

Hygienic Evaluation of Students' Nutrition with Products from Fast Food Vending Machines

Alexander Olegovich Karelin*, Daria Valentinovna, Pavlova Harutyun and Vardanovich Babalyan

Department of General Hygiene and Ecology, Saint-Petersburg State Medical University Saint-Petersburg, Russian Federation

***Corresponding Author:** Alexander Olegovich Karelin, Department of General Hygiene and Ecology, Saint-Petersburg State Medical University Saint-Petersburg, Russian Federation.

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Abstract

The article presents the results of a study of students' nutrition with products from fast food vending machines, taking into account the consumer priorities of medical students, the nature and possible consequences of their use by students. The assortment of products sold through fast food vending machines on the territory of the First St. acad. I.P. Pavlova. For each food product, net calorie content, protein, fat and carbohydrate content, glycemic index, and glycemic load were determined. Information on the use of fast food vending machines was obtained through a questionnaire survey of second and fourth year students of the medical and dental faculties using the method of standardized interviews. It has been established that most of the products sold through fast food vending machines have a high energy value, mainly due to refined carbohydrates, and are characterized by an average and high glycemic load. The products offered are low in protein. The majority (87.3%) of students buy goods from fast food vending machines due to lack of time to visit the canteen and buffets. Only 4.2% of students like the range of fast food vending machines. More than 50% of students have complaints about the condition of the gastrointestinal tract. A reliable relationship was established between the time of study at the university and the morbidity of the gastrointestinal tract, as well as the number of students in need of dietary nutrition. At the same time, students who need dietary meals use fast food vending machines significantly more often (46.6% versus 37.3% of students who do not need dietary meals).

Keywords: Food; Students; Fast Food Vending Machines

Introduction

Currently, the process of education in a higher educational institution is characterized by a variety of forms and methods of teaching, high labor intensity, the introduction of new technical means and educational technologies. Informational and emotional stresses accompanying education make certain demands on the state of students' health [2,4,7]. Students of medical universities have common features inherent in this social group as a whole, but at the same time they have a number of significant differences determined by the nature of education and the specifics of practical activity. Among these features are increased intellectual and emotional stress caused by training sessions, contact with seriously ill people, etc., which creates increased requirements for the physical and mental health of students.

The most important factor affecting a person is the nature of the diet. According to a number of experts, the nutritional factor is even more important for maintaining health (2 - 2.5 times) than environmental and socio-economic factors [5,11].

Rational nutrition contributes to the formation of a person's health and performance, his resistance to infections and other unfavorable external factors [6,10]. There is no doubt about its importance for maintaining the health of students. At the same time, in modern

conditions, new technologies for the preparation and sale of food products, which have not been sufficiently studied from a hygienic standpoint, are being actively introduced.

One of the most radical changes in the organization of student meals in recent years has been the widespread use of fast food vending machines. Undoubtedly, their use has its positive aspects, including the possibility of placing machines within walking distance and the absence of queues, which is important in conditions of limited time breaks, as well as round-the-clock operation. At the same time, most of the products sold through fast food vending machines are industrial products that have undergone rigorous technological processing and, as a result, have a reduced biological value.

Aim of the Study

The aim of this study was the hygienic assessment of the offered assortment of fast food machines, taking into account the consumer priorities of medical students, the nature and possible consequences of their use by students.

Materials and Methods

The study analyzed the full range of products supplied through fast food vending machines located on the territory of the First St. acad. I.P. Pavlova. Data on the range of products and the frequency of filling the machines with them were obtained from the suppliers. In addition, during the week, we carried out our own monitoring of the filling of fast food vending machines. In total, 60 types of goods are sold on the territory of the university through fast food vending machines, including 2 types of hot drinks, 19 types of cold drinks, 39 types of snack products. In order to determine the usefulness of products sold through fast food vending machines, the net calorie content, the content of protein, fats and carbohydrates were calculated for each item of the assortment, and the glycemic index (GI) was determined. Calculation of energy and nutritional value of products, as well as determination of GI for glucose was carried out using reference tables [9,12,14,15].

For a more complete assessment of the quality and quantity of carbohydrates included in the considered food products, we used the glycemic load (GL) index, which was calculated by the formula [9]: $GL = GI \text{ (in percent)} / 100 \times \text{the amount of carbohydrates (in grams)}$. For products with a large number of components (sandwiches), the GN was determined separately for each ingredient, followed by the calculation of the total GN. Depending on the magnitude, there are high, medium and low degrees of GN [9]. At the same time, up to 10 units of GN for one portion is low, 11 - 19 units are medium, 20 units and more are high. For the whole day, GN less than 80 units is considered low, the average GN is about 100 units, and GN more than 120 is high.

