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ALEKSANDRA MAZURKIEWICZ, JOANNA MRÓZ, MONIKA MAĆKÓW,
EWA RACZKOWSKA, MARTA HABÁNOVÁ, ROBERT GAJDA

SELECTED SOCIODEMOGRAPHIC FACTORS AND NUTRITIONAL STATUS - DIFFERENCES IN KNOWLEDGE ABOUT PRO-FERTILITY DIET AMONG PEOPLE BEING IN THEIR REPRODUCTIVE AGE - A PILOT STUDY

S u m m a r y

Background. Male and female fertility is the subject of much scientific research. However, there is a lack of researches concerning the impact of factors such as gender, nutritional status, place of residence and relationship status on the level of nutritional knowledge of pro-fertility diet among people being in their reproductive age. Therefore, the study aimed to identify differences in the level of nutritional knowledge among women and men aged between 20 and 37 based on the above factors. The main research tool was a questionnaire to be completed by respondents themselves, which was made available to 209 people via social networks. The respondents were selected purposefully, and their participation in the study was anonymous and voluntary. To assess the nutritional knowledge of the respondents, an original index was created, which included four levels of knowledge: insufficient, sufficient, good and very good. A logistic regression analysis was used to identify differences in nutritional knowledge based on selected factors. Furthermore, a hierarchical classification of variables was applied using Ward's method.

Results and conclusions. It was mainly shown that there was an insufficient level of nutritional knowledge among the respondents (70.81 %). The level of nutritional knowledge was higher among those with a higher educational level ($p = 0.005$). Furthermore, those in the 26 ÷ 37 age range were more likely to give correct answers. It is worth mentioning that the present study was a pilot one. Thus, the results obtained cannot be regarded as a comprehensive reference in relation to the entire population, which is undoubtedly a limitation of the study. The results of our own research can provide an important reference for future analyses. Therefore, it is necessary to continue updating information in this crucial area of public health.

Mgr A. Mazurkiewicz, ORCID: 0009-0004-5622-9741; mgr J. Mróz, ORCID: 0009-0006-7204-8144; mgr M. Maćków, ORCID: 0000-0003-3961-7609; dr hab. inż. prof UPWr E. Raczkowska, ORCID: 0000-0003-4205-1351; Department of Human Nutrition, Faculty of Biotechnology and Food Science, Wroclaw University of Environmental and Life Sciences, 37 Chelmonskiego Street, 51-630 Wroclaw, Poland; Prof. M. Habánová ORCID: 0000-0003-1721-7161, Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture, Trieda Andreja Hlinku 2, 94976 Nitra, Slovakia; Dr hab. inż., prof. UPWr R. Gajda, ORCID: 0000-0001-7957-918X; Department of Human Nutrition, Faculty of Biotechnology and Food Science, Wroclaw University of Environmental and Life Sciences, 37 Chelmonskiego Street, 51-630 Wroclaw, Poland.
Contact e-mail: ewa.raczkowska@upwr.edu.pl

Keywords: pro-fertility diet, nutritional knowledge, gender, nutritional status, sociodemographic factors

Introduction

The reproductive period, when people are able to conceive offspring, is associated with the concept of health, as developed by the World Health Organization (WHO). In 1994, during the International Conference on Population and Development (ICPD) in Cairo, the definition of reproductive health was clarified. The term is understood as the totality of psychological, social and physical well-being with regard to the reproductive system [33].

It is estimated that the time of maximum female fertility oscillates between 20 and 25 years of age and then gradually decreases. Until recently, the upper limit for becoming pregnant was considered to be 35 years of age [13]. However, according to new data, the reproductive phase lasts until the age of 37. In the case of men, semen has the best quality until the age of 34. From that time forward, the mobility, number and concentration of sperm cells with the normal structure, as well as the volume of the ejaculate, decreases [4].

According to many authors, there exists a significant correlation between diet and male and female fertility. The crucial role in this aspect is played by an adequate supply of energy and macronutrients, such as protein, fat and carbohydrates. Both the excessive and insufficient body weight have a negative influence on fertility. Obesity and overweight cause, among other things, disturbances in the menstrual cycle and ovulation and disruption of normal ovarian function [39]. In the case of men, the excessive body weight leads to the reduction of total sperm count and impaired ejaculate quality, which prevents effective conception [8]. Analyzing the impact of being underweight among women, symptoms such as increased secretion of folliculotropic hormone, shortened luteal phase and even the disappearance of menstruation are observed. Whereas, in the case of underweight men, endocrine disruption or testicular dysfunction (hypogonadism) is diagnosed [6].

In relation to protein, the significant role is played by its origin, as confirmed in the study by Chavarro et al. [11]. The energy substitution at the level of 5 %, derived from animal protein – with plant protein, reduced the infertility risk by an average of 50 %. A similar relationship is observed with fat – the quality of this macronutrient in a diet can have both a positive and negative effect on fertility. Monounsaturated and polyunsaturated fatty acids, whose sources include plant oils, seeds and nuts, contribute to increased reproductive capacity [5]. In contrast, saturated fatty acids and trans fatty acid isomers have a negative impact on reproductive capacity. Studies by Jensen et al. [22] confirmed that these fatty acids contribute to a decrease in semen parameters – concentration and sperm count. However, ovulation disorders occur among women as

a result of an increased intake of saturated fatty acids, as demonstrated in a study by Chavarro et al. [10]. Furthermore, it is worth considering the supply of cholesterol, as an excess of this component that is supplied with food can contribute to fertility disorders. What is more, a high risk of infertility is associated with abnormalities in spermatogenesis and ovulation, and often the absence of ovulation correlates with the excessive consumption of simple carbohydrates. Highly processed foods that provide simple carbohydrates, among other things, impair reproductive capacity, hence the largest percentage of dietary energy should come from complex ones [9].

