

ANNA JĘDRUSEK-GOLIŃSKA, KRYSZYNA SZYMANDERA-BUSZKA,  
MAŁGORZATA MAGOTT

Department of Food Service and Catering  
Poznań University of Life Sciences

## COMPARISON OF THE LEVEL OF NUTRITIONAL KNOWLEDGE AND SELECTED BEHAVIOUR AMONG CONSUMERS WITH REGULAR BMI AND THE OBESE

PORÓWNANIE POZIOMU WIEDZY ŻYWIENIOWEJ I WYBRANYCH  
ZACHOWAŃ U KONSUMENTÓW NORMOWAGOWYCH I OTYŁYCH

### Summary

**Background.** Due to the growing obesity epidemic, it is necessary to take action to halt its development. To try to make the desired changes in the diet of obese people, it is necessary to discover their eating habits and what they know about nutrients and their role.

**Material and methods.** Knowledge and selected nutritional behaviors of people with elevated ( $n = 100$ ) and normal BMI ( $n = 100$ ) from Wielkopolska were studied using a direct survey. The aim of the study was to compare some behaviors related to diet and the level of knowledge of people with elevated and normal body mass index.

**Results.** 59% of the obese group and 44% of the reference group never eat breakfast. Dinner was the main meal of the day for 64% of obese respondents and 68% of control group. More than half of the respondents (63% obese and 66% of the reference group) claimed that every day or several times a week they eat 4–5 meals. Obese respondents showed profound knowledge of dietary fiber and natural sources of antioxidants in food. It has been calculated that both groups showed overall average knowledge of food ingredients.

**Conclusions.** Effective nutritional education is an element necessary to stop the obesity epidemic. It should consist not only in raising the awareness of nutrition, but also in motivating to change current improper habits.

**Key words:** nutritional knowledge, nutritional behaviors, obesity, questionnaire survey

## Introduction

Adherence to the principles of good nutrition allows the proper functioning and development of the human body. Both prolonged deficiencies of individual components and their excess intake are dangerous. One of the consequences of improperly balanced energy in the diet is obesity, now considered as an epidemic disease. Statistics show that most people in the world live in countries where overweight and obesity kills more people than underweight. The consequences of obesity are serious. They include an increased risk of many noncommunicable diseases, including cardiovascular disease, cancer and diabetes, as well as physical disability or psychological problems (WHO, 2015). Obesity should be treated, but now more and more importance is given to the development of prevention programs, methods or campaigns. It seems that for the effectiveness of these measures it is necessary to examine eating behaviors and knowledge of obese people in order to offer them personalized changes and consistently support them in changing their eating habits.

The aim of the study was to compare some behaviors related to diet and the level of knowledge of people with increased and normal body mass index.

## Material and methods

The study of a qualitative nature was preceded by a pilot group of 15 people, and carried out from September 2012 to April 2013 in the Wielkopolska region. 200 people took part in the study, 100 with excess weight (BMI > 30) and 100 with normal body mass index (reference group). Direct interview was selected as a research method. The research tool was a closed-questions questionnaire. Respondents were recruited by a physician from a family clinic. Detailed characteristic of the respondents is given in Table 1. The results are presented as percentage of individual responses, and in order to determine statistical significance of the relationship between the variables, chi-square test was applied ( $p$  value is given) using the Excel spreadsheet and STATISTICA 10 ( $\alpha = 0.05$ ).

To assess the level of nutritional knowledge, the surveyed were presented with 19 claims. The task of the respondents was to select whether they are true or false. The respondents also had the opportunity to select the answer "I do not know". Questions of a slightly higher level of difficulty were chosen deliberately, in order to test the knowledge of not only well-known principles, but also those requiring the respondents' interest in matters of nutrition. Food ingredients which are considered as elements of a healthy diet were selected for the research. The first group of questions concerned fiber and its effect on the body, the second - the role of calcium in the body and products that may be its source in the diet. Other questions concerned the n-3 and n-6 fatty acids, probiotics and other bioactive substances. In order to assess the level of knowledge of the components present in food, the frequency of correct answers was calculated as a quotient of the sum of correct responses to the questions listed in the questionnaire and the maximum number of correct answers. The following levels of nutritional knowledge were accepted: low (0.00–0.40), medium (0.41–0.7) and high (0.71–1.00). "I do not know" answers were classified as incorrect. The level of knowledge was compared using t-test ( $\alpha = 0.05$ ).

