Appendix no 2

# Summary of professional accomplishment

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## PERSONAL DATA

Name and surname: Joanna Anna Myszkowska-Ryciak

Workplace: Chair of Dietetics, Department of Dietetics

Faculty of Human Nutrition and Consumer Sciences

Warsaw University of Life Sciences WULS – SGGW

## I. EDUCATION AND SCIENTIFIC DEGREES

**2005 - Doctor of Philosophy degree in agricultural sciences,** discipline: food technology and nutrition; field: human nutrition, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences WULS-SGGW, thesis entitled: *The influence of the amount and size of meals on the protein utilization by growing rats*, supervisor: Prof. Janusz Keller

**1998 - Master of Science degree in agricultural sciences,** specialization: food technology and human nutrition, field: human nutrition and dietetics, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences WULS SGGW: *The influence of feeding frequency on protein status and immune response*, supervisor: Jacek Bujko, Ph.D.

## II. INFORMATION ON PREVIOUS EMPLOYMENT

**since 2006** - adjunct, Chair of Dietetics, Department of Dietetics, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences WULS – SGGW

**2005-2006** - assistant, Chair of Dietetics, Department of Dietetics, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences WULS – SGGW

**1999-2004** - PhD study, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences -SGGW

**1999** - food technologist, The National Food and Nutrition Institute, Warsaw

## III. SCIENTIFIC ACHIEVEMENT BEING THE BASIS OF THE HABILITATION PROCEDURE

### A. Title of the scientific achievement

The scientific achievement, in accordance with Article 16, Paragraph 2 of the Act of 14 March 2003 concerning the scientific degrees and titles (Journal of Laws No. 65, item 595, as amended), is the series of 7 publications entitled:

**Impact of nutritional education and legal regulations on the quality of nutrition in pre-school education centers in Poland**

### B. The list of publications which constitute scientific accomplishment

(numbering according to appendix no 3, I.B.)

I.B.1. Myszkowska-Ryciak J., Harton A.: Ocena realizacji norm i zaleceń żywieniowych w wybranych placówkach przedszkolnych z terenu Krakowa. Monografia „Metabolizm i fizjologia jako podstawy postępowania dietetycznego" red. J. Gromadzka-Ostrowska, 2016; 357-368

4 MSaHE points, IF 0

I.B.2. Myszkowska-Ryciak J., Harton A.: Ocena realizacji norm i zaleceń żywieniowych w wybranych placówkach przedszkolnych z terenu Poznania. Probl. Hig. Epidemiol. 2018; 99(1): 7-11

9 MSaHE points, IF 0

I.B.3. Myszkowska-Ryciak J., Harton A.: Implementation of dietary reference intake standards on preschools menus in Poland. Nutrients 2018; 10: 592; doi:10.3390/nu10050592

35 MSaHE points, IF 4,196

I.B.4. Myszkowska-Ryciak J., Harton A.: Do preschools offer healthy beverages to children? A nationwide study in Poland. Nutrients 2017; 9: 1167; doi:10.3390/nu9111167

35 MSaHE points, IF 3,550

I.B.5. Myszkowska-Ryciak J., Harton A.: Eating healthy, growing healthy: Impact of a multistrategy nutrition education on the assortments of beverages served in preschools, Poland. Int. J. Environ. Res. Public Health 2018; 15: 1355; doi:10.3390/ijerph15071355

30 MSaHE points, IF 2,145

I.B.6. Myszkowska-Ryciak J., Harton A.: Impact of Nutrition Education on the Compliance with Model Food Ration in 231 Preschools, Poland - Results of Eating Healthy, Growing Healthy Program. Nutrients 2018; 10(10): 1427; https://doi.org/10.3390/nu10101427

35 MSaHE points, 4,196 IF

I.B.7. Myszkowska-Ryciak J., Harton A.: Nutrition-related practices in kindergartens in the context of changes to legal regulations on foodstuffs used in canteen menus for children. Roczniki PZH 2018; 69 (1): 31-36

14 MSaHE points, 0 IF

**In total: 162 MSaHE points and IF 14,087 (from year of publication).**

In all these publications, I am the first and the corresponding author. My contribution to the mentioned works is presented in Appendix no 3 and the statements of co-author are presented are Appendix 4, while the full texts are presented in Appendix no 5.

Publications submitted as a scientific achievement constituting the basis for the habilitation procedure present the results of research and educational grant *Eating Healthy, Growing Healthy*, funded by Danone Ecosystem (2014-2017), implemented in cooperation with partners: Comenius Foundation, the NUTRICIA Foundation, the Mother and Child Institute and Academic Business Incubators.

The aim of the project was to improve the children nutrition at an early age by improving the level of knowledge and nutritional awareness of nurseries and kindergartens staff. The project had a nationwide reach: within 3 years, 2,638 institutions (nurseries and pre-school education centers) were covered by various forms of nutritional education, and 13,214 employees of the above-mentioned institutions participated directly in nutritional training.

## C. Discussion of the scientific objective and results achieved

### C.1. Introduction

Children attending full-time kindergartens (up to 10 hours a day) consume a significant part (up to 75%) of their daily energy and nutrient requirements while in the institution [23]. In Poland, pre-school education covers children from 3 years of age to the start of

primary school education (currently at the age of 7 or 6 at the request of parents / guardians). In total, in the school year 2016/2017, 80.7% of the population aged 3-6 participated in various forms of pre-school education, which is 1 299,138 children in total. Of these, 982,024 children received full board (i.e. at least 3 meals, including 2 main meals) during their stay in care and educational centers [4], which indicates the decisive role of these institutions in child nutrition.

Proper nutrition in kindergarten is therefore of key importance for the health of preschoolers: it can prevent deficiencies and / or excessive supply of nutrients, as well as shape proper eating habits [23,7,16,12]. The role of nutrition in care and education centers is also becoming more and more important due to the common problem of overweight and obesity in children around the world [37], as well as in Poland [22,29,19]. A nationwide survey of 5,119 children aged 2-6 showed that, according to the international body mass index (IOTF), the problem of excessive body weight involved 12.2% boys and 15.0% girls [19]. Secular trends in body mass index (BMI) and waist circumference indicate that abdominal obesity in Polish children has increased significantly in the last 46 years, with a simultaneous greater increase in the percentage of children with central obesity compared to general obesity [42]. The increasing prevalence of obesity in children is associated with the appearance of comorbidities, including type 2 diabetes, hypertension, non-alcoholic hepatitis, obstructive sleep apnea and dyslipidemia [41,11,37].

This situation is alarming and requires appropriate, population-based preventive activities at the earliest possible stage of life. Particular attention should be paid to nutrition in childcare facilities, with emphasis on compliance with dietary standards and recommendations on the level of energy and nutrients, the more that the research show that the quality of nutrition in kindergartens is not always consistent with dietary norms and recommendations, both in Poland and in the world. The analysis of menus in 46 Australian care facilities showed that none of them served children the recommended number of portions of vegetables, while in all institutions children were given high fat, sugar and salt products [46]. There were insufficient quantities of cereal products from whole grains, lean meats, fruits and vegetables on the menu of childcare facilities in the USA [28]. Nutritional analysis of 300 pre-school food samples from Serbia showed that despite the appropriate energy of the pre-school diet, the share of energy from vegetables and fruit was low, which may imply inappropriate eating habits (low fruit and vegetable consumption) [24]. The menu in kindergartens in Granada (Spain) provided the right amount of vegetables, fruits, meat, and fish, but it did not meet the recommendations

regarding the content of calcium and zinc [40]. Nutrition studies in kindergartens in Poland also show the existence of irregularities [34, 10, 32, 26, 21]. Analysis of the 10-day menu of one of the kindergartens in Legnica (in the Lower Silesia Voivodship), indicated an adequate supply of energy, but for a low content of calcium, vitamin C and iron in comparison with the recommendations [34]. Kwiecień et al. [21] in a weekly menu in one of the kindergartens in Lublin observed an insufficient amount of dietary fiber, potassium, calcium and iron, while exceeding the recommendations for protein and sodium. In the two kindergartens in Warsaw, a significant exceeding of the recommended caloric value of menus was observed, with a larger transgression (by 39%) in the kindergarten using the services of a catering company [32]. Analysis of decadent menus from 5 kindergartens (public and non-public) from the Mazowieckie Voivodeship showed too much energy, protein, fat, carbohydrates and sucrose [10].

The causes of observed irregularities may be attributed to the insufficient level of nutritional knowledge of personnel involved in the organization and implementation of nutrition in institutions, as well as in the absence of appropriate legal regulations in this regard. In Poland, until 31 August 2015, there were no mandatory regulations regarding the implementation of nutrition in pre-school institutions in qualitative and quantitative terms (including provisions imposing the need to comply with relevant nutritional norms). These regulations were only introduced by the *Regulation of the Minister of Health of 26 August 2015 on groups of foodstuffs intended for sale to children and adolescents in units of the education system and the requirements that must be met by foodstuffs for mass catering for children and adolescents in these units* [39]. The regulation specified, among others which products can be used in collective catering (significantly limited the amount of sugar, salt and additives), as well as the number of servings of vegetables, fruit, dairy products and fish served, which was supposed to improve the way children are fed. Due to the relatively high stringency of the products approved for use, the above regulation met with a large social criticism and was consequently repealed. Currently (from 1 September 2016) the Regulation of the Minister of Health of 26 July 2016 [38] is in force, in which the requirements for the implementation of collective catering have been significantly relaxed. In accordance with applicable law, foodstuffs used as part of collective catering for children and adolescents in units of the education system (including kindergartens) must meet the relevant requirements for a given age group, resulting from current nutrition standards for the Polish population. In all-day nutrition foodstuffs from various product groups, including in main meals (i.e. breakfast, lunch) should be found: cereals or potatoes, vegetables or fruits, milk or dairy products, meat, fish, eggs, nuts , legume seeds and other seeds and fats should be used. The products should be of natural ingredients,

fried foods (in rapeseed oil or olive oil) should be served no more than twice a week, and beverages prepared from the scratch in institutions kitchen should not contain more than 10 g of sugars in a 250 ml ready-to-drink beverage. At the same time, at least two servings of milk or dairy products should be served to children, vegetables or fruit should be given each day to each meal and at least one portion of fish per week [38]. However, the quality of the menu implemented in accordance with the Regulation may vary, due to the general nature of the regulations, including no detailed guidelines on the portion size.

At this point, it should also be noted that the existing publications on nutrition in kindergartens in Poland are based on analyzes of individual institutions (rarely a few), as well as varied methodology of research (e.g. qualitative analysis of menus, analytical studies of the food ration, quantitative evaluation of menus) ). As each institution implements children feeding independently, so data obtained from analyzes of individual kindergartens can not be the basis for drawing general conclusions on the quality of nutrition in pre-school institutions in Poland. There is also a lack of data showing the impact of mentioned above Regulations [39, 38] on the quality of feeding in pre-school education centers.

What is more, the authors of previously cited studies analyzing the quality of nutrition in kindergartens [10,32,21,34] conclude the need to educate the staff of facilities to improve nutrition. Although there are educational programs addressed to pre-school institutions (e.g. "Mom, Dad I choose Water", "Proper nutrition of the child and health of an adult person", "Academy of Healthy Preschooler"), at the same time, there are no objective indicators of the effectiveness of education.

Therefore, it is important that the quality of nutrition, also in terms of education effectiveness and / or legal regulation, should be assessed in pre-school education institutions with a uniform methodology and in a larger sample of institutions located in different regions of the country. This approach allows for a reliable assessment of the diet quality in kindergartens, finding the most common irregularities, as well as formulating practical suggestions for improving the existing situation.

## C.2. Scientific objective and hypotheses

The main purpose of the presented achievement was to analyze the influence of nutrition education and legal regulations on the quality of nutrition in pre-school education centers in Poland.

The specific objectives included:

— assessment of the implementation of nutritional norms and recommendations in pre-school education centers in Poland

— assessment of the impact of nutritional education of personnel on the implementation of nutrition standards in pre-school education institutions

— assessment of the impact of legal regulations on selected parameters of the nutrition in pre-school education centers.

Based on the goals formulated above, the following research hypotheses were adopted:

Main hypothesis:

— Nutrition in pre-school education centers is a result of many factors, of which the nutritional education of personnel and applicable legal regulations play an important role.

Detailed hypotheses:

— The existing situation in Poland in terms of the quality of nutrition in pre-school institutions is characterized by many irregularities, of which the most problematic are: low supply of milk and dairy products, vegetables and a high supply of sugar and sweets.

— Irregularities in the quality of nutrition in pre-school institutions in Poland occur regardless of their status (public vs. non-public kindergartens) and nutrition organizations (own kitchen vs. catering).

— Nutritional education of the staff through increasing the knowledge and nutritional awareness improves the quality of nutrition in pre-school education centers.

