

Change in Knowledge of Kindergarten Employees
Participating in the Course “Diet full of life”
in the Field of Children’s Nutrition,
as Assessed by Generalized Estimating Equations

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Abstract. Nutrition is one of the most important environmental factors affecting the physical development and health of children. Education in this area and the development of proper eating habits are priorities. A prerequisite for the proper nutrition of preschool children is knowledge of proper nutrition of people working there. The aim of this study was an evaluation of the knowledge of kindergarten employees participating in the course “Diet full of life – courses in the field of children’s nutrition”. The study included 90 employees of nurseries and kindergartens, participants of the course in the field of children’s nutrition. The research tool was an original questionnaire. Study I (pre-test) was performed before the beginning of the course, while study II (post-test) was performed after its completion. Generalized Linear Models with a Generalized Estimating Equations extension was used to estimate the impact of the number of covariates on knowledge of course participants, taking into consideration the correlation between before- and after-course results. An increase in the knowledge of the participants of the investigated course on children’s nutritional standards was significant and reached 2.053 points on average. No relationship between age, job position, and knowledge level was determined. In the area of principles of proper nutrition for children, older participants had a lower level of knowledge compared to younger ones, and participants with higher education showed a significantly higher knowledge increase as compared to those with vocational education. A significant knowledge increase in the field of dietary behaviors of children was obtained during the course by all examined women, 1.6 points on average ($p < 0.001$). Younger participants obtained significantly more knowledge from the course than older ones ($p < 0.001$). Thus, it can be concluded that realization of the course entitled “Diet full of life” specifically relating to young children’s nutrition affected a significant increase in participant knowledge, particularly among the younger age groups and people with higher

education. Kindergarten employees need constant supplemental education in the form of training courses, during which they acquire actual knowledge given in an accessible manner for use in practice. The proper assessment of the supplemental education course presented herein, as well as of the course participants, was performed using General Estimating Equations.

Introduction

Proper children's nutrition determines proper development and maintenance of physical, intellectual, and emotional efficiency. Early childhood is a time when eating habits are formed. During this period of intensive growth, children are especially sensitive to any arising nutritional deficiencies (Hartton et al., 2015). A poor diet can disturb growth and maturation processes, and concurrently predispose children to many chronic diseases, e.g., obesity, type II diabetes, hypertension, and osteoporosis. Particularly worrying trends in the range of overweight and obesity in increasingly younger children have been clearly observed in recent years (Jarosz et al., 2011; Lim et al., 2012; Ng et al., 2014).

The National Health Program for 2007–2015 (Ministerstwo Zdrowia, 2007) highlighted the need to improve the nutrition of the population, with special emphasis put on the dissemination of proper nutrition principles in kindergartens and schools, and the need for widely understood health education. Except the parents, in the case of children attending nurseries and kindergartens, just the employees of these institutions have a big impact on what, at what times, and in what quantity children eat. The child spends the predominant part of the day in the nursery or kindergarten, usually eating three meals there. The study of many authors suggests that the condition that must be met for these children to receive proper nutrition is the possession of proper nutritional knowledge by people working in nurseries and kindergartens (Kozłowska-Wojciechowska et al., 2005; Newerli-Guz et al., 2014; Orkusz et al., 2014).

The aim of the study was an evaluation of the knowledge of kindergarten employees participating in the course “Diet full of life – courses in the field of children's nutrition”.

Methods

The study included 90 women, aged 25 to 61, working in kindergartens in the Podlasie region, who participated in the course in children's nutrition.

The research tool was an original questionnaire, which was completed by the participants before the course and after its completion. This study was carried out within the framework of the project entitled “Diet full of life – courses in the field of children’s nutrition” which was co-financed by the European Union from the European Social Fund for the 2010/2011 school year. The course consisted of 30 hours of teaching. The theoretical module (10 hours) included: basic issues related to childhood nutrition, division of food products into groups with a discussion of their role in children’s diets and recommended standards of nutrition and feeding, the most common nutritional deficiencies and excesses, as well as types of diets and methods for evaluating states of nutrition. The “practical” module (20 hours) involved workshops on implementing nutritional principles and menu planning for preschool children.

