

SELECTED QUALITY INDICATORS OF POLISH REGIONAL DISH FROM WARMIA

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Key words: Polish dumplings, Polish regional food, nutritional characteristics, organoleptic assessment.

Abstract

The objective of this study was to determine selected quality indicators and to evaluate the acceptability of traditional dishes from the Region of Warmia on the example of *dzynzałki z hreczką i skrzeczkami* (dumplings stuffed with buckwheat topped with sour cream and bacon).

The nutritional value of the analyzed dish was determined from the recipe. The index of nutritional quality (INQ) was calculated based on an empirical formula. To determine the correct balance of an exemplary daily meal, reference GDA values were used to supplement the meal with an additional dish – *chłodnik*. The dish was prepared three times and evaluated by flavor profiling. The dish was analyzed to determine its sodium chloride content, DPPH· radical scavenging activity and inhibition of synthetic LDL cholesterol oxidation.

Dumplings have a high energy content of 305 kcal per 100 g serving, which provides 8.5 g of protein, 15.8 g of fat, 78 mg of cholesterol and nearly 35 g of carbohydrates. The dish is a very good source of sodium, but not enough calcium, vitamins A and C. The INQ values of the remaining minerals and vitamins were determined in the range of 0.5–0.7. The dish is characterized by a low antioxidant capacity (12.9%) and it is not capable of inhibiting the oxidation of synthetic LDL cholesterol ($C_{50} < 1$). Dumplings received high scores in a sensory evaluation. The dish combined distinctive sensory attributes characteristic of its ingredients, in particular spices, and significant differences in quality indicators were observed between the aroma and taste of marjoram and fat. Atypical, foreign and pungent aromas or tastes were not detected.

The results of this study indicate that regional dishes prepared with the use of locally available ingredients and traditional recipes can be a valuable component of the contemporary diet.

WYBRANE WSKAŹNIKI JAKOŚCI POLSKIEJ POTRAWY REGIONALNEJ Z WARMII**Jadwiga A. Spiel, Joanna Ciborska**Katedra Żywienia Człowieka
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A b s t r a k t

Celem pracy była charakterystyka wybranych wskaźników jakości oraz ocena akceptowalności sensorycznej potrawy regionalnej z Warmii – *dzyndzałków z hreczką i skrzechkami* (pierogi z farszem z kaszą gryczaną polane śmietaną i skwarkami).

Na podstawie składu recepturowego oszacowano wartość odżywczą potrawy oraz obliczono wskaźnik jakości żywieniowej INQ. W celu ustalenia prawidłowego zbilansowania przykładowego dziennego posiłku posłużono się referencyjnymi wartościami GDA, uzupełniając posiłek dodatkowym daniem – chłodnikiem. Potrawę wykonano trzykrotnie i oceniono sensorycznie metodą profilowania. Każdorazowo oznaczono zawartość chlorku sodu oraz zdolność wygaszania rodnika DPPH i hamowania reakcji utleniania syntetycznego cholesterolu LDL.

Dzyndzałki charakteryzują się wysoką wartością energetyczną – 305 kcal, 100 g gotowej potrawy dostarcza 8,5 g białka, 15,8 g tłuszczu, 78 mg cholesterolu i około 35 g węglowodanów. Są bardzo dobrym źródłem sodu, natomiast niewystarczającym źródłem wapnia, witaminy A i C. Wartość INQ pozostałych składników mineralnych oraz witaminy E wynosi od 0,5–0,7. Potrawa cechuje się słabymi zdolnościami antyoksydacyjnymi przejawiającymi się zdolnością wygaszania rodnika DPPH na poziomie 12,9% ($EC_{50} = 947,7$ mg). Wykazano także brak zdolności hamowania reakcji utleniania syntetycznego cholesterolu LDL ($C_{50} < 1$).

Oceniający uznali badaną potrawę za atrakcyjną pod względem sensorycznym. Cechowała się swoistymi wyróżnikami charakterystycznymi dla użytych surowców, szczególnie przypraw, a istotne statystycznie zróżnicowanie wyróżników zaobserwowano między zapachem i smakiem majeranku oraz tłuszczowym. Nie stwierdzono występowania nietypowych, obcych, ostrych zapachów i smaków.

