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Relationship of eating habits of pregnant women and daily delivery of nutrients as well as their influence on the course of pregnancy and condition of the neonate

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SUMMARY

Introduction. Early dietary exposure of pregnant women becomes the main determinant of normal fetal development and shapes health of future generations. A range of scientific evidence indicates that nutrition in pregnancy can modify gene expression and result in susceptibility to various diseases. The aim of the study was to analyze the relationship between eating habits of pregnant women and daily delivery of nutrients as well as their influence on the postnatal condition of the neonate.

Materials and methods. The study enrolled 178 healthy pregnant women aged 19–38 years (mean age 29.9 years) at 1–4 days post-labor hospitalized in maternity units of hospitals in the Silesian Province of Poland. The study was conducted using a standardized questionnaire of the National Health Institute: Diet History Questionnaire (DHQ II) and a proprietary history questionnaire.

Results. The mean energy value in daily dietary allowance during pregnancy was 2,609.87±1,199.86 kcal per day. Considering total fat intake in grams, it was concluded that the mean fat intake level was 90.87±42.98 g (103.4% of the recommended intake), which falls within the referential values for the pregnant (46–90 g + 13–16 g). Carbohydrate intake was nearly twice higher than the recommended intake (244.4%). Women having neonates with normal birth weight (2,500–4,000 g) had meals with a lower energy, protein, fat, carbohydrate and cholesterol content than mothers having neonates with macrosomia. A statistically significant correlation found in the study was a negative correlation between the Apgar score and alcohol consumption during pregnancy. The estimated quantities of individual groups of food products did not conform to the recommended dietary reference intake models for pregnant women. Of the studied women, none followed a vegetarian diet or excluded meat, fish, eggs and dairy products from the diet.

Conclusions. Eating habits of pregnant women negatively affect the structure of daily intake of selected nutrients, energy content and contribution of the individual groups of products to the total diet. The mean intake of fruit and added sugars in the daily diet of pregnant women considerably exceeds the recommended reference intake for the pregnant. There is no correlation between omega-3 fatty acid intake and neonatal birth weight.

Key words: nutrition in pregnancy; course of pregnancy; neonatal condition

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AUTHORS' CONTRIBUTION: (A) Study Design · **(B)** Data Collection · **(C)** Statistical Analysis · **(D)** Data Interpretation · **(E)** Manuscript Preparation · **(F)** Literature Search · **(G)** Funds Collection

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INTRODUCTION

Early dietary exposure of pregnant women becomes the main determinant of normal fetal development and shapes health of future generations. All dietary changes that cause increased incidence of contemporary metabolic diseases form the basis for epigenetic paradigms. A range of scientific evidence indicates that nutrition in pregnancy can modify gene expression and result in susceptibility to various diseases. Modern studies on nutrition form the basis for the creation of new nutrition models. Moreover, the interest in health-related effects of individual nutrients in the diet of pregnant women is growing [1]. Nutrition in pregnancy is the fundamental determinant of fetal growth, birth weight and morbidity as well as long-term irreversible effects harmful for fetuses [2].

The modern civilization is characterized by considerable intake of high glycemic index foods and high-energy products as well as pro-

cessed foods with a large amount of salt and chemical substances [3]. The preconception period and pregnancy is a special time when eating preferences do matter. The manner of nutrition during pregnancy belongs to the most significant environmental factors responsible for the normal course of pregnancy, fetal development and future health of the child. The interest of modern medicine in health-related effects resulting from delivery of nutrients in pregnancy and their influence on the course of pregnancy and fetal development is growing [4].

In light of scientific studies, one of the most teratogenic and toxic substances, frequently consumed by pregnant women, is alcohol. Alcohol consumption during pregnancy may lead to intrauterine growth restriction and preterm labor. In Poland, approximately 10,000 neonates are born with a low birth weight due to maternal alcohol consumption during pregnancy. According to the statement of the Royal College of Obstetricians and Gynaecologists (RCOG), it is recommended to reduce alcohol consumption to 1 unit of alcohol daily [5]. However, the ACOG (American College of Obstetricians and Gynecologists) recommends total alcohol abstinence during pregnancy [6]. Nutrient delivery during pregnancy affects the pace of fetal growth, development of internal organs and metabolic pathways as well as tastes that will shape the child's eating preferences [7]. The nutritious environment in which a fetus or neonate develop affects the risk of metabolic disorders in the later life. Scientists suggest that the occurrence of certain diseases in adulthood may be associated with prenatal nutrition due to the possibility of genetic modification (altered gene expression: DNA methylation as well as histone and micro RNA modification) and the resulting permanent memory of previous nutrition statuses. There is evidence from animal tests suggesting that this epigenetic programming should be viewed as a transgenerational phenomenon, which entails the necessity of preventive initiatives in the pregnant [8].