Study I (pre-test) was performed before the beginning of the course, while study II (post-test) was performed after its completion. The original questionnaire contained 30 questions in part I: in the field of knowledge of nutritional standards and principles of nutrition as well as eating attitudes and behaviors. Total knowledge in these 3 areas was assessed according to the number of correct answers to these questions. Part II of the questionnaire contained 23 questions related to socio-demographic data: age, sex, education, work status, and income. Post-secondary and secondary levels of education were combined for statistical analyses, due to the low number of participants in these groups. Part III (post-test in this case) consisted of 14 questions covering observations and opinions of the course.

Comparison of the distribution of the results obtained in the studies were performed using statistical analysis.

To investigate factors associated with level of nutritional knowledge (separately in three areas including knowledge of nutritional standards, principles of nutrition, and children’s eating behaviors) Generalized Linear Models were used. The covariates introduced into these models were age, level of education, and occupational position in kindergarten. An additional important variable to include in the models was time of knowledge assessment – before or after the course – which would allow researchers to estimate the impact of the course on participants’ knowledge. As knowledge of the same person before and after the course is correlated, this variable cannot be entered into the ordinary Generalized Linear Model, as that would violate the assumption that observations are independent. To overcome this difficulty, the Generalized Estimating Equations extension was used (Liang et al., 1986). To evaluate the influence of other variables

on change in knowledge related to the course, interaction terms were also included in the models.

Another problem to avoid was high correlation between two variables – level of education and position, as the latter is frequently the result of the former. Including both variables in the same model would result in the problem of multicollinearity, which would also be a violation of model assumptions. For this reason, it was decided to estimate the impact of these variables in separate models. Statistical models were presented using regression coefficients (B) and p-values for regression coefficients (p).

All statistical calculations were carried out using IBM SPSS Statistics 20.0 software. Generalized Linear Models fitted into the analysis assumed normal distribution of errors and identity link function. A robust estimator for covariance matrix was used. An exchangeable working correlation matrix was selected to describe the dependency of the before-after course knowledge measurements. Type I error level for statistical hypotheses was set at 0.05.

Results

The participants included cooks (28.9%), suppliers (44.4%) and others (including teachers/educators, teacher assistants, administrative and technical staff 26.7%). As far as level of education, 12.2% of the participants declared higher education, 4.5% higher vocational, 7.8% post-secondary education, 54.4% secondary, and 21.1% of participants had basic vocational education. The declared work experience ranged from 1 to 39 years. The average age of participants was 44.4 years. The mean age for cooks was 46.0 years (SD = 7.4), 46.4 years for stewards (SD = 8.0) and 36.7 for others (SD = 7.9). Based on level of education, average age was as follows: 48.2 years for basic vocational education (SD = 6.5), 45.7 years for post-secondary and secondary education (SD = 7.5), 37.7 years for higher vocational education (SD = 12.6) and 34.1 years for higher education (SD = 6.7).

Statistical models explaining relationships between nutritional knowledge and the covariate set, including level of education, are shown in Table 1.

The increase in course participant knowledge concerning the current standards of nutrition for young children (expressed as a number of correct answers in the test summarizing the training) was significant ($p < 0.001$) and it was 2.053 on average (Figure 1). Moreover, an analysis of the effect of education and study time interaction (before and after the training)

Table 1. Generalized Linear Models explaining knowledge in 3 studied areas including level of education as a covariate

