Balancing Blood Glucose Level by Using Effective Nutrition Strategies and Change of the Lifestyle

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Abstract

The elevation of glucose levels in the blood adversely affects the quality of life. It is a health condition that results in a disturbance or dysfunction of a specific physiological process in the body and may manifest through various symptoms. The purpose of this research is to examine the impact of lifestyle and dietary habits in patients with hyperglycemia and to demonstrate that modifications to these factors can lead to significant improvements and regulation of hyperglycemia levels. To conduct the research, a survey questionnaire was administered to patients in Kosovo who are experiencing issues with elevated blood glucose levels. For this purpose, a total of 200 respondents aged between 27 and 85 were included. The questionnaire comprises 48 survey questions. A statistical analysis of the collected data was conducted using SPSS, Reviews, and MS Excel software applications. The data obtained indicate that the majority of respondents are aged between 51 and 60 years. According to the educational structure, a maximum of 60% has completed secondary education. A total of 23 patients exhibits normal body mass, defined as a Body Mass Index (BMI) ranging from 18.5 to 24.9. In contrast, 38% of patients, equating to 76 individuals, demonstrate excess body mass as determined by BMI criteria. Fifty percent (50%) of patients exhibiting hyperglycemia frequently omit breakfast. Eighty percent (80%) of respondents reported that they do not engage in regular exercise or that their exercise frequency is infrequent. Forty-six (46%) percent of respondents indicated that they occasionally consume fruit in quantities ranging from 250 to 500 grams. More than half of the respondents indicated that they predominantly consume bread and pasta made with whole meal flour, whereas 28% reported not consuming bread and pasta at all. Additionally, 46% of patients occasionally utilize artificial sweeteners, while 57% reported occasional use of natural sweeteners. In conclusion, it can be asserted that enhancing the lifestyle and dietary practices of patients can effectively prevent the progression of the condition and the advancement to type 2 diabetes.

Keywords: Hyperglycemia, Lifestyle, Nutrition

1. Introduction

Balancing blood glucose is a critical component of maintaining overall health and well-being. With the increasing prevalence of diabetes and metabolic disorders, controlling blood sugar levels through effective dietary and lifestyle changes has never been more important. The main goal of balancing blood glucose levels is not only to prevent and regulate diabetes but also to maintain energy levels so that the body can perform its functions. More often, hyperglycemia does not cause symptoms until the concentration of glucose in the blood rises significantly. The longer the high blood sugar level is maintained, the more serious problems it causes[1]. The first step in maintaining optimal blood sugar levels begins with a comprehensive approach that includes dietary modifications and lifestyle changes. Diet plays a fundamental role in regulating blood glucose levels. Eating a balanced diet rich in fiber, protein, healthy fats, and complex carbohydrates can help maintain stable blood sugar levels throughout the day. Foods with a low glycemic index, such as grains, legumes, and non-starchy vegetables, allow for a gradual release of glucose into the blood and keep the body feeling full for a longer period. In addition to a balanced and tailored diet, lifestyle changes are vital for blood glucose control.

Regular physical activity improves the body's sensitivity to insulin, allowing cells to use glucose more

efficiently. The proper implementation of aerobic exercises, such as walking or cycling, can improve overall metabolic function and contribute to better regulation of blood sugar. In addition, stress management and good sleep are also critical. Chronic stress and insufficient sleep can disrupt hormonal balance and lead to high blood sugar levels, making glucose management even more difficult [2]. The general process is a dynamic process that involves the integration of effective nutrition strategies and lifestyle [3]. With the right approach, an individual can achieve better blood sugar control, reduce the risk of chronic diseases, and improve the quality of life. The purpose of this research is to examine the influence of lifestyle and food habits in patients with hyperglycemia and to prove that changes in diet and lifestyle in these individuals can lead to a significant improvement in the level of hyperglycemia. The research is designed in such a way to analyze the eating habits and lifestyle of the patients who are the subject of research, to determine the possible directions of influence on level of hyperglycemia. Based on personal profile, respondents receive specific dietary recommendations and are to determine which food products affect level of hyperglycemia.

2. Materials and Methods

A structured questionnaire was developed based on published literature and different standardized questionnaires (Canadian diabetes risk questionnaire CANRISK). The targeted individuals on whom this research has been conducted are patients from Kosovo who have a problem with high blood glucose levels. For this purpose, 200 patients aged between 27 and 85 years old were included, who were given instructions for completing the questionnaire.

2.1. Methods

For purposes of this research, a survey questionnaire was created with a total of 42 survey questions related to the eating habits and lifestyle of patients, as well as 6 additional demographic questions (gender, age, height, weight, completed education and employment).In questions related to eating habits and lifestyle, frequency of consumption of certain groups of food and beverage products (For example, dairy products, fruits and vegetables, alcohol, juices, etc.), and quantity of their consumption. In order to achieve goals of this research, a statistical analysis of obtained data carried out, with aim of obtaining concise knowledge between food habits and lifestyle, on one hand, and blood glucose level of patients with hyperglycemia on other hand. Statistical analysis includes descriptive statistics and correlation, as well as tests of equality. In addition, tests for normal distribution of quantitative variables (such as blood glucose level, body mass index, age of patients, etc.) performed to determine whether they met conditions for performing parametric tests in further analysis, or if it is more appropriate to apply alternative non-parametric tests. To determine whether there is a linear relationship between blood glucose level and patients' age, that is, body mass index, Spearman's rank correlation coefficient (as an alternative to Pearson's correlation coefficient) was applied. Statistical analysis for needs of this research done in SPSS, Reviews, and MS Excel software applications. This selection of statistical tests gives us a complete picture of structure of data, i.e. shows whether and how blood glucose levels vary in different groups of patients according to their eating habits and lifestyle.

3. Results and Discussion

Blood glucose levels can vary depending on the patient's gender, age, and body mass index, and it is necessary to consider these factors in relation to other patient-specific factors. With the summary of the responses obtained from the conducted survey, these results were obtained from a total of 200 respondents, the majority are aged 51 to 60 years, specifically 54 people - 27%. According to Mazzola [4] the older age group has a higher risk of hyperglycemia and for this reason regular screening is recommended in this population. Regarding gender, a balanced ratio has been observed between male and female respondents. According to the status, 52% of respondents, a total of 104 surveyed, stated that they employed, while rest are unemployed (17%) and pensioners (31%). According to educational structure of total number of respondents, 16% have completed primary education, 60% have secondary education, while 24% have completed higher education, including postgraduate studies and doctoral studies. Funnell & Anderson [5] concluded that higher education improves diabetes management and patient self-efficacy, especially in populations with lower education levels. Parchman & Zeber [6] indicate that comprehensive educational strategies needed to reduce illiteracy and to better manage diabetes. Obesity, measured by body mass index (BMI), is a critical risk factor for development of type 2 diabetes, requiring early intervention strategies.