Wyniki badań wskazują, że potrawy regionalne przygotowane z lokalnych surowców na bazie tradycyjnej receptury mogą być podstawą dobrze zbilansowanej współczesnej diety.

Introduction

The popularity of traditional and regional foods has soared in recent years. Numerous cook books, historical books and memoirs dedicated to regional cuisine have been published. Despite the above, there is a general scarcity of reliable and factual information confirming the geographic origins of a given product or dish. Scientific publications investigating regional cuisine are even less frequent. European research papers authored by French, Italian and German scientists (TRICHOPOULOU et al. 2007, KÖGL and TIETZE 2010) present the results of sensory evaluations, analyses of the fatty acid profile, selected health benefits, risks and consumer preferences associated with regional foods. Numerous review papers (WEICHELBAUM et al. 2009, BOROWSKI 2010) discuss

the history, production technology and nutritional characteristics of traditional and regional foods in Europe. Despite the recent rise in the popularity of traditional cuisine, the knowledge about regional foods remains quite limited in Poland. The popularization of knowledge about the culinary heritage of European regions could contribute to the elimination of stereotypes and prejudices, it could strengthen international relations, provide an additional source of income for regions, including through tourism promotion. Promotional measures improve consumer awareness of a product and its region of origin, thus increasing product's competitive advantage on the international market. Research on traditional cuisine can contribute to the effectiveness of the socio-economic development strategy of the Region of Warmia and Mazury until 2020, whose priority goal is to increase the competitiveness of the local economy.

The objective of this study was to determine selected quality indicators and to evaluate the sensory acceptability of traditional dishes from the Region of Warmia on the example of *dzyndzałki z hreczką i skrzeczkami*. Our aim was to verify the research hypothesis that despite natural modifications in the composition and properties of original food ingredients over the years, the nutritional value of regional dishes supports rational eating habits and contributes to a well-balanced diet of contemporary consumers. Contemporary quality evaluation methods can be applied in analyses of regional and traditional foods to verify their quality and facilitate the registration of regional specialties with a protected designation of origin.

Material and Methods

The experimental material was *dzyndzałki z hreczką i skrzeczkami* a dish unique to the Region of Warmia, prepared based on a traditional recipe (ORŁOWSKA 2011) with the use of organically produced and locally supplied ingredients. The dish was composed of the following ingredients: raw bacon, 200 g; garlic, 8 g; salt, 15 g; wheat flour, 500 g; whole eggs, 180 g; rapeseed oil, 25 g; buckwheat groats, 200 g; smoked bacon, 150 g; onions, 200 g. 1.5 kg of dumplings were obtained.

The nutritional value of a 100 g portion was determined in view of recipe ingredients based on Food Composition and Nutrition Tables (KUNACHOWICZ et al. 2005). The index of nutritional quality (INQ), a measure of nutrient density, was calculated based on an empirical formula (GAWEŃCKI 2012):

$$\text{INQ} = \frac{\text{amount of nutrient in 100 g of the product} \cdot \text{average energy requirement}}{\text{energy value of 100 g of the product} \cdot \text{reference intake for nutrient}}$$

Guideline daily amounts (GDA) (ANIOŁA 2011), which define the percentage of nutrients and energy per one serving of the product relative to the recommended daily nutrient and energy requirements, were used to plan a balanced meal. The dish was prepared three times, and it was evaluated by a team of 10 sensory panelists trained according to standard *Sensory analysis...* PN-EN ISO 8586:2014-03. The intensity of every analyzed attribute was evaluated by the flavor profiling method (*Sensory analysis...* PN-EN ISO 6564:1985) on a 6-point scale.

Numbers from 1 to 6 are assigned the following wordings referring sensibility of the discriminant:

- 1 – Non-detectable;
- 2 – Hardly detectable;
- 3 – Slightly detectable;
- 4 – Moderately detectable;
- 5 – Distinctively detectable;
- 6 – Strongly detectable.

