Assessment of hospital meals dedicated to diabetic patients. Divergencies between received meals, model menu and guidelines. HDMI- Hospital Diet Medical Investigation Study

Keywords
diabetes, hospital nutrition, clinical care

Abstract

Introduction
In Poland, it is estimated that more than 2 million individuals have diabetes. Intervening in modifiable risk factors can effectively prevent and delay the onset of type 2 diabetes. Previous reports claimed that the Polish healthcare system did not guarantee proper nutrition and nutritional education. This publication aimed to examine the dietary provisions for diabetic patients in Poland's hospitals and evaluate their compliance with the "Good Meal in the Hospital" guidelines.

Material and methods
Hospital workers were asked to fulfil the survey regarding hospital (degree of reference, number of beds in total and internal medicine unit, availability of diet dedicated to diabetic patient, performing nutritional education and presence of dietitian) and attach menus from meals received by patients from following 10 days. Then the menus were analyzed, compared to self-made model menu and “Dobry Posiłek w Szpitalu” (Good Meal in Hospital) guidelines.

Results
Seventy menus from seven hospitals were examined. Five hospitals met eight and two hospitals met seven out of thirteen criteria. The discrepancies particularly concerned excessive levels of saturated fatty acids and mono- and disaccharides, and insufficient amounts of legumes and fish in the hospital diets. Only four out of seven hospitals had a resident dietitian present.

Conclusions
Providing meals containing typical nutritional errors representing the pattern of the Polish population during hospitalization may lead to potential post-discharge dietary errors. They might result in deterioration in glycemic regulation, lipid profiles, and heightened susceptibility to complications, including an elevated cardiovascular risk.

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Hospital workers were asked to fulfil the survey regarding hospital (degree of reference, number of beds in total and internal medicine unit, availability of diet dedicated to diabetic patient, performing nutritional education and presence of dietitian) and attach menus from meals received by patients from following 10 days. Then the menus were analyzed in computer program dedicated to assessment of institutional nutrition and then compared to self-made model menu and “Dobry Posiłek w Szpitalu” (Good Meal in Hospital) guidelines. Those are the first such recommendations in Poland that introduce a coherent system to compose meals in hospitals. For each nutritional value, the mean (M), standard deviation (SD), and range (Min-Max) were calculated. To assess differences in means for nutrients and products a one-way ANOVA followed by Dunnett's two-tailed test was used.

Results.

Seventy menus from seven hospitals were examined. Five hospitals met eight and two hospitals met seven out of thirteen criteria. The discrepancies particularly concerned excessive levels of saturated fatty acids and mono- and disaccharides, and insufficient amounts of legumes and fish in the hospital diets. Only four out of seven hospitals had a resident dietitian present.

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Providing meals containing typical nutritional errors representing the pattern of the Polish population during hospitalization may lead to potential post-discharge dietary errors. They might result in deterioration in glycemic regulation, lipid profiles, and heightened susceptibility to complications, including an elevated cardiovascular risk.

Keywords: hospital nutrition, diabetes, clinical care

Conflicts of Interest: The authors declare no conflict of interest.

Funding: This research received no external funding.

Introduction:

Data indicates that 537 million adults are living with diabetes mellitus (DM) worldwide (1). In Poland, over 2 million people have DM, 25% of them unaware of their condition (2). Forecasts predict that this number will double in the next 15-20 years (2). Their projected lifespan is reduced, since DM elevates the likelihood of cardiovascular (CV) ailments and heightens the susceptibility to other illnesses (3). According to guidelines lifestyle interventions are paramount in treating DM and in preventing the development of atherosclerotic cardiovascular disease (4). Diets, that favor a higher intake of whole grains, green leafy vegetables and a lower intake of refined grains, red, processed meat, and sugar-sweetened beverages have been linked with reduced risk of type 2 DM (5–8). Adhering to Mediterranean-style or Dietary Approaches to Stop Hypertension (DASH) or diets, which exclude animal products decrease the likelihood of developing type 2 DM and reduce risk of CV complications (9–11). Nutritional education is a continuous, permanent process and an integral part of the treatment during every doctor's visit or nursing consultation (12). Standards of Medical Care in Diabetes recommend reeducation of the patient when complication factors influencing self-management such as new health conditions occur (13).

The most recent and reliable data regarding nutrition in Polish hospitals were presented in the report of the Supreme Audit Office from 2018(14). It revealed that the healthcare system did not guarantee proper nutrition. There were no nutritional standards, health requirements or methods for

assessing the quality of nutrition and rules for employing dieticians in hospital wards. Such gaps in the system and low financial outlays resulted in meals that were inadequate for patients' health conditions, prepared from low-quality raw materials, with unsuited energy and nutritional values. The food provided by hospitals could harm patients' health. The problem of poor-quality hospital nutrition is also noticeable in other Central European countries, such as the Czech Republic and Germany (15, 16). Since 1991, hospital nutrition in the Czech Republic has a form of recommendation by the Ministry of Health. As a result, individual hospitals may offer very different diets. They have to accomplish nutrients and energy value but often lack quality, taste and do not fulfil patients' needs. In Germany, the Physicians Association for Nutrition prepared an open letter to the Ministry of Health in which they requested changes in hospital meals. Nutrition there is included in the so-called "non-medical services" and therefore competes in financing with 12 other services (including training and further education, IT, administration, laundry, controlling and cleaning).

The aim of the study was to investigate the nutrition provided to diabetic patients in hospitals located in Poland and assess their adherence to "Good Meal in the Hospital" recommendations, designed at the request of Polish Ministry of Health (16). We hypothesized that the menus offered to diabetic patients in Polish hospitals failed to adhere to recommendations and lacked proper balance.

Materials and Methods:

Study Design and Setting

The comparative cross-sectional study was conducted between January and August 2022. Menus of diabetic diet were collected. Inclusion criteria were: (1) location in Poland (2) being a public hospital, (3) having a general medicine ward, (4) submitting meal plans from 10 consecutive days, which contained all essential information for analysis (precise ingredients and their weight), and (5) completing the entire questionnaire. Exclusion criteria were: (1) being a private hospital, (2) focusing on specific illnesses or patient demographics, e.g. military personnel, (3) sending

incomplete surveys or (4) inaccurate and unreadable menus (without the weight of the ingredients or containing only general information eg. sandwich with ham). The aims of the study, information about anonymity and terms of participation were mentioned before the beginning of the survey. Completing and submitting the form was regarded as providing informed consent to participate in the study.

Bioethical Committee

This study was conducted according to the guidelines of the Declaration of Helsinki. Although conducting survey studies in Poland does not require Bioethical Approval, it was acquired retrospectively for publication purposes by the Institutional Review of the Bioethical Committee at the Medical University of Warsaw (date: 11 September 2023, number: AKBE/258/2023).

Data Collection

Participants- heads of the departments, specialists and resident doctors from various districts of Poland were reached by an email dedicated to the study. They were asked to fulfil a survey created with Google Forms and send the meal menus received by diabetic patients for the upcoming ten days.