Apart from macronutrients, fertility is influenced by vitamins, inter alia: A, C, E, D, B9, B6, B12 and minerals: iron, magnesium, zinc, selenium, iodine [5]. Particular attention is paid to the correct supply of folic acid, whose main function is to protect the fetal neural tube. In addition, its properties include an effect on regular menstrual cycles and the production and maturation of male reproductive cells [19]. The significant role of iron is highlighted with reference to women. This is related to the process of cyclic endometrial exfoliation, during which this element is lost. Indirectly, the impact of iron is related to the function of transferrin, which – as a complex protein – is involved in the proper development of ovarian follicles and the female gamete [7]. When it comes to the male fertility, it is crucial to have a proper supply of selenium, which contributes to the reduction of the hormones that negatively affect the reproduction process. Furthermore, this component is responsible for intensified testosterone secretion and improved semen quality [30].

In addition to the elements mentioned above, fertility is also affected by stimulants (inter alia, alcohol, nicotine and caffeine). Increased alcohol consumption has a significant influence on the development of endometriosis, inappropriate folliculogenesis and reduced ovarian reserve, that is reproductive potential, among women [45]. However, in males, long-term exposure to alcoholic beverages correlates with reduced testosterone and sperm synthesis, testicular atrophy and decreased gonadotropin release. Furthermore, study conducted by Pendharkar et al. [37] have reported that alcohol abuse influences reduced sexual desire, as well as erectile and ejaculatory dysfunction. Moreover, nicotinism is a part of the factors which negatively affect reproductive health. Nicotine smoke interferes with the ovulation process by increasing folliculotropic hormone and decreasing luteinizing hormone levels. Apart from that, nicotine accelerates menopause, induced by a decrease in the number and quality of ovarian follicles [28]. The indicated neurotoxin has oxidative and destructive effects on the DNA of male reproductive cells, causing an increase in the number of leukocytes in semen, intensified testosterone secretion, erectile dysfunction and a general deterioration of ejaculate quality [34]. A substance prevalent in many products is caffeine. This compound can be found, among others, in: coffee, tea, chocolate and fizzy drinks, such as coke. An excessive amount of this compound has a direct effect on fertilization,

hindering the transport of the female germ cell in the fallopian tube and thus interfering with the implantation of the embryo in the uterus. Among men who consume more than three cups of coffee per day, it is shown a 20 % increase in the number of sperm with damaged genetic material [24].

Finally, it is concluded that one of the key factors inducing reproductive health is proper nutrition. Other researchers have shown that healthy dietary patterns during the procreative period among men and women have a beneficial effect on fertility. Thereby, a mechanism based on learning about the principles of a pro-fertility diet can have tangible health benefits in terms of maintaining reproductive health among women and men [29]. According to our knowledge, there is a lack of research on the above-mentioned issue, hence the authors' own study examines in detail the matters related to the level of nutritional knowledge of the pro-fertility diet among people being in their reproductive period. The self-reported study also took into account the factors that can potentially have an impact on the respondents' state of nutritional knowledge. Consequently, the study aimed to identify differences in the level of nutritional knowledge among women and men aged between 20 and 37 based on the variables such as gender, nutritional status and selected sociodemographic factors. As the main hypothesis, it was assumed that the knowledge of people being in their reproductive age ranks at a good level.

Materials and methods

Research method

The study was conducted using a survey, an online method. The main research instrument was a self-administered questionnaire made available to respondents via social networks. The answerers were purposively selected and their participation in the survey was anonymous and voluntary. The purposive respondents' choice was to send the questionnaire to people being in their reproductive age (between 20 and 37 years old). The research method chosen allowed for easier and quicker access to the selected group of respondents. The choice of the method indicated above is also argued by the target age of those surveyed. The research method which was used is now considered to be modern and more convenient in terms of location, time and data collection and visualization. Thus, those surveyed, upon receiving the link, were able to respond immediately using any internet-enabled device (for instance, a smartphone, a laptop). The questionnaire-based, web-based method also minimizes the risk of non-response and errors by respondents, which would result in their exclusion from the examination [40].

The research was approved by the Research Ethics Committee of Wrocław University of Life Sciences (no. 14/2023 of 29 June 2023). The study was conducted in accordance with the guidelines of the Declaration of Helsinki [47]. The respondents

gave their consent to participate in the study. Based on the provisions of the European Parliament's General Regulation on Personal Data Protection, the personal data of the respondents were secured (GDPR 679/2016).

The survey instrument – the self-administered questionnaire

The authors' questionnaire was prepared using survey administration software (Google Forms). It comprised 38 questions, 8 of which were part of metrics (these questions were related to the respondents' age, gender, place of residence, level of education, professional status, status of relationship, body weight and body height). The remaining 30 questions that concerned the knowledge of nutrition during the reproductive period were developed in a test format, basing on single- (27 questions) and multiple-choice questions (3 questions).

The single-choice questions included the following:

- Does a diet affect fertility in women and men being in a reproductive age?
- Whether the diet of women and men during the reproductive period should be varied?
- How many meals per day should people eat during their reproductive period?
- Does abnormal body weight adversely affect fertility?
- What source should the largest percentage of energy come from in the diet of people during their reproductive period?
- What type of protein should predominate in the diet of people in their reproductive period?
- What type of fatty acids should predominate in the diet of people during their reproductive period?
- Does the excessive amount of cholesterol from food reduce fertility in men and women?
- What type of carbohydrates should predominate in the diet of people in their reproductive period?
- What should be the correct percentage of nutrients for people in their reproductive period?
- What is the demand for folic acid in the reproductive period of women and men?
- Which food products are the best sources of folic acid?
- What is the demand for vitamin B12 in the reproductive period of women and men?
- Which food products are the best sources of vitamin B12?
- What is the demand for iron in the reproductive period of women?
- What is the demand for iron in the reproductive period of men?
- Which food products are the best sources of iron?
- What is the demand for zinc in the reproductive period of women?

- What is the demand for zinc in the reproductive period of men?
- Which food products are the best sources of zinc?
- What is the demand for selenium in the reproductive period of women and men?
- Which food products are the best sources of selenium?
- Can inadequate hydration adversely affect fertility?
- How much should the daily water intake be in the reproductive period of women and men?
- Do stimulants such as alcohol and nicotine have a negative impact on fertility?
- Does caffeine adversely affect fertility?
- Is coffee the only source of caffeine?

