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Evaluation of the quality of menus implemented in diets for diabetes mellitus patients in selected healthcare facilities

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A – Study Design, **B** – Data Collection, **C** – Statistical Analysis, **D** – Data Interpretation, **E** – Manuscript Preparation, **F** – Literature Search, **G** – Funds Collection

Summary **Background.** Diabetes mellitus is a group of metabolic diseases associated with abnormalities in insulin action and/or secretion. The continuous rise in the number of patients and the overall patient count, which reflects the global prevalence of this disease, unequivocally indicates that hospital facilities are frequently admitting patients with this condition. The healthcare personnel responsible for patient nutrition should ensure both the quantity and quality of their meals.
Objectives. The aim of this study was to conduct a qualitative evaluation of the menus implemented in specific hospital facilities following a diet with restricted easily digestible carbohydrates.
Material and methods. The study analyzed 182 one-day menus from 13 hospital facilities, consisting of 13 fourteen-day menus from the summer of 2021. A questionnaire was developed for qualitative evaluation.
Results. The analysis showed that the menus were subject to numerous errors, particularly in the number of meals per day, the type of fat used, the frequency of dairy products, the frequency of vegetables, the type of carbohydrate supplements used in lunches, and the frequency of non-recommended products.
Conclusions. Most of the menus showed errors that could be corrected. The analyzed material clearly indicated that in hospital nutrition, patients are often provided with inappropriate products for their disease entity, and the number of meals per day is too low.
Key words: Poland, diabetes mellitus, carbohydrates, meals, metabolic diseases.

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Background

Diabetes is a group of metabolic diseases, as defined by the Polish Diabetes Association (PTD), that is characterized by improper action and secretion of insulin, resulting in hyperglycemia. Hyperglycemia, when chronic, can lead to failure, dysfunction, and damage of various organs, particularly the kidneys, eyes, heart, and blood vessels [1–6]. The increasing number of individuals with diabetes indicates that we are currently experiencing a diabetes pandemic. Based on the studies conducted, it can be inferred that individuals diagnosed with diabetes are frequently hospitalized [4–13].

The diet of most people with diabetes should contain 15–20% protein, 25–40% fat (including < 10% saturated fatty acids, < 20% monounsaturated fatty acids, and 6–10% polyunsaturated fatty acids), while carbohydrates should constitute approximately 45% of the energy value of the diet (fiber should be over 25 g/day). These values may vary depending on many variables, such as physical activity or comorbidities. It should be noted that the supply of specific values should be tailored to the individual needs of the patient. It is also worth including an adequate supply of vitamins and minerals in the diet of people with diabetes. Particular attention should be paid to the supply of vitamin B_{12} and vitamin D, and in case of their deficiencies, supplementation should be introduced. However, the qualitative aspect of the diet of diabetic patients is also important. Particular attention should be paid to the origin of carbohydrates in the diet. According to the recommendations, their source in the diet of people with diabetes should primarily be products containing mainly complex carbohydrates, e.g. whole-grain bread, coarse-grain groats, especially those with a low glycemic index (< 55). Referring to the recommendations, at least 2 servings of whole grain products and 3 servings of vegetables consumed daily to increase the supply of fiber. In the diet of patients suffering from diabetes, its quality is more important than the total supply of fat. It is recommended to use vegetable fats, except palm and coconut, to reduce the supply of saturated fatty acids. People affected by this disease should particularly limit the consumption of simple carbohydrates. It is also recommended to limit added sugars (in the process of production and preparation of dishes) and free sugars, the sources of which are primarily sugar and sweets but also honey, juices, and fruit drinks [3].

Diabetes holds second place in terms of the economic impact on society [3], hence preventive measures must be taken to curb the progression of the disease and related complications [2]. Hospital facilities should prioritize both proper pharmacological treatment and adequate nutrition for patients to hasten their convalescence and reduce hospitalization costs [3, 4, 6, 14, 15]. Because hospitalized individuals typically experience lower levels of physical activity, their diet, in combination with pharmacological treatment, should serve as the foundation for effective diabetes therapy, with an emphasis on consuming low glycemic index foods that will not result in a sudden spike in glucose levels [16–26]. When creating menus, it is important for staff to not only ensure that the correct amount of nutrients is provided but also that the menus are properly composed for optimal quality [3, 4, 16, 25, 27, 28]. It is worth noting that in Poland, hospital facilities have a great deal of freedom when it comes to their patients' nutrition [14, 15, 29]. Research has

shown that the diet provided to patients in Polish hospitals is characterized by numerous irregularities and may lead to effects opposite to those desired in the form of developing inappropriate eating habits [30, 31].

