, and no participants were excluded from the study. The questionnaire was completed anonymously, and the participants were assured data confidentiality. All participants provided consent to participate after being debriefed about the true nature of the study.

Eating habits during the examination period of the academic year (according to the study plan schedule) and the rest of the academic year (teaching and holiday) were compared.

2.2 Questionnaire

The questionnaire included four parts. The first contained personal data: gender, age and anthropometric parameters (height and body weight).

The second part of the questionnaire included questions focused on the type of diet, evaluation of eating habits, how often they eat breakfast, where they are used to having lunch, how often they eat snacks (sweet, salty), and how much water they drink daily, how often they drink sweetened drinks and beverages for increasing energy/attention and what nutritional supplements they take.

The next part of the questionnaire focused on changes in body weight, food intake, snacks and energy drinks during the exam period. The final questions concerned the incidence of the chronic gastrointestinal tract (GIT) disorders during university studies, changes in the frequency of their occurrence during the

examination period, and ways of dealing with GIT disorders.

2.3 Body Mass Index (BMI)

Body Mass Index (BMI) is a statistical index using a person's weight and height to estimate body fat in males and females of any age. It defines a person as underweight, average weight, overweight and obese. Body Mass Index (BMI = weight/height²) was calculated by measuring the weight in kilograms and dividing it by height in squared metres [11].

2.4 Statistical Analysis

For statistical analysis, we used Microsoft Excel and Graph Pad Prism 9.4.0 (descriptive statistics, absolute values, means, standard deviation, percentages) and the R Statistics Software for the sample size.

3. RESULTS

Five hundred eighty-seven of all 1948 students completed the questionnaire – 137 men (23.3%) and 450 women (76.7%) – between the ages of 18 and 32 years old (mean ages = 22.16±2.58 years). In accepting or rejecting our hypotheses, we received when more than 50% of answers were to one question.

In our study, 60.6 % of men (N=83) had average BMI values, but more than 31.4% (N=43) were overweight. Among women, 77.2% (N=347) of those monitored had normal BMI; however, 15.1% (N=68) were underweight, and 7.3% (N=33) were overweight. The mean value of men's BMI was 34.3±3.3 kg/m² and women's mean BMI was 21.0 ±2.6 kg/m². Most participants (89.6%) ate a well-balanced diet, including meat products, and only 1.4 % of the students were vegans. The option pescatarian was selected by 3.4% of students, Lacto-vegetarian by 2.7 % and a special diet for health reasons (gluten-free, low histamine, lactose-free, dairy-free) by 3.6 % students.

3.1 Eating habits outside the examination period

During the semester, more than half of students (56.9 %) self-evaluated their eating habits as healthy. The other answers are in Table 1.

Table 1: Self-evaluation of having healthy eating habits

Rate	N (%)
Yes	70 (11.9)
Rather yes	334 (56.9)
Rather not	150 (25.5)
Not	33 (5.7)

More than half of the participants - 66.6%- ate breakfast daily, and more than half of the students (56.5%) ate lunch in the canteen (Table 2).

Table 2: Frequency of participants having breakfast and their place of eating lunch

Frequency of having breakfast N (%)	
Every day	391 (66.6)
Irregularly	91 (15.5)
Seldom	55 (9.4)
Never	50 (8.5)
Place of lunch	
Place	N (%)
Canteen	332 (56.5)
Cooking by myself	53 (9)
Restaurant	130 (22.1)
Fast-food restaurant	60 (10.2)
No cooked meal	12 (2.2)

Almost half of the participants ate junk food a few times per week, drank 1 – 2 litres of water per day (48.4%) and rarely drank sweetened drinks (49.5%); the majority of students (75.3%) drank coffee to increase their attention (Table 3).