Parameter	Knowledge of nutritional standards		Knowledge of principles of nutrition		Knowledge concerning children's eating behaviors	
	B	p	B	p	B	p
Age [1]	0.008	0.677	-0.043	0.010	-0.068	<0.001
Higher education vs basic vocational education [2]	1.196	0.175	0.714	0.229	1.081	0.192
Higher vocational education vs basic vocational education [3]	2.713	0.008	0.986	0.080	0.989	0.279
Post-secondary education/secondary education vs basic vocational education [4]	0.526	0.364	0.542	0.242	0.833	0.115
Study II vs Study I [5]	2.053	0.001	0.421	0.390	1.579	0.001
Interaction [2] and [5]	1.038	0.288	1.488	0.021	0.421	0.542
Interaction [3] and [5]	-1.303	0.254	0.329	0.711	0.171	0.783
Interaction [4] and [5]	0.733	0.279	0.847	0.127	0.314	0.556

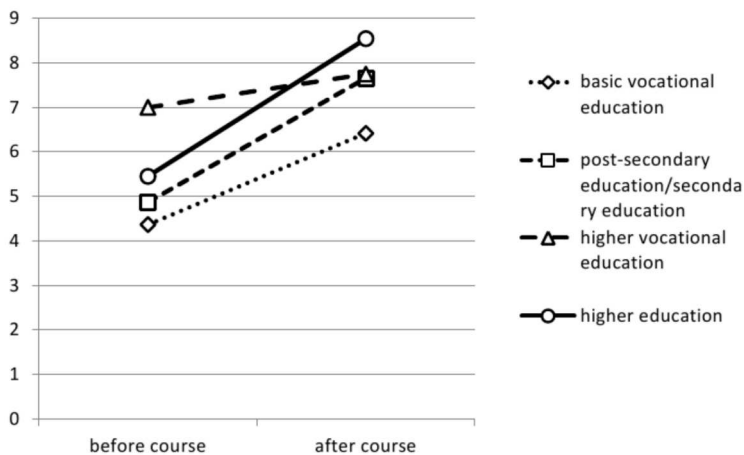


Figure 1. Mean values of knowledge of nutritional standards depending on education and testing time

demonstrated that people with higher vocational education had a greater knowledge in this respect before the training than others (more by 2.7 point in the test, $p = 0.008$).

As professional position is highly correlated with education, its impact on knowledge was analysed in separate models, shown in Table 2.

Table 2. Generalized Linear Models explaining knowledge in 3 studied areas including professional position as covariate

Parameter	Knowledge of nutritional standards		Knowledge of principles of nutrition		Knowledge concerning children’s eating behaviors	
	B	p	B	p	B	p
Age [1]	-0.015	0.428	-0.059	<0.001	-0.068	<0.001
Occupied position: others vs cook [2]	0.514	0.459	0.125	0.779	1.108	0.058
Occupied position: steward vs cook [3]	0.757	0.108	0.585	0.123	0.544	0.213
Study II vs Study I [4]	2.250	<0.001	0.719	0.082	1.469	<0.001
Interaction [2] and [4]	0.809	0.288	1.164	0.036	0.472	0.410
Interaction [3] and [4]	0.384	0.464	0.452	0.355	0.604	0.190

Regardless of position, the participants of the course achieved an improvement in the results of the test concerning knowledge of nutritional standards by 2.3 points (Figure 2a). In turn, there were no significant differences in the level of knowledge prior to the course and a significant change in the level of knowledge after the training. There was also no relationship between age and the level of expertise (Figure 2b).

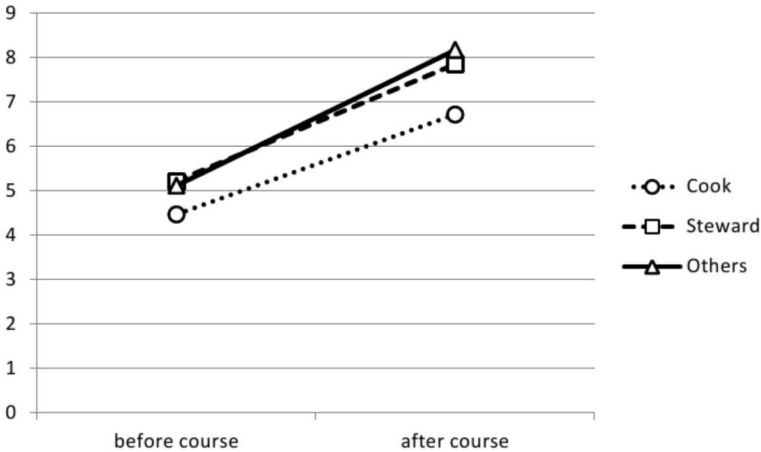


Figure 2a. Mean values of the test assessing level of knowledge of nutritional standards before and after the course, broken down according to job position