AIM

The aim of the study was to analyze the relationship between eating habits of pregnant women and daily delivery of nutrients as well as their influence on the postnatal condition of the neonate.

MATERIAL AND METHODS

The study enrolled 178 healthy pregnant women aged 19–38 years (mean age 29.9 years) at 1–4 days post-labor hospitalized in maternity units of hospitals in the Silesian Province of Poland. The study was conducted using a standardized questionnaire of the National Health Institute: Diet History Questionnaire (DHQ II) and a proprietary history questionnaire. The standardized DHQ II questionnaire concerns eating habits in the past 12 months. That is why the authors enrolled women directly after the conclusion of a physiological pregnancy.

Initially, 178 women were enrolled. However, upon the verification of all questionnaires, 75 were rejected due to incompleteness. Finally, 103 properly completed questionnaires were analyzed statistically.

RESULTS

The respondents' age ranged from 19 to 38 years. Most women (81.55%) were 26–35 years old, nearly 8% were older than 35 years and 10.68% were aged 19–25 years. The majority of the women, i.e. 81 per 103 (78.64%), were married; 17.47% were not married and 3.89% were divorced. Most of the respondents, i.e. 69 women (66.99%), had higher education, and 25 women (24.27%) had secondary education. Fifty-seven women (55.34%) assessed their socioeconomic status as good, and 2 (1.65%) as very good. The respondents resided mostly in big cities (46.60%).

The neonatal condition was assessed on the basis of birth weight, body length and Apgar score at one minute. The mean birth weight was 3,405.08 g ± 443.58 (min. 2,510 g, max.

Tab. 1. Postnatal condition of newborns

Variables tested	Mean ± SD	Median	Min	Max
Neonatal birth weight [g]	3405,08 ± 443,58	3520	2510	4200
Neonatal body length [cm]	54,60 ± 3,05	54	49	62
Apgar score at 1 minute	9,72 ± 0,69	10	6	10

SD – standard deviation

4,200 g), the mean body length was 54.60 ± 3.05 cm (min. 49 cm, max. 62 cm) and the mean Apgar score was 9.72 ± 0.69 (min. 6, max. 10). 9.7% of neonates had birth weight above 4,000 g (Tab.1, Fig.1,2).

The mean energy value in daily dietary allowance during pregnancy was 2,609.87±1,199.86 kcal/day (min. 1,000 kcal/day, max. 6,394 kcal/day). According to the average recommended daily intake during pregnancy (including the physiological condition, age, body weight, physical activity), the energy value in the daily dietary allowance should be 2,375–2,475 g. The results obtained indicate energy consumption at the level of 124.6% of the recommended daily intake in pregnancy (Tab. 2).

The mean level of selected nutrients is slightly higher than EAR, usually exceeding the recommended reference ranges. Considering total fat intake in grams, it was concluded that the mean fat intake level was 90.87±42.98 g (103.4% of the recommended daily intake), which falls within the referential values for the pregnant (46–90 g + 13–16 g).

Carbohydrate intake (244.4%) was nearly twice higher than the recommended daily intake (average 369.78±202.41g per person daily).

The mean protein intake was above the EAR (140.8%), which ranges from 54–96 g, and amounted to 91.30±42.69 g per person daily.

Mean cholesterol delivery was equal to the admissible norm, i.e. 304.55±158.03 mg (EAR = 89.0%). The percentage value of energy from fat, carbohydrates and proteins was within the upper limit of normal (Tab. 2).

The influence of intake of individual nutrients and the percentage contribution of energy to the daily diet of the pregnant women on neonatal birth weight is presented in Tab. 3. Women having neonates with normal birth weight (2,500–4,000 g) had meals with a lower energy, protein, fat, carbohydrate and cholesterol content than mothers having neonates with macrosomia. These differences are not statistically significant (Tab. 3).