Each dish was analyzed to determine its sodium chloride content by the Mohr method (*Wyroby garmazeryjne...* PN-A 82100:1985), DPPH· radical scavenging activity according to the method proposed by BRAND-WILLIAMS et al. (1995) and modified by SÁNCHEZ-MORENO et al. (1998) and MIELNIK et al. (2006), and inhibition of synthetic LDL cholesterol (SIGMA-ALDRICH) oxidation based on the method developed by ANDREASEN et al. (2001). Laboratory samples of approximately 200 g each were twice ground in the Stalgast 721129 meat grinder with a plate hole size of 3 mm. Ground samples were thoroughly mixed and homogenized. The number of replications was 3 to 6, subject to the type of analysis. In order to estimate the antioxidant properties using the DPPH· method, 10 g were weighed with an accuracy of 0.01 g and 50 cm³ of analytical grade methanol were added. The sample was then homogenised in a homogeniser (Universal Laboratory Aid, type MP W-309) for 30 s at 10,000 rpm. The sample was then centrifuged in a laboratory centrifuge, type WE-2, for 15 min at 3,000 rpm and filtered through a medium-grade filter (EUROCHEM BGD 12/5) to a graduated cylinder to read the volume of the supernatant. 1 cm³ was collected from the prepared extract and dilutions in g cm⁻³ were prepared. From each of them, 0.1 g cm⁻³ was collected to a test tube and 3.9 cm³ of a methanol DPPH· solution at a concentration of 0.025 g l⁻¹ was added. The test tubes were tightly sealed with parafilm and left in a dark place at room temperature. Absorbance was measured at a wavelength of 515 nm using a UV/VIS spectrophotometer on an hourly basis until a constant value in relation to the reagent blank (i.e. methanol) was set.

DPPH· radical scavenging ability was determined based on a curve reflecting the relationship between the % of the residual DPPH· radical and the

amount of the sample. The equation of a straight line was interpreted as an EC₅₀ ratio which determines the amount of mg of the tested raw material required to reduce the initial concentration of the synthetic DPPH· radical by 50% under the reaction conditions. The results were expressed in % using the formula below, and in relation to synthetic, water-soluble Trolox (an analog of vitamin E).

$$\% \text{ of the residual DPPH} \cdot = \frac{\text{(absorbance of the test sample)}}{\text{absorbance of the control sample}} \cdot 100$$

Oxidation of the LDL fraction was determined based on spectrophotometric measurements at a wavelength of 234 nm. The reaction was induced by copper ions by adding 10 µl of 0.9 mM CuSO₄ dissolved in PBS (Cu concentration of 5 µM, temperature of 37°C, incubation for approx. 3 hours, pH = 7.4), according to a method by ESTERBAUER et al. (1989), with modifications by ANDREASEN et al. (2001). The antioxidant activity of the samples was measured as the ability to inhibit the formation of lipid dienes compared to the control sample. Synthetic LDL was diluted to a concentration of 0.2 mg ml⁻¹ in a 0.01 M phosphate buffer (PBS). The extracts were tested at concentrations of 40–120 µl for 120 min. and the absorbance values were read every 10 and 20 min. The control sample of solvent/water was mixed in a 1:1 ratio.

The ability to inhibit the oxidation of LDL was estimated based on the absorbance-time curve equation and the inhibition percentage was calculated using the following formula:

$$\% \text{ inhibition} = \frac{(C - S)}{C} \cdot 100$$

where:

C – maximum absorbance of the control sample

S – absorbance of the sample corresponding to the absorbance of control samples at the time the control sample exhibited maximum absorbance

If the value read on the spectrophotometer was higher than zero (positive), the sample exhibited antioxidant activity, i.e. it had the ability to inhibit cholesterol oxidation. In addition, the C₅₀ factor was calculated based on the time required to obtain a 50% value of absorbance in test samples compared to the control sample.

$$C_{50} = \frac{t_{50} \text{ for the test sample}}{t_{50} \text{ for the control sample}}$$

If the value of the C_{50} factor was higher than one, the sample had both antioxidant properties and the ability to inhibit cholesterol oxidation.

The results were processed by Kruskal-Wallis ANOVA and Friedman's ANOVA in the Statistica 10.0 PL application. The data were not normally distributed (Shapiro-Wilk test) and did not meet the homogeneity of variance assumption (Levene's test of homogeneity of variance, Brown-Forsythe test, independent samples t -test at significance level of $\alpha = 0.05$), therefore, non-parametric tests for multiple independent samples were performed.