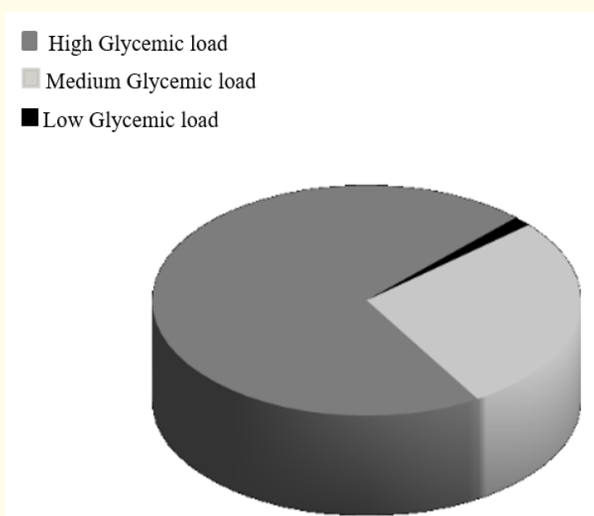


Figure 1: Distribution of products sold through fast food machines by glycemic load.

Information on the use of fast food vending machines was obtained through a questionnaire survey of second and fourth year students of the medical and dental faculties using the method of standardized interviews. Students of both selected courses (junior and senior) spend most of their study time on campus. The questionnaire survey was not carried out among the 5th and 6th year students, since they spend a significant part of their time at bases outside the university territory. The first-year students were also not questioned, since many of them have not yet formed stereotypes of eating behavior at the university. In addition, there is evidence that fourth-year students are at risk of developing diseases of the digestive system associated with inappropriate nutrition [1,3,13]. In total, 590 students were surveyed, including 307 second-year students and 243 fourth-year students.

For the purposes of the survey, a special questionnaire was developed, including 39 questions and 122 positions. Among other things, the questionnaire included information about the course of study, age and gender, indicators of length and body weight, assessment of the nature and quality of food carried out through fast food machines, as well as the presence of complaints and diagnosed diseases of the gastrointestinal tract among students.

The results were statistically processed using the IBM SPSS Statistics 21 software. The reliability was assessed using the Mann-Whitney U-test.

Results and Discussion

On the territory of the First St. acad. I.P. Pavlova, there are 18 units of fast food vending machines, including: combined vending machine "Rosso Bar" - 4 units; Snack vending machine "Foodbox" - 7 units; vending machine for drinks "Rosso" (intended for the preparation and sale of drinks, including coffee and tea) - 7 units. It was revealed that all fast food vending machines comply with the requirements of the technical regulation "On the safety of machinery and equipment" (Resolution of the Government of the Russian Federation of 15.09.2009 No. 753), GOST R 52161.12004, GOST 23833-95 and TU 5151-011-96844547-2010, the requirements of the State Tax Code 2.3.3.972-00, SN 2.2.4/2.1.8.562-96, SanPiN 2.2.4.1191-03, SN 2.2.4/2.1.8.566-96. Certificates of conformity are available, all the requirements of the operating mode of the machines are observed.

The machines are loaded regularly: at least 1 - 2 times a week, maximum daily from Monday to Saturday. The machines are loaded with products with a long shelf life: from 6 months to 3 years, which ensures their complete safety. All products are placed in sealed packaging at the manufacturing plant, which makes it impossible for biological and chemical contamination in the process of sale.

Hot and cold drinks and snacks are sold through fast food vending machines at the university. Hot drinks include Paulig Espresso Original coffee and tea. Among cold drinks, the overwhelming number of items are sweet carbonated drinks. There are also packaged juices with sugar content, cold tea of the "Nesty" company, only one type of drinking yoghurt, carbonated and still water "Bon Aqua". The assortment of snack products includes 12 varieties of chocolate bars and chocolate bars, 3 types of cookies, crackers, chips, gingerbread, crackers, popcorn, as well as sandwiches and braids with various fillings from Robin-Bobin. The chemical composition and GN of the most common representatives of the assortment of fast food vending machines are shown in the table 1.