When analyzing declared alcohol consumption during pregnancy, it was found that 58 (56.31%) pregnant women did consume alcohol during pregnancy. However, the analysis of the influence of alcohol on anthropometric parameters of the neonate showed no statistically significant differences (Tab. 4). Nevertheless, when analyzing the amount of alcohol in the daily diet of the pregnant women, a statistically significant correlation was noted. It was a negative correlation between the Apgar score and alcohol consumption during pregnancy (the more alcohol women consume during pregnancy, the lower the Apgar score at 1 minute) (Fig. 3).

Fig. 1. Neonatal birth weight

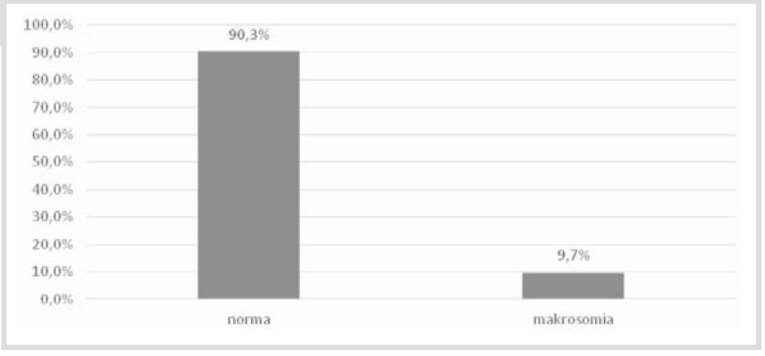
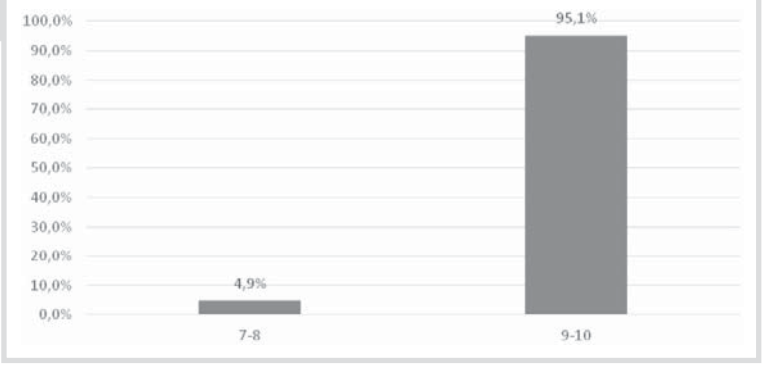


Fig. 2. Apgar score at one minute



Tab. 2. Energy and nutrients in daily diet of pregnant women compared with referential norms

Energy Nutrient per person/daily	Min	Max	Mean ±SD	EAR*	EAR % of recommended intake	Min EAR [% of the norm]	Max EAR [% of the norm]	Referential norm*
Energy USDA kcal/os/d	1000	6394	2609,87±1199,86	2367	124,6%	95,6%	99,7%	1,900–2,000 kcal + 475 kcal during pregnancy, which gives 2,375–2,475
Total fat G USDA	35,4	250	90,87±42,98	85,3	103,4%	80,5%	144,6%	46–90 g + 13–16 g during pregnancy, which gives 59 g–106 g
Carbohydrate g USDA	98,1	1058	369,78±202,41	330	244,4%	244,4%	244,4%	EAR 135 g RDA175g
Protein G USDA	29,8	276	91,30±42,69	85,9	140,8%	89,5%	159,1%	EAR 135 g RDA175g
Alcohol_G_USDA	0	11,4	0,81±1,55	0,2	-	-	-	-
Cholesterol_MG_USDA	101	780	304,55±158,03	267	89,0%	89,0%	89,0%	<300 mg
Total saturated fatty acids G_USDA	12,1	113	33,90±18,74	31,1	137,6%	137,6%	137,6%	22,6
Total monounsaturated fatty acids G_USDA	11,2	98,8	31,69±15,10	28,5	105,2%	105,2%	105,2%	27,1
Total polyunsaturated fatty acids G_USDA	5,6	64,8	17,43±9,25	15,6	86,2%	86,2%	86,2%	18,1
Trans 18:1 (trans-octadecenoic acid)	1	17,5	4,49±2,41	4,3	-	-	-	-
Trans 18:2 (trans-octadecadienoic acid)	0,1	2	0,65±0,35	0,6	-	-	-	-
Trans 16:1 (trans-hexadecenoic acid)	0	0,3	0,02±0,04	0	-	-	-	-
%Energy from TOTAL_FAT	14,9	51,4	31,95±6,32	32,4	129,6%	108,0%	129,6%	25-30%
%Energy from CARBOHYDRATE	35,4	81,3	55,73±8,45	54,6	109,2%	78,0%	109,2%	50-70%
%Energy from PROTEIN	6,9	28,3	14,35±3,07	14,8	148,0%	98,7%	148,0%	10-15%