Results and Discussion

Selected quality indicators of *dzyndzałki z hreczką i skrzeczkami*

The main ingredients of *dzyndzałki z hreczką i skrzeczkami* are wheat flour, buckwheat groats, raw and smoked bacon, which are responsible for the product's relatively high energy value of 305 kcal per 100 g. The evaluated dish is characterized by a high content of carbohydrates and fat, including saturated and monounsaturated fatty acids. A 100 g portion provides 8.5 g of protein (Figure 1). The INQ value of protein (Figure 2) is higher than 1.0, which indicates that *dzyndzałki z hreczką i skrzeczkami* are well-balanced with regard to protein content, and they cover daily energy requirements. The dish is abundant in total fat (15.8 g/100 g) with a high INQ of 1.5, but it contains mostly saturated and monounsaturated fats whose levels should be kept to a minimum in a healthy diet.

Saturated fatty acids, which are found mainly in animal products (lard, fatback, butter, meat, cheese, eggs), can increase serum LDL cholesterol levels. High levels of unhealthy fatty acids contribute to the risk of colon, mammary gland and prostate cancer (CYBULSKA and KŁOSIEWICZ-LATOSZEK 2010, GAWEŃKI 2012). Polyunsaturated fatty acids (PUFAs), including essential fatty acids (n3/n-6 EFAs), deliver numerous health benefits. They delay cell ageing (FARZANEH-FAR et al. 2010), exert anticarcinogenic effects (AUGUSTSSON et al. 2003) and reduce blood triglyceride levels (DAVIDSON et al. 2007). The latest Polish dietary guidelines (*Normy żywienia...* 2012) no longer define the desired n-6/n-3 PUFA ratio, instead they set reference values for the consumption of EFAs and recommend a reduction or elimination of saturated fatty acids and trans fatty acids from the diet. In the referenced guidelines, adequate intake (AI) values have been defined for linoleic acid at 4% of total energy and alpha-linolenic acid at 0.5% of total energy.

Fat intake is associated with dietary cholesterol levels. Maximum intake values for dietary cholesterol are not defined by Polish dietary guidelines

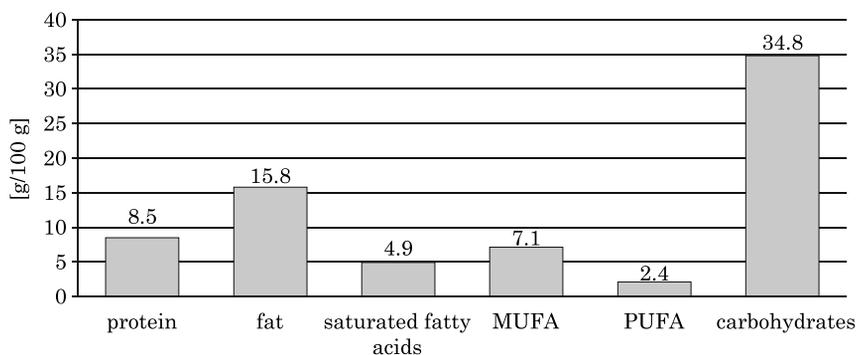


Fig. 1. The content of selected nutrients of *dzyndzałki z hreczką i skrzeczkami* [g/100 g of product]

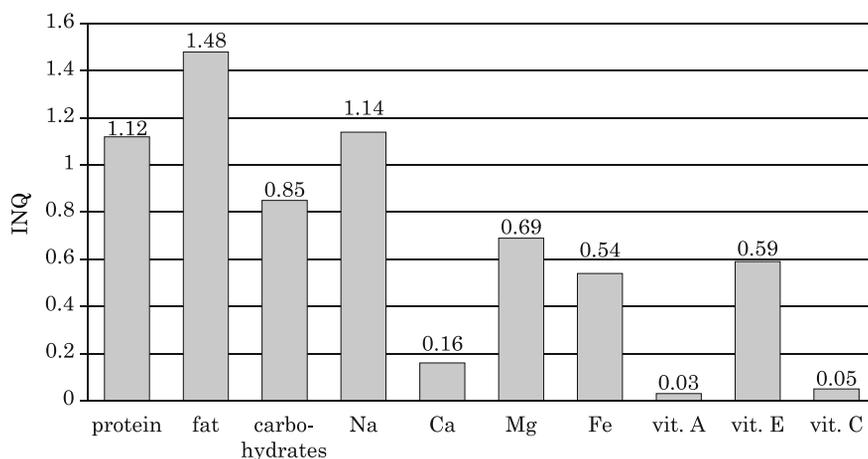


Fig. 2. Nutritional density of selected nutrients of *dzyndzałki z hreczką i skrzeczkami*