The multiple-choice questions included the following:

- Which vitamins do affect fertility in men and women during the reproductive period?
- Which minerals do affect the fertility of women being in their reproductive period?
- Which minerals do affect thefertility of men being in their reproductive period?

The questionnaire was constructed in such way that it was not too elaborated, which otherwise could discourage the respondents from participating in the study or contribute to the discontinuation of filling the questionnaire. In order to determine the length of the questionnaire, the authors took into account the time required to give a response. The questions were worded unambiguously, in a way that everyone could understand, so that they did not adversely affect the reliability of the results. Each of these addressed only one specific issue, creating a logical, coherent whole. The authors ensured that the usage of terms was simple and did not contain words of foreign origin. For each question, information on single- or multiple-choice options was assigned to eliminate errors in the answers given. During the development of the questionnaire, the authors paid attention to include only the most relevant questions for the study. These addressed the correlation between nutrition and reproductive health, by targeting the exploration of the topic and raising awareness among the respondents.

In order to assess the usefulness of the authors' questionnaire in the research, the degree of the repeatability of the respondents' answers obtained in two measurements conducted in a time interval was evaluated. The resulting mean coefficient value (0.963), given available interpretations – Cicchetti et al. [12], Fleiss et al. [16], Landis and Koch [25], showed a corresponding compliance of 'excellent', 'perfect' and 'almost-perfect' compliance. Thus, the possibility of using the authors' questionnaire in a pilot study was confirmed.

The assessment of respondents' nutritional knowledge

The authors' index was used to assess the nutritional knowledge of people of reproductive age, which included four key levels according to the following scheme (Fig. 1).

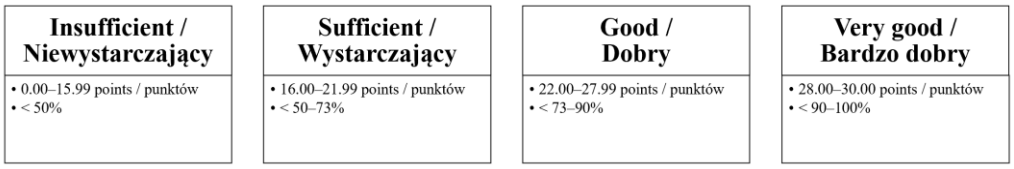

Figure 1. The knowledge assessment scheme according to the authors' index
Rycina 1. Schemat oceny wiedzy według autorskiego indeksu
Source: developed by the authors / Źródło: opracowanie własne

The authors' index for assessing nutritional knowledge was designed to take into account the specific characteristics of the study group and the study purpose. The admission of four levels of nutritional knowledge (insufficient, sufficient, good, very good) is consistent with the general standards for classifying the levels of knowledge in pilot studies. The index was developed on the basis of the general principle that the level of nutritional knowledge should be divided into categories which allow for easy interpretation of results. The levels were presented, among other things, based on the percentage of points obtained, which is a commonly used method in the assessment of various factors, including but not limited to knowledge. The indicated percentage ranges (Fig. 1) are connected with the classic scales for assessing results, which are widely accepted in the field of scientific literature. Due to the fact that some of the identified subgroups were small in number, two levels of nutritional knowledge (insufficient < 50 % of points and sufficient ≥ 50 % of points) were included in further analyses.

According to the accepted scale – the highest number of points was identified with very good knowledge, while the lowest value denoted an insufficient level of knowledge. The points were obtained using a $0 \div 1$ system. This means that the answerers could receive from 0 to 1 point for each question. Questions with more than one correct answer scored partial points, so that a maximum of 1 point could be awarded for each question.

The assessment of respondents' nutritional status according to Body Mass Index (BMI)

The respondents' nutritional status was assessed on the basis of BMI. It is obtained by dividing body weight, expressed in kilograms, by body height in meters, squared. The World Health Organization (WHO) classification of BMI was used in the

study [1]. The ranges of BMI values, by which the respondents' nutritional status was classified, are shown in Tab. 1.

Table 1. The assessment of respondents' nutritional status on the basis of BMI
Tabela 1. Ocena stanu odżywienia respondentów na podstawie wartości wskaźnika BMI

Nutritional state / Stan odżywienia	BMI values / Indeks BMI [kg/m^2]
Underweight / Niedowaga	18.5
Normal body weight / Prawidłowa masa ciała	18.5-24.9
Overweight / Nadwaga	25.0-29.0
First degree obesity / Otyłość I stopnia	30.0-34.9
Second degree obesity / Otyłość II stopnia	35.0-39.9
Third degree obesity / Otyłość III stopnia	> 40.0

Explanatory notes / Objaśnienia: developed by the authors based on the data [1] / opracowanie własne na podstawie danych [1]

The characteristics of the study group

According to the latest data concerning the age structure of the Polish population – the number of people in Poland compatible with the criteria for the survey (20 ÷ 37 years of age) is 8,238,228 [43]. Assuming a confidence level that equals 95 % and allowing for an error of ± 7 %, it was shown that the minimum sample size is 196 people. The minimum sample size was calculated using the following formula (1) [42]:

$$n = \frac{n}{1 + \frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2 N}}$$

where n – sample size; N – population size; z – z score; ε – margin of error; p̂ – population proportion.

The study included 215 adults being in the reproductive age of 20 ÷ 37 . Due to the incorrect or incomplete filling in the questionnaire, responses given by six respondents were excluded from the analyses. Thus, a final total of 209 people were eligible for the study, including 110 women (52.6 %) and 99 men (47.4 %). The subjects were divided into two age groups (20 ÷ 25 years old; 26 ÷ 37 years old). The detailed characteristics of the study group is shown in Tab. 2.