Objectives

The main objective of the study was to qualitatively evaluate the menus implemented under the diet with restriction of easily digestible carbohydrates of selected hospital facilities located the south of Poland.

Material and methods

The point assessment methods suggested by Bielińska and Starzyńska are the primary approaches for qualitatively evaluating menus. Bielińska's scoring system is utilized for assessing daily menus, while Starzyńska's quality assessment is employed for analyzing periodic menus [27]. From the reviewed literature, it can be inferred that there are currently no available tools for evaluating meal plans specifically designed to restrict easily digestible carbohydrates for individuals with diabetes. Due to the more intricate recommendations for people with diabetes, the research tool proposed in this study was modeled on the one suggested by Starzyńska for general periodic menus and was modified by considering the dietary recommendations from the Polish Society of Diabetology, the Polish Society of Dietetics, and the general guidelines for diets restricting easily assimilable carbohydrates outlined in the book by Helena and Artur Ciborowski, which is recommended for people with diabetes. However, it is important to note that the provided questionnaire has not undergone validation. Therefore, it is recommended to conduct further studies to assess the strengths and limitations of the method presented in this article [27]. The material for the study consisted of fourteen-day menus obtained from hospitals in the south of Poland, which were implemented as part of a diet with a restriction on easily digestible carbohydrates. 22 selected hospital facilities were asked to provide material for the study, of which 14 agreed to participate. 1 of the hospitals willing to participate in the study did not have menus for the group of people whose nutrition is the subject of this study. After analyzing the collected material for the study, fourteen-day menus from 13 facilities were selected for final analysis. A total of 182 one-day menus were obtained, which consisted of the number of fourteen-day menus indicated earlier. The study material came entirely from the summer period of the second quarter of 2021.

Each menu obtained for the study was qualitatively assessed using the author's scoring method. The questionnaire was developed on the basis of the recommendations applicable to diets with a restriction of easily digestible carbohydrates and using the recommendations for people with diabetes published by the Polish Diabetological Society of 2023.

Analysis of the materials obtained was carried out by assigning an individual score for each day and calculating an average for each criterion, which consisted of each individual day of a particular fourteen-day menu. A summary of the entire menu received from a particular hospital was also conducted. Points were awarded according to the fulfillment of each criterion (3 points – criterion fully meeting the requirements in the disease unit, 1 point – criterion half meeting the requirements of the disease unit, 0 points – criterion not meeting the requirements of the disease unit). Receiving 0 points on a question indicated an area in need of change. The criteria that were analyzed for the purpose of conducting this study are illustrated in Table 1, while the principles by which the analysis of the sum of points was carried out are shown in Table 2.

The maximum number of points that a menu undergoing

Table 1. Author's questionnaire for qualitative assessment of one-day menus using the principles of rational nutrition for people with type 2 diabetes

Rated feature	Number of points
1. Number of meals per day:	
4–5 meals	3
3 meals	1
less than 3 meals	0
2. Number of meals with products that are a source of animal protein:	
at least in 3 meals	3
in 2 meals	1
in fewer meals	0
3. Milk supply:	
in 1 or less meals	3
in 2 meals	1
in at least 3 meals	0
4. Number of meals in which natural dairy products are present:	
at least in 2 meals	3
in 1 meal	1
not at all	0
5. Vegetable supply:	
most low glycaemic index vegetables	3
most vegetables with a medium glycaemic index or low and high glycaemic index vegetables in a 1:1 ratio	1
most high glycaemic index vegetables or no vegetables	0
6. Number of meals in with vegetables are present:	
at least in 3 meals	3
in 2 meals	1
in fewer meals	0
7. Fruit supply:	
most low glycemic index fruit	3
most fruits with a medium glycemic index or low and high glycemic index fruit in a 1:1 ratio	1
most high glycemic index fruit or no fruit	0

Table 1. Author's questionnaire for qualitative assessment of one-day menus using the principles of rational nutrition for people with type 2 diabetes