— Legal regulations are an effective tool for improving the quality of nutrition in pre-school education institutions.

## C.3. Discussion of results

### 3.1. Evaluation of the implementation of dietary norms and recommendations in pre-school education centers in Poland

**Publications**:

**I.B.1. Myszkowska-Ryciak J., Harton A.: Ocena realizacji norm i zaleceń żywieniowych w wybranych placówkach przedszkolnych z terenu Krakowa. Monografia „Metabolizm i**

**fizjologia jako podstawy postępowania dietetycznego" red. J. Gromadzka-Ostrowska, 2016; 357-368**

**I.B.2. Myszkowska-Ryciak J., Harton A.: Ocena realizacji norm i zaleceń żywieniowych w wybranych placówkach przedszkolnych z terenu Poznania. Probl. Hig. Epidemiol. 2018; 99(1): 7-11**

**I.B.3. Myszkowska-Ryciak J., Harton A.: Implementation of dietary reference intake standards on preschools menus in Poland. Nutrients 2018; 10: 592; doi:10.3390/nu10050592**

**I.B.4. Myszkowska-Ryciak J., Harton A.: Do preschools offer healthy beverages to children? A nationwide study in Poland. Nutrients 2017; 9: 1167; doi:10.3390/nu9111167**

The quality of nutrition in pre-school institutions largely determines the regularity of the diet of attending children. Due to the time spent in the institution, the child can consume up to 4 meals here, including two main meals, i.e. breakfast and lunch. Therefore, it is assumed that the pre-school reason should cover about 75% of the child's demand for energy and nutrients [5]. Menu in kindergartens should be planned for 7 or 10 days (so-called decade), which allows for proper balancing and diversifying the diet. When planning nutrition in kindergarten, it is important to include a variety of products from all groups, including: cereal and potato products, vegetables and fruits, milk and dairy products, meat, poultry, fish, sausages, eggs and fats in proportions consistent with the principles of proper nutrition, as well as also selecting the most nutritious ones [5]. Variety of menus not only reduces the risk of insufficient supply of nutrients but also promotes appetite and acceptance of new flavors. In the practical implementation of collective catering, it is recommended to use the so-called daily model food rations (MFR, previously referred to as catering standards), covering the amounts of individual products at the level ensuring the implementation of standards and recommendations for energy and nutrients for a given population group [43].

The aim of the study was to assess nutrition in pre-school institutions located in different regions of the country. Kindergartens were recruited through written invitations sent directly to institutions, as well as through advertisements in specialist press. Participation in the project was free for kindergartens. The research was carried out both in public and non-public establishments using the same methodology. The method of feeding self-catering facilities for children was assessed by means of quantitative criteria (in relation to the said nutritional standards) and qualitative criteria (in relation to the recommendation of consumption of product groups and population nutritional recommendations). The analysis included menus and warehouse reports (out-of-service documents) from 10

consecutive days (so-called decade). The amounts of individual products and nutrients per child on each day of the analyzed decade menu were calculated on the basis of a daily stored report, taking into account the planned number of children in the facility on a given day. Nutritional value was calculated using the nutritional tables of products and dishes [20]. Then data from 10 days were averaged and given as the value of supply per 1 child per day. In the qualitative assessment of menus, the obtained supply data for individual products were referenced to the daily MFR recommendations for children aged 4-6 according to Dzieniszewski et al. [8], due to the lower content of, among others, cereal products (bread, flour and pasta) and meat, which in effect gives the nutritional value of MRP more similar to current nutrition standards [15]. In the quantitative assessment, the calculated content of energy and nutrients per 1 child / day was referred to the subject nutritional standards at the recommended level (RDA), average group requirement (EAR) or sufficient intake (AI) according to Jarosz et al. [14, 15]. When discussing the results and applying, it was assumed that due to the time spent in the facility, the children receive 4 meals (breakfast, breakfast, lunch, afternoon tea), which should account for 70-75% of the recommended daily allowance [5]; implementation at this level was considered to be correct. In the assessment of sucrose supply, it was assumed that sugars added (ie mainly sucrose) should account for no more than 10% of the diet energy. For children aged 4-6, the energy demand was set at 1,400 kcal, which after conversion gives 35g of sucrose [14]. In pre-school institutions a survey was also conducted on the frequency and type of drinks served, as well as the practice of sweetening beverages for children.

The first stage of the study included nutrition assessment in kindergartens before 1 September 2015, i.e. before the Regulation of the Minister of Health entered into force on 26 August 2015 on groups of foodstuffs intended for sale to children and youth in units of the education system and requirements they must Meet foodstuffs used for mass catering for children and adolescents in these units [39]. The surveyed group consisted of public pre-school education centers from Krakow, having their own kitchen and preparing meals for children on site [I.B.1]. In total, the analysis covered data from 14 kindergartens, ie 140 expenditures from the summer, winter and spring season. The conformity of the supply of product groups with MFR and the content of selected nutrients were assessed: calcium, iron, vitamin C, vitamin D, dietary fiber and sucrose. There were large differences in the content of individual components in menus performed in the examined facilities, especially in the case of vitamin C, vitamin D and dietary fiber. In none of the decade menus 75% of the recommended level of calcium and vitamin D was achieved. Most of the outlets were not able to obtain the proper content of iron and vitamin C. The dietary

fiber content was formed - only one decade diet was lower than the recommended dietary fiber. On the other hand, sucrose supply (on average 44 ± 6.5g / d) in all facilities exceeded 75% of the recommended level. When assessing the supply of selected product groups compared to MFR, the low share of vegetables (average implementation at 48% MRP), milk and fermented milk beverages (40%), curd cheese (41%) was particularly unfavorable, with a significant overrun of meat (191%) as well as sugar and sweets (139%).

The second stage of the study included nutrition assessment in kindergartens from 1 September 2015 to 31 August 2016, i.e. in the period of the Regulation of the Minister of Health of 26 August 2015 on groups of foodstuffs intended for sale to children and adolescents in system units education and the requirements that must be met by food products used in the context of mass catering for children and adolescents in these units [39]. The research included 27 state kindergartens from Poznań (21% of all public kindergartens in Poznań); all branches had their own kitchen and prepared meals for children on site [I.B.2]. In total, 270 out-of-date documents were analyzed. There were large differences in the content of individual components in the examined facilities, especially in the case of calcium, vitamin C, vitamin D, dietary fiber and sucrose. In none of the decade menus 75% of the standard was reached at the level of sufficient intake for vitamin D. Most establishments (23) also failed to obtain adequate calcium content in the menus (median 436 mg). However, only in one decade diet the amount of dietary fiber was lower than recommended (median supply of 16 g). The supply of sucrose in more than 2/3 of kindergartens did not exceed 10% of the recommended amount of energy (median 23 g). In contrast, all decade menus were characterized by an iron content above the EAR level (mean 6.4 ± 1.2 mg). Although the Regulation provided specific indications as to the number of portions of vegetables, fruit or dairy products in children's nutrition, the percentage of these products, with the exception of fruit, was observed in the analyzed menus compared to the recommendation. It can be assumed that the fruits are more easily accepted by children due to their sweet taste, which resulted in more changes to the establishments. Also worrying was the low content of milk and fermented dairy products (213 ± 89.2 g / d) and curd (20 ± 10.3 g / d) found in the pre-school diets, despite the regulation of serving at least 2 servings of these products. in pre-school nutrition. The supply of sugar and sweets was at the level of 18 ± 11.7 g / d (range 1-42 g / d), in 20 out of 27 preschools it did not exceed the amount recommended in MFR.

The next study covered public / public institutions recruited throughout Poland in 2016-2017, i.e. during the period of validity of two subsequent Regulations [38.39]. The

inclusion criteria included: offering children full board (i.e. 2 main meals and II breakfast and / or afternoon tea) and preparing meals on site through their own kitchen. Finally, 270 kindergartens from all over Poland were included in the analyzes [I.B.3]. The decade menus (a total of 2,700 stock reports) were analyzed in terms of energy content, macronutrients and minerals and vitamins, as well as reference standards and nutritional recommendations for two age categories, i.e. 1-3 year olds and 4-6 year olds [14,15 ]. The nutrient content was related to the reference intake [14]: (1) EAR for energy; (2) RDA for protein, carbohydrates, calcium, copper, iron, magnesium, phosphorus, zinc, vitamin A, vitamin B1, vitamin B2, vitamin B6, vitamin B12, vitamin C, vitamin E, folic acid, niacin; (3) AI for sodium, potassium, iodine, vitamin D [15] and dietary fiber; (4) acceptable range of macronutrients for protein, fat and carbohydrates (percentage of total energy). The implementation at the level of 70% of daily demand was considered satisfactory [5]. The average energy supply amounted to 1241 kcal / d, which exceeded the value recommended for the pre-school institution for both 3-year-old children and 4-6 year-old children. An irregular share of energy from macronutrients was observed: fats provided an average of 32.9% energy, of which 12.8% came from saturated fatty acids. The average energy contribution from sucrose did not exceed 10%. The protein content was 14.5% energy, while in absolute terms - 45 g / d (median value, including 27.4 g protein of animal origin). The supply of dietary fiber (on average 16.7 g / d) as well as cholesterol (165.7 mg / d) was satisfactory. With regard to vitamins, insufficient supply of vitamin D was observed (1.7 μg / d) in all facilities, and in a small percentage of the establishments too low content of vitamin E, folate and niacin in menus. However, the calcium content was significantly unfavorable (average 452.8 ± 110 mg / d); in 99% of the establishments, the menus did not provide the amount of this ingredient recommended for children aged 4-6 (in relation to 3-year-olds, it was 63% of establishments). Slightly over 1/5 of the menus analyzed did not contain the appropriate amount of iodine for both age groups (average content of 101 μg / d), and 62% of iron for children aged 4-6 (mean content of 6.5 mg / d). Potassium supply (average 2443.8 mg / d) was insufficient for children aged 4-6 in 27% of menus analyzed. It should be emphasized that the analyzed menus significantly differed in terms of content of the discussed ingredients.

The final stage of the nutrition assessment in the facilities was the analysis of beverages offered to children [I.B.4]. Due to the growing epidemic of overweight and obesity among children and adolescents, much attention is focused on the consumption of beverages by this population group [18,2,17]. Some data indicate that sugars sweetened with sugar can significantly contribute to excessive energy consumption due to the large amount of added (but also so-called) free sugars [35, 45]. Briefel et al. [3] found that sugar from

sugary drinks provides more than 200 extra calories for everyday schoolchildren's energy consumption. What's more, children who drink regular drinks of this type have an energy consumption higher by 17% to 20% [9,33]. In many sweetened beverages, sugar is the only or the main source of calories, and therefore to a lesser extent contributes to the feeling of fullness compared to products with protein or fat content. Therefore, their consumption may eventually increase the total amount of energy consumed [33, 27]. De Boer et al. [6] in a large group of children aged 2 to 5 years showed that consumption of sweetened beverages was associated with a higher BMI and / or greater increase in BMI z-score over time. The study included 720 pre-school education centers from across the country, including 529 public and 191 non-public ones. The analysis of beverages offered in the outlets used menus, warehouse reports and a questionnaire regarding the type of beverages served, the frequency of their administration and practices related to sweetening, which was carried out with the personnel responsible for the implementation of nutrition in the facility (usually the purser manager). The analyzes indicated a large variation in the type of drinks given to children to drink while in the institution. Typical drinks offered to children were: cocoa and milk coffee substitutes (95% of preschools), compote (92%), tea (84%), fruit tea (73%), water - as a drink with meals (69%) and 100% fruit juices (44%). In 93% of the facilities children had constant access to drinking water. Interestingly, a significantly lower percentage of non-public facilities offered children cocoa and milk coffee substitutes (87% vs. 98%), compote (85% vs. 94%) and fruit juices (38% vs. 47%). Only in 8% of kindergartens milk was served as a drink with a meal. As an unfavorable one should note the fact of serving diluted jelly or jelly water in some establishments (1%), which clearly contributed to the increase of sugar without affecting the nutritional value of the diet. In addition, a survey was conducted in the facilities on the sweetening of beverages prepared for children. For sweetening tea, cocoa, milk coffee substitutes or tea with the addition of milk, honey (56% outlets) or sugar (26%) was used most often; only in 14% of kindergartens, this type of beverage was not sweetened. The compote was usually sweetened with sugar (40% of kindergartens), 26% of the establishments used honey and the same percentage did not sweeten this drink. Interestingly, the use of honey was declared by a larger percentage of public facilities compared to private ones. However, a larger percentage of private kindergartens did not practice sweetening beverages like tea, cocoa, and milk coffee substitutes.