Research Tools

Questions involved: (1) The hospital's degree of reference (1st/2nd/3rd degree) - the first degree provides fundamental medical procedures, the third degree, offers the most specialized procedures. (2) The total amount of beds in the hospital and the internal medicine unit. (3) The attendance of a person delivering nutritional education. (4) Place of meal preparation- hospital kitchen or outsourced catering services. (5) The access to diets tailored for patients with diabetes. Next, the received menus were compared with the self-created model menu. It was tailored with the usage of widely accessible, and relatively affordable ingredients to meet the nutritional requirements of individuals with diabetes and at risk of cardiovascular disease. The form and model menu are available in the Supplementary Materials section. Then, all menus were evaluated in “Dieta 6”

computer program and compared with the “Dobry posiłek w szpitalu” (Good meal in Hospital) governmental recommendations. “Dieta 6" computer program was created by the National Institute of Public Health - National Institute of Hygiene in Warsaw and is tailored to the Polish population. “Dobry posiłek w szpitalu” (Good Meal in Hospital) recommendations are the first such recommendations in Poland that introduce a coherent system to compose meals in hospitals (17). They introduce an average weighted standard for energy and nutrients for the entire hospital population, regardless of gender, types of diets, their characteristics, recommended and contraindicated foods. The summary of the recommendations is presented in Table 1.

Table 1: The qualities of diet restricting easily digestible carbohydrates based on the “Good Meal in Hospital” recommendations (17).

The daily caloric value of meals should be 2000- 2400 kcal.
Protein should represent no more than 10-20% of total energy and the amount 25-50 g/ 1000 kcal
Fat should represent no more than 20-30 % of total energy and the amount 22-33 g/1000 kcal
Saturated fatty acids should represent no more than 10% of energy and the amount <11 g/1000 kcal
Carbohydrates should represent no more than 45-65% of energy and the amount 113-163 g/1000 kcal
Mono- and disaccharides should represent no more than 10% of energy and the amount <25 g/1000 kcal
The amount of sodium should be < 2000 mg per day
The amount of fibre should be at least 15 g/1000 kcal
Whole grain cereal products should be provided minimum twice a day.
Each meal should incorporate vegetables or fruit, with a minimum daily intake of 400g (excluding potatoes and sweet potatoes). Vegetables should predominate, constituting at least three portions.
Legumes or their preserves should be included in meals at least three times within ten days.
Fish or their preserves should be included in meals at least three times within ten days.
The number of meals should range from 4 to 6 per day, and it should remain consistent every day.

Statistical Analysis

Statistical analyses were carried out using STATISTICA™ 13.3 software by TIBCO Software in Palo Alto, California, United States. DIETA 6.0 software was used to calculate the nutritional values of the received menus. For every nutritional value mean (M), standard deviation (SD), and range (Min-Max) were calculated. To assess discrepancies in means for both nutrients and products among different hospitals and the standardized menu, we utilized a one-way ANOVA followed by a post-hoc Dunnett's two-tailed test. Dunnett's test is a multiple comparison method that contrasts each mean with a single control in many-to-one comparisons. The null hypothesis was declined when p-values fell below 0.05, indicating statistically significant disparities in means.

Results:

A collective of 70 daily menus dedicated to diabetic patients from seven hospitals underwent analysis (A- 1035 beds, B-452 beds, C-683 beds, D- 677 beds, E- 363 beds, F-176 beds, G-321 beds). Five of the examined hospitals were 3rd degree of reference (A, C, D, E, G) one was 2nd (B) degree and one 1st degree (F). Hospitals 1, 2, and 3 were located in the Mazowieckie Voivodeship, hospitals 4, 6, and 7 in the Śląskie Voivodeship, Hospital 5 in the Łódzkie Voivodeship. A special diet dedicated to diabetic patients was available in every hospital. Nutrition education was available in six hospitals (A, B, D, E, F, G), yet only four of them had a resident dietician (D, E, F, G). Four hospitals undertook the culinary preparations internally (C, D, F, G), while three hospitals opted to engage external catering services (A, B, E).

There was a statistically significant difference in a mean of: energy, energy from carbohydrates, total carbohydrates per 1000 kcal, fiber per 1000 kcal, mono- and disaccharides per 1000 kcal, percentage of energy from mono- and carbohydrates. Compared to the standardized menu, there was a statistically greater mean of energy in Hospitals B, C and lower in Hospital D and E; greater percentage of energy from carbohydrates in Hospitals F and G and lower in Hospital B; lower mean of fiber per 1000 kcal in Hospitals B, D, E; a grater mean of carbohydrates per 1000 kcal in Hospitals F and G and lower in Hospital B; a greater mean of mono- and disaccharides per 1000

kcal in Hospitals F, G and lower in hospital D; a greater percentage of energy from mono- and disaccharides in Hospitals F and G and lower in Hospital D. Table 2 displays precise values.

Table 2: Energy and carbohydrate content

Hospital/Unit	M	SD	Min	Max	P-value[a]
Energy [kcal] (F22.141=;P<0.001[b])					
A	2054.1	234.5	1726.4	2397.1	0.998
B	2266.4	100.7	2111.4	2394.4	0.033
C	2332.9	108.3	2180.1	2524.2	0.002
D	1620.8	65.4	1514.8	1716.5	<0.001
E	1759.1	116.3	1572.9	1940.6	0.016
F	2130.0	155.3	1881.7	2389.5	0.608
G	2162.3	192.1	1864.2	2439.1	0.344
REFERENCE	2015.8	29.3	1993.1	2055.8	–
Percentage of energy from carbohydrates [kcal] (F=25.600;P<0.001[b])					
A	53.8	4.3	46.2	59.4	0.900
B	41.8	3.1	38.3	46.9	<0.001
C	53.7	2.6	50.0	58.0	0.935
D	54.3	1.4	52.2	56.5	0.802
E	52.8	3.3	48.4	58.1	1.000
F	59.4	2.6	55.5	63.6	<0.001
G	59.6	3.1	55.9	65.3	<0.001
REFERENCE	52.2	2.6	48.5	55.7	–
Fiber/1000 kcal [g/kcal](F=7.033, p<0.001[b])					
A	20.6	2.0	16.4	22.5	0.996
B	17.1	1.9	14.9	20.3	0.004
C	18.2	2.6	15.3	22.4	0.044
D	15.6	1.5	13.7	17.6	<0.001
E	16.5	1.5	13.7	19.8	<0.001
F	18.2	1.8	15.7	19.8	0.040
G	18.1	2.1	14.1	21.6	0.035
REFERENCE	21.1	1.5	18.8	22.9	–
Carbohydrates/1000 kcal [g/kcal] (F=22.490, P<0.001[b])					
A	144.6	11.7	124.2	159.3	0.939
B	112.7	8.4	103.8	127	<0.001
C	143.1	7.6	132.6	155.9	0.996
D	143.1	3.7	137.0	148.9	0.997
E	139.7	9	128.2	154.8	1.000
F	157.4	6.7	146.4	167.2	0.003
G	157.9	8.4	146.5	173.7	0.002
REFERENCE	140.7	6.6	131.1	149.5	–
A total of mono- and disaccharides/1000kcal [g/1000 kcal] (F=20.194;P<0.001[b])					
A	32.3	6.7	18.5	41.9	0.209