Table 3: Frequency of eating fast/fried food/or daily drinking habits and drinks

Frequency of eating fast/fried food N (%)	
Never	7 (1.3)
Seldom	126 (21.5)
2 – 3 times a week	287 (48.8)
Every day	167 (28.4)
Daily water intake (litres/day) N (%)	
Less than 0.5 L	16 (2.7)
0.5 – 1.0 L	138 (23.5)
1.0 – 2.0 L	284 (48.4)
More than 2 L	149 (25.4)
Frequency of drinking sugar-sweetened beverages N (%)	
Never	156 (26.5)
Seldom	291 (49.5)
2 – 3 times a week	134 (22.8)
Every day	6 (1.2)
Drinks to increase energy/attention N (%)	
Coffee	442 (75.3)

Tea	295 (50.2)
Cola-cola and others	73 (12.4)
Energy drinks	99 (16.9)
None	78 (13.3)

Women took vitamins more often (69.5%) in comparison to men (60 %) (Table 4).

Table 4: Dietary supplements

Dietary supplement	Men N (%)	Women N (%)
Vitamins	82 (59.8)	313 (69.5)
Magnesium	55 (40.1)	231 (51.3)
Probiotics	14 (10.2)	72 (16)
Fibre	10 (7.3)	35 (7.8)
Zinc	3 (2.2)	18 (4.0)
Iron	3 (2.2)	7 (1.5)
None	42 (30.7)	(18.8)

3.2. Eating habits during the exam period

Another part of the questions focused on changes in eating habits during the exam period, which is characterised by higher exposure to stress. Half of the

women (53.3%) monitored reduced food consumption under stress exposure (Table 5). Almost half of the respondents (47.8%) ate less compared to 25.2% of students who ate more during the exam.

Table 5: Eating habit changes depending on the academic year period

	N (%)
Without changes	158 (27)
During the exam period eating less	281 (47.8)
During the exam period eating more	148 (25.2)
During the exam period eating less – women	240 (53.3)

Almost half of the students (48.8%) eat more junk food during the exam period, and more than half (55.2%) of participants drink more energy drinks.

Approximately the same number of students maintained their weight (49.4%) as they lost weight from the study at the medical faculty (50.6%) (Table 6).

Table 6: Changes in eating junk food, drinking energy drinks and changes in body weight depending on the academic year period

Changes in eating junk food depending on academic year period N (%)	
Without changes	280 (47.7)
Increased during the exam period	287 (48.8)
Decreased during the exam period	20 (3.5)
Changes in appetite depending on academic year period N (%)	
Without changes	250 (42.5)
Increased during the exam period	324 (55.2)
Decreased during the exam period	13 (2.3)
Changes in body weight from the study at the medical faculty N (%)	
No changes in body weight	290 (49.4)
Weight loss always during exam periods	297 (50.6)

3.2.1 Gastrointestinal problems during exam periods

The final questions on the questionnaire focused on the incidence of gastrointestinal tract (GIT) disorders and on ways of solving these health issues. Less than half of men (42.3 %) and less than one-third of women (26.9 %) had no digestive problems. Almost half of the women had diarrhoea (45.5 %), abdominal

cramps (42.2 %) and nausea (37.1 %), vomiting (15.3 %), gastroesophageal reflux (GER) (7.7 %) and constipation (14.8%). Among male students, digestive problems occur less often: diarrhoea (26.2%), abdominal cramps (16.7 %), nausea (19.7 %), vomiting (9.5 %), GER (16.05%) and constipation (6.6 %) (Table 7).

Table 7: Occurrence of gastrointestinal tract disorders in participants during their study at university

Gastrointestinal disorders	Men (N/%)	Women (N/%)
None	58 (42.3)	121 (26.9)
Diarrhoea	36 (26.2)	205 (45.5)
Abdominal cramps	23 (16.7)	190 (42.2)
Nausea	27 (19.7)	167 (37.1)
Vomiting	13 (9.5)	69 (15.3)
Gastroesophageal reflux (GER)	22 (16.1)	35 (7.7)
Constipation	9 (6.6)	67 (14.8)

Two-thirds of female students (66.6%) and almost half of the male students (46.7 %) noted an increased frequency of digestive problems during exam periods (Table 8). Among the students with lower appetites during exam periods, 75.1 % had digestive issues more often, precisely during this period. Among the students with the same desire during the academic

year, 60.1% noted some digestive problems during the exam period. Half of the respondents (50.6 %) with a greater appetite during the exam period also had a higher frequency of digestive issues (Table 6). Among students with a higher energy drink consumption frequency, two-thirds (67.6 %) had digestive problems more often (Table 6).