EAR* – mean for the study group; EAR – level of average requirement for the study group; RDA – Recommended Dietary Allowance; * – according to the nutrition standard for the Polish population – update (2012) ed. M. Jarosz for pregnant women >19 years

Tab. 3. Neonatal body weight and percentage contribution of energy and nutrients to daily diet

Energy Nutrients	Neonatal birth weight		
	Normal birth weight	Macrosomia	P (Student t test)
ENERGY_KCAL_USDA	2580,79±1190,19	2880,40±1321,31	Ns (p=0,455767)
PROTEIN_G_USDA	90,4±42,01	99,73±50,26	Ns (p=0,513863)
TOTAL_FAT_G_USDA	89,90±41,90	99,86±53,77	Ns (p=0,489105)
CARBOHYDRATE_G_USDA	365,29±203,52	411,5±196,91	Ns (p=0,495425)
ALKOHOL_G_USDA	0,77±1,59	1,22±1,21	Ns (p=0,384614)
CHOLESTEROL_MG_USDA	298,85±155,29	357,6±181,82	Ns (p=0,266015)
%Energy from TOTAL_FAT_G_USDA	31,99±6,44	31,56±5,37	Ns (p=0,837574)
%Energy from CARBOHYDRATE_G_USDA	55,63±8,54	56,63±7,91	Ns (p=0,724813)
%Energy from PROTEIN_G_USD	14,38±3,15	13,99±2,25	Ns (p=0,700708)

In the analysis of the influence of omega-3 acids on neonatal birth weight, it was found that women who consumed approximately 2.27±1.45 g of omega-3 acids gave birth to children with normal body weight (2,500–4,000 g). Women who gave birth to neonates with birth weight > 4,000 g consumed more omega-3 acids (average 2.52±1.83 g). These differences are not statistically significant (Tab. 5). The correlation between omega-3 acid intake and neonatal birth weight was measured. The correlation was not statistically significant; it was 0.0028 (p = 0.978). The lack of statistically significant correlation between these parameters is presented in Fig. 4.

Moreover, daily intake of foods from individual nutrition groups was analyzed and compared with the DRI norms recommended by the Institute of Medicine of the United States. The mean total intake of grains, which amounted to 6.51±3.17 ounce equivalents (1 oz = 28.34 g), fell within the recommended range of 3–10 ounces daily. However, the intake of whole-grain products should constitute a half of total grain intake. The diet of the respondents did not meet the recommendations in this aspect. The respondents consumed an average of 0.94 ounces of non-refined grain products daily, and 5.53 ounces of the remaining grains. The mean intake of vegetables (excluding legumes) was consistent with recommendations and amounted to 2.68±2.25 ounces. The situation was similar in the case of total intake of dairy products (2.99±3.25 glass equivalents) as well as meat and fish (4.16±2.78 oz). The mean fruit intake, on the other hand, exceeded the recommended norm. It was 3.54±2.78 cup equivalents and did not conform to DRI (1–2 cup equivalents).

The pregnant women surveyed ate an average of 27.24±31.10 equivalents of added sugars, which constitutes 108.96 g (29.4% of total carbohydrates), thus exceeding the recommended 10% of total daily carbohydrate inta-

Tab. 4. Influence of alcohol consumption during pregnancy on neonatal birth weight and body length as well as on Apgar score at 1 minute

Variables tested	Neonatal birth weight	Neonatal body length	Apgar
Alcohol during pregnancy – yes (n=58)	3,410.36±477.63	54.61±3.14	9.90±0.83
Alcohol during pregnancy – no (n=45)	3,377.57±409.39	54.45±2.96	9.73±0.50
ANOVA test	Ns (p=0.717744)	Ns (p=0.805074)	Ns (p=0.828279)