Graph 1 shows the value of the body mass index among the respondents. According to the body mass index (BMI), it includes patients with a body mass index ranging from 21.26 to 38.1. Of normal body mass (BMI from 18.5 to 24.9 points) there are a total of 23 patients, which is 11% of the respondents. Among the respondents, 50% have a body mass index (BMI) ranging from 25 to 29.9, while 38% of the patients, or 76 individuals, and have excessive body weight with a BMI of 30 or higher. The majority of patients (90 people, or 45% of the total number) encountered the disease for the first time at the age of 41 to 50 years. The disease's prevalence was discovered in 25% of patients aged 31 to 40 years, totaling 50 people. While from the age of 51 to 60, 36 subjects faced hyperglycemia for first time, meaning 18%. In other words, in 88% of patients, hyperglycemia first detected between ages of 31 and 60. The average level of blood glucose in patients is 10.3 mmol/L, with lowest level being 6.3 mmol/L and highest 18 mmol/L. In almost 80% of patients included in research, at least one of parents faces the same disease, while all patients have at least one member of their extended family with hyperglycemia. However, despite suggestions from the professional literature, the analysis conducted did not find sufficient consistent evidence that among different categories of patients.

There are significant statistical correlations in blood glucose levels based on gender, level of stress they exposed to, as well as body mass index. From table 1, it can be concluded that between different groups of patients, there are no significant enough differences in level of glucose in blood, so they can be considered statistically significant. In other words, all tests conducted for the three variables yield small test statistics, thus p-values greater than 0.05, which is an official confirmation of above finding. A weak positive correlation is observed between the age of patients and blood glucose level, where determined correlation coefficient is 0.18. Furthermore, there is a moderate positive linear relationship between age and body mass index, with

correlation coefficient b/w these two variables being 0.27 and statistically significant at 0.01 significance level. This means that increase in age of patients is usually followed by an increase in their body mass index. Based on summarized responses, we can say that nearly half of patients with hyperglycemia included in this study have only two main meals each day - lunch and dinner - often skipping breakfast. From graph 2, it can be observed that almost half of patients reported that they eat a light snack during day, while 16% reported they do not consume a light snack during day.

However, one-third of patients eat two meals a day, while 2%, that is 4 patients, eat more than two meals during day. According to McCarty & Brunt [7] a higher frequency of meals can help stabilize blood glucose levels in individuals with hyperinsulinemia, reducing risk of diabetes-related complications. Insufficient physical activity and a sedentary lifestyle considered causes of weight gain. Obese people often eat less than people on a normal diet, but sometimes they are very inactive and manage to accumulate an excess of energy that leads to emergence of a range of diseases, including diabetes [8]. From graph 3, it can be concluded that majority of patients involved in research (almost 80%) responded they do not exercise or only exercise occasionally. According to them, 85% (or 132 people) walk, while rest run, exercise at home or at gym, and some ride bicycles or swim. 22% of patients (or a total of 44 people) engage in regular physical activity, at least once a week, while only 6%, or 12 people, exercise every day. Of those who exercise every day, some walk (4 people) and some go to gym (8 people). According to duration of physical activity, over 45% of patients engage in less than 30 minutes of physical activity during day, while about 37% of patients exercise from 30 to 45 minutes a day.

About 12% of patients engage in physical activity for 45 minutes to 1 hour, while only 5% of patients have reported exercising for more than 1 hour during day. As for distribution model, as can be seen from graph 3, greatest variability in blood glucose levels certainly exists in individuals who exercise every day compared to other groups. The calories in alcohol are "empty calories," which means they do not provide nutritional benefits. In this way, calorie consumption through alcohol can lead to weight gain and increased blood glucose [9-11]. In response to question of how often they consume alcohol, 27% of patients answered that they do not consume alcohol, although they occasionally drink one or two glasses of beer or wine. Most patients with hyperglycemia, about half, responded that they sometimes consume alcohol, more often beer or wine, in moderate amounts (from 50 to 500 ml). About 14% of patients reported that they consume alcohol once or twice a week, mostly wine (between 250 to 500 mL) or beer (in varying amounts). Only 5% of patients consume alcohol three to five times a week, with most of these patients consuming more than 500 mL, while around 3% of patients consume alcohol every day, in significant amounts.

These patients usually consume wine (more than 500 ml) and alcoholic beverages (more than 250 ml). According to frequency of alcohol consumption, analyses showed that patients who do not consume alcohol, or those who occasionally consume alcohol, generally have lower blood glucose levels than others. Graph below shows frequency of soft drink consumption among subjects with hyperglycemia. Most patients with hyperglycemia, about

44%, reported that they sometimes consume carbonated beverages, usually 250 to 500 ml. additionally, 8% of patients reported that they do not consume carbonated drinks, while the rest (almost half of patients) regularly consume carbonated drinks. Most patients who consume carbonated beverages three to five times a week, or even daily, do so in quantities greater than 1 liter. Patients who do not consume carbonated drinks have lower blood glucose levels, those who consume carbonated drinks every day have higher blood glucose levels. The consumption of at least 400 g or five servings of vegetables and fruits per day is part of the WHO recommendations [12]. Such a diet protects against cardiovascular diseases and malignant diseases, reduces asthma symptoms in childhood, and lowers risk of developing other diseases and disorders throughout life. People with hyperglycemia should be careful in choosing and amount of fruits and vegetables consumed [13].

Most patients (46%) responded that they sometimes consume fruits in quantities ranging from 250 to 500 grams. On other hand, 27% of patients consume fruit every day, where most of these patients consume fruit in large quantities, that is, over 500 g. Only 4% of patients reported that they do not consume fruits, while rest do so several times a week. Frequency of vegetable consumption is similar to frequency of fruit consumption. Specifically, in this case, 43% of patients sometimes consume vegetables, the majority of whom do so in amounts of 250 to 500 grams. On the other hand, just under a third of patients, that is 31%, consume vegetables every day, and the quantity varies from 250 grams and above. On other hand, just under a third of patients, that is 31%, consume vegetables every day, and amount varies from 250 grams and up. 8% of patients reported that they do not consume fruits, while rest do so several times a week. According to results obtained from survey questionnaire, meat often represented among patients with hyperglycemia. 37% of patients sometimes consume meat, mainly white meat. 25% of patients consume meat once to twice a week, while 21% consume meat three to five times a week. Only 4% of patients have stated they do not consume meat at all, while 13% have reported that they consume meat every day.