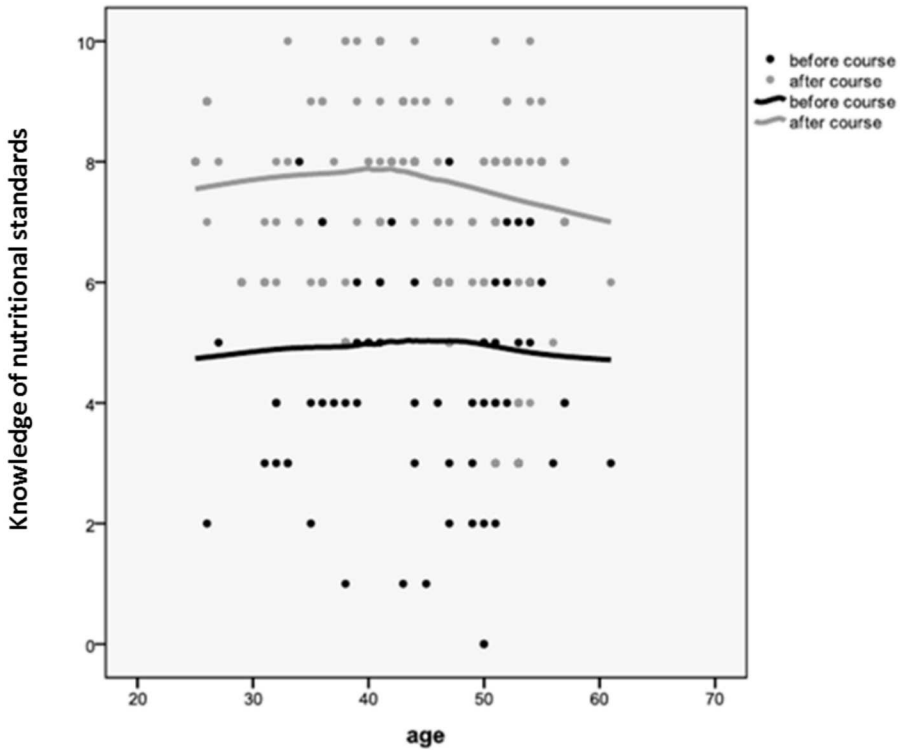


Figure 2b. Scatter plot for age of participants and knowledge of nutritional standards by time of test (including LOESS fit line)

The second evaluated area of knowledge concerned principles of proper nutrition for children. Before the training, no significant differences regarding knowledge of principles of nutrition were demonstrated between participants at particular educational levels. Knowledge increase in this area in the examined group, in general, was not statistically significant ($p = 0.421$). It was noted, taking into account the level of participant education, that people with higher education showed a significantly higher knowledge increase as compared to persons with basic vocational education ($p = 0.021$), Figure 3a. Age also significantly affected the knowledge of principles of nutrition ($p < 0.001$). The older the participants were, the lower the level of knowledge (Figure 3b).

Taking into account position, it can be concluded that the participation in the course was significantly beneficial for teachers/educators, teacher assistants, and administrative and technical staff – assigned in the study to the group “other” $p = 0.036$ (Figure 4).