B	21.6	3.6	17.3	26.8	0.293
C	32.3	3.7	26.2	36.7	0.212
D	15.5	3.8	10.4	20.0	0.001
E	27.9	7.6	14.2	42.6	0.999
F	37.6	3.2	32.8	42.1	0.001
G	37.2	3.1	32.8	42.1	0.002
REFERENCE	26.9	2.2	23.8	29.7	–
Percentage of energy from mono- and disaccharides [%] (F=20.194, p<0.001[b])					
A	12.9	2.7	7.4	16.8	0.209
B	8.6	1.4	6.9	10.7	0.293
C	12.9	1.5	10.5	14.7	0.212
D	6.2	1.5	4.2	8.0	0.001
E	11.2	3.0	5.7	17.0	0.999
F	15.1	1.3	13.1	16.9	0.001
G	14.9	1.3	13.1	16.9	0.002
REFERENCE	10.7	0.9	9.5	11.9	–

M – mean, SD – standard deviation, , [a] Dunnett's post hoc test (multiple comparisons to a reference: many-to-one comparisons); [b] one-way analysis of variance.

There was a statistically significant difference in the mean of: total protein, percentage of energy from protein, animal-based protein per 1000 kcal, plant-based protein per 1000 kcal. Comparing to the standardized menu there was a statistically lower mean of total protein in hospitals A , C, D, E, F , G and a greater in hospital B; a lower percentage of energy from protein in Hospitals A, C, D, E, F and G, a greater mean of animal-based protein per 1000 kcal in Hospital B, and a lower mean of plant-based protein per 1000 kcal in every hospital. Precise values are presented in Table 3.

Table 3: Protein content

Hospital/Unit	**M**	**SD**	**Min**	**Max**	**P-value[a]**
Total amount of protein [g] (F=25.246; P<0.001[b])					
A	79.2	10.4	70.6	101.9	<0.001
B	120.4	8.7	106.2	135	0.033
C	92.1	10.0	74.9	105.5	0.022
D	73.8	11.9	57.4	93.7	<0.001
E	77.0	7.2	66.6	90.5	<0.001
F	85.3	5.2	75.6	94.5	<0.001
G	86.1	5.8	75.2	94.5	<0.001
REFERENCE	106.1	6.7	99.8	116.0	–
Percentage of energy from protein [%] (F=21.362; P<0.001[b])					

A	15.5	1.4	12.7	18.0	<0.001
B	21.2	1.1	19.7	22.6	1.000
C	16.0	1.6	12.9	17.6	<0.001
D	17.9	1.7	14.7	20.0	0.001
E	17.6	1.7	14.8	20.2	<0.001
F	15.8	1.0	14.3	16.8	<0.001
G	15.7	1.1	14.1	16.8	<0.001
REFERENCE	21.3	1.1	20.2	22.8	–
Animal- based protein/1000 kcal [g/ kcal] (F=11.049; P<0.001[b])					
A	22.7	4.2	18.0	31.5	0.986
B	38.1	4.4	32.7	45.0	<0.001
C	22.6	4.5	13.2	27.5	0.981
D	25.2	6.1	16.1	35.4	0.998
E	25.4	4.3	17.9	30.7	0.994
F	23.5	2.9	20.0	28.4	1.000
G	23.4	2.9	19.8	28.4	1.000
REFERENCE	24.1	4.6	18.6	29.1	–
Plant based protein/ 1000 kcal [g/ kcal] (F=29.212; P<0.001[b])					
A	16.0	2.3	12.6	19.3	<0.001
B	14.6	1.7	12.3	16.8	<0.001
C	16.7	2.7	13.9	21.7	<0.001
D	19.9	1.0	18.7	21.4	<0.001
E	18.3	1.7	14.8	20.5	<0.001
F	16.5	1.1	14.8	18.0	<0.001
G	16.5	1.4	13.7	18.0	<0.001
REFERENCE	28.2	2.2	24.9	30.7	–

M – mean, SD – standard deviation, [a] Dunnett's post hoc test (multiple comparisons to a reference: many-to-one comparisons), [b] one-way analysis of variance.

Table 4 displays fat content. A one- way ANOVA revealed that there was a statistically significant difference in the mean of: total fat, fat per 1000 kcal, percentage of energy from fat, cholesterol and percentage of energy from saturated fat acids. Comparing to the standardized menu there was a statistically higher mean of total fat in Hospitals B and C; higher mean of fat per 1000 kcal in Hospital B, a higher percentage of energy from fat in Hospital B, higher mean of cholesterol in Hospitals A, B and C; higher percentage of energy from saturated fat acids in Hospital A, B, C, E, F, G.

Table 4: Fat content.

Hospital/Unit	M	SD	Min	Max	P-value [a]
Fat [g] (F=11.726; P<0.001[b])					
A	70.7	17.1	51.7	106.6	0.407
B	93.3	11.6	79.8	112.4	<0.001
C	79.4	10.1	65.3	100.9	0.019
D	50.0	1.6	47.4	52.4	0.529
E	58.4	9.9	39.5	78.2	1.000
F	58.6	12.0	44.9	79.3	1.000
G	59.0	11.7	44.9	81.0	1.000
REFERENCE	60.1	7.6	49.9	70.2	–
Fat/1000 kcal [g/kcal] (F=10.600; P<0.001[b])					
A	34.1	5.2	28.0	45.7	0.252
B	41.1	4.5	34.9	46.9	<0.001
C	34.0	3.5	27.5	40.9	0.279
D	30.9	1.5	29.2	33.3	0.998
E	33.0	3.8	25.1	40.3	0.554
F	27.3	3.7	22.1	33.8	0.768
G	27.2	4.0	21.9	33.5	0.727
REFERENCE	29.9	4.1	24.3	35.2	–
Percentage of Energy from fat [%] (F=10.607; P<0.001[b])					
A	30.6	4.6	25	40.9	0.170
B	37.0	3.9	31.1	42	<0.001
C	30.4	3.2	24.5	36.6	0.224
D	27.8	1.3	26.1	29.5	0.983
E	29.7	3.0	24.5	36.0	0.417
F	24.8	3.3	19.6	30.2	0.916
G	24.7	3.7	19.5	29.9	0.890
REFERENCE	26.5	3.6	21.5	31.3	–
Cholesterol [g] (F=6.167; P<0.001[b])					
A	329.2	100.6	173.8	445.9	0.024
B	421.3	129.6	305.7	649.0	<0.001
C	330.9	103.4	193.4	486.9	0.022
D	177.3	93.0	99.1	316.7	1.000
E	258.1	87.8	152.3	412.5	0.469
F	228.4	65.1	180.8	372.3	0.868
G	229.2	64.5	180.8	359.9	0.859
REFERENCE	177.3	97.7	93.4	318.4	–
Percentage of energy from saturated fat acids [%] (F=21.777; P=0.001[b])					
A	12.8	1.8	10.1	15.5	<0.001
B	15.7	1.5	14.3	18.6	<0.001
C	15.0	1.9	12.6	19.4	<0.001
D	9.3	1.1	7.8	10.9	0.025
E	11.4	1.1	10.3	13.6	<0.001
F	11.8	1.7	10.0	14.6	<0.001