(*Normy żywienia...* 2012). *Dzyndzałki z hreczką i skrzeczkami* provides 78 mg of cholesterol per 100 g serving, mainly from egg yolks. Raw chicken eggs contain 391 mg of total cholesterol per 100 g (KUNACHOWICZ et al. 2005). Animal products are abundant in cholesterol, but the above does not imply that atherosclerosis and other pathological changes are directly induced by excessive consumption of dietary cholesterol.

Dzyndzałki z hreczką i skrzeczkami are a relatively well-balanced source of carbohydrates (INQ = 0.85, Figure 2). In line with nutritional recommendations, a higher percentage of total energy (55%) should be supplied by carbohydrates than fats. The main source of energy in the daily diet should be non-starch polysaccharides from cereals, legumes, root and tuber vegetables (GAWEŃKI 2012).

The INQ value of sodium in *dzyndzałki z hreczką i skrzeczkami* (Figure 2) is insignificantly higher than 1.0 despite the product's high sodium content (416 mg/100 g, Figure 3). The analyzed dish contains approximately 1 g of salt, which is within the reference values for salt set at 1% of the product's total weight. According to the latest Polish dietary guidelines, the daily sodium intake (AI) of adult consumers should not exceed 1500 mg (*Normy żywienia...* 2012).

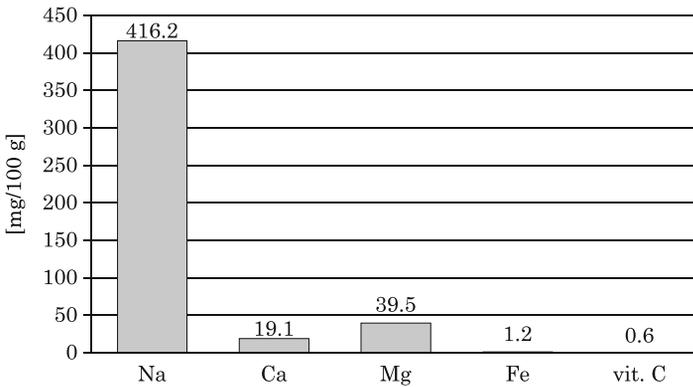


Fig. 3. The content of minerals and vitamin C in mg/100 g of *dzyndzałki z hreczką i skrzeczkami* [mg/100 g of product]

The amount of salt added to food increases sodium and chlorine levels in the body, which stimulates muscle and nerve cells and increases the permeability of biological membranes. In addition to spices, home-made foods also contain high amounts of added salt, which increases the daily intake of sodium chloride. According to the National Food and Nutrition Institute, the main sources of sodium, the major component of table salt, in the Polish diet are cereal products (22.5%), meat and meat products (19.4%), milk and dairy products (5.8%), vegetables and legumes (5.7%) (WOLNICKA and JAROSZ 2008).

Dzyndzałki z hreczką i skrzeczkami do not provide sufficient quantities of calcium (relative to the energy requirement), and the dish is not well-balanced with regard to calcium content. It does not contain calcium-rich ingredients such as ripened cheese, milk, fermented milks, kale or beans (GAWEŃCKI 2012). Buckwheat groats are abundant in magnesium, and *dumplings from Warmia* are an ample source of that micronutrient (39.5 mg/100 g, Figure 3), but their magnesium content is insufficient relative to the energy requirement. The recipe for *dzyndzałki z hreczką i skrzeczkami* contains animal-derived ingredients, and the evaluated dish is rich in iron (Figure 3). Despite the above, the

INQ of iron was low at 0.54, which indicates that *dumplings* is not a good source of iron relative to the average requirement for energy provided by the dish (Figure 2). *Dzyndzałki z hreczką i skrzeczkami* is also deficient in vitamin A (Figure 2 and Figure 4), which is found mainly in fish oil, dairy products (butter, eggs) and vegetables, mostly carrots and leafy vegetables (GAWEŃCKI 2012).