Table 2. The characteristics of the study group (n = 209)
Tabela 2. Charakterystyka grupy badanej (n = 209)

Variable / Zmienna	%
Gender / Płeć	
Female / Żeńska	52.63
Male / Męska	47.37
Age range / Przedział wiekowy	
20 ÷ 25 years old/ lat	71.29
26 ÷ 37 years old/ lat	28.71
Place of residence / Miejsce zamieszkania	
Village / Wieś	22.01
City of up to 200,000 inhabitants / Miasto < 200 tys. mieszkańców	36.36
City of over 200,000 inhabitants / Miasto > 200 tys. mieszkańców	41.63
Education / Wykształcenie	
Secondary or lower / Średnie lub niższe	52.63
Higher /Wyższe	47.37
Professional status / Status zawodowy	
Not working / Niepracujący	32.06
Working / Pracujący	67.94
Relationship status / Status związku	
Single / Singiel	40.19
In relationship / W związku	59.81
Nutritional status / Stan odżywienia	
Underweight / Niedowaga	3.35
Normal body weight / Prawidłowa masa ciała	66.99
Overweight and obesity / Nadwaga i otyłość	29.66

Statistical elaboration of the results

In order to analyze the data, the authors of the present work used Microsoft Excel 2019 spreadsheet and Statistica 13.3 (StatSoft®, Tulsa, OK, USA). The normality of the variables distribution was checked using Wilk's W-Shapiro test. A logistic regression analysis was used to assess the relationship between the level of nutritional knowledge and sociodemographic factors. Odds ratio (OR) values were calculated at the 95 % confidence level.

We used a cluster analysis with the agglomeration technique to identify the associations between categories of variables describing the level of nutritional knowledge and selected factors (age, gender, place of residence, level of education, professional status, status of relationship and nutritional status). In this analysis, a hierarchical classification of variables was applied using Ward's method [42]. The significance of the analyzed variables was assessed using a test probability (p), taking $p \leq 0.05$ as the significance level ($\alpha = 0.05$).

Results

The differences in the level of nutritional knowledge among respondents based on gender, sociodemographic factors and nutritional status

In Tab. 3 the results of the logistic regression analysis were presented. It was shown that individuals with a higher level of education had nearly 2.5 times greater odds of having higher nutritional knowledge compared to individuals with secondary or lower educational level – this was a statistically significant relationship ($p = 0.005$).

Table 3. The odds ratio taking into account nutritional knowledge and selected sociodemographic factors

Tabela 3. Iloraz szans z uwzględnieniem wiedzy żywieniowej i wybranych cech socjodemograficznych

Variable / Zmienna	Level of nutritional knowledge / Poziom wiedzy żywieniowej	
	OR	*p*
Gender / Płeć		
Female / Żeńska *(ref)*	1.00	-
Male / Męska	0.63 (0.34 ÷ 1.16)	0.137
Age range / Przedział wiekowy		
20 ÷ 25 years old / lat *(ref)*	1.00	-
26 ÷ 37 years old/ lat	1.82 (0.96 ÷ 3.44)	0.067
Relationship status / Status związku		
Single / Singiel *(ref)*	1.00	-
In relationship / W związku	1.28 (0.69 ÷ 2.37)	0.435
Place of residence / Miejsce zamieszkania		
Village / Wieś *(ref)*	1.00	-
City of up to 200,000 inhabitants / Miasto < 200 tys. mieszkańców	1.27 (0.58 ÷ 2.77)	0.923
City of over 200,000 inhabitants / Miasto > 200 tys. mieszkańców	1.50 (0.76 ÷ 2.97)	0.388
Education / Wykształcenie		
Secondary or lower / Średnie lub niższe *(ref)*	1.00	-
Higher /Wyższe	2.42 (1.31 ÷ 4.47)	0.005
Professional status / Status zawodowy		
Not working / Niepracujący *(ref)*	1.00	-
Working / Pracujący	1.32 (0.69 ÷ 2.54)	0.406
Nutritional status / Stan odżywienia		
Underweight / Niedowaga *(ref)*	1.00	-
Normal body weight / Prawidłowa masa ciała	0.80 (0.14 ÷ 4.54)	0.958
Overweight and obesity / Nadwaga i otyłość	0.70 (0.35 ÷ 1.38)	0.604

Explanatory notes / Objaśnienia: *ref* – reference group; odds ratio at 95% Wald confidence; p – significance level of the Wald's test / *ref* – grupa referencyjna; iloraz szans oszacowany metodą Walda przy 95% poziomie ufności; p – poziom istotności testu Walda.

Respondents in the age range 26 ÷ 37 showed higher chances to have better nutritional knowledge than those in the age range 20 ÷ 25 (OR = 1.82), but the result was at

the margin of statistical significance (p = 0.067). In contrast, gender, relationship status, place of residence, professional status and nutritional status did not show a significant relationship with the level of nutritional knowledge.

The level of nutritional knowledge – multivariate analysis

The structure of the association between the respondents' level of nutritional knowledge and the examined factors (age, gender, place of residence, level of education, professional status, status of relationship and nutritional status) is shown in Fig. 2. In order to minimize the influence of confounding factors, an additional multivariate analysis was performed, allowing to define two sets of variables (clusters). For this purpose, the Ward's hierarchical classification method was used.