G	11.7	1.8	9.2	14.6	<0.001
REFERENCE	6.5	1.4	4.9	8.6	–

M – mean, SD – standard deviation, [a] Dunnett's post hoc test (multiple comparisons to a reference: many-to-one comparisons), [b] one-way analysis of variance.

The hospitals showed significant differences in a mean of: fruits, vegetables, sugar in total, legumes, nuts and seeds, whole grain cereal products, red meat, processed white and red meat. Comparing to model menu lower mean fruits was observed in Hospital B, D and E, lower mean of vegetables in Hospitals A, C, D, E, F and G; greater mean of sugar in Hospitals A, C, E, F and G, greater mean of potato in Hospital F and G; lower amount of legumes in every hospital, greater mean of whole grain products in hospital A and lower in Hospital D; greater mean of red meat in Hospital B and E. Only one Hospital offered nuts and in statistically lower amount than the model menu. Other differences were not statistically significant. Every hospital provided red meat, only the reference diet did not. Precise values are presented in Table 5.

Table 5: Groups of products and sodium intake.

Hospital/Unit	**M**	**SD**	**Min**	**Max**	**P-value [a]**
Fruits [g] (F = 6.855; P<0.001[b])					
A	287.8	52.8	150.0	348.8	0.987
B	168.9	21.0	150.0	202.5	0.025
C	262.1	121.5	138.8	497.3	0.763
D	65.2	85.4	0.0	178.1	<0.001
E	155.3	90.1	0.0	281.0	0.006
F	240.5	94.2	138.8	450.8	0.433
G	237.4	94.7	138.8	450.8	0.391
REFERENCE	316.9	19.1	300.0	346.2	–
Vegetables [g] (F = 15.204; P<0.001[b])					
A	484.4	89.3	334.5	602.4	0.001
B	761.3	185.0	482.1	1021.3	1.000
C	551.2	175.6	290.7	922.3	0.025
D	424.4	125.1	272.8	641.6	<0.001
E	384.2	95.0	240.8	540.3	<0.001
F	337.5	69.4	248.8	472.2	<0.001
G	327.7	53.3	248.8	413.4	<0.001
REFERENCE	744.2	124.2	572.6	861.4	–
Fish [g] (F = 0.634; P = 0.726[b])					
A	35.3	39.2	0.0	83.3	0.997

B	33.3	88.2	0.0	233.3	0.995
C	19.6	40.9	0.0	120.0	0.839
D	11.9	31.5	0.0	83.3	0.714
E	12.0	37.9	0.0	120.0	0.654
F	8.8	27.9	0.0	88.2	0.571
G	8.8	27.9	0.0	88.2	0.571
REFERENCE	49.0	109.6	0.0	245.0	–
Sugar total [g] (F = 44.278; P<0.001[b])					
A	30.1	9.2	5.1	40.1	<0.001
B	1.2	1.6	0.0	3.8	1.000
C	33.7	3.6	31.3	43.1	<0.001
D	1.3	1.6	0.0	3.8	1.000
E	27.4	12.7	2.7	56.2	<0.001
F	33.3	2.6	31.3	39.3	<0.001
G	33.1	2.4	31.3	39.3	<0.001
REFERENCE	2.2	2.5	0.0	5.9	–
Legumes [g] (F = 43.320; P<0.001[b])					
A	3.8	11.9	0.0	37.5	<0.001
B	0.0	0.0	0.0	0.0	<0.001
C	9.1	11.9	0.0	28.1	<0.001
D	0.0	0.0	0.0	0.0	<0.001
E	1.5	3.1	0.0	7.5	<0.001
F	0.0	0.0	0.0	0.0	<0.001
G	0.0	0.0	0.0	0.0	<0.001
REFERENCE	43.3	10.5	26.3	52.5	–
Nuts and seeds [g] (F = 350.946; P<0.001[b])					
A	0.0	0.0	0.0	0.0	–
B	0.0	0.0	0.0	0.0	–
C	1.5	3.4	0.0	10.0	<0.001
D	0.0	0.0	0.0	0.0	–
E	0.0	0.0	0.0	0.0	–
F	0.0	0.0	0.0	0.0	–
G	0.0	0.0	0.0	0.0	–
REFERENCE	30.0	0.0	30.0	30.0	–
Whole grain cereal products [g] (F = 12.651; P<0.001[b])					
A	252.0	6.3	250.0	270.0	0.009
B	240.0	0.0	240.0	240.0	0.094
C	184.5	47.8	50.0	220.0	0.978
D	130.0	0.0	130.0	130.0	0.003
E	218.0	15.5	200.0	230.0	0.675
F	180.0	0.0	180.0	180.0	0.896
G	187.0	60.7	90.0	340.0	0.995
REFERENCE	196.0	8.9	180.0	200.0	–
Red meat [g] (F = 5.374; P<0.001[b])					
A	12.6	26.5	0.0	102.3	0.668

B	81.5	53.9	0.0	159.9	<0.001
C	16.6	37.9	0.0	131.2	0.312
D	16.7	52.4	0.0	191.8	0.380
E	56.9	56.3	0.0	132.5	0.001
F	21.3	43.2	0.0	115.1	0.103
G	21.3	43.2	0.0	115.1	0.103
REFERENCE	0.0	0.0	0.0	0.0	–
Processed white and red meat [g] (F = 3.534; P = 0.002[b])					
A	34.0	15.2	0.0	51.0	0.366
B	58.1	22.0	28.3	100.7	0.924
C	39.5	15.7	17.0	69.1	0.769
D	26.8	13.1	0.0	45.3	0.103
E	43.0	20.9	14.2	76.8	0.969
F	31.9	11.5	14.4	47.2	0.264
G	31.9	11.5	14.4	47.2	0.264
REFERENCE	49.7	32.1	0.0	76.8	–

M – mean, SD – standard deviation, , [a] Dunnett's post hoc test (multiple comparisons to a reference: many-to-one comparisons), [b] one-way analysis of variance.

All hospitals successfully met five criteria, which included protein, carbohydrate, fiber, whole grains, vegetables and fruits intake. Hospitals A,B,C,D, E met eight out of thirteen criteria, while hospitals F and G seven out of thirteen criteria. The summary of the results is presented in Table 6.