3.2. Evaluation of the impact of nutritional education of personnel on the implementation of nutrition standards in pre-school education institutions

**Publications**:

**I.B.5. Myszkowska-Ryciak J., Harton A.: Eating healthy, growing healthy: Impact of a multistrategy nutrition education on the assortments of beverages served in preschools, Poland. Int. J. Environ. Res. Public Health 2018; 15: 1355; doi:10.3390/ijerph15071355**

**I.B.6. Myszkowska-Ryciak J., Harton A.: Impact of Nutrition Education on the Compliance with Model Food Ration in 231 Preschools, Poland - Results of Eating Healthy, Growing Healthy Program. Nutrients 2018; 10(10): 1427; https://doi.org/10.3390/nu10101427**

Knowledge and awareness of nutritional recommendations may determine the observance of the principles of proper nutrition and translate into improving the quality of children's diet in educational and educational facilities. However, the level of nutritional knowledge of people responsible for the implementation of child nutrition is not always appropriate [30], hence the often requested need for educational activities in this group [10,34,21]. Such activities should have a wide range, cover themes related to general principles of proper nutrition, but also should focus on typical problems in feeding children in pre-school age. In addition (due to the large differences in the method of feeding in facilities) should ensure that the institution can obtain more personalized recommendations. For greater coverage, staff education should be free, due to the limited budget of the facilities [13]. What is most important, however, the effectiveness of educational activities should be verified by objective methods, i.e. on the basis of the observed change in the way children are fed, not only on the basis of the staff knowledge or subjective assessment of nutrition quality by the staff of the facility.

As part of the research [I.B.5 I.B.6], the effectiveness of a comprehensive educational program on selected parameters of nutrition quality in pre-school institutions was evaluated. In each institution, before the start of the educational program, a decade menu was assessed, and then each institution received a detailed report discussing the irregularities found together with practical proposals for changes. After this analysis, the staff of the centers took part in nutritional education. The educational program included a 24-hour series of workshops for the staff of facilities responsible for feeding children. The substantive content of the workshops was developed by specialists in the field of children's nutrition, dieticians and pediatricians; the thematic scope has been established on the basis of literature sources and preliminary examinations carried out in institutions, so that it corresponds to the needs of the participants. Among the topics implemented

were, among others general principles of proper nutrition of children, the role of sugar and salt in the diet, demand and food sources of calcium and vitamin D, the role of water, management of nutritional neophobia and mechanisms of self-regulation of appetite by the child. At each stage of education, the facility had the opportunity to directly contact the trainer in case of additional questions. The same educational materials were used in all establishments, whereas the reports for the institutions were individualized. In order to ensure repeatability as well as a uniform substantive level of the conducted workshops, the persons leading (dieticians or specialists in human nutrition) have undergone appropriate training prior to the commencement of the program. In order to evaluate the effectiveness of educational activities, the quality of the decade menus was reviewed three to six months after the end of the program using the same methodology. The objective criterion for the effectiveness of education was a favorable change in the analyzed parameters compared to the first analysis.

The first study assessed the impact of education on the range of drinks served to children in pre-school institutions [I.B.5]. The analysis included 478 kindergartens from all over the country, of which 74% were public kindergartens. The most frequently used drinks were selected for children [I.B.4], i.e.: water, fruit juices, fruit drinks, tea (black), fruit / herb tea, cocoa and cereal milk on milk and compote, as well as water available between meals. Significant changes under the influence of education were observed in the case of: water served to a meal (increase in the percentage of water serving establishments from 67% to 83%) access to water between meals (93% vs. 99%), juices (46% vs. 56%), fruit drinks (23% vs. 15%) and fruit / herb tea (75% vs. 81%). While analyzing the impact of education in public and non-public facilities, some differences were observed, especially in relation to fruit juices and beverages. Both juices and drinks are the source of the so-called free sugars in the diet, whose level should not exceed 10% of energy, or even (for greater health benefits) 5% of diet energy [45]. However, compared to fruits drinks, 100% juices have a much better nutritional value [20]. Education conducted in this direction significantly increased the percentage of public kindergartens serving children juices (from 50% to 60%) and at the same time reduced the number of those served fruit drinks (from 23% to 14%). In the case of non-public institutions, the changes were not statistically significant. Interestingly, non-public institutions had a significantly higher daily nutritional rate per one child compared to public kindergartens (8.2 vs. 5.8 PLN / day), so a higher price of juices compared to drinks should not be a limitation for them.

The second study [I.B.6] focused on the impact of education on the supply of selected product groups, taking into account the recommendations of the model food ration. 231

public branches from all over Poland were included in the analysis; all outlets had their own kitchen, served full board to the children, and the staff employed completed the training cycle. The condition for qualifying for analysis was also the delivery of full warehouse documentation. The supply of individual products per 1 child per day was determined based on the inventory documentation using the methodology described above [I.B.3], then the values from the decade menus before and after the education were compared. A favorable changes, among others, in relation to the number of vegetables served (164.3 vs. 170.8 g / d), legume seeds (2.2 vs. 2.7 g / d), milk and dairy fermented beverages (200.3 vs. 209, 5 g / d), meat (47.7 vs. 44.5 g / d), meat products (16.2 vs. 14.4 g / d), and sugar and sweets (15.9 vs. 14.4 g / d) were observed. However, despite favorable changes, the average supply of milk and dairy fermented beverages and vegetables was much lower than recommended in MRP, while in the case of meat too high.

3.3. Assessment of the impact of legal regulations on selected parameters of the diet quality in pre-school education institutions

**Publication:**

**I.B.7. Myszkowska-Ryciak J., Harton A.: Nutrition-related practices in kindergartens in the context of changes to legal regulations on foodstuffs used in canteen menus for children. Roczniki PZH 2018; 69 (1): 31-36**

In order to improve the quality of nutrition in educational and educational institutions, in 2015 the Regulation in this scope was introduced [39], which regulated in detail the type and quality of products served to children, as well as culinary techniques used to prepare dishes in child educational institutions. For example, the number of fried dishes was limited to two a week, only rapeseed oil and olive oil were allowed to fry. The establishments were obliged to use only low-sodium salt at the stage of preparing the dish (without adding a ready-made dish), as well as limiting the possibility of sweetening. The addition of sugar was not allowed for all types of drinks, while selected beverages (e.g. tea, cocoa, but not compote) could be sweetened with honey. With broad social criticism, the above regulation was repealed by another [38] after one year. Previously mentioned restrictions have been significantly relaxed: sugar was allowed in an amount of up to 10 g per 250 ml of each beverage prepared by the establishment, the limitation of the amount of salt was abolished, as well as the requirement for low sodium salt. Still, the preschools can not serve more than two portions of dishes fried during the week, as well as they must use only the previously mentioned vegetable fats. Due to the rapidly changing

situation, there is no data regarding the impact of the above-mentioned Regulations on the way of feeding in pre-school institutions.

The study [I.B.7] covered a total of 706 pre-school education centers in two periods: I. from 1 September 2015 to 31 August 2016 (349 outlets, including 266 public and 83 non-public) and II. from September 1, 2016 to May 30, 2017 (357 branches, including 255 public and 102 non-public). The selected determinants of the correctness / quality of nutrition were analyzed, with particular emphasis on mandatory requirements [38, 39]. Data were obtained on the basis of a direct interview with kindergarten staff using a validated questionnaire. For the verification of information, 706 decade menus and 7060 daily warehouse reports were analyzed for the content of vegetables and fruits, the frequency of serving fried dishes and the type of fat, sweetening and salting. It was observed that the vast majority of kindergartens (over 90%) introduced the provisions contained in the Ordinance of 26 August 2015 concerning the supply of fresh fruit and vegetables, the number of fried dishes per week (over 70%), and the use of appropriate - rapeseed oil - to frying (97% of public facilities and 89% of private). However, only half of the kindergartens (53% state and 45% private) complied with the requirement of giving vegetables and / or fruit in every meal. Major problems have been observed with respect to compliance with the sweetening and salting regulations. Over ¼ of outlets (regardless of the type of branch) used for the sweetening of tea, fruit tea, cereal coffee or cocoa forbidden sugar. A significantly higher proportion (67% vs. 46%) of public kindergartens used permitted honey for this purpose. Every fourth preschool sweetened the compote with honey and / or sugar, which was against the rules. Traditional salt was used by every second institution, with a higher percentage of public kindergartens (60% vs. 40%). From 1 September 2016, kindergartens were still obliged to serve a maximum of 2 dishes fried during the week, as well as the use of the same fats for frying and the administration of vegetables and / or fruit at every meal. However, the restrictions on sweetening and salting have been greatly alleviated: the mandatory use of only low-sodium salt has been repealed, as well as the sweetening of all beverages with sugar. In the case of an obligatory addition of vegetables or fruit to every meal, still a significant part of the outlets still did not implement this provision in practice. There were significant differences regarding the type of facility: in the case of public kindergartens it was 45%, while in the group of non-public kindergartens as much as 65%. There were no significant differences in the implementation of the provisions on the frequency of frying, as well as the use of permitted rapeseed oil. In the case of the second permitted fat - olive oil - its use was significantly more often indicated by private institutions (13% vs. 6%). Interesting observations concerned sugar and honey used for sweetening. The establishments took

advantage of the possibility of using sugar. In comparison to the previous period, significantly more establishments used it to sweeten different types of beverages. What is more, a larger percentage of private institutions used sugar to sweeten tea, milk coffee substitute, etc. drinks compared to public kindergartens (46% vs. 30%). It was also noticed that a higher percentage of non-public institutions gave up the use of honey for sweetening, while the percentage of public facilities using this product remained at the same level. A significantly smaller percentage of kindergartens declared the use of low sodium salt, but comparing the type of centres, it remained more often used in public institutions (50% vs. 20%).

## C.4. Summary

The results obtained as part of the conducted research allowed to verify the research hypotheses.

Some abnormalities have been confirmed, both in terms of quantity (implementation of nutritional norms) and qualitative (participation of products that are particularly important from the point of view of the nutritional value of products). The menus in the 270 kindergartens assessed to a large extent the recommendations regarding the supply of nutrients, in particular dietary fiber, most vitamins, with the exception of vitamin D and (in a small percentage of outlets) of vitamin E, folic acid and niacin as well as selected minerals (copper) , magnesium, phosphorus, zinc, sodium). However, some areas have also been observed to be improved, in particular with regard to the level of calcium, iron, iodine, potassium, as well as the appropriate share of energy from macronutrients. Of particular concern is the low calcium content in the analyzed menus. The main source of this ingredient in the usual Polish diet is milk and milk products. According to the recommendations of the Food and Nutrition Pyramid of Healthy Nutrition and Physical Activity of Children and Youth prepared in 2016, children and adolescents aged 4-18 should consume 3-4 servings of milk or dairy products per day. Studies on the diet of pre-school children indicate insufficient consumption of this group of products and, consequently, low calcium content in the diet [31]. Low consumption of milk and dairy products among children may result from the general tendency to reduce consumption of this product group: in 2010, milk consumption per capita was 117 ml / d, and in 2016 only 102 ml / d (decrease by 13%), a similar tendency is also observed for cheese and curd [36]. In order to increase the share of milk and milk products in the diet of children and adolescents, from 1 September 2015 an obligatory requirement was imposed on the servicing of at least two portions of these products daily in a day-long collective catering

of these population groups [38.39]. Unfortunately, these legal acts did not specify in detail nor the range of the above-mentioned products, not the portion size. Based on our own observations, it seems that the provision concerning mandatory servicing of two portions of dairy products did not fulfil its role, i.e. it did not significantly increase the share of milk and dairy products (especially fermented milk drinks) in the pre-school dietary ration. For example, in decade menus from the 14 kindergarten from Krakow acquired before the implementation of the Regulation, the average supply of milk and fermented milk beverages was 218 ml / d, and the average calcium supply was 425 mg / d. However, another analysis carried out immediately after the entry into force of the first Regulation [39] in 27 kindergartens from Poznań showed the supply of milk and milk fermented beverages at 213 ml / d, while the calcium content was 436 mg / d. Analysis of 2310 warehouse reports collected after September 1, 2015 indicates a slightly lower supply of the above of products (median 200 ml / d), which also results in an insufficient content of calcium in pre-school rations (453 mg / d, n = 270 kindergartens). Interestingly, in the aspect of increasing the amount of milk and fermented milk products, effectiveness was demonstrated in the case of education: the average supply in kindergartens covered by education increased by 5%, while in establishments with an initial low supply - up to 20%. However, in the case of educational activities, there was also no spectacular success: after education, still in 95% of kindergartens, the number of dairy products served to children was lower than that recommended in the model food ration. It can therefore be assumed that in order to obtain a significant improvement of the situation on a national scale, precise guidelines should be introduced regarding the minimum size of individual products within a group of dairy products. Increasing the share of these products would not only increase the calcium content in the food ration, but also iodine and vitamin D (although the implementation at the recommended level is very difficult to achieve in this case).