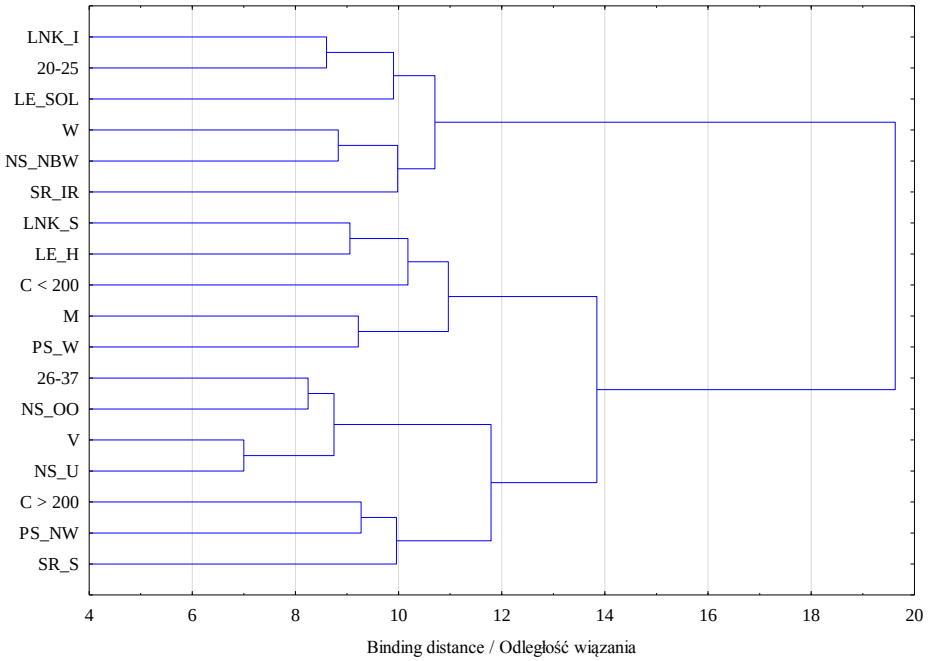

Figure 2. Hierarchical classification of variables describing the level of nutritional knowledge based on selected factors

Rycina 2. Hierarchiczna klasyfikacja zmiennych opisujących poziom wiedzy żywieniowej na podstawie wybranych czynników

Explanatory notes / Objaśnienia: LNK_I – Level of nutritional knowledge_Insufficient; LNK_S – Level of nutritional knowledge_Sufficient; 20-25 — age in years; 26-37 — age in years; LE_SOL – Level of education_Secondary or lower; LE_H – Level of education_Higher; V — village; C < 200 — city up to 200,000 inhabitants; C > 200 — city with over 200,000 inhabitants; W — woman; M — man; PS_W – Professional status_Working; PS_NW – Professional status_Not working; NS_U – Nutritional status_Underweight; NS_NBW – Nutritional status_Normal body weight; NS_OO – Nutritional status_Overweight and Obesity; SR_S – Status of relationship_Single; SR_IR – Status of relationship_In

relationship / LNK_I – Poziom wiedzy żywieniowej_Niewystarczający; LNK_S – Poziom wiedzy żywieniowej_Wystarczający; 20-25 — wiek w latach; 26-37 — wiek w latach; LE_SOL – Wykształcenie_Średnie lub niższe; LE_H – Wykształcenie_Wyższe; V — wieś; C < 200 — miasto do 200 000 mieszkańców; C > 200 — miasto powyżej 200 000 mieszkańców; W — kobieta; M — mężczyzna; PS_W – Status zawodowy_Pracujący; PS_NW – Status zawodowy_Niepracujący; NS_U – Stan odżywienia_Niedowaga; NS_NBW – Stan odżywienia_Prawidłowa masa ciała; NS_OO – Stan odżywienia_Nadwaga i otyłość; SR_S – Status związku_Singiel; SR_IR – Status związku_W związku

The first set included people who were female, having an insufficient level of nutritional knowledge, aged 20 ÷ 25, with a secondary or lower educational level, normal body weight, being in a relationship. The second set consisted of individuals with a sufficient level of nutritional knowledge, who had the following characteristics: male sex, aged 26 ÷ 37, abnormalities in nutritional status (underweight and overweight), a higher level of education.

Areas of nutritional knowledge requiring improvement

The lowest level of knowledge was reported with reference to micronutrients crucial in accordance with a pro-fertility diet. The right set of vitamins that have an influence on fertility among men and women during their reproductive period, including vitamins: A, E, C, D, B9, B6 and B12, was not chosen by any of the respondents. The greatest number of respondents (n = 101; 48 %) indicated correctly – vitamin B12, but despite this, there were also incorrect answers in their sets. As opposed – only 3 % (n = 7) of the subjects taking part in the research marked down the correct set of minerals (zinc, magnesium, selenium, iodine, iron) playing a significant role in the reproductive period among women. As the only ones, two people (1 %) of the 209 respondents had an idea of the minerals affecting male's fertility, thus choosing zinc and selenium. Equally, a low level of knowledge was reported in the context of the need for key vitamins and minerals among the respondents being in their reproductive age. The vast majority of respondents incorrectly indicated answers regarding the supply of folic acid, vitamin B12, iron, zinc or selenium. The percentage of incorrect responses in the cases mentioned above ranged from 72 % to 91 % (Fig. 3).

Diverse results were obtained with regard to the knowledge of the sources of ingredients mentioned above. When it comes to folic acid – 34 % (n = 72) of respondents indicated the correct answer, with the best sources being as follows: dark green vegetables, whole grain products and pulses. Incorrect answers were selected by approximately 66 % (n = 137) of people. Regarding vitamin B12, slightly more, as nearly 41 % (n = 85) of respondents declared correct resources providing cobalamin in the highest amounts. The best result was reached in the case of knowledge relating to the main sources of iron, with 75 % (n = 157) of people selecting the correct answer. In contrast, as many as 78 % (n = 163) of those taking part in the survey were not familiar with the products that are listed among the main sources of selenium. The lowest level

of knowledge was obtained for zinc sources. Only 11 % (n = 22) of respondents correctly answered that the main resource containing this element included: dark bread, rennet cheese and meat. Nearly 90 % of the respondents (n = 187) marked incorrect answers (Fig. 4).