Table 1. Characteristics of respondents

Tabela 1. Charakterystyka respondentów

Feature – Cecha		OG* (%) GO* (%)	RG** (%) GK** (%)
Sex Płeć	Women Kobiety	55	51
	Men Mężczyźni	45	49
Age (years) Wiek (lata)	<18	9	8
	18–45	40	34
	46–60	29	36
	> 60	22	22
BMI (kg/m <sup>2</sup> )	18.5–24.99	–	100
	30–34.99	89	–
	35–39.99	9	–
	> 40	2	–
Education Wykształcenie	Primary Podstawowe	13	18
	Vocational Zawodowe	21	20
	Secondary Średnie	37	38
	Higher Wyższe	29	24

\*OG – obese group, \*\*RG – reference group.

\*GO – grupa otyłych, \*\*GK – grupa kontrolna.

## Results

Respondents were asked to define the frequency of undertaking preferred eating behaviors (Table 2). The study considered mainly the frequency of meals consumption. 59% of the obese group and 44% from the reference group did not eat breakfast. About 20% of respondents from both groups had breakfast everyday or several times a week.

Another question concerned main meals consumed by the respondents. For 64% of obese respondents and 68% in the reference group dinner was the most important everyday meal. For the assessment of health-promoting behaviors the quantity and regularity of meals seemed significant as well. More than half of respondents (63% obese and 66% of the reference group) claimed that they consumed 4–5 meals everyday or several times a week. Obese people significantly more often marked the daily observance of this principle when compared to those with a normal BMI.

Table 2. Selected nutritional behaviors of respondents  
Tabela 2. Wybrane zachowania żywieniowe respondentów

Behavior Zachowanie	Group Grupa	Declared frequency of behavior (%) Deklarowana częstość zachowania (%)				p***
		everyday codziennie	a few times a week kilka razy w tygodniu	kilka razy w miesiącu a few times a month	never nigdy	
I eat breakfast Jem śniadanie	OG*	13	7	21	59	0.06
	RG**	6	14	36	44	
My main meal is breakfast Moim głównym posiłkiem jest śniadanie	OG	10	11	17	62	0.65
	RG	5	16	31	48	
My main meal is midday meal Moim głównym posiłkiem jest obiad	OG	64	20	8	8	0.44
	RG	68	18	14	0	
My main meal is dinner Moim głównym posiłkiem jest obiadokolacja	OG	14	18	24	44	0.29
	RG	6	12	26	56	
I eat 4–5 meals a day Spożywam 4–5 posiłków dziennie	OG	46	17	24	13	0.00
	RG	18	48	16	18	
I eat meals prepared at home Jem posiłki przygotowane w domu	OG	65	28	5	2	0.06
	RG	52	30	18	0	

\*OG – obese group, \*\*RG – reference group, \*\*\*p – Chi<sup>2</sup>.

\*GO – grupa otyłych, \*\*GK – grupa kontrolna, \*\*\*p – Chi<sup>2</sup>.

The care given to the quality of the food supplied to the body is linked by some (Bezerra et al., 2012) with the preparation of meals at home. Therefore, respondents also answered the question how often they eat meals prepared by themselves or a member of the family. The majority of respondents (65% and 52%) declared that they did it every day; only 2% of obese respondents ate out exclusively.

The questionnaire included claims about the effects of certain food ingredients on the health and general condition of the body (Table 3). In four of the six statements about dietary fiber (T1, T2, T4 and T6), the frequency of correct answers was higher among obese people than in the reference group. Significantly more respondents with normal BMI (0.6 vs. 0.38) knew that dietary fiber helps lower blood cholesterol (T5). Knowledge of obese respondents concerning fiber was on high level (0,71–1,0), with the exception of claim 5. Obese respondents showed a significantly higher average level of knowledge of dietary fiber than people with normal weight. The level of respondents' knowledge of the role of calcium in the body and products that may be its source in the diet was mainly on a high level (T7, T8 in both groups). The BMI index value did not affect the level of respondents' knowledge.