Rated feature	Number of points
8. Heat treatment:	
mainly boiling and baking	3
mostly braising	1
mostly fat frying	0
9. Fat supply:	
mainly vegetable fats	3
vegetable fats and animal fats in a ratio of 1:1	1
no fat added or mainly animal fats	0
10. Supply of vegetables and fruit:	
mainly in raw form	3
mainly after heat treatment	1
no fruits and vegetables	0
11. Carbohydrate supplements for dinner:	
mainly products that are sources of complex carbohydrates (e.g. groats, brown rice, and whole grain pasta)	3
mainly potatoes	1
mainly products made from refined flour (e.g. wheat pasta, white rice)	0
12. Type of bread used:	
mainly whole grain bread	3
mainly wheat-rye bread	1
mainly wheat bread	0
13. Frequency of lean meat:	
at least in 2 meals	3
in 1 meal	1
not at all	0
14. Meat supply:	
mainly poultry meat or fish (e.g. chicken, cod)	3
half and half poultry meat and red meat	1
mainly red meat (e.g. pork, beef)	0
15. The occurrence of products that are not recommended in the diet with a restriction of easily digestible carbohydrates (e.g. foods high in fat and sugar):	
in no meal	3
in 1 meal	1
in 2 or more meals	0

Table 2. Principles for the qualitative assessment of menus

Number of points obtained	Evaluation of the menu
42–45	correct menu
32–41	contains correctable errors
18–31	contains a considerable number of errors
< 18	contains errors that cannot be eliminated

qualitative evaluation could receive was 45. The greater the correctness of the menu, the higher the number of points it received. Failure to score points indicated that the menu had to be revised in relation to the specific criterion adopted. The average number of points was obtained based on the evaluation of individual one-day menus.

Results

Table 3 shows the results obtained after scoring analysis of one-day menus by the aspects evaluated. Among the one-day menus subjected to analysis, 53.8% (n = 98) contained 3 meals during the day, while the remaining menus had 4–5 meals. From the tabulated data, it can be concluded that in most of the menus subjected to analysis, animal protein was included in at least 3 meals, which met the requirements of a disease entity such as diabetes. With regard to the frequency of lean meat supply, the largest number, 45.6%, of the hospital menus studied contained lean meat in 1 meal. Dairy products were among the most common items, as they appeared in 53.8% (n = 98) of the menus in 1 meal, while 28 (15.4%) of the surveyed menus did not contain any products of this type. When analyzing the frequency of milk supply, it should be pointed out that the majority, 179 (98.4%), of the studied menus completely met the adequate supply of milk in the diet of a person with diabetes. When analyzing the data, it should also be mentioned that 101 (55.5%) of the one-day menus met the criterion of the correct frequency of vegetable supply. Most of the analyzed menus were characterized by a low glycemic index of vegetables and fruits. On the other hand, the complete absence of vegetables or a majority of vegetables with a high glycemic index was recorded for 3 (1.6%) menus. The same glycemic index or absence of fruits was found in 46 (25.3%) of the surveyed menus. The most common method of thermal processing was mainly boiling and baking (139 menus – 76.4%), which met the requirements of the diet in diabetes. 101 (55.5%) of one-day hospital menus included a supply of vegetables and fruits mainly in raw form. In contrast, the supply of products from this group mainly after heat treatment was found in 80 (44%) menus. In the surveyed one-day hospital menus for diabetics, the most common type of fat used was vegetable and animal fats in a 1:1

Table 3. Results of the qualitative analysis of the scoring of one-day menus

Assessed features	Menus fully compliant with the requirements in the disease unit *n* (%)	Menus half compliant with the requirements in the disease unit *n* (%)	Menus not compliant with the requirements in the disease unit *n* (%)
Number of meals	84 (46.2%)	98 (53.8%)	0 (0%)
Frequency of animal protein supply	176 (96.7%)	6 (3.3%)	0 (0%)
Frequency of lean meat supply	58 (31.9%)	83 (45.6%)	41 (22.5%)
Frequency of supply of dairy products	56 (30.8%)	98 (53.8%)	28 (15.4%)
Frequency of milk supply	179 (98.4%)	3 (1.6%)	0 (0%)
Frequency of vegetable supply	101 (55.5%)	40 (22%)	41 (22.5%)
Glycaemic index of vegetables	148 (81.3%)	31 (17%)	3 (1.7%)
Glycemic index of fruit	136 (74.7%)	1 (0.6%)	45 (24.7%)
Type of heat treatment used	139 (76.4%)	33 (18.1%)	10 (5.5%)
Type of fat used	28 (15.4%)	87 (47.8%)	57 (31.3%)
Form of vegetable and fruit supply	101 (55.5%)	80 (44%)	1 (0.5%)
Types of carbohydrate supplements most commonly used in dinners	32 (17.6%)	118 (64.8%)	32 (17.6%)
Most commonly used type of bread	168 (92.3%)	14 (7.7%)	0 (0%)
Most common type of meat	110 (60.4%)	21 (11.6%)	51 (28%)
Frequency of products not recommended in the diet with the restriction of easily digestible carbohydrates	49 (26.9%)	84 (46.2%)	49 (26.9%)