Table 8: The frequency of gastrointestinal tract disorders depends on the academic year period

	Men (N/%)	Women (N/%)
Without changes	73 (53.3)	168 (37.3)
Increased during the exam period	64 (46.7)	282 (66.7)
Decreased during the exam period	-	-

Among students with digestive problems, 63.2 % did not solve their problems, 13.3% decided on a change of diet, 11.8 % took over-the-counter drugs,

10.2 % visited a doctor, and 9.2 % drank digestive tea (Table 9).

Table 9: Solving gastrointestinal tract disorders by the participants

	N (%)
Did not solve the GIT disorder	371 (63.2)
Diet	78 (13.3)
Taking an over-the-counter drug	69 (11.8)
Drinking digestive tea	54 (9.2)
Visiting a doctor	60 (10.2)

4. DISCUSSION

The main results of this study indicated that most respondents had average weight, but one-third of the men were overweight. In Polish, Hungarian and American students, a higher incidence of overweight in men was also noted compared to women [12–14]. On the other hand, the obesity of Iranian students has proportionally reversed: 22.5 % of Iranian women were overweight compared to 7.3 % of Slovak women, and 7.9% of Iranian men were overweight in contrast to 31.4 % of Slovak men [15]. The prevalence of obesity among university students was caused by their socio-economical situation, ethnicity, education, income, culture, eating and exercise habits. Different amounts of muscle mass may also cause a higher incidence of overweight in male students than in women; thus, a better indicator of obesity is measuring the amount of fat and its distribution in the body [16].

Most Slovak medical students reported eating a varied diet that included animal products, and only 1.4% were vegans. Studies show that vegans have a low body mass index (BMI) and low cholesterol levels in

blood plasma [17]. The Mediterranean diet prevents cardiovascular diseases and obesity [18], [19]. We can speak about the Mediterranean diet as it comprises extra virgin olive oil, fresh fruit, vegetables, cereals, nuts, legumes, fish, meat, dairy products, red wine and low amounts of eggs and sweets [20].

In our study, more than half of the participants had breakfast regularly, the same as Chilean students, who ate breakfast 5 – 7 times per week [21]. The percentage distribution of the diet during the day affects body composition. Chilean students with a low-fat body percentage consumed almost 19% of their daily intake at breakfast, whereas students with a high body fat percentage consumed only 8.9% of their daily intake for breakfast [22].

Eating junk food can increase body weight. In our study, 48.8% of students eat junk food a few times per week. *Caso et al.*, [23, 24] confirmed that overweight students eat junk food more often and mainly during times of negative emotions (sadness,

anger, fear, academic stress) in comparison to students with average weight [23].

Slovak and American students drink coffee to improve concentration. In addition, American students drink coffee to increase attention (79 %), because of its taste (68 %), for socialising (39 %), to improve physical energy (27 %) and mood (18 %), and to relieve stress (9 %) [25].

Most students experience academic stress [26], and the exam period appears to be the primary source of stress [27]. Academic stress refers to the anxiety associated with the educational environment, writing tests, performing complex cognitive tasks or being evaluated [28]. The current literature offers inconsistent findings regarding gender relative to perceived stress levels [29]. Ng *et al.*, [30] found that females were more likely to feel they experienced higher stress levels, which agreed with Thawabien [31]. In addition, female students reported more stress-related issues, such as low self-esteem, pressure from exams and depression [31]. However, no gender differences in coping with stress were found by Donaldson [32].

Exposure to stress factors can lead to gastrointestinal problems [33]. Knowles *et al.*, [34] reported significantly more digestive issues, increased levels of cortisol and decreased amounts of bacterial strains before exam periods. These findings play an important role in preventing and treating digestive problems during stress periods. Increased cortisol levels are characteristic of chronic stress [35], and there is a relationship between abdominal obesity and higher levels of cortisol [36]. Activation of the sympathetic adrenal medullary system, with the release of catecholamines (epinephrine and norepinephrine) during the acute stress response, reduces appetite [35].