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Table 3. Level of respondents' nutritional knowledge  
Tabela 3. Poziom wiedzy żywieniowej respondentów

T	Claim content – Treść twierdzenia	OG* GO*	RG** GK**	P***
1	2	3	4	5
The level of knowledge of the role and sources of fiber Poziom wiedzy o roli i źródłach błonnika				
T1	Graham bread is a good source of dietary fiber Chleb graham jest dobrym źródłem błonnika	0.82	0.32	0.00
T2	Fruits and vegetables are a good source of dietary fiber Owoce i warzywa są dobrym źródłem błonnika	0.76	0.52	0.01
T3	Wheat bread contains more fiber than wholemeal bread Chleb pszenny jasny zawiera więcej błonnika niż chleb razowy	0.73	0.66	0.54
T4	Presence of dietary fiber has a positive effect on the digestive system Obecność błonnika wpływa pozytywnie na układ pokarmowy	0.81	0.61	0.02
T5	Dietary fiber promotes lowering cholesterol in blood Błonnik pokarmowy sprzyja obniżeniu poziomu cholesterolu we krwi	0.38	0.6	0.03
T6	Dietary fiber prevents obstruction Błonnik pokarmowy zapobiega zaporciom	0.72	0.36	0.00
T1-T6	Average knowledge level about the role and sources of fiber Średni poziom wiedzy o roli i źródłach błonnika	0.70	0.51	0.02
The level of knowledge about the role and sources of calcium Poziom wiedzy o roli i źródłach wapnia				
T7	Fish is a good source of calcium in the diet Ryby są dobrym źródłem wapnia w diecie	0.56	0.54	0.88
T8	Cheese is a good source of calcium in the diet Ser żółty jest dobrym źródłem wapnia w diecie	0.54	0.57	0.18
T9	Fruits are a good source of calcium in the diet Owoce są dobrym źródłem wapnia w diecie	0.34	0.38	0.36
T10	Sufficient calcium intake ensures proper bone mineralization Wystarczająca podaż wapnia zapewnia odpowiednią mineralizację kości	0.73	0.43	0.73
T7-T10	Average knowledge level about the role and sources of calcium Średni poziom wiedzy o roli i źródłach wapnia	0.54	0.48	0.49
The level of knowledge about the role and sources of n-3 and n-6 fatty acids Poziom wiedzy o roli i źródłach kwasów n-3 i n-6				
T11	n-3 and n-6 fatty acids prevent cardiovascular diseases Kwasy n-3 i n-6 przeciwdziałają chorobom krążenia	0.63	0.46	0.03
T12	Butter is a good source of n-3 and n-6 fatty acids Masło jest dobrym źródłem kwasów n-3 i n-6	0.32	0.32	0.73
T13	n-3 and n-6 fatty acids ensure normal development of the nervous system Kwasy n-3 i n-6 zapewniają prawidłowy rozwój układu nerwowego	0.47	0.32	0.47

Table 3 – cont. / Tabela 3 – cd.

1	2	3	4	5
T11- -T13	Average knowledge level about the role and sources of n-3 and n-6 fatty acids Średni poziom wiedzy o roli i źródłach kwasów n-3 i n-6	0.47	0.37	0.19
The level of knowledge about the role and sources of probiotics Poziom wiedzy o roli i źródłach probiotyków				
T14	Probiotics help increase immunity and the growth of normal intestinal flora Probiotyki sprzyjają podnoszeniu odporności i rozwojowi prawidłowej mikroflory przewodu pokarmowego	0.63	0.38	0.00
T15	Probiotics are a selected culture of bacteria and yeasts Probiotyki to wyselekcjonowane kultury bakterii i drożdży	0.56	0.38	0.09
T14- -T15	Average knowledge level about the role and sources of probiotics Średni poziom wiedzy o roli i źródłach probiotyków	0.59	0.38	0.10
The level of knowledge about the role and sources of bioactive substances Poziom wiedzy o roli i źródłach składników bioaktywnych				
T16	Fruits and vegetables contain natural antioxidants that protect the body against free radicals Owoce i warzywa zawierają naturalne przeciwutleniacze chroniące organizm przed wolnymi rodnikami	0.72	0.6	0.111
T17	Coffee contains bioactive components Kawa zawiera składniki bioaktywne	0.17	0.2	0.88
T18	Bioactive components are used to preserve food Składniki bioaktywne są używane do konserwowania żywności	0.44	0.38	0.24
T16- -T18	Average knowledge level about the role and sources of bioactive substances Średni poziom wiedzy o roli i źródłach składników bioaktywnych	0.44	0.39	0.37
The knowledge (T1-T18) Poziom wiedzy (T1-T18)		0.58	0.43	0.01

\*OG – obese group, \*\*RG – reference group, \*\*\*P- $\chi^2$  for T1–T19 and for average knowledge level, t-test.