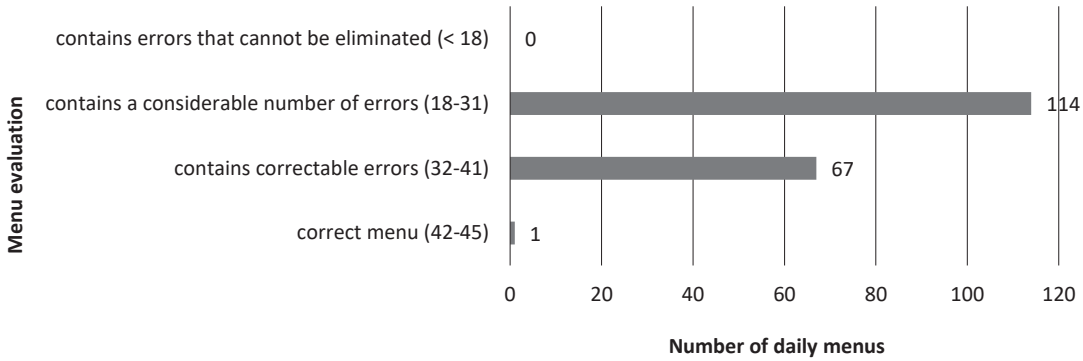

Figure 1. Summary of the assessment of one-day menus based on the number of points in the analyzed menus obtained from the proprietary questionnaire

ratio (87 menus – 47.8%). The most common carbohydrate additives used in lunches were potatoes. Their presence was found in 118 menus (64.8%). In 32 (17.6%) dinners, products that were a source of complex carbohydrates were the most common carbohydrate supplements. The same number of menus contained products that were a source of simple carbohydrates as dinner supplements most often. 92.3% of the analyzed menus met the criterion of the appropriate type of bread used. The analyzed menus were also mainly characterized (110 menus – 60.4%) by the correct type of meat for the disease entity. One-day menus in which 1 meal contained products not recommended in a diet with a restriction of easily digestible carbohydrates were the largest number and accounted for 46.2% (*n* = 84) of all those analyzed. 49 (26.9%) of the menus each showed the absence of such meals and 2 or more meals in which such products were present.

A summary of the qualitative analysis of the one-day menus conducted showed that only 1 (0.5%) menu was determined to be correct. 36.8% (*n* = 67) of the one-day menus received 32–41 points. Most of the menus (62.6%, 114 menus) contained correctable errors. No menus achieved a score below 18 points out of a possible 45 points. The results of the summary of the qualitative evaluation of one-day menus are shown in Figure 1.

Discussion

As previously noted, a thorough evaluation of a menu should be conducted through both quantitative and qualitative analyses. Concerning the quantitative assessment, attention should be paid to the ratios of protein, fat, and carbohydrate energy, as well as the overall micronutrient and macronutrient compositions of the menus [3, 4, 16, 25, 27, 28]. In the previously published own work on quantitative assessment, the menus were characterised by a correct balance in terms of protein, fibre and fats, and monounsaturated fatty acids. Nevertheless, there were multiple inaccuracies in the amounts of carbohydrates, saturated, and polyunsaturated fatty acids. A summary of the quantitative assessment of the aforementioned menus revealed that a significant majority of them were constructed improperly and contained numerous mistakes [32]. The analysis below focuses on the qualitative assessment of the menus discussed above.