Stress can cause an increased or decreased appetite. Chronic stress is characterised by a preference for junk food (with high levels of fat and sugar), and studies show that chronic stress can lead to being overweight, mainly in the male population [35]. In our study, half of the participants consumed less; however, they consumed more junk food during the examination period. Caso [23] confirmed that academic stress is connected with higher consumption of junk food. Oliver [7] found that approximately the same number of students ate less (38%) or more (42 %) food during examination periods. In contrast, the appetite of English students did not change; there were changes in the macronutrient intake ratio, but total calorie intake did not vary during exam periods [37]. In our study, half the participants (55.1 %) drank energy drinks to improve their concentration, and approximately the same number of students (50 %) lost weight or did not change in weight during academic stress.

Stress can increase or decrease appetite, and a well-balanced diet and BMI can also be affected by gender [6]. Stress-eaters (people who eat more under negative emotions, such as fear and sadness) often choose a high-fat and high-carbohydrate diet under stress conditions [38].

Brain signals can affect the motor, sensory and secretory modalities of the gastrointestinal tract; however, gut signals are affected by emotional behaviour. Stress and pain modulate this system using the nervous, endocrine and immune systems. As a result, the gut-brain axis has changed to the microbiota-gut-brain axis. Therapy with probiotics appears to be suitable for abdominal dysfunction caused by stress. Kato-Kataoka *et al.*, [39] monitored the effect of the probiotic bacteria *Lactobacillus casei* strain Shirota on abdominal dysfunction in a double-blind study composed of students before an exam period. They reported the positive impact of daily intake of probiotics. They found that the number of bacterial strains in the gut microbiota was significantly increased in the placebo group. In contrast, cortisol levels were significantly increased in the group with probiotic intake. The percentage of members of the family *Bacteroidaceae* was reduced considerably.

Exposure to stress factors plays a vital role in developing visceral pains (e.g. functional gastrointestinal diseases; irritable bowel syndrome [40]. In our study, almost 60 % of students had digestive problems during the examination period, and women, in particular, suffered from diarrhoea, abdominal cramps, nausea and constipation. Yildirim *et al.*, [41] confirmed the interaction between stress and constipation in Turkish medical students. They also observed the percentage increase in the number of students with constipation depending on the year of study. Abdominal aroma and meridian massage positively affect constipation and frequency of defecation in female students. Application of abdominal massages leads to a reduction of drug intake and can help to release stress during an exam period [42]. Focus appears to be one-factor affecting irritable bowel syndrome's origin. The prevalence of irritable bowel syndrome in Chinese students was 15.7 %. The most common symptoms were changes in stool consistency, frequency of defecation and the presence of abdominal pain released with excretion. The symptoms appeared more often in female students. Psychological and psychosomatic symptoms of affairs and depression were more common in patients with irritable bowel syndrome [43]; therefore, increased demands on students' psyches during exam periods could lead to digestion problems. Polish students with a lack of physical activity repeatedly suffered from digestive issues. They were frequently more absent from school because of abdominal pains than students with sufficient physical activity [44].

4.1 Limitations

The limitation of the study is that the questionnaire on diet and health habits was completed by 587 students from 1948 medical students from the 1st to the 6th year, the Faculty of Medicine in Bratislava. The response rate was 30 %. Thus, the participants in our study do not necessarily represent the dietary habits of Slovak medical students in general.

5. CONCLUSIONS

In conclusion, this is the first study dealing with the dietary habit issues of Slovak medical students depending on the academic year period. Our results suggest that in higher exposure to stress, mainly during exam periods, the participants consumed less food but more junk food and energy drinks, leading to overweight or obesity. We confirmed the assumption that academic stress plays an essential role in the origin of digestive problems, which could be decreased by nutrition education, enhancing self-regulation components towards dietary intake and practical approaches to cope with stress during university life.

Author Contributions

AG and ZJ conceived and designed the study. DF and AG were responsible for data collection. ZJ, DF, ZF, JK and AG analysed the datasets. ZJ, DF, ZF, JK and AG wrote the primary draft of the manuscript. All authors critically reviewed the manuscript and have approved the final article.

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