Table 6: The summary of the recommendations fulfilled by the Hospitals.

	A	**B**	**C**	**D**	**E**	**F**	**G**
Energy: 2000-2400 kcal per day	+	+	+	-	-	+	+
Protein: 25-50 g/ 1000 kcal and 10-20% of total energy	+	+	+	+	+	+	+
Fat: 22-33 g/1000 kcal and 20-30 % of Energy in total	-	-	-	+	+	+	+
Saturated fatty acids: No more than 10% of Energy and <11 g/1000 kcal	-	-	-	+	-	-	-
Carbohydrates: 113-163 g/1000 kcal and 45-65% of energy	+	+	+	+	+	+	+
Mono- and disaccharides: <25 g/1000 kcal and no more than 10% of energy	-	+	-	+	-	-	-
Fibre: 15 g/1000 kcal	+	+	+	+	+	+	+
Sodium: < 2000 mg/ day	-	-	-	-	-	-	-
Whole grain cereal products should be given at least 2 times per day	+	+	+	+	+	+	+
Vegetables or fruit should be added to each meal (minimum 400 g per day excluding potatoes and sweet potatoes); vegetables should be predominating – (at least 3 portions)	+	+	+	+	+	+	+
Legumes or their preserves should be served at least 3 times in 10 days	-	-	+	-	+	-	-

Fish or their preserves should be served at least 3 times in 10 days	+	-	-	-	-	-	-
Number of meals should be the same every day- 4-6 a day	+	+	+	-	+	-	-

(+) recommendation fulfilled, (-) recommendation not fulfilled

Discussion:

Results of our study show a significant discrepancy between the recommendations and meals received by the patients. Although every hospital provided a "diabetic diet", its quality was inadequate and unadjusted. The lack of appropriate nutritional patterns promoted in the hospital raises the potential for patients to make nutritional mistakes, which could negatively impact the control of DM. According to the recommendations of the Polish Diabetes Association, there is no universal diet for all people with diabetes (12). Optimal macronutrient proportions for people with diabetes should be determined individually, taking into account age, physical activity, presence of diabetes complications, comorbidities, and personal preferences. Implementing the proper dietary recommendations can be challenging for diabetics, who are generally in good health. For those, who undergo hospitalization or treatment procedures maintaining glycemic control can be even more difficult. Failure to follow prescribed treatments, particularly dietary recommendations, is a critical issue in managing DM (18,19).

The crucial role of healthcare providers in encouraging individuals with DM to adopt health-promoting behaviors has been highlighted in many studies (20,21). Research confirmed improved management of diabetes among patients who received care from a multidisciplinary team (19,22). Doctors and nurses play a significant role, as they interact with patients most frequently (23). They are usually the first to notice glycemic irregularities and dietary and treatment errors. Polish Diabetes Society emphasizes that education performed by authorized professionals (doctors, diabetes nurses, dietitian, diabetes educators) is crucial for proper diabetes management (12). Effective communication between doctors and patients enhances patient satisfaction, boosts adherence to treatment plans, and results in better health outcomes (24). Discussion of self-care successes and failures with physicians enables to individualize treatment and increase the

likelihood of success (25). Detailed dietary recommendations should be individualized according to the patient's needs and capabilities. Three out of seven examined hospitals did not have a dietician permanently available on the ward. In two of them, nutritional education was not provided at all. This presents a suboptimal scenario wherein delivering comprehensive assistance to a patient with diabetes becomes challenging.

Analyzing the menus it can be asserted that they did not meet the criteria for a diet tailored to the needs of diabetic patients. The menus contained typical nutritional errors representing the nutritional pattern of the Polish population: insufficient intake of whole grain products, legumes and fish and excessive intake of meat and its preserves (26). Although all hospitals met the requirements regarding the amount and percentage of carbohydrates only two out of seven hospitals met the criteria regarding the intake of mono and disaccharides. Research and recommendations show a lack of sufficient scientific evidence for determining one optimal amount of carbohydrates in the diet of people with diabetes (10,27). Emphasis should be placed on high-quality, nutrient-dense carbohydrate sources that are rich in fiber. Intake of mono- and disaccharides should be limited to the minimum (12). Consistent consumption of an adequate amount of dietary fiber is linked to a reduced risk of all-cause mortality in individuals with diabetes (28,29). The primary source of carbohydrates should be whole grain cereal products, especially those with low glycemic index (GI). Encouraging carbohydrate intake from vegetables, fruits, whole grains, legumes, and dairy products is recommended over consumption from other carbohydrate sources, especially those containing added fats, sugars, or sodium (4,27). Low-GI diets may be useful for glycemic control and may reduce body weight in people with prediabetes or diabetes (30). Meta-analysis revealed that low-GI diets effectively reduced glycated haemoglobin, fasting glucose, BMI, total cholesterol, and LDL, but did not impact fasting insulin, HOMA-IR, HDL, triglycerides, or insulin requirements. In principle, every hospital adhered to the requirement of including two whole grain products daily. Upon closer examination, it becomes evident that this primarily consisted of whole-grain bread. Products such as oat flakes, brown rice, millet and buckwheat were either absent or only occasionally featured in other menus.

The fat composition was also inadequate. Three out of seven hospitals exhibited an excessive fat intake, only one meet the criteria for limiting saturated fatty acids. According to the recommendations, the quality of fat is more important than its total quantity (12,19). Adhering to a Mediterranean eating pattern can enhance glycemic control, blood lipid levels and contribute to reduction in CV risk (10). Vegetable fats are recommended (19). Patients are advised to increase their consumption of foods rich in long-chain omega-3 fatty acids from fatty fish and omega-3 linolenic acid. Evidence indicate that high-MUFA diets are associated with improved glycemic control and CVD risk or risk factors (31). None of the menus contained seeds, nuts or fatty fish but poultry, meat and butter were included every day in most of the meals. Given this distribution of fat sources, meeting recommendations and achieving a well-balanced diet is unfeasible.

The recommendations for protein intake for patients with diabetes align with those for the general population (12,19). All the examined hospitals met the stipulated protein requirements. However, the distribution of protein sources was not optimal. Animal protein predominated, surpassing plant protein by approximately 1.5 times. The prevalence of animal protein contributes to an elevated intake of saturated fatty acids, with six out of the seven surveyed hospitals falling short of the recommended limit. A closer examination of meal compositions revealed minimal inclusion of plant proteins, with legumes present in trace amounts and the absence of nuts and seeds. Legumes share several characteristics with whole grains that could potentially benefit glycemic control, including the presence of slow-release carbohydrates and a high fiber content (21). According to the recommendations, diabetic patients should receive 4-6 meals with a 3-4 h break between them (17). Three out of seven examined hospitals offered only three meals a day, which was insufficient and could lead to deterioration of glycemic control and increased the risk of hypoglycemia.