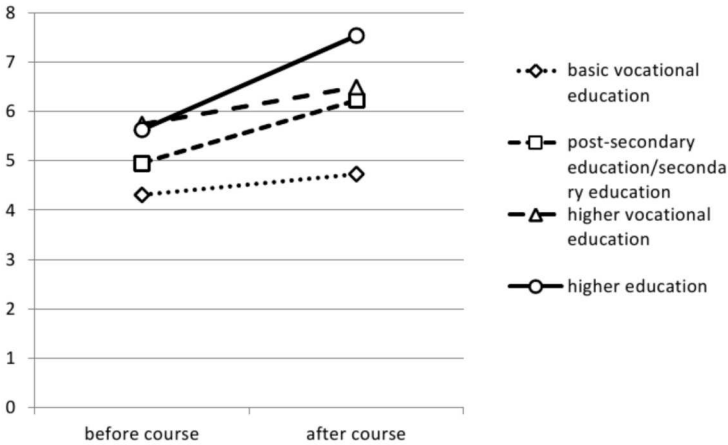


Figure 3a. The level of participant knowledge of principles of nutrition before and after the course, taking level of education into account

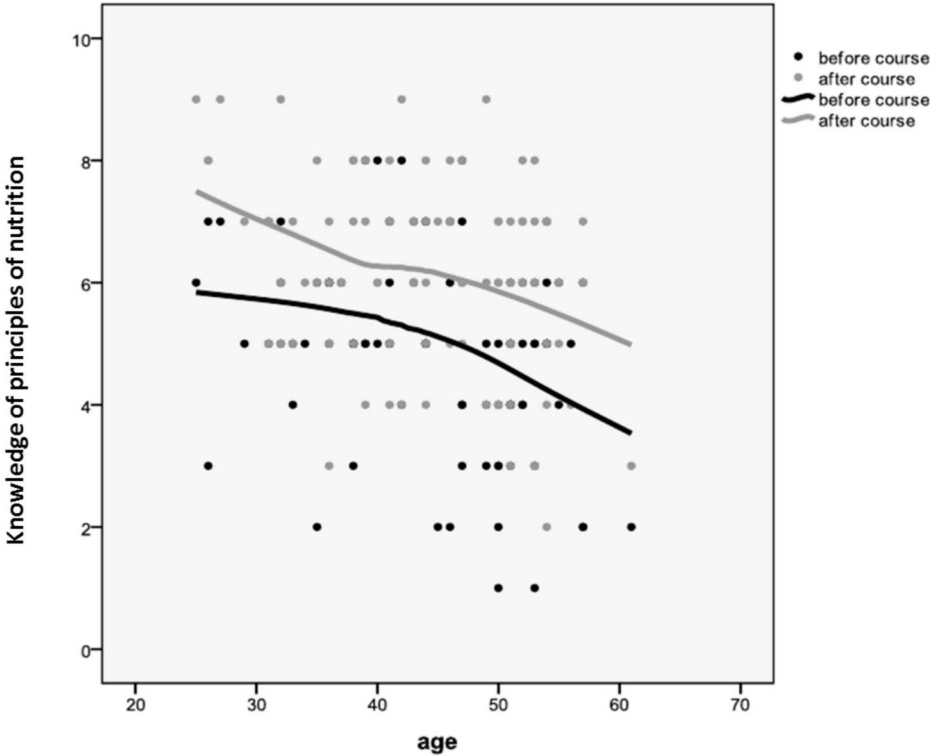


Figure 3b. Scatter plot for age and knowledge of principles of nutrition by time of test (including LOESS fit line)

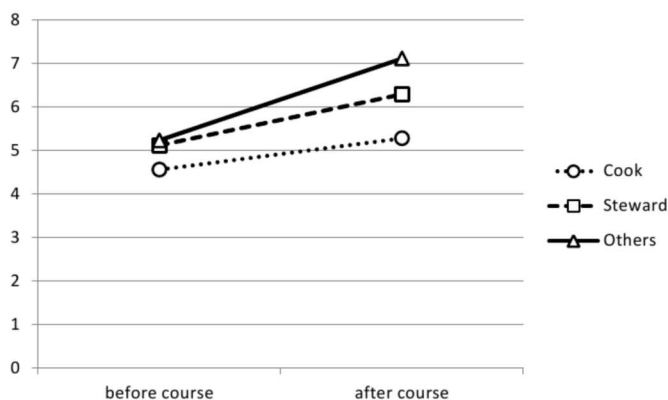


Figure 4. The level of participant knowledge of principles of nutrition before and after the course, taking position into account