Conducting a qualitative analysis of the menus showed that only 1 (0.5%) of the menus that were analyzed was correct. According to the principles of rational nutrition, a diabetic patient should eat 4 to 5 meals per day [27]. Only 46.2% of the analyzed menus met this recommendation. Different results of the conducted studies on the quality of the diet of diabetic pa-

tients were obtained by Bronkowska and Piejko et al., for they showed an adequate supply of meals in the diet of most patients [18, 33]. It should be mentioned, however, that the studies cited above dealt with individual nutrition, while the studies conducted for this paper dealt with menus in mass nutrition. The inability of individuals to take care of the correctness of the menus used can certainly account for the differences shown in the studies conducted.

The basis of nutrition for diabetic patients should be carbohydrate products with a low glycemic index and high fiber content. At this point, it should be pointed out that 44.5% of the menus analyzed did not contain fruits and vegetables, or the fruits and vegetables contained had undergone prior heat treatment, which increased their glycemic index. In addition, the study shows that potatoes were the main source of carbohydrates, and their presence was found in 64.8% of the menus constituting the study material. The use of the indicated products with a high glycemic index in the diet of people with diabetes can significantly contribute to the occurrence of late diabetic complications, and this is closely related to their rapid digestion, which contributes to their equally rapid absorption in the gastrointestinal tract, thereby causing an increase in blood glucose levels [34–36]. In contrast, a study showed that 92.3% of the menus contained whole-grain breads, which is beneficial in the diet of a person with diabetes, because due to the low glycemic index of these products, they are digested longer and minimize the risk of a strong increase in glycemia and postprandial insulinemia [27, 36–38].

Vegetables in people with diabetes should be included in a minimum of 3 meals per day, and in the situation of maintaining the appropriate amount of carbohydrate exchangers for a particular person, they can be included in up to 5 meals per day [27]. At this point, it should be noted that 55.5% of the analyzed menus met the assumptions indicated above. At the same time, it is necessary to state that the rest of the study material (44.5%) contained vegetables in 2 or fewer meals. Analogous results were obtained during a study on the comparison of physical activity and diet of people with diabetes conducted by Mędrela-Kuder and Bis. The aforementioned studies showed a supply of vegetables only once or twice a day [22]. Due to the inadequate supply of vegetables in the diets of people with diabetes, hospital facilities should pay more attention to this so that their supply would ensure the correct amount of vitamins and minerals and could improve the health of patients [22, 39, 40].

A proper diet should be characterized by a supply of animal protein provided in at least 3 meals. Nearly all menus (96.7%) fulfilled this premise. This is particularly important in the diet of diabetic patients, since protein has an important building function, and if the menus are properly balanced, they will help normalize glycemia [27, 36].

The diet of people with diabetes should include milk and dairy products, and their supply should be for the former once a day, while for the latter twice a day [3, 25, 27, 40]. The studies conducted have shown an adequate supply of milk, though an inadequate supply of dairy products, most often present only in one meal. The lower supply of milk is due to the fact that it also provides rapidly absorbed carbohydrates (lactose). Instead, natural acidified dairy products are indicated, which are more beneficial for a person with diabetes, as they have a lower glycemic index [3, 27, 28, 40, 41].

In a diet with a restriction of easily digestible carbohydrates, products contraindicated are, for example, alcoholic beverages, fatty meats and cured meats, fatty cheeses, products with added sugar, highly processed products, and spicy condiments. Effective elimination of these product groups is particularly important, as their consumption contributes significantly to the deterioration of the patient's health [15, 27]. Analysis of the menus showed a disturbing tendency to offer patients sausages and fatty types of meat. The presence of undesirable products as such in a single meal was found in 42.6% of the menus analyzed, while in 26.9% of them, they were present in 2 or more meals.

In view of the detection of numerous irregularities in the surveyed menus and the fact that, as already mentioned, diet should be an integral part of the treatment process in addition to pharmacotherapy, it seems necessary to better train the staff of a given hospital facility in the proper creation of hospital menus and then improve the process of composing them. Creating and improving the questionnaire used in the study could identify areas that are worth changing so that menus for diabetic patients are more qualitatively adjusted and include the most beneficial products.

Conducting analyses such as the one above is important to show shortcomings in diet planning. Showing this problem could be a starting point for the development of standard recommendations for dietary planning in mass catering units.

Conclusions

Most of the menus showed errors that could be corrected. From the analyzed material, it is clear that in hospital nutrition, patients are often provided with products inappropriate for their disease unit, and the number of meals per day is too small. The data obtained showed that it is necessary to introduce effective mechanisms to control hospital menus and take corrective measures.

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Tables: 3
Figures: 1
References: 33

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