\*GO – grupa otyłych, \*\*GK – grupa kontrolna, \*\*\*p- $\chi^2$  dla T1–T19 i dla średniego poziomu wiedzy, test t.

Lower scores were obtained for claims related to n-3 and -6 fatty acids. Respondents from both groups well assessed the truth of claim (T11), speaking about the role of these fatty acids in the prevention of cardiovascular diseases; the level of their knowledge on the subject depended on the value of BMI. Other claims (T12 and T13) showed respondents' lower understanding of the sources of n-3 and -6 acids in the diet and their impact on the development of the nervous system. In the case of statements regarding probiotics (T14-15), the level of respondents' knowledge from both groups differed significantly as to the role of these bacteria in the increase of immunity and development of good microflora of the gastrointestinal tract. Numerous respondents in both

groups knew that fruits and vegetables contain natural antioxidants, protecting the organism against free radicals (T16). Very few of all respondents knew that coffee contains bioactive components (T17) – both groups showed a low level of knowledge on this subject. The key here might be the phrase “bioactive components” because, as shown by the opinions on the following statement (T18), the majority of the respondents either does not know what they are or associates them with e.g. preservatives. The value of the body mass index had no effect on the level of respondents' knowledge about bioactive components.

The analysis of responses using the t-test revealed that although the average level of knowledge of the respondents in both groups on the individual food components differ significantly only in certain cases, the general level of knowledge of all the ingredients together was significantly higher in obese respondents.

## Discussion

Proper nutrition, in addition to a proper balance of nutrients, should provide a permanent structure of meals, maintenance of proper regularity and frequency of consumption. Daily breakfast consumption and not overeating for dinner (Tsigos et al., 2008) are believed to be essential.

In the research presented over 60% of respondents from both groups consumed 4–5 meals every day or several times a week. This is a result similar to that obtained by Ostrowska et al. (2002), but higher than those described in the studies of Szczepańska et al. (2013), where such a declaration was made by approximately 40% of patients with higher and primary education and 25% with a secondary education degree.

The impact of not eating breakfast on obesity is widely discussed (Dhurandhar et al., 2014). There are results suggesting that eating breakfast, especially a high-protein one, causes a decrease in appetite for sweet, salty and greasy foods (Leidy and Racki, 2010). This can be explained, among others, by higher levels of dopamine in the blood, which is a neurotransmitter from the group of catecholamines and is responsible for the interpretation of emotional stimuli (Drożdżak and Bryła, 2005). On the other hand, Brown et al. (2013), conducted a detailed analysis of data from the world literature, and claim that even though the belief about the impact of not eating breakfast on the development of obesity is at a level of over 80%, scientific evidence can only confirm it in about 20%. Everyday consumption of breakfast is associated with a higher activity of postprandial thermogenesis in slim persons, but impact of this eating behavior on the height of the resting metabolic rate has not been proven. It has been demonstrated, however, that eating breakfast (in contrast to fasting) is associated with more stable blood glucose in the afternoon and evening (Betts et al., 2014).

One of the crucial issues in the development of obesity appears to be the increase of the size of consumed portions, as a result of overeating seizures, especially without the subsequent reduction in energy consumption. Great importance is attributed to the hour at which meals are consumed (Ostrowska, 2010). In addition to the necessity of eating the last meal no later than 2–3 hours before bedtime, it also raises the question of reducing the number of calories provided with lunch or dinner (Jakubowicz et al., 2013). It is