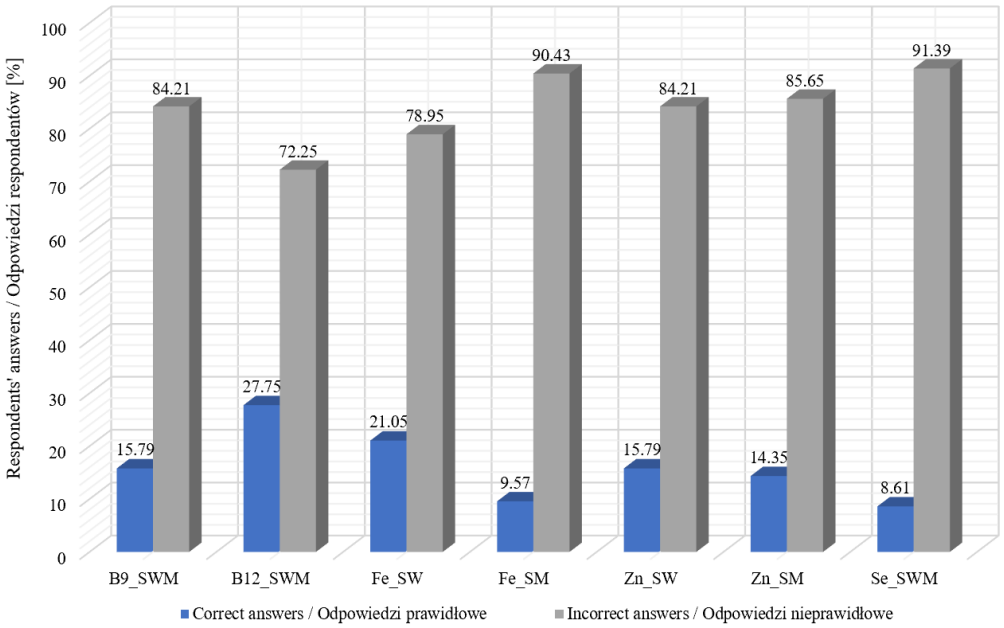

Figure 3. Respondents' level of nutritional knowledge concerning the supply of vitamins and mineral elements during reproduction phase

Rycina 3. Poziom wiedzy żywieniowej respondentów na temat podaży witamin i składników mineralnych w okresie reprodukcyjnym

Explanatory notes / Objaśnienia: B9_SWM – Folic acid (the supply among women and men); B12_SWM – Cobalamin (the supply among women and men); Fe_SW – Iron (the supply among women); Fe_SM – Iron (the supply among men); Zn_SW – Zinc (the supply among women); Zn_SM – Zinc (the supply among men); Se_SWM – Selenium (the supply among women and men) / B9_SWM – Kwas foliowy (podaż u kobiet i mężczyzn); B12_SWM – Kobalamina (podaż u kobiet i mężczyzn); Fe_SW – Żelazo (podaż u kobiet); Fe_SM – Żelazo (podaż u mężczyzn); Zn_SW – Cynk (podaż u kobiet); Zn_SM – Cynk (podaż u mężczyzn); Se_SWM – Selen (podaż u kobiet i mężczyzn)

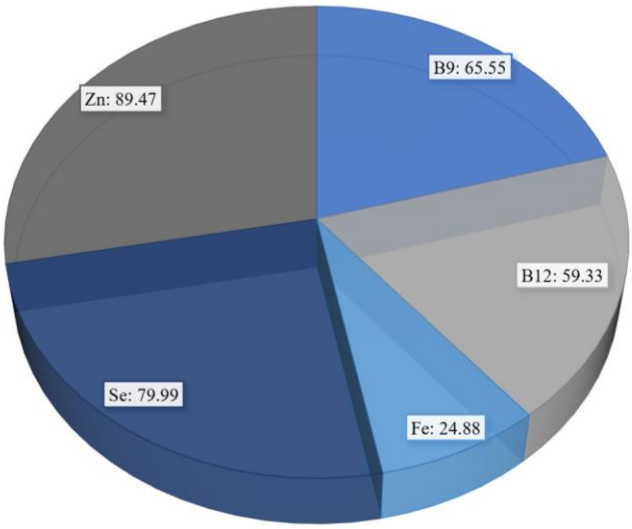

Figure 4. Respondents' level of nutritional knowledge regarding sources of key vitamins and mineral elements in the pro-fertility diet

Rycina 4. Poziom wiedzy żywieniowej respondentów na temat źródeł kluczowych witamin i składników mineralnych w diecie propłodnościowej

Discussion

Fertility is a key element of human life. Throughout the years, it is possible to observe an increased interest of this issue. Factors affecting reproductive capacity include: age, health status and physical activity. Furthermore, fertility correlates with the way of nutrition. However, this aspect is often marginalized. Therefore, familiarizing with the level of knowledge of women and men being in the reproductive period should be an important topic of contemporary research [36, 41]. For that reason, the main aim of the authors' study was to identify differences in the level of nutritional knowledge among women and men aged between 20 and 37 based on the variables such as gender, nutritional status and selected sociodemographic factors. The authors of the current research accepted the hypothesis saying that the knowledge of people being in the reproductive age is at a good level. The accepted hypothesis was eventually disproved, because the study showed that nearly 71 % of the respondents had insufficient nutritional knowledge. However, it is worth emphasizing that the final results recorded in this area coincided with the findings of other authors. Furthermore, on the basis of the study conducted, a statistically significant difference in the level of nutritional knowledge was found among people with a varied educational level ($p = 0.005$). Thus, those with higher education were about 2.5 times more likely to have higher nutritional knowledge compared to those with secondary or lower education. Furthermore, there was a discrepancy in the level of nutritional knowledge at the limit of sta-

tistical significance in relation to the respondents' age ($p = 0.067$). Those being in the age range of 26 ÷ 37 showed higher odds of better nutritional knowledge than those aged 20 ÷ 25 years (OR = 1.82).

There are still too few reports in the available literature regarding the level of knowledge of the relationship between diet and fertility among people in their reproductive period, and especially connected with the male part of the population. The authors' study is one of the few works showing the problem in question. It is extremely important considering that the way of nutrition plays a crucial role in maintaining reproductive health in both women and men. It is also worth highlighting that the authors' study addressed the topic of the relationship between nutrition and fertility in a multifaceted way. Thus, apart from the general level of knowledge relating to the profertility diet, the factors that could significantly influence it, that is age, gender, relationship status, place of residence, education or occupational status, were analyzed in a broad context.