Some concerns are also raised by the observed failure to implement recommendations for iron in more than half of kindergartens, and for potassium in every fourth institution (for the age group of 4-6 year olds). The main food sources of iron include: meat / fish and meat products, eggs (egg yolk), but also cereals and vegetables (including legumes). The currently binding [38], but also the earlier Regulation [39] regulates the participation of these products in a very general way: in main meals there must be products that provide high biological value proteins (e.g. meat products, dairy products or legumes), cereals and vegetables or fruit (the latter should be included in each meal). In this case, there is also no additional information regarding the quality of the above-mentioned products or specific portion sizes. Preliminary studies of warehouse reports indicated a large share of

meat and meat products, which contributes to to high protein content, so corrective actions should focus rather on improving the quality of meat products served, especially cold meats (for example, beef ham cooked in 100g contains twice as much iron than sausages [20]). It is also worth paying attention to the techniques of preparing dishes: in the facilities of inferior meat (e.g. bones, chicken carcasses) it is still quite often used to prepare soup ingredients, which in theory increases the amount of meat per child, but does not contribute to the improvement of value nutritious menu (the prepared decoction is the source of unfavorable purines). The situation could be improved by the more frequent inclusion of eggs, because their number in menus is lower than recommended in the model food ration. Attention should also be paid to legumes (present in a very small amount) and the quality of cereal products (higher share of whole grains and groats). Here, a partial beneficial effect of educational activities was observed: the share of groats, flakes (higher average iron content) significantly increased, while the supply of potatoes, flour and pasta decreased (lower average iron content), the supply of leguminous seeds was significantly increased, but the quantity of eggs did not change.

The dietary source of potassium is primarily vegetables and (to a lesser extent) fruits. At present, kindergartens should plan these products for each meal, however (also in this case) the size of the portion is not specified, as well as the ratio of the number of vegetables to the amount of fruit. Earlier observations indicate that kindergartens to a greater extent followed the recommendations of the model food ration for fruit, while the recommended amount of vegetables was definitely more difficult to achieve. Even before the introduction of the legal regulations in question, the average fruit supply amounted to 227 g / d, and vegetables only 191 g / d. After the introduction of the first Regulation of 2015 defining mandatory ratio of vegetables to fruits as 3 to 2, the share of fruit remained at the same level, however, there was an increase in the supply of vegetables to 201 g / d. Thus, the required quantitative ratio was not implemented in practice. In this case, the educational activities contributed to a significant increase in the number of vegetables served to children (from 164 to 171 g / d), with no change in relation to fruit (however, the share of the latter was higher compared to vegetables). This suggests that educational activities should be directed specifically at increasing the amount of vegetables, not vegetables and fruits in total. In global terms, it would certainly be useful to have detailed regulations regarding the minimum portion size or total vegetable (and possibly fruit) content in the daily menu. However, it should be emphasized that education and / or more effective control methods are also necessary, because over two years of mandatory rules for the obligatory addition of vegetables and / or fruit to each meal, it was still implemented by every second public institution and every third private.

It should be emphasized, however, the effectiveness of legal regulations in relation to the content of sugar and sweets in pre-school food rations. The analysis of warehouse reports collected before introducing any regulations in this respect, indicated a large share of this group of products in children's nutrition (average supply of sugar and confectionery was 42 g / d, and sucrose alone 44 g), with sweets and sweetened beverages commonly served. After adopting the first (more restrictive) Regulation in 2015, the observed average supply of sugar and confectionery was less than 18 g / d, while the content of sucrose alone was 23 g / d. The establishments significantly limited not only the share of sweets, but above all the practice of sweetening beverages. The 2015 regulation prohibited completely the addition of sugar to beverages, allowing only the use of honey. Sugar (cheaper product) was, however, used to sweeten typical beverages by more than 20% of outlets, and this percentage significantly increased after the regulations were relaxed in 2016. Current limitation of added sugar to all types of drinks prepared on-site at the facility (10 g per 250 ml the drink), seems to be a good compromise between the ease of practical use by kindergarten and the effect in terms of the quality of the diet: the average sugar and confectionery content in the analyzed 2310 storage reports was 15 g / d, of which the sugar itself was 9 g. It seems that the facility staff understands the need to limit these products in the children's diet. In the case of kindergartens with a larger initial supply (31 g / d), education effectively reduced it (a decrease of 18%), which was not observed in the establishments more limiting these products (in which the initial supply of sugar and confectionery was below 10 g / d).

On the basis of the observations, it is also possible to confirm the relatively high effectiveness of legal regulations with regard to limiting salt, including by introducing the obligatory use of only low sodium salt [39]. Such salt was introduced by over half of public facilities and nearly 40% of non-public facilities (however, traditional salt was still used before a large percentage of kindergartens). After the abolition of obligatory use of low sodium salt, the widespread use of it decreased significantly; the average sodium content in kindergarten meals (data from 270 kindergartens) was on the level of 2118 mg / d, which gives about 5.3 g of table salt. This is below the general recommendation, however, it should be remembered that general recommendations [15,14] are formulated to a large extent to the adult population, as well as the pre-school policy does not include all-day consumption. The education conducted in this field turned out to be ineffective, hence, in order to reduce the sodium content (table salt) in the pre-school diet, the introduction of appropriate legal regulations should be considered.

At the same time, conducting analyzes in a large group allowed to observe a very large quantitative and qualitative differentiation in the supply of individual product groups, and hence large differences in the level of energy and nutrient content in pre-school menus. This points to the urgent need to develop and implement uniform regulations that ensure adequate nutrition quality in all kindergartens in the country, as well as to include in the above-mentioned studies of two age groups, i.e. 3 and 4-6 year olds due to differences in energy and nutrient requirements resulting from the subject nutritional standards [15].

Hypotheses regarding the impact of pre-school education (public vs. non-public) and the way food is organized (own kitchen vs. catering) for the implementation of nutrition, only partially verified. Premises indicating possible differences in the quality of nutrition between public and non-public kindergartens include significant differences in the amount of the nutritional rate (5.8 vs. 8.3 PLN / child, n = 720 kindergartens, including 529 public and 191 non-public), as well as the nutrition organization: owning a kitchen, using catering or a mixed method. Over 93% of public facilities prepare meals for children themselves, whereas in the case of non-public institutions, this form of nutrition organization was declared by slightly more than half of kindergartens. In the case of using the services of external companies, it was impossible to obtain warehouse reports, and the menus available only generally determined the size of the portions. Therefore, in this case, a quantitative assessment of nutrition was not possible. Whereas the qualitative assessment of selected elements of nutrition indicated some differences; among others in relation to the range of served drinks, sweetening, the type of substance used to sweeten beverages, the use of various types of frying fat and the use of table salt and sodium salt. Interestingly, despite the higher nutritional rate, more expensive products have not always been used more often in non-public kindergartens (eg honey for sweetening or low sodium salt). What's more, the lower percentage of non-public facilities gave vegetables and / or fruit to every meal, and 100% natural juices were also served there. The amount of budget can affect the supply of products on the menu. I observed a significant positive correlation (Pearson's correlation coefficient) for bread, cereals, potatoes, vegetables, fruit, milk and fermented milk beverages, curd cheese, meat, processed meat, eggs. It seems, however, that the amount of the nutritional rate is not the main determinant of the quality of nutrition, because at the same time there was no relationship between the amount of the feeding rate and the supply of fish (more expensive product) (analyzes in 231 public kindergartens with their own kitchen and serving full board). The correctness of nutrition can also be influenced by the employment of properly trained personnel. Most of the examined institutions did not employ a

dietitian (only 17 out of 270 kindergartens), usually the person responsible for feeding children was the authorizing officer. The necessary qualifications for this position are defined by the Act [44] and the relevant Regulation [47]. According to the above the authorizing officer should have secondary education with a general or vocational profile or basic vocational education enabling them to perform tasks at the post, so it does not have to be a person with education in the field of human nutrition and / or dietetics. It seems that in order to identify the causes of irregularities in the performed nutrition, further, in-depth studies, including interviews with staff, are necessary.

In summary, the presented results are unique due to the size of the group being examined, its diversity (state / public and private / non-public institutions), as well as nationwide coverage. The unquestionable strength of the research is a uniform methodology of data collection and analysis (the use of not only menus, but above all warehouse reports from 10 days), as well as an identical educational program conducted with direct methods using uniform materials. However, the limitation may be that the group can not be treated as being representative for all kindergartens in Poland due to the way of recruitment (voluntary application for participation in the project).

## C.5. Conclusions

The research carried out and the results discussed in the achievement, regarding the assessment of the impact of nutritional education and legal regulations on the quality of nutrition in pre-school education centers in Poland, significantly contribute to the knowledge in this field. They allowed to formulate the following conclusions:

— menus offered in pre-school education establishments largely met the recommendations regarding the content of nutrients, in particular dietary fiber, selected vitamins and minerals. However, there were areas for improvement, especially in terms of increasing levels of calcium, iron, iodine, potassium, vitamin D, as well as optimizing the level of energy and the proportion of energy from macronutrients. Observed irregularities, particularly low calcium content, high share of energy from protein, total fat and saturated fatty acids, may increase the risk of disturbances in the nutritional status as well as diet-related diseases at a later age.

— low share of milk, fermented milk beverages and curd and vegetables in kindergarten menus, as well as the popular sweetening of beverages, is not conducive to shaping the correct eating habits of children

— observed large differences in the level of energy and nutrients in individual kindergartens suggest the need to introduce uniform standards of child nutrition in facilities, as well as the employment of suitably qualified staff (dietitian, nutrition specialist) to plan nutrition and assess the correctness of its implementation

— while planning the kindergarten's diets one should take into account the differences in the energy and nutrient requirements of children in the 3. and 4-6 year of life

— ration (food standard) can be a practical tool facilitating the planning of balanced menus in mass catering for children

— education of personnel carried out by direct methods has a positive effect on selected indicators of nutrition quality in pre-school education institutions, however its effectiveness is not fully satisfactory. The effectiveness of educational activities may be limited by factors related to the functioning of the facility, i.e.: the type of facility, way of organizing nutrition in kindergarten, the nutrition rate or the usual way of feeding provided by the institution. It would be advisable to conduct further research in order to identify factors limiting the effectiveness of educational activities

— to improve the quality of nutrition in pre-school institutions, mandatory food standards should be introduced, i.e. food rations covering product groups, along with their number to be implemented in a pre-school education center offering full-board children's meals. Mentioned above food rations should be adapted to the specificity of nutrition in pre-school institutions, i.e. cover the energy and nutrients needs of children in a given age group at the level of 70-75%

— in order to ensure equal chances for proper implementation of nutrition in pre-school institutions, the introduction of a minimum feeding rate per child should be considered

— legal regulations can be an effective tool for introducing changes in the way of feeding in kindergartens in a short time. To this end, the relevant legal provisions must be clearly formulated and realistic. The introduction of obligatory provisions regarding nutrition should be accompanied by an appropriate educational campaign directed to institutions implementing children's nutrition.

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## IV. DISCUSSION OF OTHER SCIENTIFIC AND RESEARCH ACHIEVEMENTS

I graduated from the Faculty of Human Nutrition and Consumption Sciences at the Warsaw University of Life Sciences in 1998 with a very good grade, on the basis of a very good master's exam and an equally evaluated master's thesis: *The influence of feeding frequency on protein status and immune response,* obtaining a master's degree in engineering. The master's thesis was of an experimental nature, the basis for its writing was biological experience conducted on Wistar rats. I carried out the experimental part of the work under the supervision of Dr. V. Schreurs as part of a 4-month scholarship obtained at the Wageningen Institute of Animal Sciences, (Wageningen University, The Netherlands) (Appendix No. 3; III.L.1).

After completing my master's studies I worked as a food technologist in the Food and Dietary Supplement Department at The National Food and Nutrition Institute in Warsaw, where I was involved in the preparation of opinions on products marketed for the Chief Sanitary Inspector for the purposes of issuing the relevant production permits, placing on the market and importing from of foreign foodstuffs, in accordance with the Regulation of the Minister of Health and Social Welfare of December 17, 1973. Working in a team of dr Iwona Traczyk enabled me to deepen my knowledge of the legal conditions for the introduction and marketing of food products in Poland.

In the years 1999-2004 I started doctoral studies at the Faculty of Human Nutrition and Consumption Sciences at WULS in Warsaw, during which my scientific interests focused on various factors (including eating frequency: 2 vs. 4 vs. 6, protein administration vs free amino acids, feeding vegetable protein vs. animal protein) that affect the use of protein from the diet, both in humans and animal models.