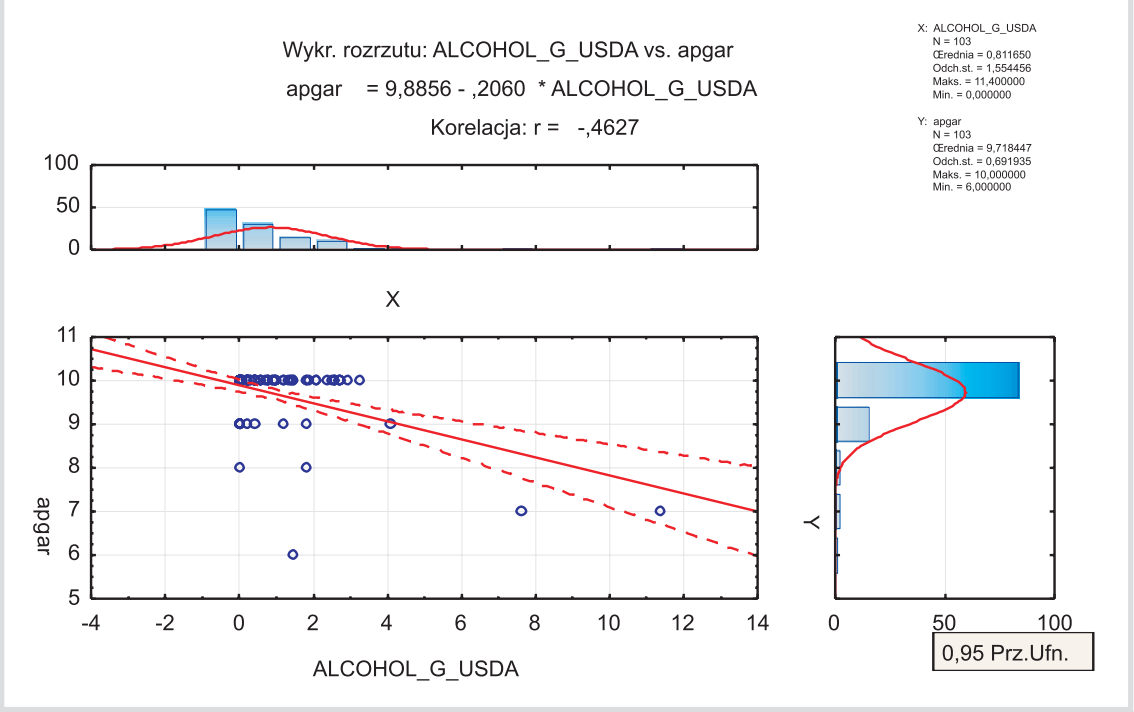


Fig. 3. Influence of alcohol consumption during pregnancy on Apgar score at 1 minute

ke, which amounted to 369.78±202.41 g. Table 6 presents the results of mean daily intake of food groups based on the recommendations of the food pyramid.

DISCUSSION

The study was conducted to evaluate pregnant women's diet based on an analysis of energy delivery and intake of selected nutrients in the daily dietary allowance by comparing selected detailed data with recommendations of the Food and Nutrition Institute for pregnant women in the Polish population. The study has confirmed irregularities in quantitative and qualitative assessment of daily diet in pregnant women. The physiology of pregnancy is itself a factor of positive energy balance and overweight [9]. In own studies, the mean energy value in daily diet during pregnancy was 2,609.87 ±1,199.86 kcal/day, thus exceeding the EAR recommended by the Food and Nutrition Institute (124% of EAR). There are considerable discrepancies between energy values of daily diet in pregnant women as reported in the published literature. Myszkowska-Ryciak et al. noted considerable in-group variety in terms of the contribution of energy to daily diet of the pregnant, ranging from 1,310 kcal to 2,573 kcal. Own studies showed even greater diversity: from 1,000 kcal to 6,394 kcal. In the study of Myszkowska-Ryciak et al., the contribution of fats was 33.1%±4.9%. It was slightly higher than in the present study (31.95%±6.32%) and slightly exceeded the recommended ranges [10].