Regarding the general level of the respondents' nutritional knowledge – the authors' study showed that nearly 71 % of them had insufficient nutritional knowledge, while only 5 % had good knowledge. Comparable results were recorded in Mirek's [31] study, conducted among a group of 180 people aged between 18 and 25. A low level of nutritional knowledge prevailed among the respondents (54 %) and a good one was shown by only 13 % of the respondents [31]. Similar results were reported in a study conducted by Laz et al. [27]. Among the surveyed women attending the reproductive health clinics in Texas, nutritional knowledge ranked low level [27]. On the other hand, Yahia et al. [48] carried out a study based on a cross-sectional questionnaire. They found that only 4 % of students attending Central Michigan University had good nutritional knowledge. Furthermore, the authors point out that further attempts are needed to increase the awareness of reproductive health knowledge and, consequently, to improve nutritional knowledge [36, 48]. The above results and observations are therefore consistent with the results of our own study.

Basing on the examined factors that potentially determine the level of nutritional knowledge of reproductive subjects – there was a discrepancy in the level of nutritional knowledge at the limit of statistical significance in relation to the respondents' age ($p = 0.067$). Thus, those being in the age range of 26 ÷ 37 showed higher likelihood of better nutritional knowledge than those aged 20 ÷ 25 (OR = 1.82) (Tab. 3). It can be linked to the demographic data according to which the average of pregnancy is 26 years of age.

On the basis of the study carried out by Almeida-Santos et al. [2], it was found that respondents' lower age was associated with the highest level of knowledge concerning fertility. The results reported can be linked to the technological advances made over the last few years and the consequent wider access to information from the Inter-

net sources, which are definitely closer to the younger generations. According to the available literature, the vast majority of young people use the Internet as their main source of knowledge [23].

Statistically significant relationships were not observed between the level of nutritional knowledge of the surveyed and demographic factors. The same lack of a statistically significant association between the level of nutritional knowledge and the place of residence was reported by Mirek [31] in her study. In contrast, the opposite observations were noted in the study conducted by Jabłonowska [21]. In her study, the author examined the relationship between the level of knowledge of lifestyle components affecting fertility among a group of people during the procreation period and selected factors, including a place of residence. Thus, the author showed that the place of residence has an impact on the respondents' level of knowledge [21].

In the authors' study, a statistically significant difference in the level of nutritional knowledge was found among people with a varied educational level ($p = 0.005$). Thus, those with higher education were about 2.5 times more likely to have higher nutritional knowledge compared to those with secondary or lower education (Tab. 3). The above results turned out to be somewhat contradictory to the results of a cross-sectional study conducted by El Gelany and Moussa [14]. The authors concluded that in the study group of 220 female students from Egyptian universities, the level of knowledge regarding the reproductive health was low. In contrast, a different point of view was presented in the study performed by Almeida-Santos et al. [2]. Among respondents with higher education, the researchers reported the highest level of knowledge about fertility [2]. The observations made in the authors' study are also comparable to the results of a study conducted by Mohammadi et al. [32] in Iran among a group of 1,200 people. The authors registered a significantly better ($p < 0.05$) level of knowledge of fertility among those people who declared a higher economic status, which can be linked to a higher educational level. To complement the above observations, this study also used multivariate analysis to minimize the influence of interfering factors. Thus, two sets of variables (clusters) were defined, determining the respondents' level of nutritional knowledge.

The first set included people who were female, having an insufficient level of nutritional knowledge, aged 20 ÷ 25, with a secondary or lower educational level, normal body weight, being in a relationship. Lower nutritional knowledge recorded among the above age group can be justified by the fact that, according to demographic data, the average age of becoming pregnant is 26. Furthermore, according to Orlicka [35], later motherhood, reaching up to 35 years of age, is becoming increasingly common. It is also worth noting that nowadays, values focused on widely understood personal development (including, among others, the one that is related to a healthy lifestyle) and professional development are promoted, which is undoubtedly associated with postponing

the decision to conceive offspring until a later point of life and a lower level of interest in this regard [44, 46]. It can also be speculated that women with a lower educational level may be more susceptible to misinformation that is widely accepted in society. Thus, there is often a prevalent perception that the pro-fertility diet mainly concerns people with weight disorders, such as overweight or obesity, which may lead women with a normal body weight to feel that the issue of pro-fertility diet does not apply to them. Consequently, the aforesaid individuals do not perceive the need to deepen their knowledge of the pro-fertility diet. Therefore, the above aspects may justify the inadequate level of nutritional knowledge recorded among the described group.

The second set consisted of individuals with a sufficient level of nutritional knowledge, who had the following characteristics: male sex, aged 26 ÷ 37, abnormalities in a nutritional status (underweight and overweight), a higher level of education. It has been pointed out by other researchers that the increased awareness of fertility is observed among groups of people planning to start a family [46]. Moreover, in recent years, there has been a growing awareness of the role that a diet plays in men's reproductive health, which may predispose them to seek knowledge concering this topic to improve their chances of fatherhood. In addition, weight disorders may also predispose individuals to a desire to explore their nutritional knowledge. Therefore, it can be assumed that such people, while looking for various methods of infertility treatment, are more willing to explore knowledge, also the one concerning nutritional aspects, including a pro-fertility diet. Difficulties in conceiving offspring definitely concern people with diagnosed weight abnormalities, as pointed out by numerous authors. Among the complaints associated with infertility as a result of being underweight or obese, researchers point to such aspects as: disruption of the menstrual cycle, disruption of proper ovarian function, reduced total sperm count, impaired ejaculate quality and testicular dysfunction [8, 15, 39]. Therefore, the abnormal nutritional status (including underweight and obesity) may predispose to the willingness to explore nutritional knowledge.