The third analyzed area of knowledge was knowledge in the field of eating behaviors of young children. A significant increase in knowledge concerning children's eating behaviors was obtained during the course by all examined women, and it was 1.6 points ($p < 0.001$) on average (Figure 5a). However, no significant differences between groups were found when comparing the levels of particular groups' knowledge at the beginning and at the end of the training, regardless of level of education. It was once again demonstrated in this range that older participants had a significantly lower knowledge compared to younger ones ($p < 0.001$) (Figure 5b).

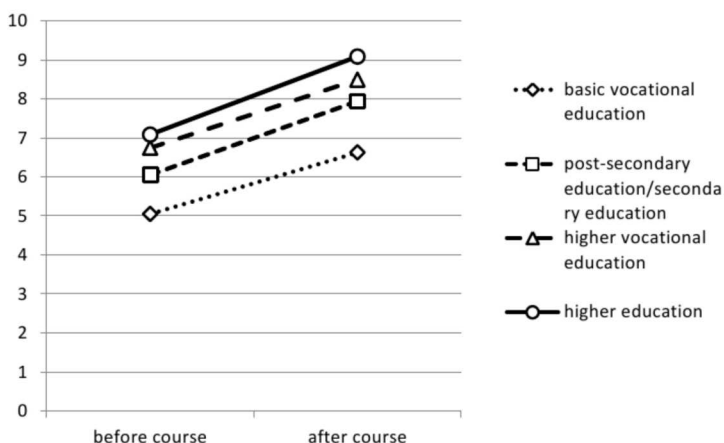


Figure 5a. Mean values of the level of participant knowledge concerning children's eating behaviors before and after the course, according to level of education

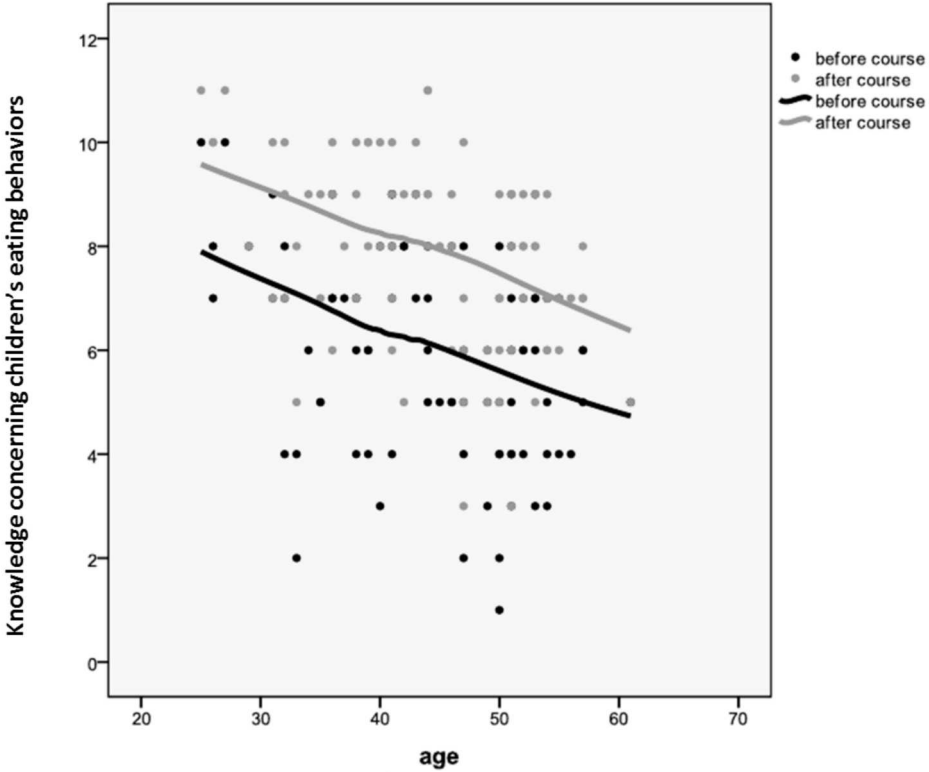


Figure 5b. Scatter plot for age and knowledge concerning children's eating behaviors before and after the course (including LOESS fit line)

Similar results were obtained in the case of evaluation of course participants' knowledge in the field of children's eating behaviors, depending on professional position. The level of knowledge in this area evaluated after course completion increased by 1.5 point on average ($p < 0.001$) (Figure 6.).