According to the Polish literature, the most common nutritional error is excessive fat and cholesterol intake, which causes a number of chronic conditions [11]. Daily total fat intake in the assessed pregnant women exceeded the recommended norms for pregnancy. Apart from this, a high cholesterol level was also noted in the daily diet of the surveyed women. According to current recommendations of the Institute of Food and Nutrition, cholesterol delivery should be lower than 300 mg daily. Mean cholesterol intake in the study group was 304.55±158.03 mg. The percentage contribution of energy from carbohydrates was 55.73 ±8.45%, thus falling within the recommended norms of the Institute of Food and Nutrition. Similar results were noted in the case of energy from protein; the percentage contribution was consistent with the Institute of Food and Nutrition recommendations and amounted to 14.35±3.07%. However, total carbohydrates, expressed in grams, exceeded EAR considerably (244.4% of EAR). This was associated with considerable intake of added sugars, including sucrose, in the study group.

When analyzing the influence of intake of certain nutrients on selected parameters of the neonatal condition (birth weight, body length and Apgar score at 1 minute), no direct statistically significant correlations were confirmed apart from the fact that alcohol consumption during pregnancy significantly decreases neonatal health assessment in Apgar scale at 1 minute. Alcohol consumption during pregnancy can become the main risk factor of intrauterine

Tab. 5. Influence of omega-3 fatty acid consumption on neonatal birth weight

P=0.617259 (Student t test) Variable	Neonatal birth weight	
	Normal	Macrosomia
Omega 3 fatty acids [g]	2,27 ± 1,45	2,52 ± 1,83

*– daily omega-3 acid requirement: 1–1.5 g.