According to some interpreters, incorrect nutrition is inconsistent with current medical knowledge and should be considered a violation of the Act on Patient Rights and the Act on the Patient Ombudsman (32). Medical entities – hospitals and clinics are responsible for providing the proper diets. Given all the mentioned deficiencies in hospital nutrition, it is necessary to consider whether and how state authorities should oversee its quality. New legal regulations are also needed. The

National Health Fund, as the authorized body, would then have a stronger basis and duty for assessing the quality of hospital nutrition and its compliance with the requirements.

Limitations: The largest limitation of the study is the relatively small number of examined hospitals, which may affect its representativeness. Nonetheless, despite the sample size, the results underscore the severity of the issue from a specific viewpoint. We analyzed 70 menus, which were received by a considered a large number of patients. Each hospital's capacity, based on its province and annual occupancy rate, allows us to estimate the total number of patient beds and hospitalization days. For example, Hospital 1 has 1,035 beds, Hospital 2 has 452 beds, Hospital 3 has 683 beds, Hospital 4 has 677 beds, Hospital 5 has 363 beds, Hospital 6 has 176 beds, and Hospital 7 has 321 beds. Summing these data helps us determine the number of patients missing out on nutrition education, impacting the healthcare system negatively. Hospitals 1, 2, and 3 are in the Mazowieckie Voivodeship, with an average of 40.8 patients per bed per year, resulting in (2,170 × 40.8) 88,536 patients. Hospitals 4, 6, and 7 are in the Śląskie Voivodeship, with an average of 36.2 patients per bed per year, resulting in (1,174 × 36.2) 42,498.8 patients. Hospital 5 is in the Łódzkie Voivodeship, with an average of 42.4 patients per bed per year, resulting in approximately 15,391 patients annually. Adding these numbers, we get an estimated total of 146,425.8 patients. The limited number of hospitals results from the scarce availability of data, complicated access to the person responsible for hospital nutrition and not providing us with necessary data (such as portion sizes, preparation methods, and specific diets). Therefore more research on the topic is needed. Another limitation arises from the operation of the Dieta 6 program, which uses approximations to estimate nutritional values. The program also includes pre-prepared standardized dishes, such as soups, which may differ from the actual meals and slightly impact the values of the meals.

Conclusions:

To conclude, our current data revealed that the so-called “diabetic” diets failed to meet patient requirements. This suggests an insufficient level of public awareness on the subject (21).

Insufficient nutrition education during hospitalization may lead to potential post-discharge dietary errors leading to deterioration in glycemic regulation, lipid profiles, and heightened susceptibility to complications. In situation when doctors and nurses are often overburdened with work and a small number of dietitians on the wards, meals received during a hospital stay are of particular importance - sometimes they are the only form of education. To address these challenges effectively, it is essential to implement policy reforms, initiate extensive educational campaigns, and implement regular and binding quality controls for hospital nutrition. Additionally, more research on this topic is needed to exert pressure on decision-making bodies such as the National Health Fund and the Ministry of Health. By recognizing and actively addressing the disparities uncovered in this research, we can improve the care of diabetic patients and ultimately enhance their overall health. This preliminary study not only brings attention to present challenges but also establishes a basis for promising future research opportunities.

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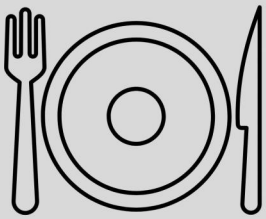
Assessment of hospital meals dedicated to diabetic patients. HDMI-Hospital Diet Medical Investigation Study



Methods

A survey was sent to the hospital workers, **menus** from hospital were collected.

7- day **model menu** was created.

Outcomes were compered with the **"Good meal in hospital"** recommendations.

Results

None of the hospitals fulfil all of the recommendations.

The discrepancies particularly concerned excessive levels of **saturated fatty acids and mono- and disaccharides**, and insufficient amounts of **legumes and fish** in the hospital diets.

Only **four out of seven** hospitals had a resident dietitian present.

Conclusions

The collected data reveals a significant **disparity within the Polish healthcare system.**

Hospials provided diets that **do not meet** specific nutritional needs of diabetic patients

By recognizing and addressing the disparities uncovered in this research, we can **improve the care** of diabetic patients

Table 1: The qualities of diet restricting easily digestible carbohydrates based on the "Good Meal in Hospital" recommendations (17).

The daily caloric value of meals should be 2000- 2400 kcal.
Protein should represent no more than 10-20% of total energy and the amount 25-50 g/ 1000 kcal
Fat should represent no more than 20-30 % of total energy and the amount 22-33 g/1000 kcal
Saturated fatty acids should represent no more than 10% of energy and the amount <11 g/1000 kcal
Carbohydrates should represent no more than 45-65% of energy and the amount 113-163 g/1000 kcal
Mono- and disaccharides should represent no more than 10% of energy and the amount <25 g/1000 kcal
The amount of sodium should be < 2000 mg per day
The amount of fibre should be at least 15 g/1000 kcal
Whole grain cereal products should be provided minimum twice a day.
Each meal should incorporate vegetables or fruit, with a minimum daily intake of 400g (excluding potatoes and sweet potatoes). Vegetables should predominate, constituting at least three portions.
Legumes or their preserves should be included in meals at least three times within ten days.
Fish or their preserves should be included in meals at least three times within ten days.
The number of meals should range from 4 to 6 per day, and it should remain consistent every day.

Table 2: Energy and carbohydrate content

Hospital/Unit	**M**	**SD**	**Min**	**Max**	**P-value[a]**
Energy [kcal] (F22.141=;P<0.001[b])					
A	2054.1	234.5	1726.4	2397.1	0.998
B	2266.4	100.7	2111.4	2394.4	0.033
C	2332.9	108.3	2180.1	2524.2	0.002
D	1620.8	65.4	1514.8	1716.5	<0.001
E	1759.1	116.3	1572.9	1940.6	0.016
F	2130.0	155.3	1881.7	2389.5	0.608
G	2162.3	192.1	1864.2	2439.1	0.344
REFERENCE	2015.8	29.3	1993.1	2055.8	–
Percentage of energy from carbohydrates [kcal] (F=25.600;P<0.001[b])					
A	53.8	4.3	46.2	59.4	0.900
B	41.8	3.1	38.3	46.9	<0.001