The white meat, as most represented at table among patients who are the subject of research, is consumed in varying quantities, usually over 150 g. Among other products with functional properties related to prevention of type 2 diabetes are dairy products. Low-fat dairy products, which considered predictors of a reduced risk of diabetes, regardless of any effect on body mass and other known risk factors. Unlike meat, dairy products are generally more common on table of patients with hyperglycemia. In fact, 36% of these patients consume dairy products every day, in quantities over 100 g. About one third of patients sometimes consume dairy products, in amounts of around 50 or 75 grams, while same number of patients consume dairy products up to five times a week, mostly in amounts of 75 to 100 g. According to laboratory analyses, consumption of dairy products may lead to changes in blood glucose levels. Frequent consumption of dairy products leads to higher blood glucose levels. When asked what type of bread and pasta they usually consume, just over half of patients with hyperglycemia responded that they mainly consume bread and pasta made from whole-grain flour, while 28% do not eat bread and pasta at all. Among the patients who consume whole grain bread and pasta more often, majority consume it in quantities greater than 150 g.
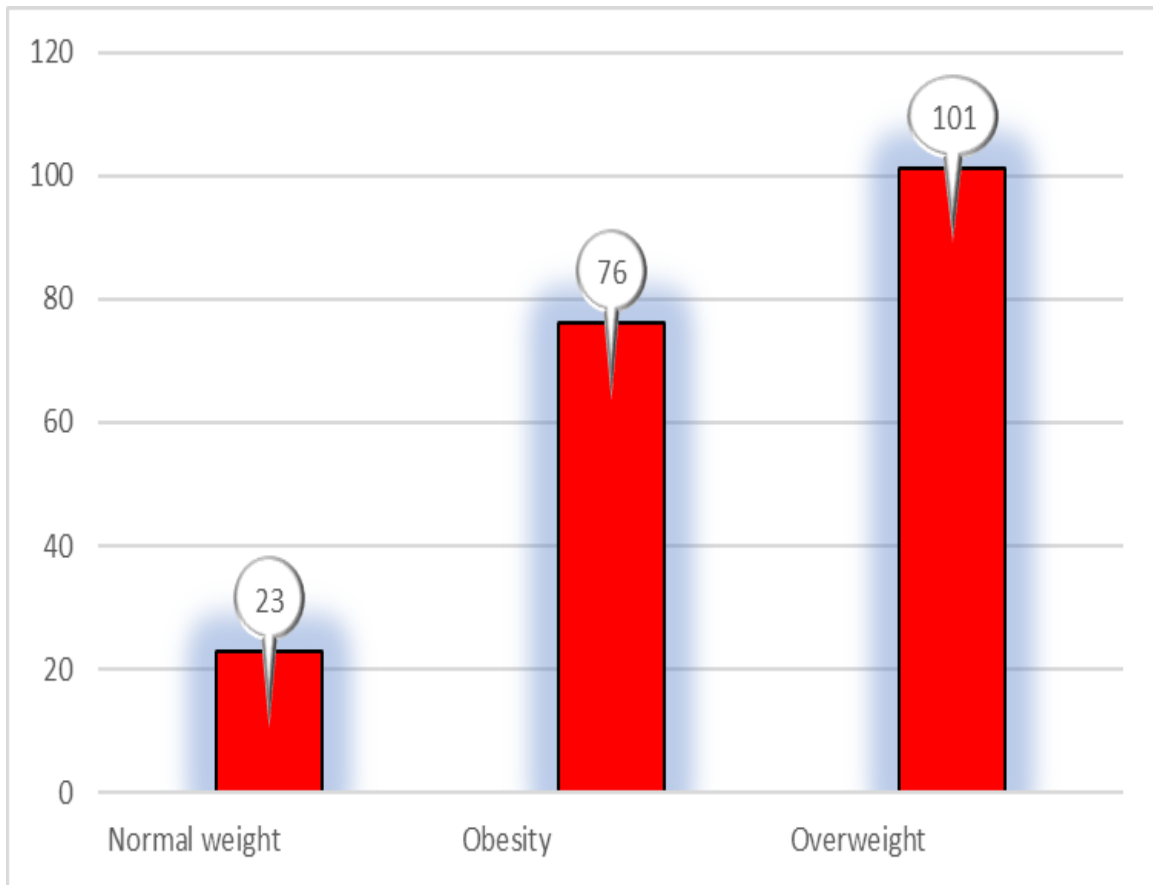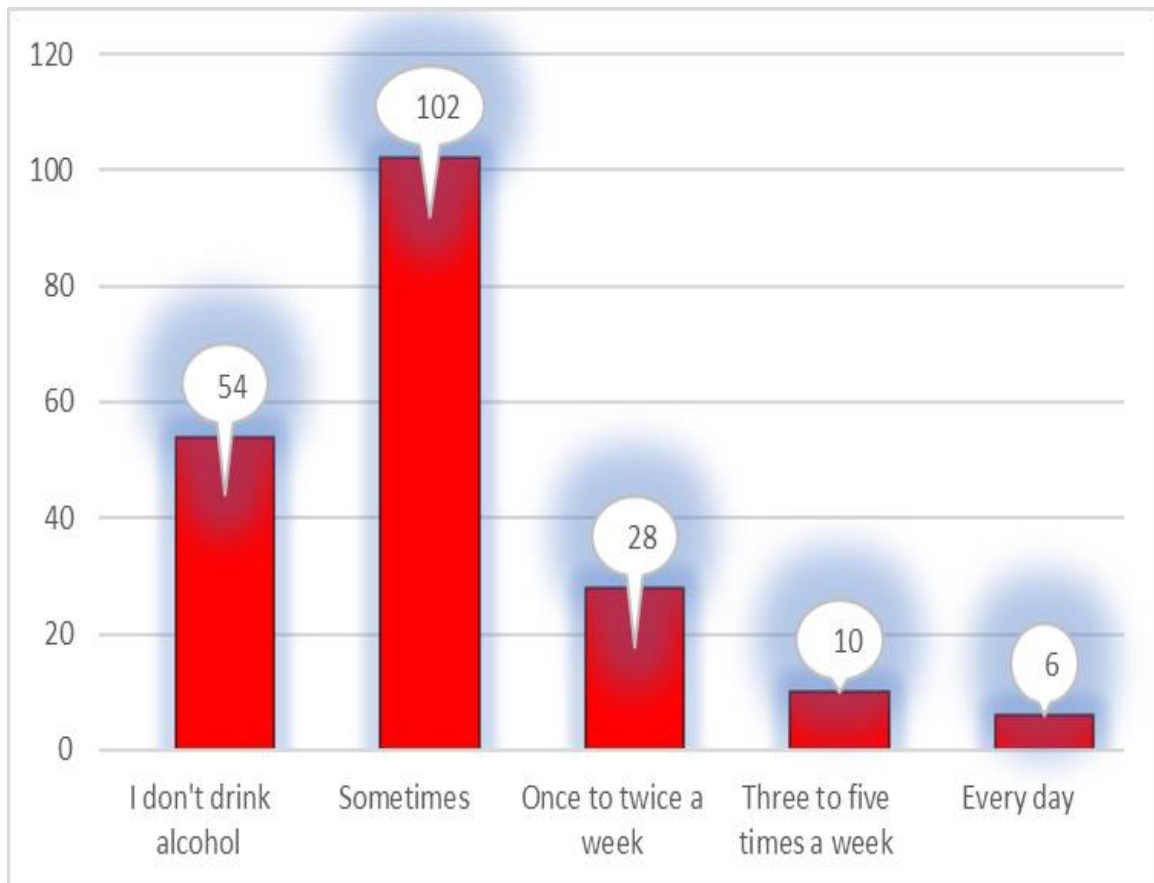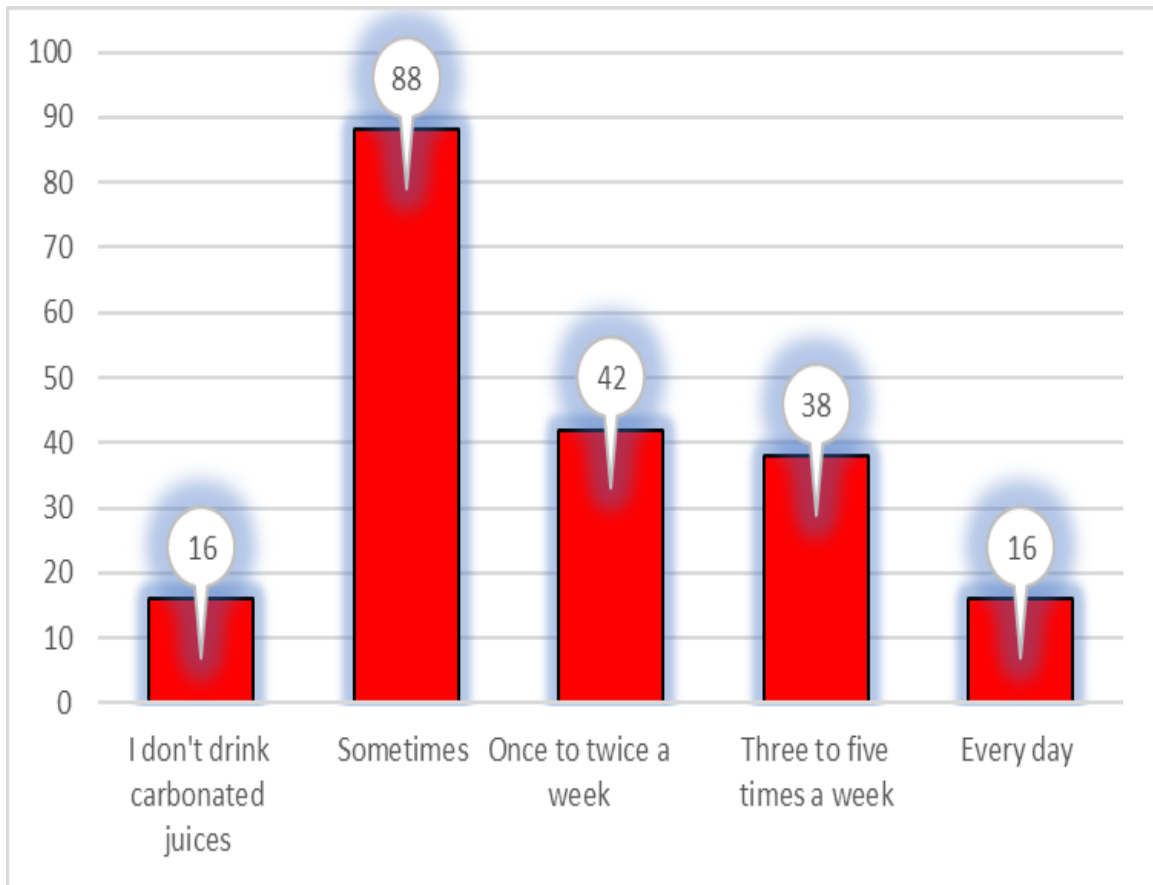
Graph No. 1: Value of the body mass index
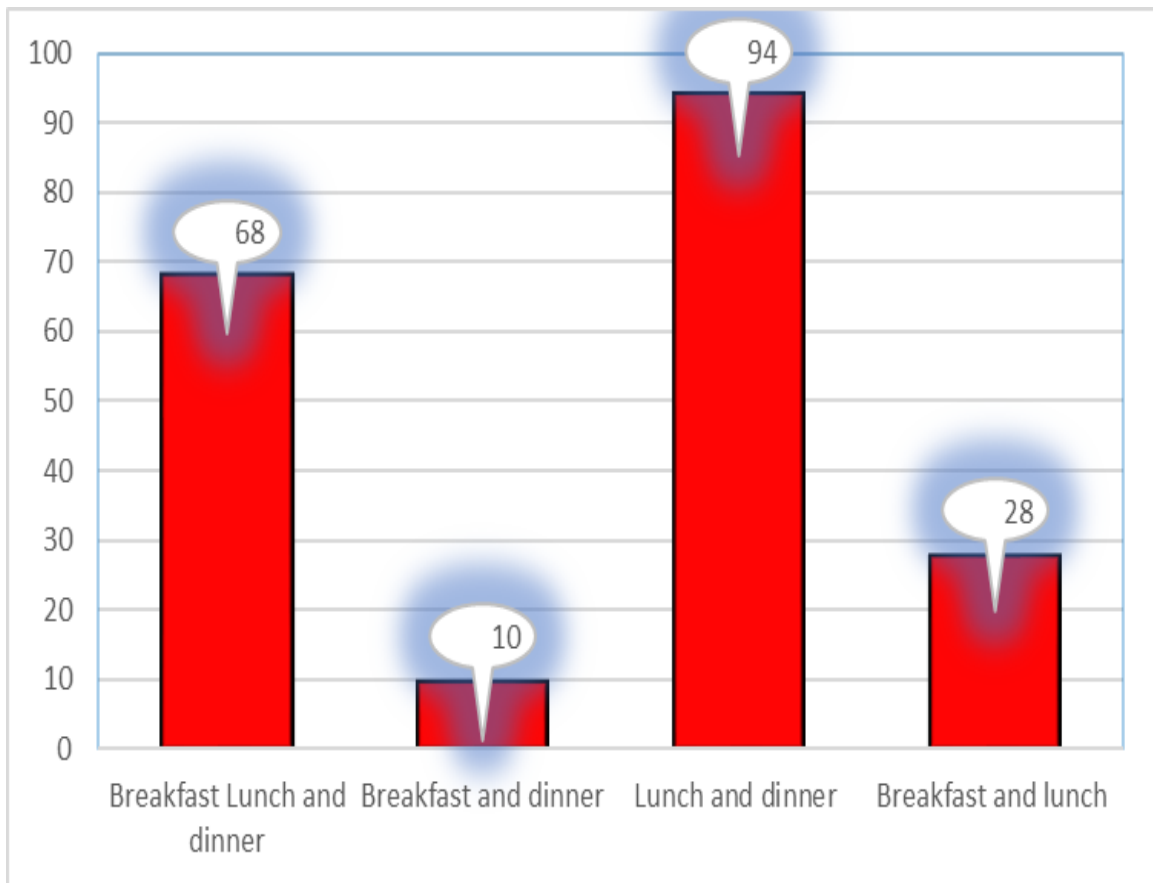
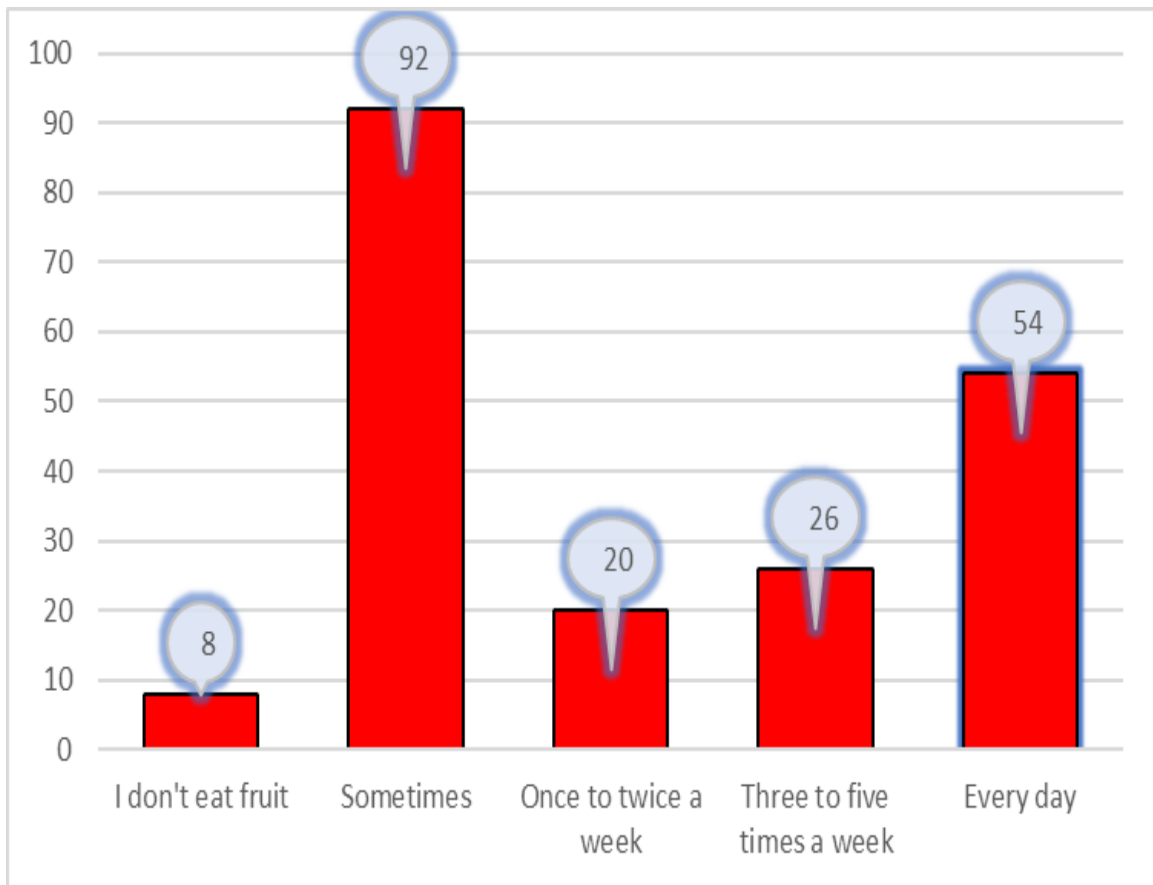
Graph No. 2: Main meals during the day
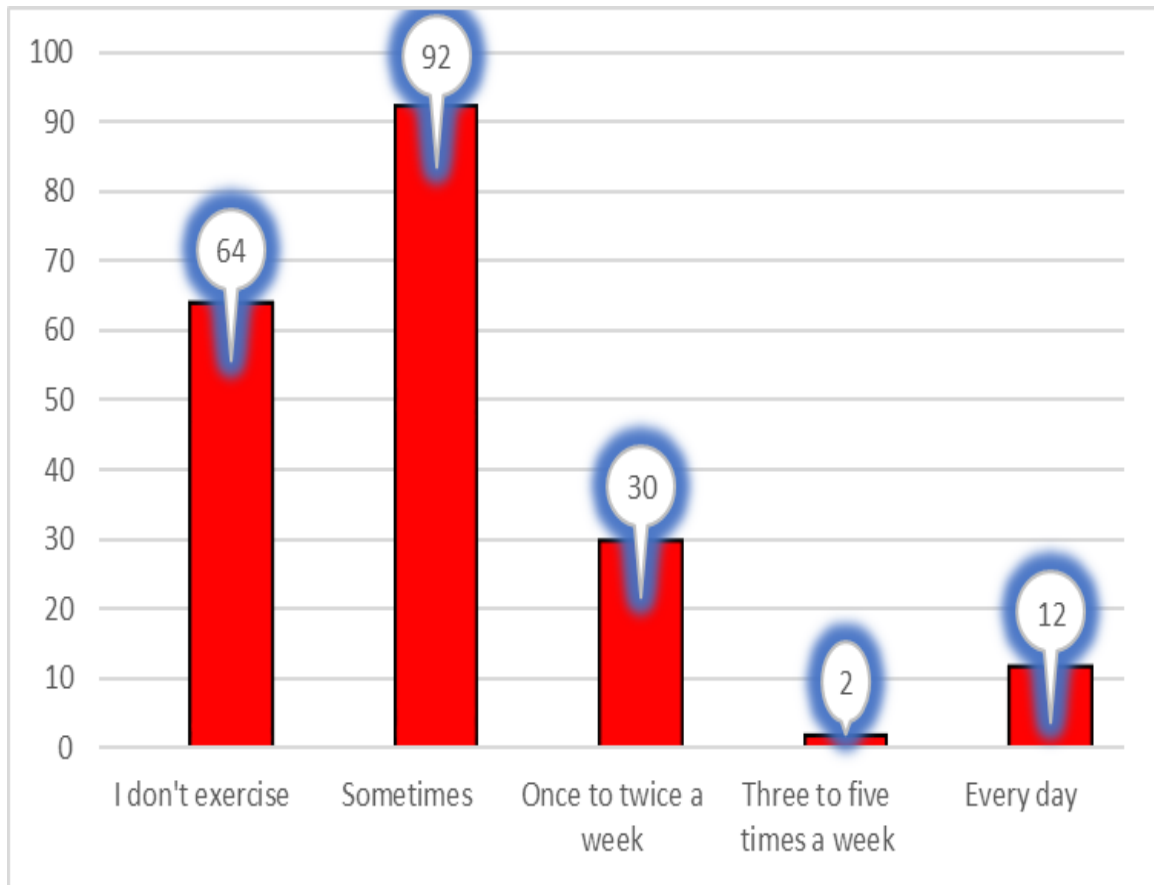
Graph No. 3: Frequency of physical activity in patients with hyperglycemia
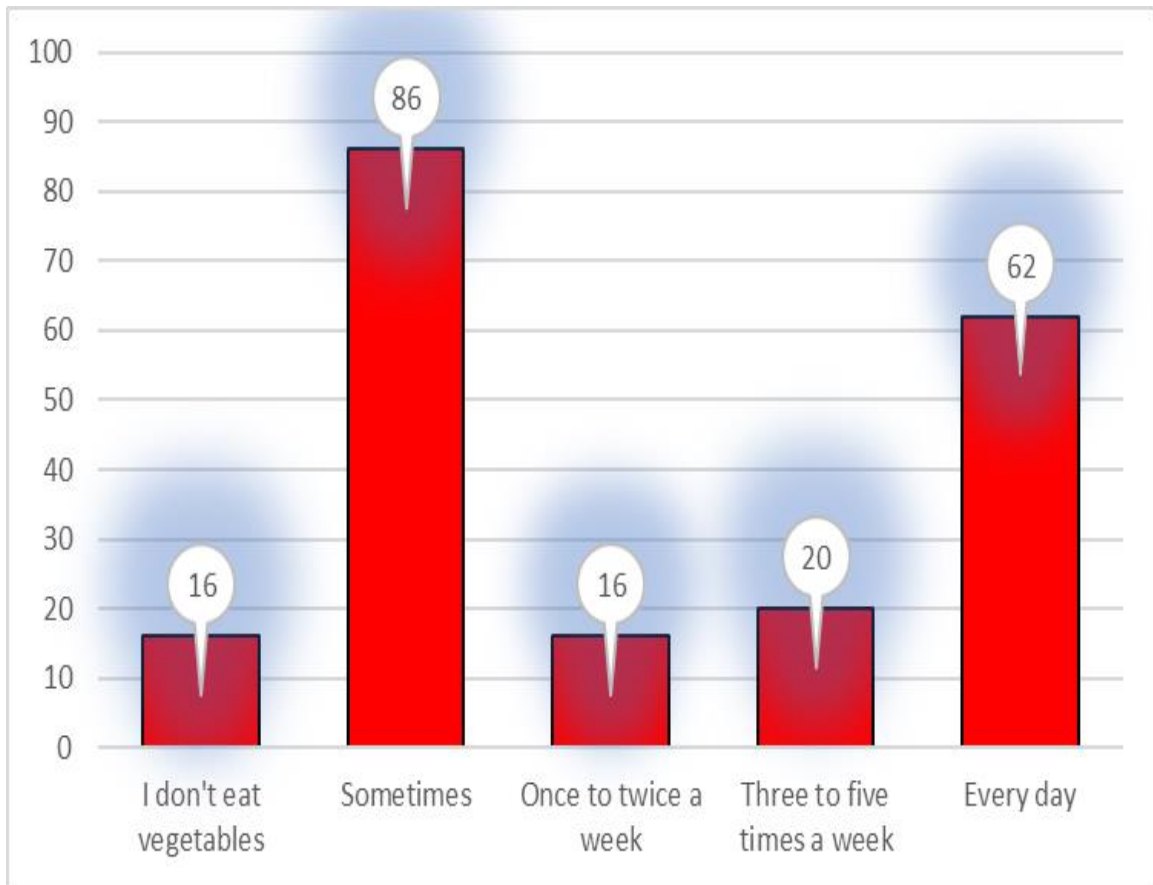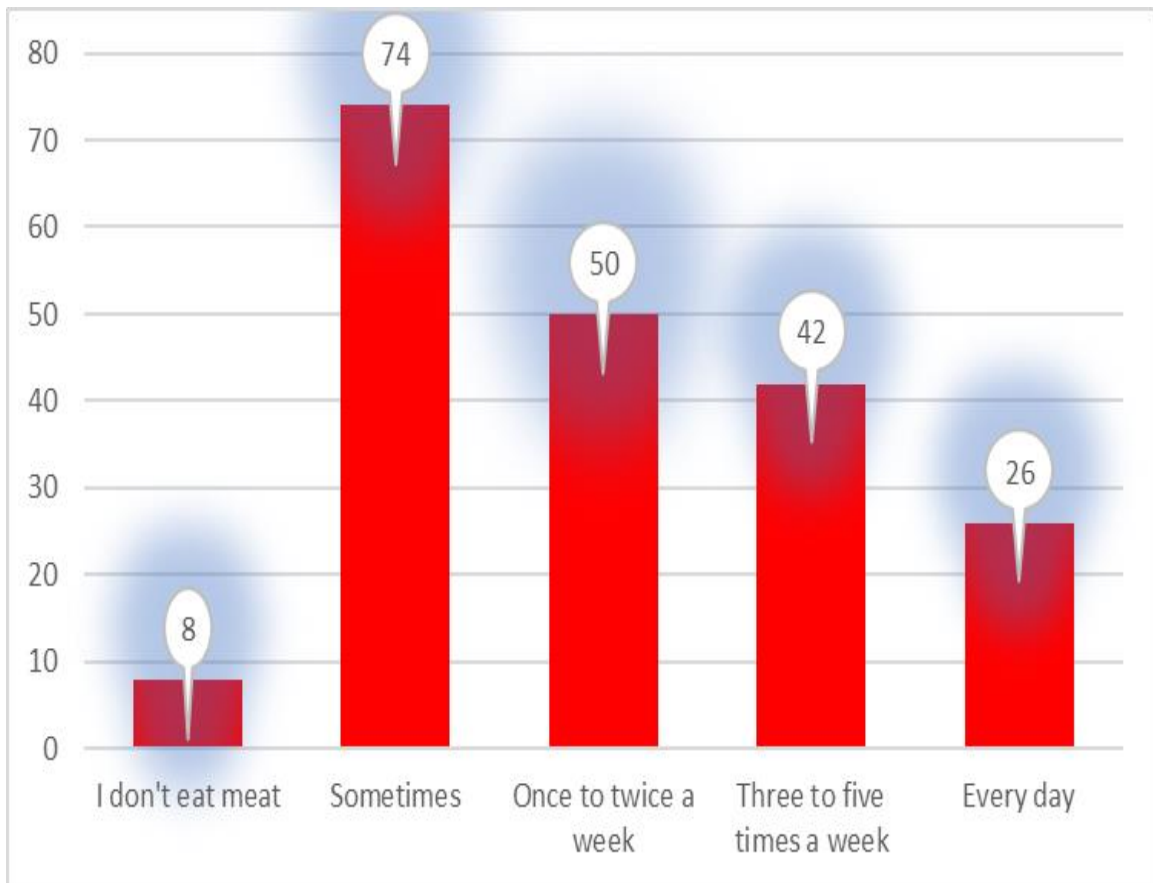