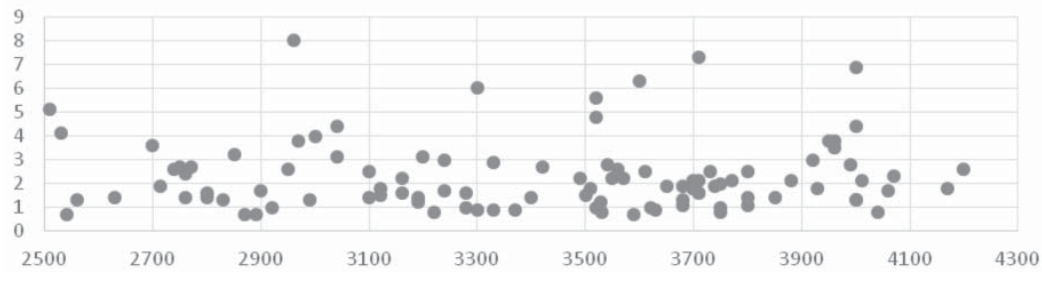


Fig. 4. Omega-3 acid consumption during pregnancy and neonatal birth weight

Tab. 6. Daily intake of food groups during pregnancy based on food pyramid

Food groups based on food pyramid	Mean intake ±SD	Min	Max	Median	DRI recommendation
Całkowita ilość zbóż w ekwiwalentach uncji MPED_GRAIN_TOTAL_USDA Total number of grain ounce equivalents	6,51±3,17	1,50	19,20	5,90	3-10 ounce equivalents
Ilość pełnoziarnistych zbóż w ekwiwalentach uncji MPED_GRAIN_WHL_USDA Number of whole grain ounce equivalents	0,94±0,84	0,00	6,40	0,80	to equal half of total grain ounce equivalents
Ilość niepełnoziarnistych zbóż w ekwiwalentach uncji MPED_GRAIN_NWHL_USDA Number of non-whole grain ounce equivalents	5,53 ±2,87	1,10	16,80	5,00	
Całkowita ilość warzyw bez roślin strączkowych MPED_VEGETABLE_TOTAL_USDA Total number of vegetable cup equivalents, excl legumes	2,68±2,25	0,50	17,90	2,30	1-4 cup equivalents
Warzywa ciemno-zielone MPED_VEGETABLE_DRKGR_USDA Number of dark-green vegetable cup equivalents	0,33±0,52	0,00	2,90	0,10	
Warzywa pomarańczowe MPED_VEGETABLE_DPYEL_USDA Number of orange vegetable cup equivalents	0,34±1,29	0,00	13,00	0,10	
Ilość białych ziemniaków MPED_VEGETABLE_POTATO_USDA Number of white potato cup equivalents	0,64±0,54	0,00	2,60	0,50	
Ilość innych warzyw bogatych w skrobię MPED_VEGETABLE_STARCY_USDA Number of other starchy vegetable cup equivalents	0,03±0,05	0,00	0,20	0,00	
Pomidory MPED_VEGETABLE_TOMATO_USDA Number of tomato cup equivalents	0,44±0,38	0,00	2,00	0,30	
Pozostałe warzywa MPED_VEGETABLE_OTHER_USDA Number of other vegetable cup equivalents	0,68±0,74	0,00	5,00	0,50	
Całkowita ilość owoców MPED_FRUIT_TOTAL_USDA Number of other fruit cup equivalents	3,54±2,78	0,40	13,20	2,70	1-2½ cup equivalents
Owoce cytrusowe,melony, jagody MPED_FRUIT_CITMLB_USDA Number of citrus, melon, berry cup equivalents	1,29±1,28	0,10	6,00	0,80	
Pozosałe owoce MPED_FRUIT_OTHER_USDA Number of other fruit cup equivalents	2,19±1,90	0,10	9,70	1,70	
Ilość produktów mlecznych w ekwiwalencie szklanki MPED_DAIRY_TOTAL_USDA Total number of milk group (milk, yogurt & cheese) cup equivalents	2,99±3,25	0,10	20,80	2,10	2-3 cup equivalents
Mleko MPED_DAIRY_MILK_USDA Number of milk cup equivalents	1,76±3,05	0,00	20,70	0,80	
Jogurty MPED_DAIRY_YOGURT_USDA Number of yogurt cup equivalents	0,35±0,35	0,00	1,50	0,30	
Sery MPED_DAIRY_CHEESE_USDA Number of cheese cup equivalents	0,79±0,75	0,00	3,70	0,60	
Mięso i ryby MPED_M_MPF_USDA Oz cooked lean meat from meat, poultry, fish	4,16±2,78	0,60	21,50	3,20	2-7 ounce equivalents

Tab. 6. (cont.)

Grupy żywności na podstawie piramidy żywności	Średnie spożycie ±SD	Min	Max	Mediana	DRI zalecenia
Gotowane chude mięso(wołowina, wieprzowina, cielęcina i jagnięcina) MPED_M_MEAT_USDA Oz cooked lean meat from beef, pork, veal, lamb, and game	1,09±0,93	0,00	5,00	0,90	
Podroby MPED_M_ORGAN_USDA Oz cooked lean meat from organ meats	0,0097±0,08	0,00	0,80	0,00	
Kiełbasy MPED_M_FRANK_USDA Oz cooked lean meat from franks, sausages, luncheon meats	1,51±1,38	0,00	9,80	1,10	
Mięso z kurczaka i innego drobiu MPED_M_POULT_USDA Oz cooked lean meat from chicken, poultry, and other poultry	0,83±0,81	0,00	5,60	0,60	
Ryby i owoce morza bogate w omega3 MPED_M_FISH_HI_USDA Oz cooked lean meat from fish, other seafood high in omega-3	0,16±0,38	0,00	3,50	0,00	
Ekwiwalent uncji ilości ryb i owoców morza z niską zawartością omega3 MPED_M_FISH_LO_USDA Oz cooked lean meat from fish, other seafood low in omega-3	0,37±0,80	0,00	7,80	0,20	
Jaja MPED_M_EGG_USDA Oz equivalents of lean meat from eggs	0,38±0,40	0,00	2,10	0,30	
Produkty sojowe MPED_M_SOY_USDA Oz equivalents of lean meat from soy product	0,001±0,009	0,00	0,10	0,00	
Orzechy i nasiona MPED_M_NUTSD_USDA Oz equivalents of lean meat from nuts and seeds	0,64±1,56	0,00	10,30	0,20	
Ilość gotowanej, suchej fasoli i grochu MPED_LEGUMES_USDA Number of cooked dry beans and peas cup equivalents	0,004±0,02	0,00	0,10	0,00	
Ilość uznaniowa oleju wyrażona w gramach MPED_DISCFAT_OIL_USDA Grams of discretionary oil	20,48±15,34	3,20	110,00	16,70	
Ilość tłuszczu stałego wyrażona w gramach MPED_DISCFAT_SOL_USDA Grams of discretionary solid fat	54,59±30,91	15,50	185,00	49,30	
Równoważnik łyżeczki cukrów dodanych MPED_ADD_SUG_USDA Teaspoon equivalents of added sugars	27,24±31,10	2,40	179,00	18,00	