No	Food name	Weight, g	Energy, kcal	Content in the product, g			Glycemic index	Glycemic load
				Protein	Total fat	Carbohydrate		
Snack products								
1.	Lays Chips	80	408	5,2	24,0	42,4	80	33,9
2.	7Days croissants (chocolate)	65	287	4,5	17,1	28,6	75	21,5
3.	Biscuit "Alenka"	40	116	1,76	7,6	22,3	75	16,7
4.	Snickers Super chocolate bar	95	482	1,2	26,1	52,4	70	36,7
5.	Gingerbread "Tul'skij" (evaporated milk)	140	517	10,1	10,8	95,5	65	62,1
6.	Cream waffles	200	1040	13,2	56,4	120,2	65	78,1
7.	Crackers "HrusTim"	90	378	7,9	12,6	58,5	70	40,9

8.	Crackers "Yubilejnoe"	130	556	10,2	20,3	87,7	55	48,2
9.	Dragees "M&M's" with peanuts	50	256	4,5	11,8	30,9	55	16,9
10.	Crackers "Flotskaya" (with cheese)	100	296	8,8	4,1	59,1	50	29,6
11.	Salty peanuts	100	604	28,5	49,8	10,5	15	1,6
12.	Chicken sandwich							
	Sesame bun	60	193	5,8	2,5	35,7	80	28,6
	Chicken fillet	31	35	7,3	0,6	0,1	30	0,03
	Cheese	25	88	5,8	7,1	0	0	0
	Mayonnaise 67%	10	63	0,3	6,7	0,4	60	0,2
	Mustard	2	3	0,2	0,1	0,3	55	0,2
	Ketchup	4	4	0,07	0,04	0,9	55	0,5
	Pickled cucumbers	20	3	0,2	0,02	0,3	15	0,05
	Lettuce leaf	5	1	0,06	0,02	0,2	10	0,02
	Parsley	3	2	0,1	0,01	0,2	15	0,03
	Total	160	392	19,8	17,0	38,1	-	29,6
13.	Loaf with servelat	160	455	12,2	8,5	85,9	80	68,7
14.	Muffin "Robin-Bobin" with ham	150	431	15,3	20,9	51,3	80	41,0
15.	Popcorn	50	165	4,5	5,3	27,0	85	22,9
Drinks								
16.	Juice "Dobryj" with pulp (orange)	450	194	0	0	40,5	65	26,3
17.	Pepsi	600	269	2,28	1,1	64,2	70	44,9
18.	Coca-Cola	500	210	0	0	51,1	70	35,7
19.	7 UP	600	228	0	0	52,2	70	36,5
20.	Fanta	330	162	0	0	39,7	70	27,8
21.	Lemon Fresh	500	240	0	0	59,0	70	41,3
22.	Tea "Nesti" (lemon)	500	180	0	0	45,5	70	31,8
23.	Yogurt "Ermigut" (strawberries- kiwis)	385	339	7,7	0	69,3	52	36,0
24.	Energy drink "Burn"	500	245	0	0	58,0	70	40,6
25.	Kvass "Nikola" Traditional	500	155	0	0	29,0	45	13,1
26.	Water "Bon Akva" Viva Lemon	500	95	0	0	23,0	68	15,6

Table 1. Energy value, nutritional value and glycemic load of the main types of products sold through fast food vending machines

An analysis of the qualitative composition of the assortment sold through fast food vending machines allows us to conclude that these are products of predominantly high energy value, mainly due to the content of carbohydrates and fats. So, for 80% of the names of snack products, the energy value of 1 portion ranges from 250.0 - 1040.0 kcal. BV sodas contain only simple carbohydrates (sugar). Most (over 70%) snacks are low in protein, not exceeding 5.0g per serving.

Moreover, this is a protein of predominantly vegetable origin, i.e. defective. Against the general background, sandwiches look somewhat better in their composition. They include ingredients such as chicken fillet, cheese, cucumbers, lettuce.

For example, a sandwich with chicken roll (160g) contains 19.8g of protein, 17.0g of fat, 38.1g of carbohydrates with a caloric value of about 392 kcal. However, a significant part of the sandwich is made up of a sesame bun, which determines its high GL (29.6 units).

We have not calculated the content of basic minerals and vitamins in the fast food products sold. However, taking into account the assortment of products offered in the machines and based on the literature data [8], we can conclude that if a student is focused mainly on this type of food, there will be a lack of dairy and meat products in his diet, as well as vegetables and fruits, which can negatively affect the vitamin status. At the same time, the proportion of products containing refined carbohydrates will be quite high. Since students spend a significant part of the day at the university, it is quite difficult to make up for this deficiency by eating at home.