C	53.7	2.6	50.0	58.0	0.935
D	54.3	1.4	52.2	56.5	0.802
E	52.8	3.3	48.4	58.1	1.000
F	59.4	2.6	55.5	63.6	<0.001
G	59.6	3.1	55.9	65.3	<0.001
REFERENCE	52.2	2.6	48.5	55.7	–
Fiber/1000 kcal [g/kcal](F=7.033, p<0.001[b])					
A	20.6	2.0	16.4	22.5	0.996
B	17.1	1.9	14.9	20.3	0.004
C	18.2	2.6	15.3	22.4	0.044
D	15.6	1.5	13.7	17.6	<0.001
E	16.5	1.5	13.7	19.8	<0.001
F	18.2	1.8	15.7	19.8	0.040
G	18.1	2.1	14.1	21.6	0.035
REFERENCE	21.1	1.5	18.8	22.9	–
Carbohydrates/1000 kcal [g/kcal] (F=22.490, P<0.001[b])					
A	144.6	11.7	124.2	159.3	0.939
B	112.7	8.4	103.8	127	<0.001
C	143.1	7.6	132.6	155.9	0.996
D	143.1	3.7	137.0	148.9	0.997
E	139.7	9	128.2	154.8	1.000
F	157.4	6.7	146.4	167.2	0.003
G	157.9	8.4	146.5	173.7	0.002
REFERENCE	140.7	6.6	131.1	149.5	–
A total of mono- and disaccharides/1000kcal [g/1000 kcal] (F=20.194;P<0.001[b])					
A	32.3	6.7	18.5	41.9	0.209
B	21.6	3.6	17.3	26.8	0.293
C	32.3	3.7	26.2	36.7	0.212
D	15.5	3.8	10.4	20.0	0.001
E	27.9	7.6	14.2	42.6	0.999
F	37.6	3.2	32.8	42.1	0.001
G	37.2	3.1	32.8	42.1	0.002
REFERENCE	26.9	2.2	23.8	29.7	–
Percentage of energy from mono- and disaccharides [%] (F=20.194, p<0.001[b])					
A	12.9	2.7	7.4	16.8	0.209
B	8.6	1.4	6.9	10.7	0.293
C	12.9	1.5	10.5	14.7	0.212
D	6.2	1.5	4.2	8.0	0.001
E	11.2	3.0	5.7	17.0	0.999
F	15.1	1.3	13.1	16.9	0.001
G	14.9	1.3	13.1	16.9	0.002
REFERENCE	10.7	0.9	9.5	11.9	–

M – mean, SD – standard deviation, , [a] Dunnett's post hoc test (multiple comparisons to a reference: many-to-one comparisons); [b] one-way analysis of variance.

Table 3: Protein content

Hospital/Unit	M	SD	Min	Max	P-value[a]
Total amount of protein [g] (F=25.246; P<0.001[b])					
A	79.2	10.4	70.6	101.9	<0.001
B	120.4	8.7	106.2	135	0.033
C	92.1	10.0	74.9	105.5	0.022
D	73.8	11.9	57.4	93.7	<0.001
E	77.0	7.2	66.6	90.5	<0.001
F	85.3	5.2	75.6	94.5	<0.001
G	86.1	5.8	75.2	94.5	<0.001
REFERENCE	106.1	6.7	99.8	116.0	–
Percentage of energy from protein [%] (F=21.362; P<0.001[b])					
A	15.5	1.4	12.7	18.0	<0.001
B	21.2	1.1	19.7	22.6	1.000
C	16.0	1.6	12.9	17.6	<0.001
D	17.9	1.7	14.7	20.0	0.001
E	17.6	1.7	14.8	20.2	<0.001
F	15.8	1.0	14.3	16.8	<0.001
G	15.7	1.1	14.1	16.8	<0.001
REFERENCE	21.3	1.1	20.2	22.8	–
Animal- based protein/1000 kcal [g/ kcal] (F=11.049; P<0.001[b])					
A	22.7	4.2	18.0	31.5	0.986
B	38.1	4.4	32.7	45.0	<0.001
C	22.6	4.5	13.2	27.5	0.981
D	25.2	6.1	16.1	35.4	0.998
E	25.4	4.3	17.9	30.7	0.994
F	23.5	2.9	20.0	28.4	1.000
G	23.4	2.9	19.8	28.4	1.000
REFERENCE	24.1	4.6	18.6	29.1	–
Plant based protein/ 1000 kcal [g/ kcal] (F=29.212; P<0.001[b])					
A	16.0	2.3	12.6	19.3	<0.001
B	14.6	1.7	12.3	16.8	<0.001
C	16.7	2.7	13.9	21.7	<0.001
D	19.9	1.0	18.7	21.4	<0.001
E	18.3	1.7	14.8	20.5	<0.001
F	16.5	1.1	14.8	18.0	<0.001
G	16.5	1.4	13.7	18.0	<0.001
REFERENCE	28.2	2.2	24.9	30.7	–

M – mean, SD – standard deviation, [a] Dunnett's post hoc test (multiple comparisons to a reference: many-to-one comparisons), [b] one-way analysis of variance.

Table 4: Fat content.

Hospital/Unit	M	SD	Min	Max	P-value [a]
Fat [g] (F=11.726; P<0.001[b])					
A	70.7	17.1	51.7	106.6	0.407
B	93.3	11.6	79.8	112.4	<0.001
C	79.4	10.1	65.3	100.9	0.019
D	50.0	1.6	47.4	52.4	0.529
E	58.4	9.9	39.5	78.2	1.000
F	58.6	12.0	44.9	79.3	1.000
G	59.0	11.7	44.9	81.0	1.000
REFERENCE	60.1	7.6	49.9	70.2	–
Fat/1000 kcal [g/kcal] (F=10.600; P<0.001[b])					
A	34.1	5.2	28.0	45.7	0.252
B	41.1	4.5	34.9	46.9	<0.001
C	34.0	3.5	27.5	40.9	0.279
D	30.9	1.5	29.2	33.3	0.998
E	33.0	3.8	25.1	40.3	0.554
F	27.3	3.7	22.1	33.8	0.768
G	27.2	4.0	21.9	33.5	0.727
REFERENCE	29.9	4.1	24.3	35.2	–
Percentage of Energy from fat [%] (F=10.607; P<0.001[b])					
A	30.6	4.6	25	40.9	0.170
B	37.0	3.9	31.1	42	<0.001
C	30.4	3.2	24.5	36.6	0.224
D	27.8	1.3	26.1	29.5	0.983
E	29.7	3.0	24.5	36.0	0.417
F	24.8	3.3	19.6	30.2	0.916
G	24.7	3.7	19.5	29.9	0.890
REFERENCE	26.5	3.6	21.5	31.3	–
Cholesterol [g] (F=6.167; P<0.001[b])					
A	329.2	100.6	173.8	445.9	0.024
B	421.3	129.6	305.7	649.0	<0.001
C	330.9	103.4	193.4	486.9	0.022
D	177.3	93.0	99.1	316.7	1.000
E	258.1	87.8	152.3	412.5	0.469
F	228.4	65.1	180.8	372.3	0.868
G	229.2	64.5	180.8	359.9	0.859
REFERENCE	177.3	97.7	93.4	318.4	–
Percentage of energy from saturated fat acids [%] (F=21.777; P=0.001[b])					
A	12.8	1.8	10.1	15.5	<0.001
B	15.7	1.5	14.3	18.6	<0.001
C	15.0	1.9	12.6	19.4	<0.001
D	9.3	1.1	7.8	10.9	0.025
E	11.4	1.1	10.3	13.6	<0.001

F	11.8	1.7	10.0	14.6	<0.001
G	11.7	1.8	9.2	14.6	<0.001
REFERENCE	6.5	1.4	4.9	8.6	–

M – mean, SD – standard deviation, [a] Dunnett's post hoc test (multiple comparisons to a reference: many-to-one comparisons), [b] one-way analysis of variance.