believed (Ostrowska, 2010) that the maintenance of a healthy body weight is associated with a hygienic life-style, care given to the quality of food and sufficient food intake, but also with nutritional knowledge. Obese respondents were more familiarized with information regarding dietary fiber. Similarly, in the study of Thakur and D'Amico (1999), obese respondents better identified the foods with a higher content of dietary fiber. That knowledge is deemed essential, because a diet rich in products that are a good source of dietary fiber promotes a weight loss; data obtained with the use of fiber supplements do not seem to be so clear (Papathanasopoulos and Camilleri, 2010). The respondents' knowledge of calcium and polyunsaturated fatty acids of family n-3 and n-6 was varied. Supplementation of diet with n-3 acids could – by reducing plasma triglyceride levels – alleviate insulin resistance, hypertension, and dyslipidemia, in the course of obesity-related metabolic syndrome (Lorente-Cebrián et al., 2013). On the other hand, an adequate intake of antioxidants naturally present in food can reduce oxidative damage associated with obesity, dangerous especially in co-existing hyperglycemia and hyperlipidemia (Erdeve et al., 2004).

A link between knowledge and eating behaviors were studied by Thakur and D'Amico (1999), who found no differences in the level of general knowledge concerning the principles of nutrition between obese and lean respondents. What is more important, a number of publications show that often, despite sufficient nutritional knowledge, eating habits remain unsatisfactory, both among adults and adolescents (Wojtyła-Buciora and Marcinkowski, 2010).

Nevertheless, it appears that the education of adults and children as well as whole families is one of the right ways to control the epidemic of obesity. It is important to transfer the knowledge in an easy-to-remember way, to implement it, and to encourage a change in eating habits.

## Conclusions

1. Comparison of dietary behaviors of respondents with normal weight and obese indicates that in both groups the most common mistake was not eating breakfast. Due to the importance of this meal in the daily diet, this habit should be changed.

2. The level of nutritional knowledge of the respondents in both groups was at a medium level. Obese respondents showed a significantly higher level of knowledge concerning selected food ingredients.

3. It appears that further, effective nutritional education is a necessary element helping contain the epidemic of obesity. It should include not only promotion of nutritional knowledge, but also the motivation to change current improper habits.

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## PORÓWNANIE POZIOMU WIEDZY ŻYWIENIOWEJ I WYBRANYCH ZACHOWAŃ U KONSUMENTÓW NORMOWAGOWYCH I OTYŁYCH

### Streszczenie

**Wstęp.** Ze względu na narastającą epidemię otyłości konieczne jest podejmowanie działań mających zahamować jej rozwój. Aby próbować wprowadzić pożądane zmiany w diecie osób otyłych, trzeba najpierw dobrze poznać ich zachowania żywieniowe oraz wiedzę na temat składników odżywczych i ich roli.

**Material i metody.** Metodą wywiadu bezpośredniego badano osoby z podwyższonym ( $n = 100$ ) i prawidłowym BMI ( $n = 100$ ) z Wielkopolski. **Celem** badania było porównanie wybranych zachowań związanych z odżywianiem oraz poziomu wiedzy osób z podwyższonym i prawidłowym wskaźnikiem masy ciała.

**Wyniki.** Nigdy nie jadała śniadań 59% osób z grupy otyłych oraz 44% z grupy referencyjnej. Dla 64% otyłych respondentów i 68% z grupy kontrolnej głównym posiłkiem w ciągu dnia był obiad. Ponad połowa respondentów (63% otyłych i 66% z grupy kontrolnej) twierdziła, że codziennie lub kilka razy w tygodniu spożywa 4–5 posiłków. Otyli ankietowani wykazali się dużym zasobem wiedzy na temat błonnika pokarmowego oraz naturalnych źródeł przeciwutleniaczy w żywności. Wykazano, że ogólny poziom wiedzy respondentów na temat składników żywności był średni.

**Wnioski.** Koniecznym elementem opanowania epidemii otyłości jest dalsza, skuteczna edukacja żywieniowa. Powinna ona obejmować nie tylko szerzenie wiedzy żywieniowej, ale także motywowanie do zmiany dotychczasowych nieprawidłowych nawyków.

**Słowa kluczowe:** wiedza żywieniowa, zachowania żywieniowe, otyłość

*Corresponding address – Adres do korespondencji:*

*Anna Jędrusek-Golińska, Katedra Technologii Żywnienia Człowieka, Uniwersytet Przyrodniczy w Poznaniu, ul. Wojska Polskiego 28, 60-637 Poznań, Poland, e-mail: [angol@up.poznan.pl](mailto:angol@up.poznan.pl)*

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