During my doctoral studies, I continued my cooperation with the Wageningen Institute of Animal Sciences, (Wageningen University, The Netherlands) as part of three scholarships awarded by the European Commission Research Directorates General Marie Curie Host Fellowships (Appendix No. 3; III.L.2, III.L.3 , III.L.4). Thanks to cooperation in the above I had the opportunity to get acquainted with the research methods using isotope-labeled amino acids, breath tests as well as the possibility of respirometric measurements in animals. As part of the tests using the breath test, I observed that postprandial oxidation of [1-13C] leucine and [1-13C] methionine added in the same amount to test meals in a free form and embedded in the protein proceeds in a different way. I presented the results

of my research at national conferences (Appendix No 3, III.B.25, III.B.61, III.B.62) and foreign (Appendix No. 3, III.B.1), as well as I published in peer-reviewed conference materials (Annex 3, III.B.20, III.B.21) and papers (Appendix 3, II.A.5, II.D.2, II.D.3, II.D.4, II .D.12, II.D.67, II.D.68).

The results of research on the use of protein by growing rats (females) were used to prepare a doctoral dissertation entitled The influence of the amount and size of meals on the use of protein by growing rats, promoted by prof. dr hab. Janusz Keller. After public defense (rated as distinctive), in 2005 I obtained a PhD in agricultural sciences in the discipline of food and nutrition technology. In the same year, I started working at the Department of Nutrition at the Department of Nutrition at the Faculty of Nutrition and Consumption of the Warsaw University of Life Sciences, initially as an assistant, and since 2006 as an adjunct.

My research work is related to the analysis of nutritional status and diet, in which I use various methods, diet-based treatment and diet therapy of diet-related diseases, and research on the impact of diet modification on selected health parameters.

Among my scientific and research interests, one can distinguish the following thematic groups (numbering of publications according to Appendix 3, points II.A., II.D., II.E.):

A.1. Evaluation of the correctness of nutrition and implementation of dietary recommendations in various disease (publications no: *II.A.1, II.D.5, II.D.6, II.D.8, II.D.17, II.D.18, II.D.22, II.D.26, II.D.27, II.D.28, II.D.29, II.D.30, II.D.32, II.D.33, II.D.35, II.D.37, II.D.38, II.D.39, II.D.40, II.D.43, II.D.45, II.D.48, II.D.55, II.D.69, II.D.70, II.D.73, II.D.76, II.D.77, II.D.78)*

A.2. Nutritional value and economic aspects of therapeutic diets based on specialized products (publications no: *II.D.21, II.D.52, II.D.61)*

A.3. Analysis of the diet of different population groups in the aspect of prevention of diet-related diseases (publications no: *II.A.4, II.D.1, II.D.7, II.D.13, II.D.14, II.D.15, II.D.16, II.D.19, II.D.20, II.D.25, II.D.31, II.D.33, II.D.34, II.D.36, II.D.41, II.D.44, II.D.47, II.D.50, II.D.51, II.D.53, II.D.54, II.D.57, II.D.58, II.D.60, II.D.72, II.D.74)*

A.4. Body composition assessment and estimation of energy expenditure in dietetic practice (publications no: *II.D.23, II.D.24, II.D.27)*

A.5. Assessment of the correctness of the implementation of nutrition standards in care and educational institutions (publications no: *II.D.10, II.D.56, II.D.59, II.D.80, II.E.1)*

A.6. The role of education and the impact of the level of nutritional knowledge on selected aspects of diet (publications no: *II.D.9, II.D.11, II.D.42, II.D.46, II.D.48, II.D.56, II.D.59, II.D.63, II.D.75, II.D.79, II.D.80, III.B.18)*

A.7. The effect of restrictive nutrition on selected physiological parameters in model studies (publications no: *II.A.2, II.A.3; conferences presentations and posters: III.B.41, III.B.42, III.B.46, III.B.47, III.B.82, III.B.83, III.B.84)*

## A. Overview of scientific interests in thematic groups

### A.1. Evaluation of the correctness of nutrition and implementation of dietary recommendations in various disease

In the field of my scientific interests, which has been evolving since the beginning of employment at the Department of Nutrition, is the analysis of patients' nutrition in the context of implementing dietary recommendations in various disease entities requiring appropriate dietotherapy [publications: II.A.1, II.D.5, II.D.6 , II.D.8, II.D.17, II.D.18, II.D.22, II.D.26, II.D.27, II.D.28, II.D.29, II .D.30, II.D.32, II.D.33, II.D.35, II.D.37, II.D.38, II.D.39, II.D.40, II.D .43, II.D.45, II.D.48, II.D.55, II.D.69, II.D.70, II.D.73, II.D.76, II.D.77 , II.D.78].

My interests in the initial stage of this trend concerned patients with renal failure in various stages of the disease [II.D.18, II.D.21, II.D.22, II.D.32, II.D.38]. The goals of therapy in chronic kidney disease are: reduction of uremic symptoms, delaying the need to start renal replacement therapy and improving the quality of life, to achieve what is necessary to use the right diet along with other elements of therapy [2]. The most important elements of dietotherapy include adequate protein supply, which on the one hand is aimed at suppressing the progression of kidney disease and, on the other hand, maintaining the proper nutritional status, with an adequate supply of minerals as well [8, 7].

That is why in my research I analyzed the nephrological patients' intake with particular emphasis on the energy supply and macronutrients [II.D.21, II.D.22, II.D.32, II.D.38], mineral components [II.D .18, II.D.21, II.D.32], as well as analyzed the impact of nutritional education on the progression of kidney disease [II.D.21] and the impact of the rhythm and time of dialysis on the intake of selected nutrients [II.D.22 ]. As part of my research, I found, among others that patients consumed a diet with too low energy value and an abnormal profile of fatty acids [II.D.38], but the supply of protein and phosphorus was in accordance with the recommendations [II.D.38]. The low caloric value of the diet

on one hand favored a low supply of protein [II.D.38], but on the other hand it resulted in the lack of coverage of the demand for minerals [II.D.18].

The reason for this condition was the occasional use of low-protein products by nephrological patients. In the group of 200 patients treated conservatively, only 10% used this type of specialized products [II.D.21], which resulted in a significant reduction (or even exclusion) from the food ration of meat, fish, poultry and milk and its products, in favor of cereal products, vegetables and fruit. Nutritional errors of patients were also transferred to the period of dialysis (hemodialysis), although in this case the quality of the diet improved in terms of energy level, protein, potassium and magnesium content with the time of this form of therapy [II.D.32]. An interesting issue is the influence of rhythm (dialysis day) and pores (start time) of the dialysis treatment on the intake of selected nutrients (energy, protein, fat, carbohydrates, potassium and phosphorus) by patients with end stage renal disease [II.D.22 ]. In this case, dialysis did not significantly change the energy value and content of essential nutrients in the daily food rations of the subjects compared to the level of these components on the day without hemodialysis, while the time of hemodialysis significantly affected energy, carbohydrates and fat content in the daily food intake of the subjects [III.B.28]. A practical conclusion from these studies may be a recommendation to introduce rotation in a shift system, which would have a beneficial effect on the diet of patients on dialysis in the longer term [III.B.28]. The research conducted simultaneously indicates the benefits of nutritional education of nephrological patients: after 8 years of participation in nutritional education, 36% of patients were still treated conservatively [II.D.38].

In my research I also assessed the implementation of dietary recommendations by patients with diseases of the cardiovascular system: ischemic heart disease and hypertension [II.D.37, II.D.43, II.D.48, II.D.5, II .D.77, II.D.78, II.A.1]. In the group of 210 men I observed, among others inadequate consumption of milk and dairy products (67% of men aged up to 60 and 46% of men over 60 years fulfilling the recommendation of a model diet with a controlled amount of fat [38] at <50%), incorrect structure of fat intake (low share vegetable fats), as well as low fish consumption in the group of elderly patients [II.D.37]. I have shown that various factors may influence the implementation of dietary recommendations by patients, including age [II.D.37], duration of illness, place of residence, economic status, going through surgery, but also personality traits - especially openness to experience [II.D.5].

In my research I also paid attention to non-pharmacological methods of therapeutic treatment, i.e. phytotherapy [II.D.77]. Phytotherapy has proven efficacy in the prevention

of cardiovascular disease [21], however, vegetable raw materials should be used carefully, at the appropriate dose and in accordance with the doctor's recommendations [53], including due to possible drug interactions [21]. In the analyzed group, 74 people with cardiovascular disease between the ages of 40 and 87 years, dietary supplements (magnesium, potassium, and fish oil preparations) were used by 30% of patients, and 43% declared the use of herbs (most often herbal mixtures). As a source of knowledge about the used herbs, friends and / or family were most often indicated, and only 31% of patients consulted their consumption with the attending physician [II.D.77]. Lifestyle modification, including adherence to dietary recommendations, is an indispensable element of therapy, and at the same time the cheapest and safe method for patients [32]. My observations indicate insufficient knowledge in this regard among patients: knowledge of non-pharmacological methods of treatment of hypertension was declared by 75% of respondents, but only 63% of patients claimed that they received such recommendations [II.D.48]. The use of dietary modifications in practice was declared by only 15% of patients; the low-calorie diet was the most frequently used one, and none of the patients used the DASH diet, which indicates insufficient knowledge about hypo- and hypertensive products / ingredients [II.D.48]. My observations proved that nutritional education carried out by a dietician can contribute to beneficial changes in the diet of patients with cardiovascular diseases [II.D.78].

As part of the research carried out with the Department of Nutrition and the implemented grant [N 312 014 31/1330, 2006-2009], I also participated in the assessment of the diet and nutritional status of patients with dyspepsia and / or Helicobacter pylori infected [II.D.8, II .D.29, II.D.17, II.D.26]. The incidence of Helicobacter pyloric infection diagnosed using a urease respiratory test was 23% [II.D.17] in a group of randomly drawn 322 WULS students, and 35.8% in a group of 148 patients of 2 Warsaw gastroenterological counseling centers with dyspepsia [II.D.8 ]. The results of research on the diet of patients with dyspepsia were presented at the international dietary conference [III.B.2, III.B.3].

In my research I also analyzed the nutrition and nutritional status of girls and young women suffering from anorexia nervosa [II.D.27], women with polycystic ovary syndrome [II.D.69], patients with celiac disease [II.D.6] and people addicted to alcohol who take part in addiction therapy [II.D.45, II.D.70, II.D.55]. In all of the above disease units, proper dietary management played an important role in the therapeutic process. The effectiveness of diet therapy conducted by a qualified dietitian was proved in the case of people with excessive body mass [II.D.30, II.D.76].

Taking into account the conclusions of the above mentioned research, concerning incorrect nutritional behaviors of patients, which may partly result from lack of knowledge or the ability to put into practice recommendations by medical personnel, I participated in preparation of studies aimed at presenting current dietary knowledge for people professionally involved in dietetics and in contact with patients [II.D.33, II.D.35, II.D.73, II.D.7, II.D.1, II.D.34, II.D.51]. I participated in the preparation of an academic book used in the subject of Dietoterapia [III.I.1, III.I.2], standards of dietary management in obesity [III.I.48] and diabetes [III.I.49], as well as publications regarding dietary recommendations for patients with gastrointestinal diseases [II.D.39, II.D.40] and kidneys [II.D.28, III.I.50, III.I.52, III.I.58], which have been published in diet and medical journals.

### A.2. Nutritional value and economic aspects of therapeutic diets based on specialized products

In some disease (e.g. celiac disease or allergies / food hypersensitivity), the diet is the basic and often the only form of treatment. In others, such as chronic renal failure or pancreatic diseases, adherence to appropriate dietary recommendations is a necessary complement to pharmacological treatment in medical treatment. The necessity of strict adherence to dietary recommendations, including elimination diets, may be connected with the impossibility or lack of possibility to obtain a balanced diet with traditional, widely available food products. In this case, it is necessary to use specialized products in dietotherapy, previously referred to as products for special nutritional or medical use. Specialty products can also be used in nutrition of population groups with special nutritional requirements, e.g. infants. Due to the previous interest in nephrological diseases and celiac disease, I paid special attention to the nutritional value and economic costs of diets used in these disease entities.

For people suffering from celiac disease, a gluten-free diet is the only method of treatment and must be continued throughout the patient's entire life. The elimination of gluten from the diet requires the replacement of all food products containing 3 typical European cereals (wheat, barley, rye) with their gluten-free counterparts produced from raw materials not containing gluten or those from which gluten has been removed by technological means [16] . Despite the high availability of specialized gluten-free products replacing traditional bread, flour, pasta, confectionery, pastry, etc., as well as naturally gluten-free products, my previous research indicates the existing problems in both compliance and balancing a gluten-free diet [II.D.6] . Among the arguments explaining deviations from dietary recommendations, the authors state the issue of higher costs of

such a diet compared to the basic / customary diet [36], however, there is no such data for Poland. On the other hand, the problem of proper balancing of a gluten-free diet is perceived in a lower nutritional value of specialized gluten-free products [39].