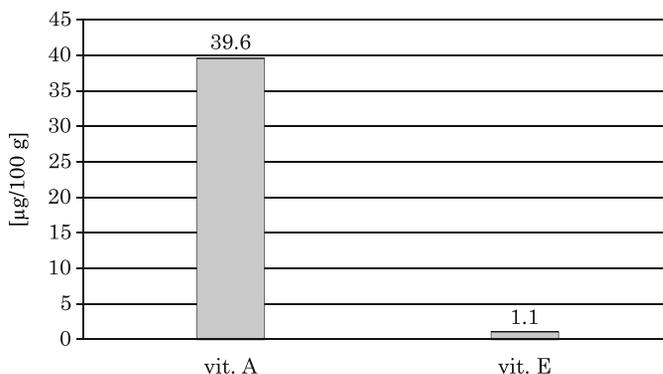


Fig. 4. The content of vitamins in µg/100 g of *dzyndzałki z hreczką i skrzeczkami*

Vegetable oils and margarine are rich in vitamin E, which is also found in selected animal products. Vitamin E is one of the major scavengers of superoxide radicals, and it protects lipids against oxidation (SROKA et al. 2005). A 100 g serving of *dzyndzałki z hreczką i skrzeczkami* supplies approximately 1 µg of vitamin E (Figure 4) with INQ < 1 (Figure 2), which indicates that the analyzed product is not a rich source of vitamin E relative to the energy requirement.

Cruciferous vegetables are rich in vitamin C, and foods containing those ingredients are a valuable source of ascorbic acid. Vitamin C plays an important biological role by reducing Fe^{3+} ions to Fe^{2+} ions, which improves iron absorption from the duodenum. Under certain conditions, vitamin C is capable of destroying animal cells, including cancer cells. Vitamin C is a potent antioxidant, and *in vitro* studies demonstrated that it protects blood lipid fractions (LDL) against oxidation. Vitamin C can also act as a pro-oxidant, but ascorbate doses that induce pro-oxidant effects have not been determined (SROKA et al. 2005). *Dumplings from Warmia* are not a good source of vitamin C whose concentrations are low relative to the energy requirement.

Regional foods can be a part of a healthy and well-balanced diet. A healthy meal incorporating traditional dishes was planned with the use of GDA reference values (Table 1). GDA values define the percent content of nutrients

and energy per serving relative to the recommended daily intake. They enable consumers to make well-informed choices and plan a well-balanced diet where GDA values do not exceed 100% (Figure 5).

GDA values for the planned meal [%]

Table 1

Dish	Energy value	Protein	Carbohydrates	Fat	Saturated fatty acids	Sodium	Salt
Chłodnik, 200 g	2.8	5.2	1.6	6.8	12.1	20.8	23.4
<i>Dzyndzałki z hreczką i skrzeczkami</i> , 250 g	38.0	42.5	32.3	56.5	62.0	43.3	41.8
Σ	40.8	47.7	33.9	63.3	74.1	64.1	65.2

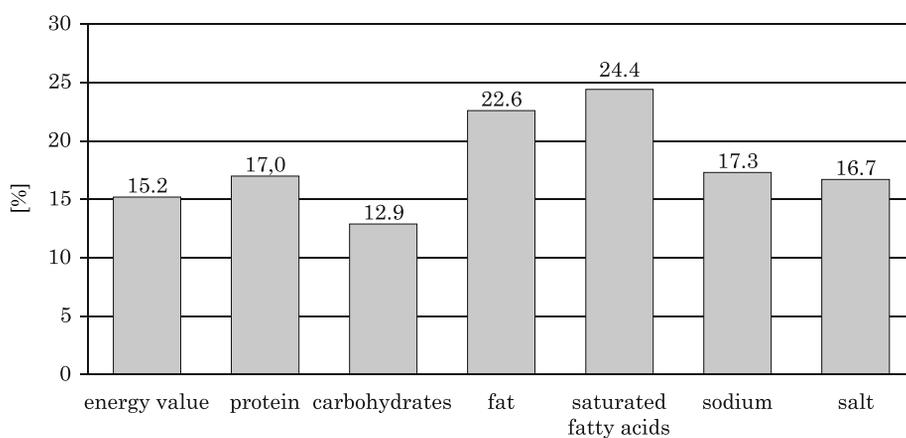


Fig. 5. The percentage of guideline daily amounts of energy and macronutrients of *dzyndzałki z hreczką i skrzeczkami*

The planned meal comprised two regional dishes – *chłodnik* (200 g) and *dzyndzałki z hreczką i skrzeczkami* (6 dumplings – approximately 250 g).