Discussion

The aim of the study was an evaluation of the level of knowledge of issues related to healthy nutrition for young children possessed by employees of kindergartens participating in a training course aiming to improve childhood eating behaviors, as well as an investigation into the effectiveness of the course in increasing this level.

The use of Generalized Estimating Equations allowed for correct estimation of parameters' standard errors in the presence of correlated outcomes.

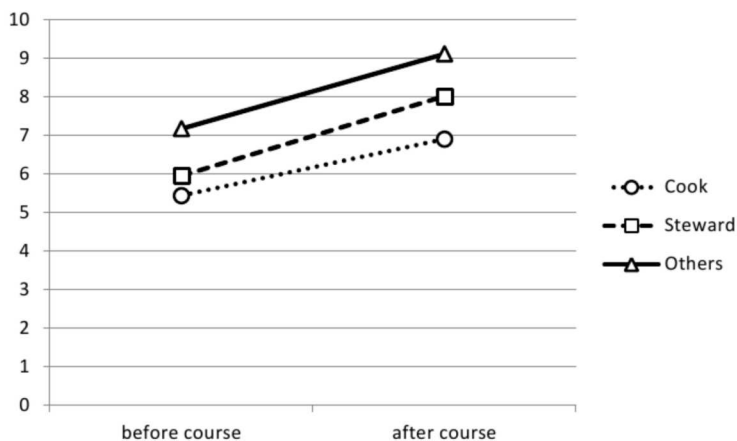


Figure 6. Mean values of the level of participant knowledge concerning children's eating behaviors before and after the course, according to professional position

Therefore, the statistical significance of parameters in presented models are more reliable.

Parents and caregivers are expected to take specific actions favoring the formation of proper nutritional attitudes and habits. Kindergartens should be responsible for 75% of the daily diet, with the remaining 25% of dietary needs being met at home (IMiD, 2012). It is essential that parents know what their children eat in kindergarten, in order to be able to compose home cooked meals that constitute a complement to the daily ration.

Unfavorable habits of young children result from a lack of knowledge of parents or caregivers, as well as a low awareness that a child's demand for nutrients changes with age, and lack of knowledge concerning the consequences of inadequate nutrition for children. Stankiewicz et al. (2013) confirms the need for nutritional education among the people preparing meals for kindergartens and at home, as well as the children themselves.

The studies of other authors reveal some irregularities in preschool nutrition regarding nutritional standards (Kozioł-Kozakowska et al., 2007; Sadowska et al., 2010; Starbała et al., 2009). For example, Michota-Katulaska and Zegan (2014) noted a significantly high protein share in the kindergarten diet, one that exceeded the standards several times over. Many studies concerning evaluation of kindergarten menus find irregularities in the range of too high energy, fat and carbohydrate intake in relation to the recommended standards (Dymkowska-Malesa et al., 2011; Kowieska et al., 2009;

Orkusz et al., 2014). These abnormalities may be due to a lack of knowledge of current standards for young children's nutrition.

It may be concluded from the report of the study conducted by CBOS in 2006 that nearly 60% of people think that the most important factor is that the child received the products they like during the meal and that they enjoyed the meal. In addition, even though parents are interested in what children eat at kindergarten, they, by and large, do not include this information in the nutrition at home. This may indicate that parents possess insufficient knowledge concerning the importance and principles of proper nutrition, and/or that they lack the ability to introduce new products into the child's diet. Frequent administration of certain types of food in a friendly family atmosphere gives the child a good example and would result in the child's positive attitude to new, previously unknown products and dishes. This indicates the great role of preschool institutions in the formation of healthy eating habits, mainly through the introduction of knowledge and formation of critical attitudes towards convenience food, as well as presentation of appropriate eating behaviors for children.