In my work, I evaluated the content of selected nutrients in a full-day model food ration at 2000 kcal [38] and estimated the cost of gluten-free diet at 2000 kcal using natural gluten-free products and specialist gluten-free food on the Polish market in relation to the isocaloric diet [ II.D.52]. I developed the model food ration based on the guidelines of Turlejska et al. [41], and then modified it for the conversion of cereal products into naturally gluten-free products and gluten-free foodstuffs in accordance with the assumptions of a gluten-free diet; I estimated the nutritional value on the basis of the Table of composition and nutritional value of food [20]. I made analyzes of the costs of food rations based on price lists of companies offering gluten-free products on the Polish market and the average prices of food products from Warsaw supermarkets from April 2013. I have shown that with a similar amount of energy and total carbohydrates, gluten-free replacements of cereal products contribute to the ration significantly less nutritional value in relation to protein (more than twice less), iron (47% of the amount supplied with products containing gluten), zinc (38%) , magnesium (60%), thiamine (45%) and dietary fiber (34%) with a more than 40% fat content. At the same time, the cost of a gluten-free food ration, assuming the conversion of only traditional cereal products, increased by almost 30%. In the case of using non-standard substitutes of gluten-type sorghum, tapioca or quinoa, the cost of such a reason increased even more because of their high price. The real cost of a gluten-free diet is even higher, because patients because of the common addition of gluten to many products (such as cold meats), often have to choose their more expensive, specially marked types. Conversion of traditional products to their gluten-free counterparts results in a significant reduction in the nutritional value of the diet while increasing its economic costs, which may be useful information for dieters who advise patients on a gluten-free diet and those who use it.

As in the case of celiac disease, diet, in addition to pharmacological treatment, is one of the main components of the therapeutic process in the treatment of chronic kidney disease [29]. Patients with chronic renal failure with a glomerular filtration rate (GFR) below 40 ml / min / 1.73 m 2 are advised to have a low protein diet [7,29]. This means the need to control the consumption of products such as milk, dairy products, meat and meat products, fish, poultry, eggs and cereals. Dietary restrictions are all the greater, the lower the GFR value, and this type of diet requires a lot of nutritional discipline on the part of the patient and increased financial expenses [55]. In my work, I attempted to estimate the

cost of low-protein diet for patients using low-protein products available on the Polish market [II.D.21]. The composition of the model food ration for a low-protein diet was developed on the basis of training materials for patients [27] and compared with the food ration of standard protein content [41]. I made analyzes of the costs of food rations based on price lists of companies offering low-protein products on the Polish market and average prices of food products from Warsaw supermarkets. As an example, I chose a food ration with an energy value of 2,300 kcal due to the highest percentage of patients with such energy supply in diet [II.D.21]. Based on the analysis, I found that in comparison to the cost of a daily ration of reduced protein content, taking into account industrially produced low-protein products, and a model food ration with standard protein supply, the price of low-protein reason was not higher. It resulted from the structure of a low protein food ration, in which relatively more expensive meat and milk products are restricted (e.g. cheeses). The mere replacement of standard bread with low-protein bread increased the cost of the diet, while composing the rations according to specific dietary recommendations [27] did not cause such an effect. The use of specialized products (low-protein) does not necessarily lead to an increase in the cost of such a diet, however, it is necessary to strictly comply with nutritional recommendations, i.e. modification of the participation of individual product groups in the food ration (including reducing the share of milk and its products, meat and meat) preparations and increasing the share of fats), which is possible in the case of close cooperation with a dietician.

Population groups with special dietary requirements include infants. Raw food products used for preparing meals for infants should be characterized by high nutritional value, quality, as well as be safe in terms of the content of impurities. Pollutants in food can pose a serious health risk to infants and young children, whose process of their removal is generally slower than in the case of adults, as well as they have a lower body mass. Toxic metals (lead, cadmium) which are characterized by high accumulation factor in living organisms are of particular importance in this aspect [52]. In infant nutrition, ready-made foods intended for this age group may be used [35]. These products are characterized by a high degree of safety in terms of health quality, they show high microbiological purity and limited to levels of safe content of substances adverse to health (for example, pesticide residues, harmful metals, nitrates and nitrites) [46]. However, the price of such products is usually higher than that of traditional food, which may limit their use by parents and carers.

Therefore, the purpose of my research was to analyze the costs of a diet based on specialty products compared to a diet prepared on the basis of natural raw materials [II.D.61]. Based on the guidelines for infant nutrition [37], I developed a model menu for an infant aged 9 months including 4-5 meals, including 3 dairy meals. In the developed menu I used products available on the market, i.e.: following milk formula, cereal cereals, soup dishes with meat addition, fruit mousses and biscuits for babies of popular brands (Gerber, Nutricia, Hipp, Nestle). The cost of such a daily meal based on average prices from Warsaw supermarkets amounted to PLN 11.68. Then, based on the raw material composition of used baby products, I have developed analogue recipes using natural products / raw materials, in the case of continuation of natural feeding in the cost analysis, I omitted the position of modified milk. In this case, the average cost of meals amounted to 2.38 PLN / day. If the cost of 2 servings of modified milk is included, it increased by approximately PLN 2.54. Although the real cost of "traditional" nutrition after considering the cost of working time and costs of energy and water is higher, the use of specialized products causes a significant increase in child nutrition costs, which may be a factor limiting the popularity of their use, especially among people with worse economic conditions [ II.D.61].

In the area related to the properties of food / specialized products (for special nutritional purposes) I participated in the determination of the glycemic index of innovative cereal products, aimed among others to people with carbohydrate disturbances. I analyzed the impact of the above of products on postprandial glycemia levels in adults [II.D.62].

### A.3. Analysis of the diet of different population groups in the aspect of prevention of diet-related diseases

Monitoring the energy and nutrients intake is an important aspect of prevention of diet-related diseases and serves to formulate nutritional recommendations. Therefore, an important topic of the conducted research was the evaluation of the diet of various population groups: children [publications: II.D.16, II.D.25, II.D.54, II.D.60, II.D.72, II.D .74], youth and young adults [publications: II.D.15, II.D.19, II.D.41, II.D.44, II.D.53, II.D.49], women in reproductive age [publications: II.A.4, II.D.20, II.D.31, II.D.36, II.D.50, II.D.57, II.D.58], pregnant [ publications: II.D.47, II.D.46] and older people [publications: II.D.13, II.D.14, II.D.20].

In the face of the growing epidemic of metabolic civilization diseases, the basis of which is m.in. improper nutrition, an important aspect of pro-health activities is early prevention.

A special case in this respect are children born with low birth weight. Barker et al. [3,4] observed a relationship between birth weight and cardiovascular diseases. Low birth weight significantly increased the incidence of deaths due to cardiovascular diseases in men, as well as increased the risk of hypertension, elevated cholesterol and intolerance of glucose in adulthood [5]. Nutrition of this specific group of children should not only ensure their proper psychophysical development, but also meet the recommendations of the primary prevention of cardiovascular diseases. That is why I focused on the assessment of the energy and nutritional value of the diet of children born with low birth weight in the first year of life [II.D.25] and before puberty [II.D.16], with particular emphasis on nutrition factors related to the prophylaxis of cardiovascular disease cular. In my research, I showed that the diet of the studied group of children was unsatisfactory, especially with reference to norms and recommendations for the calendar age; observed, among others too short breastfeeding and premature introduction of supplementary food [II.D.25], and later, high consumption of saturated fatty acids, sucrose and sodium, and low levels of antioxidant vitamins, especially with regard to the recommendations for the calendar age [II.D.16] . The presented abnormalities may in the future lead to disorders in the state of health, including cardiovascular diseases, therefore in this population group it would be reasonable to introduce dietary counseling and nutritional education.

Referring to the above studies, I also analyzed the way of feeding children in pre-school age, especially in terms of nutritional behaviors that promote obesity [II.D.54, II.D.60, II.D.72, II.D.74]. In this population group, I observed the occurrence of numerous irregularities, such as: repeatability of meals at home and kindergarten, consumption of sweets in the form of snacks and sweetening of meals prepared for children by parents [II.D.74]. Nearly 90% of all children did not follow the recommended daily intake of vegetables, over 30% - fruit [II.D.54]. Frequent eating behavior was eating between meals, and sweets were consumed in more than half of cases [II.D.60]. In this case, the mother's education was important: women with higher education significantly more often gave their children fruit. Although dietary recommendations clearly indicate water as the most recommended drink, children often received juices and beverages containing sugars added or so-called. free sugars [II.D.72], which may increase energy intake and, consequently, increase the risk of excessive body weight and tooth decay.

Eating habits created in childhood often go back to a later age. At the same time, adolescents and young adults are particularly vulnerable to inadequate nutrition due to high mental and physical activity and the final phase of the anabolic period. During adolescence, on the one hand, eating habits from childhood are consolidated, and on the

other hand, it is a period of strong influence of peers, "fashions" or nutritional novelties promoted in the media. There is a close relationship between nutrition and development and immunity of the organism, as well as the occurrence of many civilization diseases, eg hypertension, neoplastic diseases, and musculoskeletal disorders [49]. The nutritional errors observed in this population group, such as inadequate calcium intake [II.D.15, II.D.41], potassium [II.D.41], magnesium [II.D.41], iron [II .D.15], high sodium intake [II.D.15] and inadequate intake of vegetables and fruits [II.D.19] may increase the risk of diet-related diseases in a later period. The reason for this may be the insufficient level of knowledge of young adults about dietary risk factors for diet-related diseases, which I observed in the case of high school students in relation to cardiovascular diseases [II.D.49]. Young people and young adults more often opt for an alternative diet, such as veganism. Vegan diet is associated with numerous health benefits, including lower risk of cardiovascular diseases or type II diabetes, however, it requires greater nutritional knowledge for proper balancing [9]. In the group of young adult vegans examined by me, I found insufficient intake of calcium, zinc, vitamin B12 and D [II.D.53].

In my research I paid a lot of attention to the analysis of the diet of women in procreative age and pregnant women [II.A.4, II.D.31, II.D.36, II.D.47, II.D.50, II .D.57, II.D.58]. I assessed the quality of women's diet in terms of the number of meals, the share of dairy products, vegetables and fruits [II.D.20, II.D.36, II.D.58], whole grain cereal products [II.D.36], sweets and beverages carbonated and alcoholic, "instant" and "fast food" products [II.D.36], as well as in terms of the quantitative implementation of nutritional norms and recommendations [II.D.58]. My observations confirm the occurrence of irregularities signaled in relation to the nutrition of adolescents and young adults. In this population group, I also analyzed the consumption of flavonoids [II.A.4], lycopene, lutein and zeaxanthin [II.D.50], mono- and disaccharides [II.D.57] and caffeine and theobromine [III.B.101 ].

The last population group in the area of my interests are the elderly. This age group has special dietary requirements due to the higher risk of malnutrition related to age, but also to the need for prophylaxis and / or therapy of various types of diseases, including diet-related diseases (women at this age are particularly vulnerable to the occurrence of osteoporosis) [50]. In this population group, I analyzed the nutritional value of the diet [II.D.13, II.D.14, II.D.20], consumption of selected product groups [II.D.20], as well as factors that may affect the way of nutrition [II .D.13]. Although the diet of women living in Warsaw over the past several decades has indicated some beneficial changes in eating behavior in relation to the number and quality of meals included in the daily food ration,

improvement in the general order of menus, reduction of energy from fats, it is still noticeable low calcium content [II.D.20], as well as an unfavorable calcium to phosphorus ratio [II.D.13]. I also observed that loneliness and bad economic situation is a risk factor for food shortages [II.D.13]. At the same time, the recommendation to reduce the consumption of meat and its products (often occurring in too much) in favor of an increase in the supply of vegetables and fruit and milk products would improve the diet of women without increasing financial outlays.

The results of the research clearly indicate the need to intensify preventive activities, including actions to increase physical activity and promote healthy eating habits in every age and population group. To improve the health of Polish society in the future, the scope of nutritional education should be increased both among children, adolescents, as well as adults and seniors. The obtained results, in addition to the need for further monitoring, also indicate the need to promote the principles of healthy nutrition in order to reduce the risk of developing diet-related diseases in Poland. In this area I try to actively promote knowledge about proper nutrition through involvement in educational programs, including: Swiss-Polish Cooperation Program (SPPW), Project No. KIK-34 "Prevention of overweight and obesity and chronic diseases through public education in the field of nutrition and physical activity ", Wise Nutrition - healthy generation, ABC Healthy Eating, Healthy eating, healthy growing, Yellow plate, Health Wizard (under the health program" National program for counteracting civilization diseases "Module I" Program to prevent overweight and obesity and chronic non-infectious diseases by improving nutrition and physical activity of POL-HEALTH for 2012-2014), Lower cholesterol with taste, Keep Balance.