Table 5: Groups of products and sodium intake.

Hospital/Unit	**M**	**SD**	**Min**	**Max**	**P-value [a]**
Fruits [g] (F = 6.855; P<0.001[b])					
A	287.8	52.8	150.0	348.8	0.987
B	168.9	21.0	150.0	202.5	0.025
C	262.1	121.5	138.8	497.3	0.763
D	65.2	85.4	0.0	178.1	<0.001
E	155.3	90.1	0.0	281.0	0.006
F	240.5	94.2	138.8	450.8	0.433
G	237.4	94.7	138.8	450.8	0.391
REFERENCE	316.9	19.1	300.0	346.2	–
Vegetables [g] (F = 15.204; P<0.001[b])					
A	484.4	89.3	334.5	602.4	0.001
B	761.3	185.0	482.1	1021.3	1.000
C	551.2	175.6	290.7	922.3	0.025
D	424.4	125.1	272.8	641.6	<0.001
E	384.2	95.0	240.8	540.3	<0.001
F	337.5	69.4	248.8	472.2	<0.001
G	327.7	53.3	248.8	413.4	<0.001
REFERENCE	744.2	124.2	572.6	861.4	–
Fish [g] (F = 0.634; P = 0.726[b])					
A	35.3	39.2	0.0	83.3	0.997
B	33.3	88.2	0.0	233.3	0.995
C	19.6	40.9	0.0	120.0	0.839
D	11.9	31.5	0.0	83.3	0.714
E	12.0	37.9	0.0	120.0	0.654
F	8.8	27.9	0.0	88.2	0.571
G	8.8	27.9	0.0	88.2	0.571
REFERENCE	49.0	109.6	0.0	245.0	–
Sugar total [g] (F = 44.278; P<0.001[b])					
A	30.1	9.2	5.1	40.1	<0.001
B	1.2	1.6	0.0	3.8	1.000
C	33.7	3.6	31.3	43.1	<0.001
D	1.3	1.6	0.0	3.8	1.000
E	27.4	12.7	2.7	56.2	<0.001
F	33.3	2.6	31.3	39.3	<0.001
G	33.1	2.4	31.3	39.3	<0.001
REFERENCE	2.2	2.5	0.0	5.9	–
Legumes [g] (F = 43.320; P<0.001[b])					

A	3.8	11.9	0.0	37.5	<0.001
B	0.0	0.0	0.0	0.0	<0.001
C	9.1	11.9	0.0	28.1	<0.001
D	0.0	0.0	0.0	0.0	<0.001
E	1.5	3.1	0.0	7.5	<0.001
F	0.0	0.0	0.0	0.0	<0.001
G	0.0	0.0	0.0	0.0	<0.001
REFERENCE	43.3	10.5	26.3	52.5	–
Nuts and seeds [g] (F = 350.946; P<0.001[b])					
A	0.0	0.0	0.0	0.0	–
B	0.0	0.0	0.0	0.0	–
C	1.5	3.4	0.0	10.0	<0.001
D	0.0	0.0	0.0	0.0	–
E	0.0	0.0	0.0	0.0	–
F	0.0	0.0	0.0	0.0	–
G	0.0	0.0	0.0	0.0	–
REFERENCE	30.0	0.0	30.0	30.0	–
Whole grain cereal products [g] (F = 12.651; P<0.001[b])					
A	252.0	6.3	250.0	270.0	0.009
B	240.0	0.0	240.0	240.0	0.094
C	184.5	47.8	50.0	220.0	0.978
D	130.0	0.0	130.0	130.0	0.003
E	218.0	15.5	200.0	230.0	0.675
F	180.0	0.0	180.0	180.0	0.896
G	187.0	60.7	90.0	340.0	0.995
REFERENCE	196.0	8.9	180.0	200.0	–
Red meat [g] (F = 5.374; P<0.001[b])					
A	12.6	26.5	0.0	102.3	0.668
B	81.5	53.9	0.0	159.9	<0.001
C	16.6	37.9	0.0	131.2	0.312
D	16.7	52.4	0.0	191.8	0.380
E	56.9	56.3	0.0	132.5	0.001
F	21.3	43.2	0.0	115.1	0.103
G	21.3	43.2	0.0	115.1	0.103
REFERENCE	0.0	0.0	0.0	0.0	–
Processed white and red meat [g] (F = 3.534; P = 0.002[b])					
A	34.0	15.2	0.0	51.0	0.366
B	58.1	22.0	28.3	100.7	0.924
C	39.5	15.7	17.0	69.1	0.769
D	26.8	13.1	0.0	45.3	0.103
E	43.0	20.9	14.2	76.8	0.969
F	31.9	11.5	14.4	47.2	0.264
G	31.9	11.5	14.4	47.2	0.264
REFERENCE	49.7	32.1	0.0	76.8	–

M – mean, SD – standard deviation, , [a] Dunnett's post hoc test (multiple comparisons to a reference: many-to-one comparisons), [b] one-way analysis of variance.

Table 6: The summary of the recommendations fulfilled by the Hospitals.

	A	B	C	D	E	F	G
Energy: 2000-2400 kcal per day	+	+	+	-	-	+	+
Protein: 25-50 g/ 1000 kcal and 10-20% of total energy	+	+	+	+	+	+	+
Fat: 22-33 g/1000 kcal and 20-30 % of Energy in total	-	-	-	+	+	+	+
Saturated fatty acids: No more than 10% of Energy and <11 g/1000 kcal	-	-	-	+	-	-	-
Carbohydrates: 113-163 g/1000 kcal and 45-65% of energy	+	+	+	+	+	+	+
Mono- and disaccharides: <25 g/1000 kcal and no more than 10% of energy	-	+	-	+	-	-	-
Fibre: 15 g/1000 kcal	+	+	+	+	+	+	+
Sodium: < 2000 mg/ day	-	-	-	-	-	-	-
Whole grain cereal products should be given at least 2 times per day	+	+	+	+	+	+	+
Vegetables or fruit should be added to each meal (minimum 400 g per day excluding potatoes and sweet potatoes); vegetables should be predominating – (at least 3 portions)	+	+	+	+	+	+	+
Legumes or their preserves should be served at least 3 times in 10 days	-	-	+	-	+	-	-
Fish or their preserves should be served at least 3 times in 10 days	+	-	-	-	-	-	-
Number of meals should be the same every day- 4-6 a day	+	+	+	-	+	-	-

(+) recommendation fulfilled, (-) recommendation not fulfilled