In the course of the analysis of the GI of the considered products, it turned out that 74% were foods with a high GI, products with medium and low GI were almost equal (12% and 14%, respectively). At the same time, only the GI of salted peanuts is really low (GI = 15%).

Bottled water is not a carbohydrate product. For the rest of the products in this group, the GI is close to the average and is in the range of 45 - 55%. It should be borne in mind that when eating at a time a sufficiently large amount of a product with a relatively low GI, the GN may turn out to be medium and even high.

Of the entire assortment of snacks, only salted peanuts and "Wagon Wheels" biscuits are classified as low GI products. In the latter case, low GI is determined by the small mass of the product (22g).

The share of these products from all snacks is insignificant, only 2.3%. Products with average GN is about 1/3 (30.2%). Among them are chocolate "Alpen Gold", "Milky Way", "Kit-Kat", croutons "KhrusTim".

The highest percentage is made up of snacks with high GL (67.5%). All chocolate bars (Snickers, Mars, Bounty, etc.), popcorn, gingerbread, dryers, waffles fall under this category. This group also includes the entire range of Robin Bobbin sandwiches and braids on offer.

A similar picture is observed in the assortment of drinks. Low GL drinks are almost completely absent. This group can include only mineral water and only if it does not contain sugar. Two thirds (75.9%) of the offered drinks are sugar-containing carbonated drinks with high GN (Sprite, Fanta, Coca-Cola, 7 UP, Laimon Fresh, Nesty tea, etc). The rest (23.2%) are drinks with medium GN, including kvass "Nikola" and juice "Dobry" (apple, multifruit).

It is necessary to take into account the fact that the calculation of GN was carried out for the complete list of products provided by the supplier. In this list there are food products of the same name that have different weights and, therefore, different GN. For example, for crackers "KhrusTim" in a package weighing 40g, the GN was 18.2, which is regarded as average. For the same croutons, but in a package weighing 90g, the GN is 40.9 (high GN). Likewise for the Snickers (57g) and Snickers Minis (180g) chocolate bars. In this case, the GN, which is already high, increases by 3 times. The monitoring of the filling capacity of fast food vending machines showed that the supplier, in practice, prefers products with a higher weight. Therefore, we can conclude that among the goods sold through fast food vending machines, the overwhelming majority are products with high GBV.

The situation is aggravated by the fact that students rarely buy one product at a time. As a rule, this is a kind of set, at least consisting of a drink and some kind of snack. In this case, GN will inevitably increase significantly.

The results of the survey showed that, on average, students are on the territory of the university 74.1% of the study time, while in the second year - 87.9% (the most frequent answer is 100%), in the fourth year - 59%. Assuming the possible influence of the living condi-

tions of students on the nature of their nutrition, we studied this issue. According to the survey results, $47.3 \pm 3.3\%$ of students live in families, $32.4 \pm 3.3\%$ - in hostels and $19.7 \pm 3.3\%$ - in rented housing. There was no significant difference in the frequency of use of vending machines, meals in the canteen and buffets, depending on the living conditions.

Attention is drawn to the fact that among all possible food sources for students on the territory of the university, fast food vending machines are the most popular. Thus, 75.6% of the respondents purchase food in them with an average frequency of purchases of 2.77 ± 0.10 times a week. The university canteen is used by 61.5% with an average number of visits per week 1.74 ± 0.08 , buffets - 49.5% (1.17 ± 0.07 visits). 33.9% of the respondents take food from home, and, finally, 13.9% of the respondents do not eat at all while at the university.

The main reason why students use fast food vending machines is the lack of time to visit the canteen or buffet, followed by convenience, unwillingness to bring food from home. Only 4.2% of the respondents indicated that they like the assortment of machines as a reason (Figure 2).