### A.4. Body composition assessment and estimation of energy expenditure in dietetic practice

One of the basic problems in dietary practice is the correct estimation of the patient's energy needs [56]. It should take into account: basic energy expenses, food-induced thermogenesis (about 5-10% of total energy expenditure) and energy expenses related to physical activity, which in a non-trainer account for an average of 15 to 30% of total energy expenditure [33]. The value of basic energy expenditure of an organism depends on: genetic factors, hormonal factors (including mainly thyroid hormone metabolism), sex, previous or existing diseases, medications (e.g. glucocorticoids or other hormonal drugs), nutritional status and type of character, or mental state. Both basic and physical expenditure related to energy expenditure depend on body weight, including fat content and muscle mass [33.1]. The use of generally accepted resting formulas, or basic energy

expenses, as well as commonly used physical activity coefficients, may give values differing from actual energy expenditure not only in people with excessive body weight, but also in those with normal or too low [56]. For this reason, my research included the possibility of using instrumental methods for the assessment of energy demand (indirect calorimetry) and body composition, as well as the reference of measurement results to commonly used designs [publications: II.D.23, II.D.24].

The patient's energy demand / expenditure can be examined by many methods, but non-invasive techniques are particularly valuable, including indirect calorimetry (IC), which, however, requires specialized equipment. From the point of view of working with a patient in a diet counseling, methods that are quick and easy to use are particularly desirable. Due to the above, I focused on the comparison of specialist methods of resting metabolic measurement with commonly used mathematical formulas [II.D.23]. In the group of 42 young women, I performed measurements of resting metabolism by means of indirect calorimetry, consisting in the respiratory determination of the volume of oxygen consumed and the separated carbon dioxide per unit of time (60 min). The measurements were made in the respiration chamber of the Nutrition Department of the Faculty of Human Nutrition and SGGW Consumption. I determined energy expenditure on the basis of the Weir formula [45]. Then I compared the mean values of resting metabolic rate with the average values estimated on the basis of selected mathematical formulas: Harris-Benedict [13], Owen [30], Mifflin-St Jeor [26], WHO [54] and Bernstein [6]. I observed significant differences in the resting values of metabolism estimated on the basis of the formulas compared to the value measured experimentally (the latter was significantly higher). The most similar average in relation to the obtained by measuring method (underestimation at the level of ~ 6%), I noted using the Harris-Benedict formula [13], and the greatest differences were observed using the Bernstein formula [6]. In the case of young women, the Harris-Benedict formula can be useful for a quick estimation of the level of resting metabolism in the absence of the possibility of measurement [II.D.23]. In practice, I used the instrumental methods of researching energy expenditure, among others for estimating the actual energy demand of patients with excessive body mass [II.D.30, II.D.76].

In practice, the most commonly used indicator of nutritional status is the body mass index (BMI, kg / m2). BMI has one of the highest correlation coefficients with values obtained in experimental measurements and can be used in population studies [51], however, it does not give information about the real level of body fat, especially in people with BMI below 30 [22]. The percentage of adipose tissue can be easily estimated on the basis of

appropriate mathematical formulas, which, however, may be subject to error. Therefore, the aim of my research was to determine the body composition of young adult women using instrumental methods, and then to compare the obtained results of adipose tissue content with the values calculated on the basis of selected mathematical formulas [II.D.24]. In a group of 65 women, I made body composition measurements using the bioimpedance method (Akern-RLJ BIA 101 / s), then I calculated the fat content according to the formulas by Deurenberg et al. [10, 11], Gallaghera et al. [12] for each subject. Jackson-Pollock [15]. Based on my research, I found that the percentage of adipose tissue estimated in the available group of women on the basis of available mathematical equations did not differ significantly from the values determined by the bioimpedance method. However, in the case of people with excessive body mass, I observed a tendency to lower the fat content calculated on the basis of mathematical formulas as compared to the experimentally determined value. In working conditions in the diet counseling center, especially in the case of patients with excess or deficiency in body weight, for a reliable assessment of the nutritional status, it is beneficial to perform the assessment of the body composition by the instrumental method [II.D.24, II.D.27, II.D.30, II.D.76].

### A.5. Assessment of the correctness of the implementation of nutrition standards in care and educational institutions

In my scientific work I paid particular attention to the assessment of the implementation of nutrition in care and educational institutions [II.D.10, II.D.56, II.D.59, II.D.80]

Proper nutrition at the beginning of a child's life has a decisive impact on health and its development. For many children, a nursery (and later a kindergarten) is a place where they spend the greater part of the day (up to 10 hours) and consume most meals (up to 75% of all day energy and nutrient needs). Proper implementation of nutrition in care and educational institutions to a large extent shapes pro-health habits and dietary preferences, it also has an educational element by developing cognitive skills of a small child [46,34]. According to art. 22, the amended act on care for children up to 3 years old, in force since 1 January 2018 (Journal of Laws of 2017, item 1428), nurseries are obliged to provide children with full-fledged meals: appropriate in terms of the share of all ingredients nutrients, in accordance with current nutrition standards [42].

My research on the nutrition quality in nurseries has shown many irregularities in this area. Analyzes of decade menus in 8 randomly selected nurseries from Warsaw indicated too low supply of calcium (average content of 397 ± 37 mg / d), iron (average content of

4.8 ± 0.3 mg / d) and iodine (average content of 46, 9 ± 14.3 μg / d). Particularly worrying was the low calcium content - none of the examined facilities performed recommendations for this component [II.D.80]. Analyzes of decade menus from 7 public crèches from Poznań (half of this type of outlets in the city) confirmed the low supply of calcium (average content 420.9 ± 46.2 mg / d) in menus, as well as problems in balancing the diet in terms of iron content ( mean content 4.3 ± 0.4 mg / d) and vitamin D (mean content 1.3 ± 0.4 μg / d) [II.D.59]. Adequate supply of energy and nutrients is ensured by the implementation of quantitative recommendations of the food ration (MFR) for the appropriate age group [48]. In the next study I focused on the assessment of the supply of individual product groups and compliance with the MFR recommendations in 35 nurseries from Warsaw and other large Polish cities [II.D.56]. I showed that the MFR recommendations were implemented at a minimum level of 70% for potatoes, vegetables, fruit, curd and cheese as well as fish. Too low average supply was recorded in the case of flour and pasta, groats, rice and cereals, milk and milk fermented beverages and vegetable fats. On the other hand, the share of bread, meat, poultry and meat products, fat of animal origin as well as sugar and confectionery was too high in relation to MFR [II.D.56]. The low implementation of MFR recommendations for milk and dairy fermented products was also observed in nurseries from Poznań [II.D.80], where none of the outlets gave children the recommended amounts of these products. The low share of milk and dairy products in children's diets results in insufficient amount of calcium, which was observed in our own research [II.D.80, II.D.59], as well as other authors [47]. It should be emphasized, however, that most of the outlets implemented recommendations for serving fresh vegetables and fruits, as well as in most outlets children had permanent access to water [II.D.10]. Interestingly, my observations in 128 nurseries from different regions of Poland indicate that the significantly higher rate of nutrition in non-public institutions (9,35 ± 2,62 PLN vs. 5,28 ± 1,25 PLN in public) did not guarantee a better implementation of the recommendations. nutritional, especially in the aspect of serving wholegrain products or the presence of vegetables and / or fruits in every meal [II.D.10]. In feeding infants and young children, it is recommended to use special modified milk for the given age group, as well as they may still be breastfed. In this respect there are no specific provisions regulating such situations in institutions. Therefore, I undertook a topic concerning the type of milk or milk substitutes used for feeding children in 211 nurseries in Poland. The manuscript Fri What Type of Milk and / or its Substitutes Are Given to Children (6-36 Months) in Nurseries in Poland? Data from the Research and Education Project "Eating Healthy, Growing Healthy" (Harton A., Myszkowska-Ryciak J.) is currently at the stage of reviewing the journal from the JCR list.

As part of my research work, I also participated in a study on the organization of nutrition in junior high schools, carried out at the request of the City Hall of St. Warsaw as part of the "I know what I eat" campaign. As part of the project, in 2013, selected aspects of the nutrition organization were analyzed in 114 public Warsaw gymnasiums. It was shown, among others a large percentage of outlets using external services (catering), which makes it difficult to control the quality of meals, as well as adversely affects their price. In 42% of schools, there were vending machines available to buy drinks and / or sweets, and the range of school shops was in most cases only in oral form. The reported problem in schools was also too short breaks (breakfast and lunch). Based on the results of the research, among others, minimum length of breakfast break (15 minutes), lunch (over 25 minutes) and the introduction of a unified policy on meal prices in schools, which could encourage teenagers to eat school canteens [II.E.1].

My research indicates a further need to modify the quality of nutrition in care and educational and educational institutions, which can be significantly influenced by the introduction of specific (detailed and practical) regulations, as well as nutritional education of personnel in these institutions.

### A.6. The role of education and the impact of the level of nutritional knowledge on selected aspects of diet

Nutritional behaviors are multifactorial, including by economic factors, but also non-economic factors: environmental, psychological and socio-cultural [17]. Also, the level of nutritional knowledge may influence preferences and eating habits, and consequently, nutritional behaviors [28]. It can therefore be assumed that increasing nutritional awareness through nutritional education can have a beneficial effect on improving nutrition.

The previously indicated role of proper nutrition in the prevention of diet-related diseases, as well as the opportunity to improve the quality of nutrition by increasing knowledge, prompted me to assess the impact of knowledge and / or verification of the effectiveness of educational activities in different population groups. In my research, I focused on population groups particularly sensitive to the consequences of poor nutrition, i.e. women of childbearing age [II.D.71, II.D.79], pregnant [II.D.46, II.D.79], children (parents / guardians of children) [II.D.63] and adolescents [II.D.42, II.D.75].

Proper nutrition of a woman during pregnancy is necessary for its proper course, but it can also affect the health condition of a child at a later age through mechanisms of

nutritional programming [43, 25]. Research conducted on 122 young women (pregnant or already with children) indicated an insufficient level of knowledge in this population group, especially in the field of beneficial role of n-3 fatty acids, sources of caffeine, iron or the need to reduce animal fats in favor of vegetable fats [II.D.79]. I also observed that women can overestimate the level of their nutritional knowledge as well as the correctness of their diet. Over 66% of the surveyed women were convinced of the correctness of their diet, but at the same time 28% declared the need to avoid fish intake, and 40% - milk during pregnancy [II.D.46]. Such modifications of the diet may increase the risk of insufficient supply of components important for fetal development: calcium, vitamin D and iodine.

Nutritional knowledge of parents can influence the way their children are fed. In a study conducted in a group of 100 parents of children aged 3-6, I observed that the nutritional knowledge of parents determined the quantitative consumption of milk and dairy products by children, as well as influenced the product range of this group [II.D.63].

Knowledge in the field of estimation of energy demand, as well as the ability to assess the correctness of body weight is an important element of nutrition education. This is particularly important in the case of girls and young women, whose incidence of eating disorders is more common than in men [14]. In my research in this area, I focused on the analysis of selected elements of nutrition knowledge related to eating disorders and self-esteem in body weight in the context of its regularity in teenage girls [II.D.75], as well as knowledge about eating disorders in pregnant women and in the period no longer than 12 months after delivery and the presence of potentially dangerous nutritional behaviors in this population group [II.D.42].

The weight gain typical for the adolescence period, with the simultaneous increase in interest in the external appearance and the propagated pattern of the slim figure may lead - especially in girls - to the feeling of unattractiveness and attempts to control body mass [44]. In a study conducted in a group of 160 girls aged 13-18 years from randomly selected secondary schools in Węgrów and Sokołów Podlaski, I observed a high level of knowledge about the most common eating disorders, ie anorexia and bulimia nervosa, but knowledge about compulsive overeating or correct defining symptoms of the above disorders were definitely less frequent. At the same time, I noticed that the self-esteem of girls did not coincide with an objective assessment of body weight, the correctness of which was assessed using the body mass index BMI and appropriate percentile grids [19, 18]. Only slightly more than half of the respondents (51%) believed that their figure is "normal" or "athletic", while according to an objective assessment of the nutritional status,

the normal body weight was more than ¾ girls. Almost 1/5 of the teenagers considered themselves "thick", and according to objective criteria, the percentage was only 7% [II.D.75]. The inadequate perception of your body weight, and especially its over-inflating, can be disturbing, because a greater impact on deciding on weight loss has a self-assessment of body weight than the actual excess of it [31]. It can therefore be concluded that teenagers tend to inadequately assess their own figure, which indicates the need to conduct education in this area [II.D.75].