Considering the results of our own study and the findings of other authors' surveys, there is a generally insufficient level of knowledge concerning the pro-fertility diet. Thus, the main hypothesis set at the beginning, stating that the knowledge of people being in the reproductive period is at a good level, turned out to be wrong. The research conducted treats the issue of reproductive health in a broad manner, with a particular emphasis being laid on identifying differences in the level of nutritional knowledge among women and men aged between 20 and 37 based on gender, sociodemographic factors and nutritional status. Addressing the above topic is extremely important when it comes to the growing problem of infertility nowadays [3, 38]. It is worth noting that the study refers to the most current data concerning the extension of the reproductive age, which used to reach the limit of 35 years of age, while it is now

37 years of age. According to the authors' knowledge, this is one of the few studies that also includes men in the study group. This is exclusively important due to the fact that the problem of infertility affects not only women, but also men, who are often marginalized in this area [20, 26]. Therefore, it provides an important reference for conducting future research. It is worth highlighting that the study carried out was a pilot one, hence 209 people were included in the study group. Thus, the results obtained cannot be regarded as a comprehensive reference in relation to the entire population, which is undoubtedly a limitation of the study. There is no doubt that surveys in this area should be continued, which can help to eliminate nutritional abnormalities and therefore, improve reproductive health.

This is particularly relevant in the context of an increasing infertility risk, which currently constitutes a serious challenge for public health. Furthermore, it is necessary to place a crucial emphasis on nutrition education for people in their reproductive period, which would undoubtedly translate into the greater awareness of the relationship between nutrition and fertility. The above statements are evidenced by the observations obtained on the basis of our own research and the results of other authors' research cited above, demonstrating the inadequate level of nutritional knowledge of people being in their reproductive period. Therefore, the improvement of fertility in the context of public health should be linked to activities in favor of increasing the level of nutritional knowledge, especially among people being in their reproductive period, thereby the improvement of procreation. The emphasis should be placed on the planning and implementation of health-promoting attitudes, as well as the prevention of negatively correlating reproductive health behavior among women and men being in their reproductive age. This term should be understood as the promotion of a healthy lifestyle, that is increasing the level of physical activity among the population, eliminating stimulants and maintaining a healthy nutritional status. The above aspects are closely related to the prevention of infertility in both environmental and social terms. The results of our own study can therefore constitute the basis for the development of further recommendations in the broad areas of health policy aiming at the promotion of healthy lifestyles and the prevention of infertility [17, 18].

Conclusions

1. The present survey allowed for the assessment of nutritional knowledge among people being in their reproductive age in a general way and identified differences in the level of nutritional knowledge among women and men aged between 20 and 37 based on the variables such as gender, nutritional status and selected sociodemographic factors. In this manner, the predominantly insufficient level of nutritional knowledge among respondents was demonstrated.

2. Due to the above facts, it is planned to extend the survey to specific areas of Poland in order to be able to relate the results to the national population. This will make it possible to examine the diversities between the country's geographical regions and thus will show further relationships.
3. Additionally, population groups, especially with regard due to age and an educational level, particularly in need of education in this area, were identified. It was observed that those in the age range of 26 ÷ 37 showed a greater predisposition to knowledge concerning a pro-fertility diet, which is the most likely related to the average age of conception.
4. Promoting knowledge concerning the topic of the link between nutrition and fertility at an earlier age could have positive effects in maintaining reproductive health. This should be understood as broadly focused nutritional education, including, among others, the topic of the impact of key nutrients, minerals and vitamins, as well as general lifestyle on maintaining reproductive health.
5. There is no doubt that maintaining reproductive health in conjunction with a pro-fertility diet would contribute to lowering the risk of infertility. On that account, data in this important area of public health should be expanded and updated.

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WYBRANE CECHY SOCJODEMOGRAFICZNE I STAN ODŻYWIENIA - RÓŻNICE W WIEDZY NA TEMAT DIETY PROPŁODNOŚCIOWEJ W GRUPIE OSÓB W WIEKU REPRODUKCYJNYM - BADANIE PILOTAŻOWE

S t r e s z c z e n i e

Wprowadzenie. Płodność mężczyzn oraz kobiet jest przedmiotem wielu badań naukowych. Brakuje jednak analiz dotyczących wpływu czynników takich jak m.in. płeć, stan odżywienia, miejsce zamieszkania i status związku na poziom wiedzy żywieniowej w odniesieniu do diety propłodnościowej wśród osób w wieku rozrodczym. Celem badania było zatem zidentyfikowanie różnic w poziomie wiedzy żywieniowej wśród kobiet i mężczyzn w wieku od 20 do 37 lat w oparciu o powyższe czynniki. Głównym narzędziem badawczym był kwestionariusz ankiety do samodzielnego wypełnienia, udostępniony 209 respondentom za pośrednictwem sieci społecznościowych. Respondenci zostali dobrani celowo, a ich udział w badaniu był anonimowy i dobrowolny. Do oceny wiedzy żywieniowej respondentów stworzono autorski indeks, który obejmował cztery poziomy wiedzy: niedostateczny, dostateczny, dobry i bardzo dobry. Do identyfikacji różnic w poziomie wiedzy żywieniowej w oparciu o wybrane czynniki wykorzystano analizę regresji logistycznej. Ponadto zastosowano hierarchiczną klasyfikację zmiennych metodą Warda.

Wyniki i wnioski. Zarejestrowano głównie niedostateczny poziom wiedzy żywieniowej wśród badanych (70,81 %). Poziom wiedzy był wyższy wśród osób o wykształceniu wyższym ($p = 0.005$). Z kolei osoby będące w przedziale wiekowym 26 ÷ 37 lat częściej udzielały prawidłowych odpowiedzi. Wyniki badań własnych mogą stanowić ważny punkt odniesienia dla przyszłych analiz. Warto zaznaczyć, że przeprowadzone badanie miało charakter pilotażowy. Tym samym uzyskanych wyników nie można traktować jako kompleksowego odniesienia w stosunku do całej populacji, co niewątpliwie stanowi ograniczenie badania. Należy więc w dalszym ciągu aktualizować dane, w tym istotnym obszarze zdrowia publicznego.

Słowa kluczowe: dieta propłodnościowa, wiedza żywieniowa, płeć, stan odżywienia, czynniki socjodemograficzne