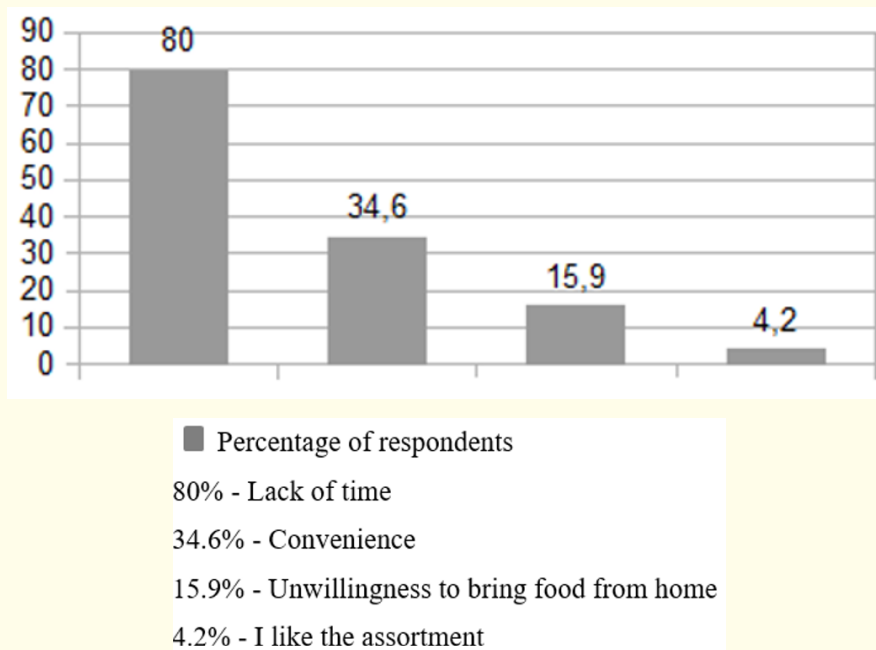


Figure 2: Reasons for using fast food vending machines.

A detailed assessment of the use of fast food vending machines showed that, on average, a student uses vending machines 3.5 times a week. At the same time, only 12.7% of the respondents do not use fast food vending machines at all. Thus, 87.3% of students purchase certain goods in them. Comparison with the previous question about the use of vending machines as a food source, to which 75.7% of respondents gave a positive answer, allows us to conclude that 11.7% of students purchase only drinks from vending machines.

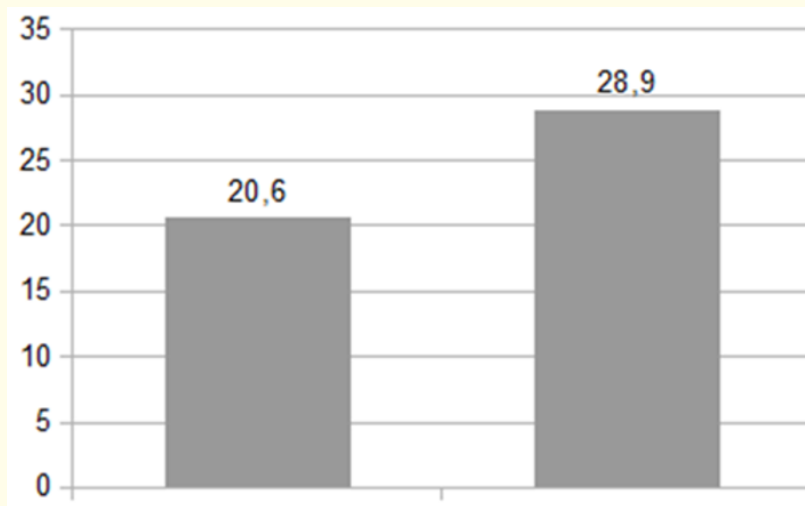
Most often, vending machines buy chocolate bars, coffee and mineral water.

A significant problem is that food purchased from vending machines is often consumed by students in classrooms ($57.8 \pm 0.2\%$) and classrooms ($58.5 \pm 0.2\%$), and even more often in corridors and on stairs ($65.6 \pm 0.2\%$).

This is unhygienic, leads to a haste of the food process, and causes littering of premises and territory.

The students' assessment of the quality of food from vending machines is quite contradictory. While 71% of those surveyed believe that food offered in fast food vending machines has adverse health effects, 74.2% believe that fast food vending machines are essential. At the same time, 46.9% of respondents are not satisfied with the assortment of machines.

As mentioned above, a number of studies have noted an increase in disorders of the digestive system associated with an increase in the duration of training. The results of our research have confirmed this conclusion. According to the data obtained, $24.6 \pm 5\%$ of all surveyed students were examined by a gastroenterologist and have an established diagnosis of diseases of the gastrointestinal tract. At the same time, another $27.3 \pm 5\%$ of students were not examined, but they have complaints from the gastrointestinal tract. Only $44.9 \pm 5\%$ of students have no complaints from the gastrointestinal tract. Thus, disorders of the gastrointestinal tract were noted in more than half of the respondents, which indicates problems in the organization of their nutrition. At the same time, the number of interviewed students with an established diagnosis in the second year is about 20%, and in the fourth year it is statistically significantly 1.4 times higher, the odds ratio is 1.83, $p = 0.003$ (Figure 3).