More and more concerns about excessive weight gain are observed in the population of pregnant women, which resulted in the introduction of a new term - pregorexia - to determine this phenomenon [23]. In the group of 62 pregnant women or in a period not longer than 12 months after the birth of the child, I carried out an assessment of knowledge about eating disorders and analyzed the prevalence of behaviors typical for pregorexia [II.D.42]. Over 90% of surveyed women declared knowledge about eating disorders. Interestingly, in this group also some women inadequately assessed their body weight (before pregnancy): excessive body mass using objective BMI criteria was found in less than 1/5 of women, however, 1/3 of women considered themselves to be "too plump". Over 1/4 of women did not accept weight gain during pregnancy, but none of them declared a low-calorie diet or other potentially dangerous behaviors (e.g. vomiting, intense exercise) during this period [II.D.42]. Although the study was conducted on a small group of women, its results are disturbing and point to the need to educate women in childbearing and pregnant not only in subjects related to proper nutrition, but also about eating disorders and proper weight gain.

As a continuation of research on the quality of nutrition in care and educational institutions, I showed that nutritional education can also be an effective tool for improving the quality of mass nutrition in the aspect of vegetable supply [II.D.59, II.D.56], milk and fermented milk products [II.D.59, II.D.56] and the range of beverages offered to children [III.B.18] in nurseries. I also noticed that the staff of the institutions shows a tendency to overestimate the scope of changes introduced by them, hence there is a need for an objective assessment of the effectiveness of educational activities [II.D.9, II.D.11]. What is also important, education addressed to the staff of branches should be free, because despite the interest in participating in various educational programs, the vast majority of nurseries do not have an adequate budget for this purpose [II.D.9].

Taking into account the conclusions of the above-mentioned research regarding the possibilities of modelling nutritional behaviors through educational activities, I participated in the preparation of educational materials addressed to people involved in

education of children and young people [III.I.45], as well as I participated in educational programs addressed to young people [Wise nutrition, healthy generation] and adults [III.I.47].

### A.7. The effect of restrictive nutrition on selected physiological parameters in model studies

A separate, although referring to animal models carried out as part of the master's and doctoral thesis, area of my scientific interests was the effect of limited nutrition on selected physiological parameters. I carried out these studies as a team member in the N N312 379037 grant (2009-2011). In model studies in male Sprague Dawley rats of varying ages, the effect of 20% and 40% energy restriction on the level of gene expression, amount of receptor and enzyme proteins, circulating hormone levels as well as the impact of the energy value of the diet on the functioning of the pituitary-thyroid axis were evaluated. Additionally, pituitary-adrenal, endocrine activity of white adipose tissue, insulin action and glucocorticoid metabolism in this tissue and in the liver, myocardium morphology and the system regulating blood pressure in the kidneys and heart have been examined.

As part of the project, I participated in the preparation and conducting of animal experiments and the extraction of material for chemical and biochemical tests, I conducted tests for leptin levels and βAkt proteins in adipose tissue, as well as participated in the preparation of data for the final report and publication.

The research carried out under the project had a wide cognitive dimension in the aspect of the impact of caloric restriction on various physiological parameters depending on age. In the conditions of a negative energy balance, a reduction in the activity of all thyroid axis floors and the severity of adrenal axis and changes in peripheral TH and GCs metabolism in which iodothyronine dediodinases (DIO1, DIO3) and hydroxysteroid dehydrogenases (11β-HSD1) are involved. In conditions of reducing the energy value of the diet, liver metabolism of thyroid hormones was different in older and younger animals. The effect of the energy value of the diet on corticosterone metabolism depended on the age of the animals: in older animals, a reduction in 11β-HSD level was observed under the influence of 40% energy deficit [III.B.82, III.B.46, II.A.3]. Higher angiotensin II (AngII) concentration was observed in plasma in younger animals, whereas AngII receptors in the heart were observed in older animals. Under the influence of energy restriction, the content of AngII receptors decreased only in the younger group. There was no significant influence of the experimental factors used on the concentration of type 1 Ang II receptors in the kidneys

[III.B.42]. It was found that the plasma hormone levels of the pituitary-thyroid axis were affected by both the age of the animals and the reduction of the energy value of the diet. Age had no effect on total thyroxine (T4) and triiodothyronine (T3) concentrations, while free fraction concentrations - fT4 and fT3 and thyrotropin (TSH) were higher in younger animals. The activity of thyroid peroxidase (TPO) was higher in older animals, while the content of deiodinase type 1 and 3 in the liver was higher in younger animals. Under the influence of energy deficit, there was an increase in TPO activity only in the younger group, and the level of deiodinase in the liver did not change. The response of hormone levels of the pituitary-thyroid axis in the plasma to energy restrictions in younger animals was more strongly expressed, which can be considered as greater adaptive abilities [II.A.2]. The activity of the pituitary-adrenal axis, higher in older animals, increased under the influence of energy deficit only in this group. Serum leptin concentrations depended on both the age of the animals and the energy value of the diet. Higher leptin concentrations in plasma were observed in older animals. Decreased leptin concentration in the younger group caused a lower energy deficit than in the older one. A significant increase in ghrelin concentration under the influence of caloric restriction was observed only in older animals. Plasma adiponectin concentration depended on the age of the animals (higher in the older group); caloric restriction did not affect its change [III.B.47]. The rate of resting metabolism correlated positively with the energy value of food, the concentration of TSH, fT3, T4 and leptin [III.B.84].

The subject of my special interests in the realized grant was insulin sensitivity. Decreased insulin sensitivity is a strong predisposing factor for the development of type 2 diabetes and ischemic heart disease [40]. As a measure of systemic insulin sensitivity, the HOMA-IR ratio [24] is commonly used, another indicator may be the concentration of βAct protein kinase. It was shown that lowering the energy value of the diet by 20% in the older group resulted in a significant reduction in insulin concentration, however a larger deficit did not cause further changes in insulin levels in this age group, such changes were not observed in younger animals. The insulin resistance index HOMA-IR was significantly higher in the group of older animals fed *ad libitum* compared to the younger group. In the group of older animals, 20% and 40% energy restriction caused a significant reduction, this relationship was not observed in younger animals. The β Act level in adipose tissue correlated negatively with food intake. The obtained results indicated that the reduction of the energy value of the diet increases the sensitivity to insulin in a manner dependent on age [III.B.83], which indicates the need for further studies with regard to the age factor.

Summing up the results of the study, it was found that reducing the energy value of food caused both beneficial effects (increased insulin sensitivity, lowering Ang II heart receptors, cholesterol and triacylglycerols in plasma), and those that could potentially be a health risk (decreased activity). the pituitary-thyroid axis and the increase in pituitary-adrenal axis activity in the older group). Decreased activity of the pituitary-thyroid axis was associated with a change in the profile of myosin heavy chains in the heart characterized by weaker and slower contractility [III.B.41].

The practical conclusion is that the differences in the response to caloric restriction in two age groups indicate the need for special caution in the use of low calorie (slimming) diets in old age.

## B. Summary of the scientific and research work

My scientific achievements consist of a total of 127 items, including:

— 9 publications from the JCR list,

— 58 publications from the B list of the Ministry of Science and Higher Education,

— 18 chapters in monographs (Polish and English),

— 1 publication in a foreign peer-reviewed journal outside the list of Ministry of Science and Higher Education,

— 6 articles in peer-reviewed Polish journals outside the list of Ministry of Science and Higher Education,

— 12 popular science articles,

— 11 works / abstracts in peer-reviewed Polish and English-language conference materials

— 3 chapters in academic textbooks.

Detailed information on scientific achievements is presented in Table 1.

**Table 1. The list of published scientific papers with the number of points from the list of Ministry of Science and Higher Education (MSaHE) and Impact Factor (IF)**

| Publication | Number of publications | IF [a] | IF [b] | Points MSaHE [a] | Points MSaHE [c] |
|---|---|---|---|---|---|
| **PUBLICATIONS PUBLISHED BEFORE THE DOCTOR** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| *Scientific journals without an IF impact factor listed in Part B of the Minister's List* | | | | | |
| Annales Universitatis Mariae Curie-Sklodowska, Sectio D, Medicina | 1 | - | - | 4 | - |
| Polish Journal of Food and Nutrition Sciences | 1 | - | - | 6 | 15 |
| Żywienie Człowieka i Metabolizm | 3 | - | - | 12 | 24 |
| *Chapters in scientific monographs* | | | | | |
| in Polish | 2 | - | - | 6 | 8 |
| *Others* | | | | | |
| Abstracts in peer-reviewed English-language conference materials (international conferences) | 3 | - | - | - | - |
| **Total** | **10** | **-** | **-** | **28** | **47** |
| PUBLICATIONS PUBLISHED AFTER THE DOCTOR | | | | | |
| *Publications in scientific journals with impact factor Impact Factor (IF), included in the Journal Citation Reports (JCR)* | | | | | |
| Agro FOOD Industry Hi Tech | 2 | 0.499 | 0.458 | 30 | 30 |
| International Journal of Environmental Research and Public Health | 1 | 2.145 | 2.608 | 30 | 30 |
| Journal of Animal and Feed Science | 3 | 1.533 | 2.571 | 60 | 60 |
| Nutrients | 3 | 11.942 | 13.809 | 105 | 105 |
| **Total** | **9** | **16.119** | **19.446** | **225** | **225** |
| *Scientific journals without an IF impact factor listed in Part B of the Minister's List* | | | | | |
| Annales Universitatis Mariae Curie-Sklodowska, Sectio D, Medicina | 2 | - | - | 10 | - |
| Bromatologia i Chemia Toksykologiczna | 13 | - | - | 59 | 78 |
| Gastroenterologia Praktyczna | 2 | - | - | 2 | 8 |
| Przegląd Gastroenterologiczny | 1 | - | - | 14 | 15 (A) |
| Handel Wewnętrzny | 5 | - | - | 48 | 60 |
| Kosmos | 3 | - | - | 18 | 36 |

| | | | | | |
|---|---|---|---|---|---|
| Medycyna Ogólna i Nauki o Zdrowiu | 1 | - | - | 6 | 6 |
| New Medicine | 1 | - | - | 4 | 8 |
| Pomeranian Journal of Life Sciences | 1 | - | - | 9 | 9 |
| Problemy Higieny i Epidemiologii | 12 | - | - | 81 | 108 |
| Roczniki Państwowego Zakładu Higieny | 4 | - | - | 36 | 56 |
| Standardy Medyczne Pediatria | 1 | - | - | 8 | 8 |
| The Journal of Pre-Clinical & Clinical Research | 2 | - | - | 12 | 20 |
| Żywienie Człowieka i Metabolizm | 5 | - | - | 11 | 40 |
| **Total** | **53** | **-** | **-** | **318** | **452** |
| ***Chapters in scientific monographs*** | | | | | |
| In Polish | 13 | - | - | 52 | 52 |
| In English | 3 | - | - | 21 | 15 |
| **Total** | **16** | | | **73** | **67** |
| ***Papers in peer-reviewed foreign journals outside the list of Ministry of Science and Higher Education*** | | | | | |
| NutraCos | 1 | - | - | - | - |
| ***Papers in peer-reviewed Polish magazines outside the list of Ministry of Science and Higher Education*** | | | | | |
| Annales Universitatis Mariae Curie-Sklodowska, Sectio D, Medicina | 2 | - | - | - | - |
| Journal of Health Inequalities | 1 | - | - | - | - |
| Polish Journal of Applied Sciences | 1 | - | - | - | - |
| Problemy Lekarskie | 2 | - | - | - | - |
| Dietetyka. Oficjalne Czasopismo Polskiego Towarzystwa Dietetyki | 6 | - | - | - | - |
| ***Popular science publications*** | | | | | |
| Bez Glutenu | 1 | - | - | - | - |
| Biologia w Szkole | 1 | - | - | - | - |
| Diabetyk | 2 | - | - | - | - |

| | | | | | |
|---|---|---|---|---|---|
| Dziecko | 9 | - | - | - | - |
| Gazeta Lekarska | 1 | - | - | - | - |
| Przegląd Gastronomiczny | 1 | - | - | - | - |
| ***Abstracts in reviewed conference materials*** | | | | | |
| In Polish | 5 | - | - | - | - |
| In English | 3 | - | - | - | - |
| ***Chapters in textbooks, scripts*** | | | | | |
| Dietoterapia 1 | 2 | - | - | - | - |
| Edukacja prozdrowotna i promocja zdrowia | 1 | - | - | - | - |
| **TOTAL (all publications)** | **127** | **16.119** | **19.446** | **644** | **791** |

*a - in the year of publication*

*b - average five-year IF*

*c - according to the list of Ministry of Science and Higher Education on 26/01/2017*

The total number of point from my publications is 644 (according to the MSaHE lists compliant with the year of publication), and 791 points according to the list of MSaHE dated 26/01/2017.

The point value (according to the MSaHE lists compliant with the year of publication) of the papers published after the doctoral thesis is 616 points.

The total Impact Factor of my papers, according to the year of publication, is 16.119, and the 5-year Impact Factor 19.446.

The number of publications cited according to the Web of Science database is 16 (9 without self-citations), according to Google Scholar 165.

The Hirsch index according to the Web of Science database is equal to 2, according to Google Scholar 7.

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