The planned meal indicates that regional products can constitute the basis of a healthy and well-balanced diet. GDA values provide consumers with simple information about products and ingredients that are missing from the diet. The planned meal (Table 1) should incorporate other products to keep sodium chloride levels within the recommended range. The intake of sodium, fat and, above all, saturated fatty acids, should be reduced.

The Mediterranean diet is an excellent example of healthy eating plan that incorporates traditional foods rich in macronutrients and micronutrients, in particular calcium and magnesium, and vitamins, including vitamin E (VASILOPOULOU and TRICHOPOULOU 2009). The main ingredients of the Greek diet are fresh vegetables (tomatoes, leeks), legumes, cereals, fresh fruit, eggs, feta-type cheese, yogurt and fish. Meat and meat products are consumed in limited quantities. Olive oil is an important ingredient in most dishes, and red wine intake is relatively high. The Mediterranean diet is well balanced, and it is characterized by average daily energy intake below 2473 kcal, where the following percentage of energy is provided by the following nutrient groups: protein – 12%, dietary fat – 40.3%, carbohydrates – 41.4% and dietary fiber – 2.4% (TRICHOPOULOU et al. 2006).

Antioxidant activity

In recent years, researchers and nutrition scientists have been emphasizing the beneficial effects of antioxidant compounds, mainly polyphenols (DRUŻYŃSKA and KLEPACKA 2005). Antioxidants inhibit the activity of enzymes that participate in carcinogenesis, and play an important role in preventing cardiovascular diseases and Alzheimer's disease (SZLACHTA and MAŁECKA 2008).

Dzyndzałki z hreczką i skrzeczkami contain processed cereal grains, mostly buckwheat groats, which are responsible for the antioxidant properties of the dish whose DPPH· radical scavenging activity was determined at 12.9% ($EC_{50} = 947.7$ mg – Table 2).

Table 2

Antioxidant activity of a selected dish measured by two different methods

Antioxidant properties of the dish whose DPPH· radical scavenging activity			
%	Equation of the standard curve	EC_{50} [mg]	μ mole Trolox/g
12.9	% of the residual DPPH· = $99,079 - 9,758 * \text{sample concentration mg ml}^{-1}$	947.7	21.2
Antioxidant activity is associated with the inhibition of LDL cholesterol oxidation			
%	Equation of curve of absorbance – time	C_{50}	C_{50} Trolox
58.7	$A = 0.4325 + 0.0002 * \text{time}$	0.32	6.3

Light and dark varieties of buckwheat groats are rich in flavonoids, rutin and isovitexin, but their content is reduced by nearly half during cooking. Wheat contains inositol hexaphosphate, which is resistant to heat processing,

but is degraded during seed germination and dough fermentation. Cereal germ is also a source of selenium and vitamin E (SZAJDEK and BOROWSKA 2004). ZIELIŃSKI and KOZŁOWSKA (2000) classified cereals in the following descending order based the antioxidant activity of their methanol seed extracts: buckwheat, barley, oats, wheat and rye. The synergistic interactions between tocopherols (α and γ fractions) and phospholipids are responsible for the antioxidant properties of vegetable oils. *Dzyndzałki z hreczką i skrzeczkami* were prepared with the use of rapeseed oil, a rich source of sinapinic, ferulic, caffeic and coumaric acids (SZAJDEK and BOROWSKA 2004).

Antioxidant activity is associated with the inhibition of LDL cholesterol oxidation because free radicals are responsible for lipid oxidation (DRUŻYŃSKA and KLEPACKA 2005). Lipids contained in meat products, including dietary cholesterol, are particularly susceptible to oxidation, and the content of cholesterol oxidation products (COPs) during food processing and storage can reach up to 10% of total cholesterol content (DEREWIAKA et al. 2008). Autooxidation products, including low-molecular-weight volatile compounds such as short-chain aldehydes, are responsible for the undesirable (rancid) odors and flavors in foods. They also deteriorate the color, texture, nutritional value and safety of meat products. Autoxidation products degrade essential fatty acids, which leads to the loss of their biological properties. Rancid fat also contributes to the degradation of biotin, riboflavin, ascorbic acid and pantothenic acid (HEŚ and KORCZAK 2007).