Graph No. 4: Frequency of Alcohol Consumption

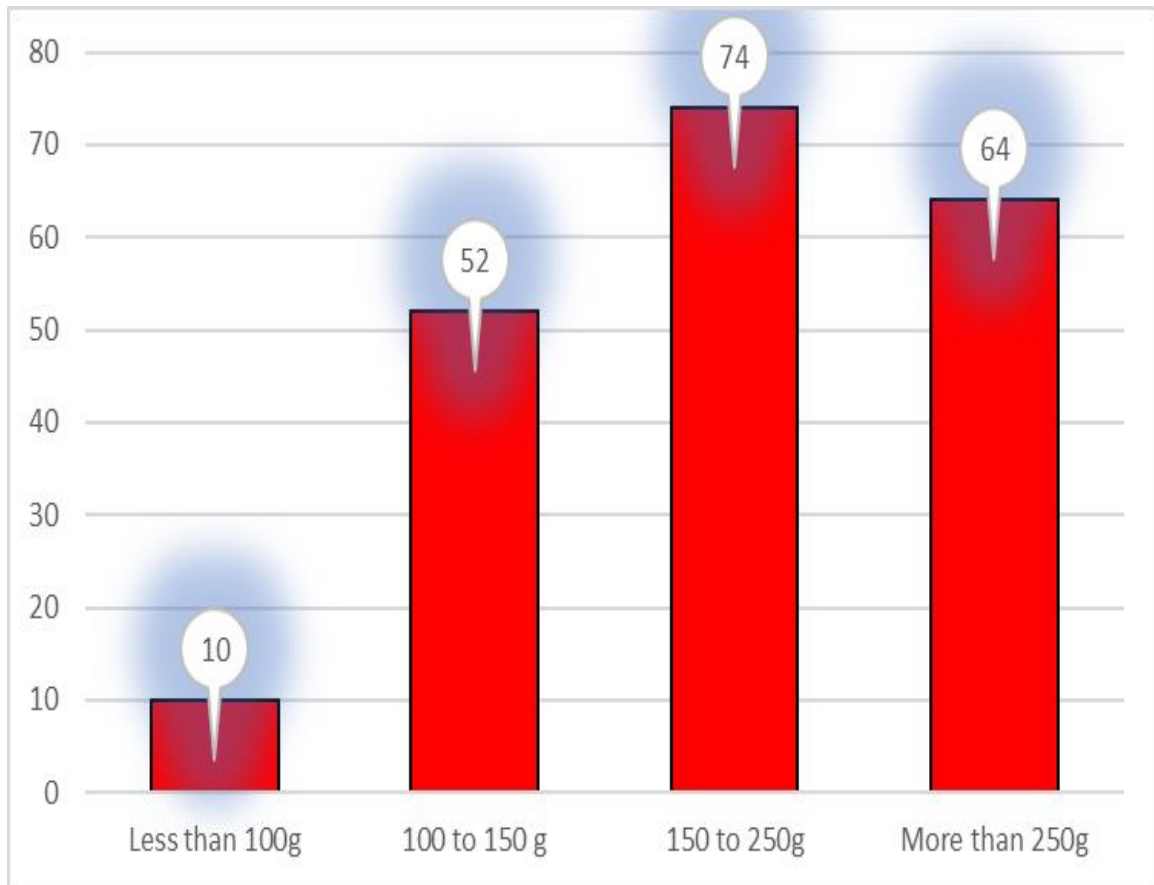**Graph No. 5:** Frequency of consumption of carbonated drinks
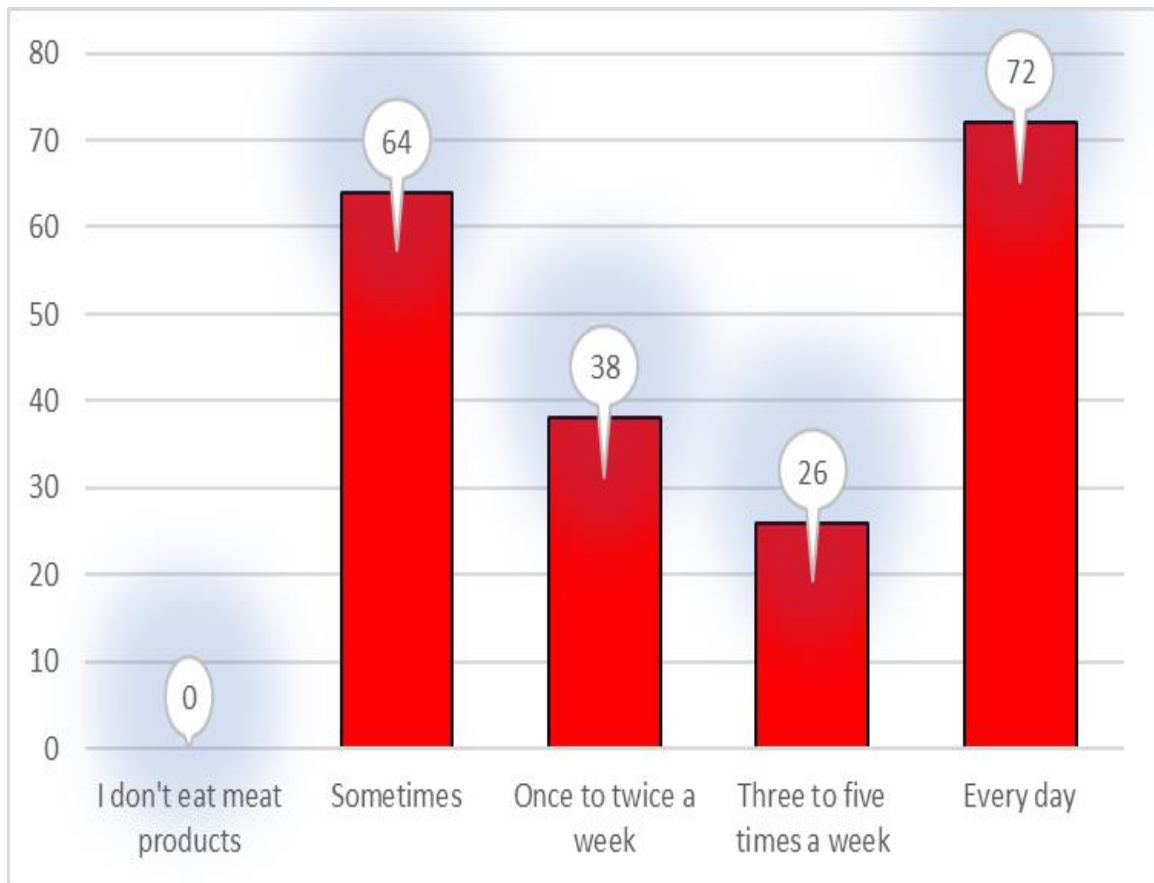

Graph No. 6: Frequency of fruit consumption

Graph No. 7: Frequency of Vegetable Consumption
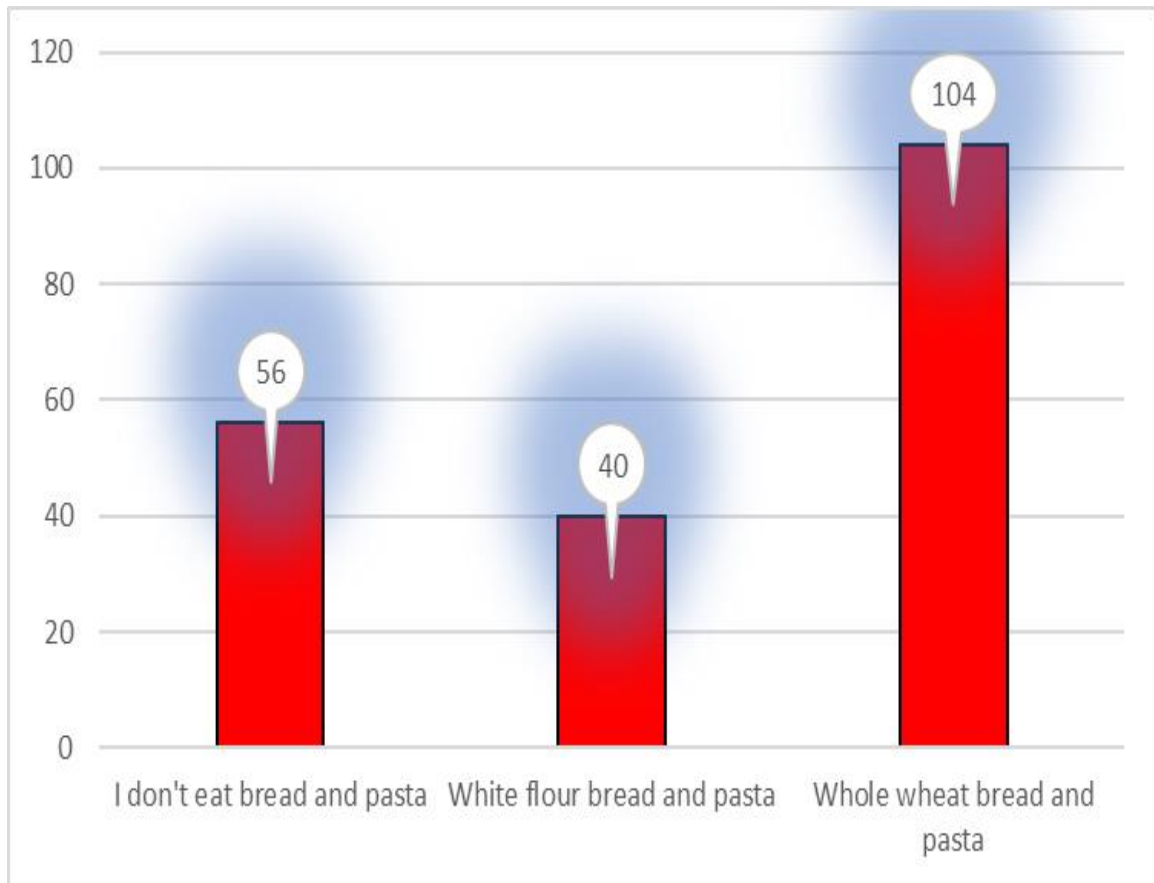