The prerequisite for introduction of proper nutritional rules is professional development. Children spend as much as 8–10 hours a day in kindergarten, where the natural process is teaching and attitude formation, through, for example, educational programs. Nutritional education during preschool education allows young children to acquire eating habits and information about what to eat. Implementation of educational programs requires a strong commitment of employees of the institutions, but also that they possess current knowledge in the field in question. Promoting healthy eating is part of the global strategy of the World Health Organization (WHO, 2003). Programs addressing kindergartens should assume that the whole community (staff, children and parents) participates together in activities aimed at improving and maintaining health and well-being through changes in nutritional habits and physical activity increase.

The results of this study indicate the existence of shortcomings in terms of knowledge of nutritional standards for children. However, there was a significant increase in the knowledge of the course participants in this regard. The level of knowledge before the course was the highest in people with higher vocational education. However, after the course, a significant increase in knowledge was observed in the whole group.

Too high an intake of energy, fat, and carbohydrates in relation to the recommended standards, calcium and vitamin C content below the standards, and an over-normative content of vitamin A were demonstrated in the study by Orkusz et al. (2014) analyzing kindergarten menus.

Knowledge of the principles of small child rational nutrition was the second area of the kindergarten employees' training. Proper nutrition means first of all the provision of energy and nutrients in an amount covering the needs of an organism (Wolnicka, 2011). Products from all the main groups included in the food guide pyramid should be included when planning the menu (Wolnicka et al., 2011). The timing of meals and size of food portions offered to the child, as well as the esthetics of the meals are also important issues. The level of knowledge of principles of proper nutrition displayed by examined course participants was dependent on age. Older participants showed a lower level of knowledge on the test compared to younger ones. Moreover, the highest knowledge increase in this area concerned the participants with higher education.

Examination of the knowledge of proper nutritional principles among employees of kindergartens was conducted by Stankiewicz et al. (2013), who indicated that respondents demonstrated a knowledge of this issue in terms of the number of meals the child should consume every day, and nearly 80% of respondents considered snacking as an improper eating habit.

In our study, the participants of the course demonstrated the highest knowledge level on the test in the field of eating behavior formation in children, indicating the causes of nutritional mistakes in children, appropriate behavior in case of meal refusal by the child, and actions in the field of nutrition education in kindergarten. The level of knowledge of examined participants of the course on children's eating behavior was dependent on age. Older people demonstrated lower knowledge as compared to younger ones.

Proper eating habits are formed in the preschool environment by properly planned educational activities. The immediate environment of the child is not always a source of appropriate eating behaviors; therefore, the change of unfavorable eating habits in relation to the child is also indirectly related to the parents (Żwirska et al., 2015).

The results of this study point to the achievement of learning outcomes during the course attended by kindergarten employees with respect to three separate areas of knowledge: standards of nutrition, principles of healthy nutrition and eating behaviors of children.

Conclusions

The preschool environment, just after the family home, is an important place of health-related education. Kindergarten employees need constant

education in the form of training courses, during which they acquire actual knowledge provided in an accessible manner for use in practice. Nutritional education seems to be an important factor that would allow negative health effects of poor nutrition to be minimized in the future for all children involved. In addition, it should be emphasized that nutritional knowledge requires updating. Participation of kindergarten employees in training course concerning nutrition should allow them the self-realization of nutritional education, but also active involvement in national and international educational programs.

Implementation of the course entitled “Diet full of life”, concerning nutrition of young children, contributed to a significant increase in the level of participant knowledge, especially among younger people and those with higher education. These results should be taken into account when planning workshops and courses on this subject in the future.

Proper assessment of all of the above presented results was conducted using Generalized Estimating Equations, which should be the method of choice in cases of modelling longitudinal data.

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