■ Percentage of students diagnosed with gastrointestinal tract disease
20.6% - 2nd year students
28.9% - 4th year students

Figure 3: Morbidity of the gastrointestinal tract in the 2nd year and 4th year students.

At the same time, the number of surveyed students who have no complaints is 50.7% in the second year, and 40.0% in the fourth year. The difference between the groups is statistically significant, students who studied for 3 years (IV course) have a significantly greater number of identified diseases of the gastrointestinal tract than those who studied for 1 year (II course), the odds ratio is 1.78 [1.17 - 2.71], $p = 0.006$. In addition, $40 \pm 2\%$ of all surveyed students require dietary nutrition (Figure 4). The differences between the courses for this indicator are also significant, the odds ratio is 1.61 [1.16 - 2.24], $p = 0.003$. Unfortunately, it should be noted that students in need of

dietary meals more often use vending machines: 46.6% of those in need of dietary meals buy food from vending machines more often 3 times a week versus 37.3% of those who do not need them (according to Pearson's χ^2 criterion, $p = 0.024$).

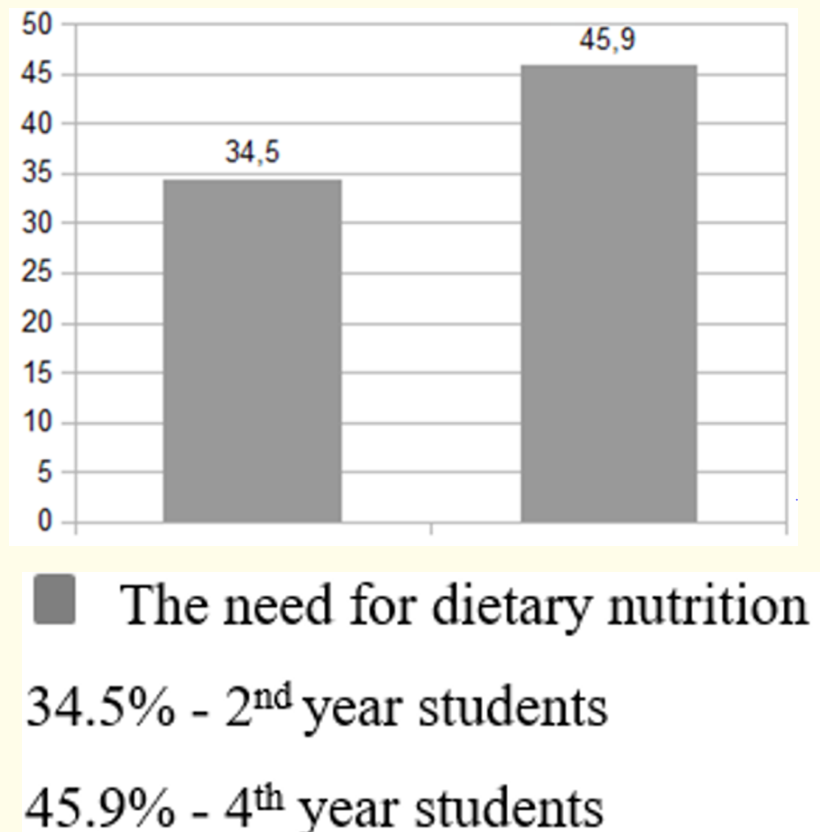


Figure 4: The need for dietary nutrition in the 2nd year and 4th year students.

Conclusion

Medical students widely use fast food vending machines: 87.3% purchase goods, while 11.6% of students only buy drinks. On average, a student uses machines 3.5 times a week. Most often, students buy chocolate, coffee, bottled water from vending machines.

The main reason why students use fast food vending machines is the lack of time to visit a canteen or a buffet (80.0% of respondents), in addition, convenience (34.6%) and unwillingness to bring food from home (15.9%).

Only 4.2% of the respondents indicated as a reason that they like the assortment of machines.

Most of the products sold through the vending machines have a high energy value, mainly due to refined carbohydrates, and are characterized by medium and high GL (70.8 and 27.7%, respectively). The offered products are low in protein, especially of high-grade animal origin. Sandwiches are an exception, but their GL is classified as high.

More than 50% of university students have complaints about the condition of the gastrointestinal tract.

A reliable relationship was established between the time of study at the university and the morbidity of the gastrointestinal tract, as well as the number of students in need of dietary nutrition.

At the same time, students who need dietary meals use fast food vending machines significantly more often.

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