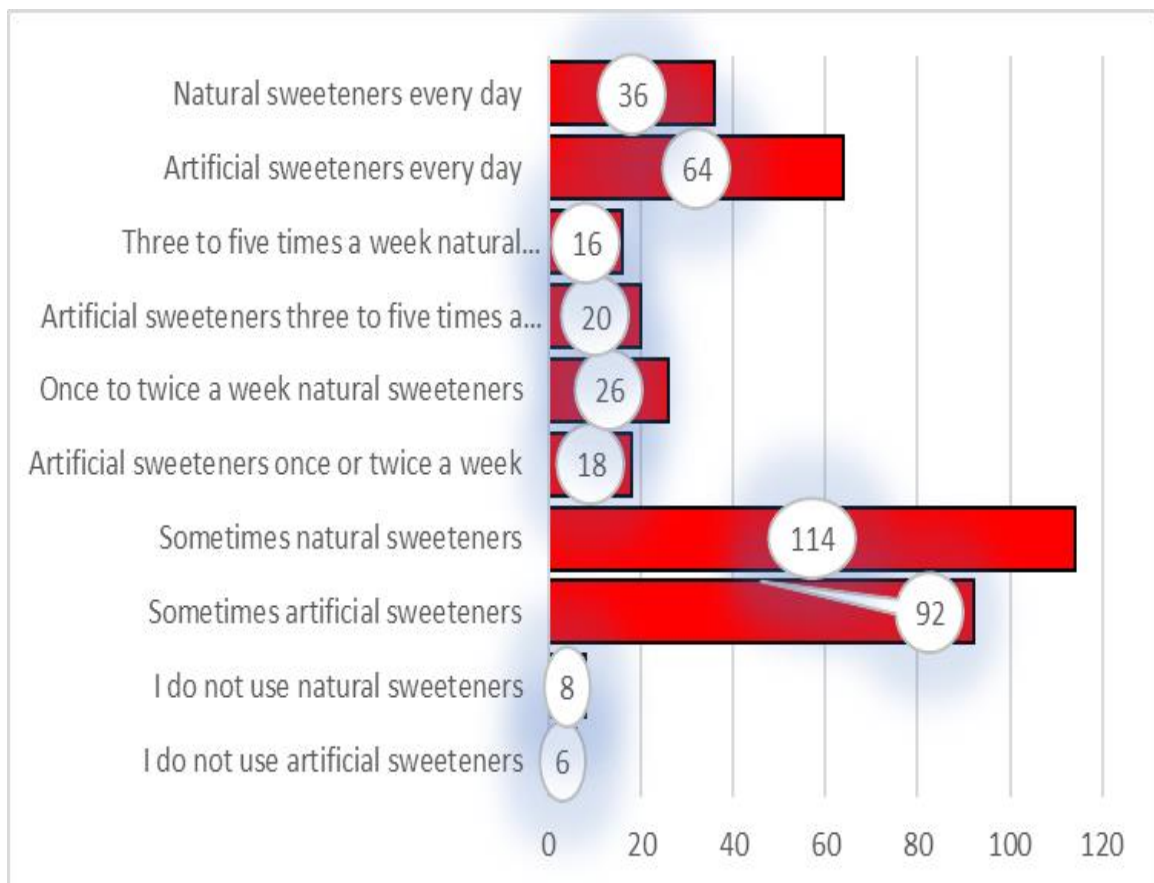**Graph No. 8:** Frequency of meat consumption

Graph No. 9: Frequency of white meat consumption

Graph No. 10: Frequency of consumption of dairy products

Graph no. 11: Consumption of bread and pasta

Graph No. 12: Frequency of Sweetener Consumption

Table 1. Tests for equality of blood glucose levels according to the gender of patients under stress and body mass index

Method	Categories by gender		Categories by stress		Categories by BMI	
	Stat.	p-value	Stat.	p-value	Stat.	p-value
Mann–Whitney U test	1.17	0.243	0.24	0.812		
Kruskal-Wallis	1.36	0.243	0.06	0.811	2.32	0.314

Table 2. Spearman's correlation coefficients

	Glucose	Age	BMI
Glucose	1		
Age	0.18 **	1	
BMI	0.04	0.27 *	1

* And ** show statistical significance at the levels of 0.05 and 0.01 respectively.

While among those patients who consume bread and pasta made with white flour, the most consume between 50 and 100 g. The American Food and Drug Administration approves the use of sugar substitutes for people with diabetes [14]. From graph 12, it can be concluded that 46% of patients sometimes use artificial sweeteners, while 57% sometimes use natural sweeteners. Conversely, artificial sweeteners are used daily by 32% of patients with hyperglycemia, while natural sweeteners are used by 18% of patients. About 20% of patients reported using natural or artificial sweeteners one to five times a week, while around 4% do not use sweeteners at all. Use of artificial sweeteners generally does not affect blood glucose levels in patients with hyperglycemia, while those patients who do not use natural sweeteners have highest blood glucose levels.

4. Conclusion

After analyzing the obtained results, the following conclusions can be drawn: Most of the patients, that is half, are overweight (BMI between 25 and 29.9 points), while 38% of the patients are obese (BMI above 30 points). Patients with hyperglycemia do not show significant differences in blood glucose levels based on their gender (men and women), whether they are exposed to stress, or according to body mass index. In addition, analysis also showed a lack of correlation between blood glucose levels and the age of the patients, as well as a lack of correlation between blood glucose levels and the body mass index. People who exercise occasionally or do it every day generally have lower levels of blood glucose. The frequency of consuming soft drinks leads to higher blood glucose levels. Similarly, patients who sometimes consume fruit, or do so once or twice a week, generally have lower blood glucose levels. Consuming milk can lead to changes in blood glucose levels, with frequent consumption of dairy products leading to higher blood glucose values. Meat is often represented in patients with hyperglycemia. Only 4% of patients do not consume meat at all, while 13% have stated that they consume meat every day. Frequent consumption of dairy products leads to higher blood glucose levels. Patients who do not use natural sweeteners have higher blood glucose levels (an average value of 11.2 units), while those who use natural sweeteners daily generally have lower blood glucose values. From what has been stated above, there is a need for additional information and better education regarding nutrition and dietary supplements, to timely prevent progression of condition and transition to type 2 diabetes. By improving lifestyle and eating habits of patients, level of hyperglycemia can be improved and regulated.

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