The analyzed product's ability to inhibit the oxidation of synthetic LDL cholesterol was established based on literature, and it was confirmed by the results of the Trolox equivalent antioxidant capacity assay where the inhibitory rate was determined at 58.7% relative to Trolox (100%) and the C_{50} factor was determined at 6.3 for Trolox and 0.3 for *dzyndzałki z hreczką i skrzeczkami* (Table 2). The value of the C_{50} factor for the analyzed product (below 1.0) indicates that *dumplings* are practically unable to inhibit the oxidation of the LDL cholesterol fraction.

Sensory evaluation of *dzyndzałki z hreczką i skrzeczkami*

The null hypothesis (H_0 , postulating an absence of statistically significant differences between quality indicators in each evaluation) was rejected in favor of the alternative hypothesis (H_1 , postulating the presence of statistically significant differences between at least two quality indicators in each evaluation) based on the results of statistical analyses (H -test for *dzyndzałki z hreczką i skrzeczkami*, evaluation I – 94.53, evaluation II – 84.94, evaluation III – 95.98, $N = 150$) and estimated probability of $P < 0.001$. Multiple

comparisons of mean ranks for all samples were performed to determine differences in quality indicators in each evaluation. In *dzyndzałki z hreczką i skrzeczkami* (Figure 6), significant differences in quality indicators were observed between the taste and aroma of marjoram and fat.

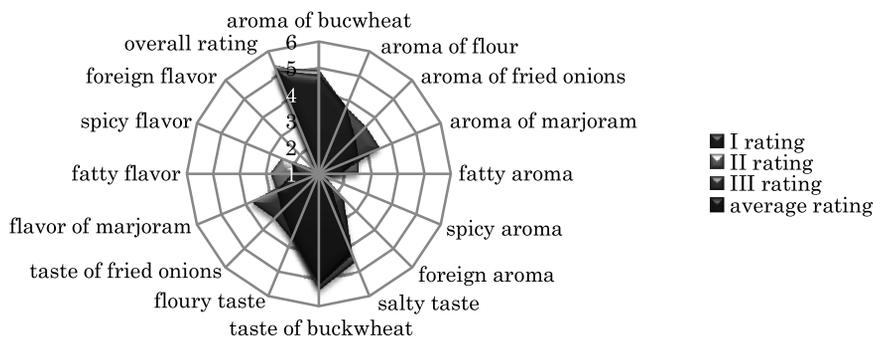


Fig. 6. Sensory profile of flavor and taste of *dzyndzałki z hreczką i skrzeczkami*

Dzyndzałki z hreczką i skrzeczkami received high scores in a sensory evaluation. The dish combined distinctive sensory attributes characteristic of its ingredients, in particular spices. The most perceptible smells and tastes were that of buckwheat (4.7 and 5.2 points, respectively), the smell of flour (3.7 points) and a salty taste (4.2 points). The overall rating was at a level of 5.2 points. Statistically significant quality factor differences were observed between the smell and taste of marjoram and of fat in particular ratings. Atypical, foreign and pungent aromas or tastes were not detected.

Conclusion

The results of this study indicate that regional dishes prepared with the use of locally available ingredients and traditional recipes can be a valuable component of the contemporary diet. The proposed lunch menu comprising *dzyndzałki z hreczką i skrzeczkami*, a local specialty of the Region of Warmia, was evaluated based on GDA reference values. The assessed product is characterized by a satisfactory nutritional value, it provides diverse nutrients, and therefore it can be successfully incorporated into a healthy and well-balanced diet.

The quality assessment method used in the study can be used in evaluations of traditional and regional foods. The sensory analysis revealed the distinctive attributes of *dzyndzałki z hreczką i skrzeczkami*. The evalu-

ated dish was characterized by a pleasing appearance, rich flavor and balanced, traditional taste. Atypical, foreign and pungent aromas or tastes were not detected.

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