1 ounce (oz) = 28.3495 g
1 teaspoon equivalent = 4g
1 cup equivalent = 225 ml
DRI – Dietary Reference Intake

growth restriction. This study revealed much greater contribution of alcohol as a factor of anti-health behaviors (56.31% of women consumed alcohol during pregnancy). Wierzejska et al. noted similar results. They found that 52% of respondents consumed alcohol during pregnancy with varied frequency, but no direct influence on birth weight and Apgar score was observed [12]. The present study yielded similar results for the lack of correlation between consumed alcohol and neonatal body weight and length, and different results for the correlation between quantitative alcohol consumption and Apgar score at 1 minute. The study demonstrated that the more alcohol was consumed by women during pregnancy, the lower the Apgar score at 1 minute. To date, there is no sufficient evidence concerning the exact amount of alcohol consumed during pregnancy in Poland. The application of the Diet*Calc

software enabled determination of daily alcohol consumption by the surveyed pregnant women. It amounted to 0.81±1.55 g/day (min – 0, max – 11.4 g/day). Alcohol intake in the diet of the pregnant respondents mainly resulted from consuming low-alcohol beverages (beer, wine). As the literature states, fetal blood alcohol levels reach maternal values after 40–60 minutes due to placental permeability. To date, there is no established alcohol amount that would be harmful for the fetus or that would affect pregnancy, and therefore it should not be consumed during pregnancy [13].

The assessment of the quality of nutrition consists not only in the assessment of energy and nutrients in the diet, but also on the assessment of consumption of proper food groups and identifying possible excesses or deficiencies. Proper nutrition is determined by adequate composition and size of food products [14]. The quantities of individual groups of food products were estimated in this study and found not to conform to the recommended dietary reference intake models for pregnant women. Of the studied women, none followed a vegetarian diet or excluded meat, fish, eggs and dairy products from the diet.

Grain intake of 184.49 g (6.51±3.17 oz) was considerably lower than recommended for women (280 g/day) but within the normal range according to DRI for pregnancy. The whole grain to non-whole grain ratio was negative. According to DRI, non-refined grain consumption should constitute a half of total grain intake. The study group delivered only 26.64 g (0.94±0.84 oz) of such products, which accounted for 15% of total grains.

Meat intake during pregnancy should fall within 150–200 g daily, including the addition of fish twice a week. The study presented meat and fish consumption at the level of 118 g daily (4.16±2.78 oz), which is slightly below the normal limit (79%). This included only 15 g daily of fish and sea food rich in omega-3 acids, whereas daily intake for adult women should be 30 g.

The mean vegetable intake conformed to DRI. However, the mean fruit intake exceeded the recommended norm. It was 3.54±2.78 cup equivalents and did not conform to DRI (1–2 cup equivalents). Mędrala-Kuder presents different results and shows too low fruit, vegetable and dairy intake in the group of pregnant women [15]. Przybyłowicz et al., on the other hand, noted high fruit and vegetable intake by pregnant women [16].

In the present study, the intake of dairy products conformed to the recommendations, but irregularities were noted in solid fat and added sugar intake. In the latter case, the norms were considerably exceeded. Simple carbohydrates in the form of sweets in the diet of pregnant women affect the development of taste receptors in the fetus, thereby increasing future preferences for consuming foods rich in carbohydrates [17]. Similar irregularities in the intake of individual groups of foods during pregnancy were also noted by Sygnowska et al. [18].

Nutritional errors made by pregnant women should be eliminated at the very beginning of pregnancy, and preferably even in the preconception period. That is why instructing pregnant women or those planning pregnancy is relevant as it is a form of early prophylaxis of complications resulting from improper nutrition [19]. Nutritional education of pregnant women is a significant element of obstetric care. Its aim is to improve the nutrition status of women and health outcomes of both women and children.

CONCLUSIONS

1. Eating habits of pregnant women negatively affect the structure of daily intake of selected nutrients, energy content and contribution of the individual groups of products to the total diet.
2. Alcohol consumption during pregnancy has a significant effect on Apgar score at 1 minute.
3. The mean total intake of fruit and added sugars in the daily diet of pregnant women considerably exceeds the recommended reference intake for the pregnant.
4. There is no correlation between omega-3 acid intake and neonatal birth weight.

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