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RAPESEED PROTEIN-FIBRE CONCENTRATE: CHEMICAL COMPOSITION AND FUNCTIONAL PROPERTIES

S u m m a r y

Dietary fibre has a beneficial effect on human health that is manifested, among other things, in a reduced risk of obesity, diabetes or neoplasms. Its numerous functional properties render it a desirable food additive.

The objective of the research study was to assess the nutritional and functional properties of a novel rapeseed protein-fibre concentrate (RPFC) developed by a NapiFeryn BioTech company. The chemical composition, including the amino acid composition, and the functional properties of RPFC were compared with those of the soy fibre (SF) and pea fibre (PF) available on the market; the purpose of the comparison was to evaluate the potential of RPFC as a novel ingredient for use in food applications. The research study showed that RPFC contained significantly more protein than SF and PF. At the same time it was found that the level of total dietary fibre in RPFC was similar to the level of this ingredient in SF. What's more, RPFC was characterized by the highest contents of ash and phytic acid. Based on the analysis results of amino acids it was proved that the level of lysine was the highest in RPFC. The RPFC was characterized by a higher content of essential amino acids than PF and a lower content thereof than SF. RPFC was distinguished by good functional features, such as emulsifying activity, emulsion stability, and water and oil absorption capacity. It was showed that RPFC had suitable features to be used as a functional food ingredient in food products.

Key words: rapeseed protein-fibre concentrate, dietary fibre, food additives, functionality

Introduction

Nowadays it is observed that the awareness of consumers grows along with their concern and interest in nutrition, healthy diet and food products, including food label-

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ling [9]. Also the consumers are open to different innovations in traditional foods, for example: food quality innovations (reduced contents of fat, sugar, or salt), using organic raw materials and adding beneficial ingredients [13]. Dietary fibre is among those ingredients with positive health effects that can be added to food preparations [21].

From the chemical point of view dietary fibre is a mixture of heterogenic components [12]. According to the definition developed by the American Association of Cereal Chemists (AACC) dietary fibre reads: 'the edible parts of plants or analogous carbohydrates that are resistant to digestion and absorption in the human small intestine with complete or partial fermentation in the large intestine' [1]. The intake of dietary fibre has positive effects on human health since this substance decreases the risk of such diseases as obesity, diabetes, hypertension, strokes or certain types of cancer [6, 8]. Dietary fibre is also a desirable food additive. It has water-binding capacity, it is able to emulsify fat, associate cations, increase the viscosity and thicken liquid formulations. It can reduce the calorific value of products, limit thermal leakage, modify and stabilize food texture, facilitate product formation, substitute fat or increase emulsion stability [19]. The properties of dietary fibre are determined by the nature of polysaccharides prevailing in the source material, however they can also be affected by processing conditions. The most typical sources of dietary fibre are: whole grain cereals, seeds, nuts, fruits and vegetables, and also legumes [7]. Moreover, the fibre fractions occur in rapeseed/canola together with oil and proteins of high nutritional value and high functional properties such as solubility, foaming, gelation or emulsification [24]. What's more, proteins play an important role in food preparations for they constitute a building block for structures and nutrients and they help develop desirable food features [5].

There are few companies attempting to market food-grade rapeseed proteins products; one of them is NapiFeryn BioTech in Lodz, Poland. This company claims to have developed a universal technological platform for extracting protein products from plants, incl. oilseed crops. The company has already introduced rapeseed protein isolate [25]; their second product is rapeseed protein-fibre concentrate intended for use as a novel food additive in numerous food applications as it combines two important food ingredients (proteins and fibre), which, as already mentioned, have a great nutritional and functional value.

The objective of the research study was to analyze the chemical composition, including amino acid composition, of the rapeseed protein-fibre concentrate (RPFC) as well as to study functional properties thereof and to compare this concentrate with commercial fibre preparations, such as soy fibre (SF) and pea fibre (PF), in order to assess the future potential of rapeseed protein-fibre concentrate as a food component. In the research study the rapeseed protein-fibre concentrate is compared with other fibre products as this product is innovative and it is hard to find a commercial product with a similar chemical composition.

Material and methods

Materials and chemicals

The rapeseed protein-fibre concentrate (RPFC) was supplied by NapiFeryn Bio-Tech Sp. z o.o. RFPC from a batch number H-81#13 was used to analyze the chemical composition, including amino acid composition, and RFPC from a batch number I-91#13 was taken to study functional properties. The source material was cold pressed rapeseed cake provided by Wilmar Group Marek Wilczyński SKA (Żórawina, Poland).

In the research study soy fibre (SF) and pea fibre (PF) were chosen as reference materials. The two products were from Edmir-pol (Poland).

All the chemicals used in the research study were of analytical grade, except otherwise stated, and all the reagents were prepared using water with a conductivity ≤ 0.05 μS/cm, derived from an HLP10 demineralizer (Hydrolab, Poland). A 96 % solution of sulphuric acid was produced by STANLAB (Poland). In Chempur (Poland) the following was purchased: 4 % solution of boric acid, 10 % solution of hydrochloric acid, 35 ÷ 38 % petroleum ether 40/60, methanol, 80 % solution of acetic acid, potassium hexacyanoferrate (II) trihydrate and sodium carbonate (anhydrous). Sigma-Aldrich Inc. (USA) delivered: sinapic acid, phenol, acetonitrile (for HPLC), phenyl isothiocyanate, trimethylamine, formic acid, D-norleucine and amino acid standard. In Eurochem BGD Sp. z o.o. (Poland) there were purchased: Folin-Ciocalteu reagent and 0.1 M hydrochloric acid solution; zinc acetate dehydrate was delivered by POCH (Poland).

Chemical composition

The moisture content was analyzed using a moisture analyzer MB90 (OHAUS, Switzerland). In brief, 1.00 ± 0.10 g of sample was dried at a temperature of 105 ºC. The results were expressed as the content of dry matter; the moisture content was calculated by subtracting the content of dry matter from 100.

The crude protein content was analyzed by a Kjeldahl method according to AOAC Official Method 2001.11 [3] with modifications. The protein amount was calculated using a 6.25 conversion factor and expressed as a percentage of sample.

The total fat amount was determined according to ISO 11085:2015 [10] with modifications. To perform a hydrolysis, a 10 % solution of hydrochloric acid was used and a petroleum ether 40/60 was utilized as a solvent in the extraction process.

The ash (crude) content was determined according to the Commission Regulation (EC) No 152/2009, III, M [20] with modifications. In brief, 1.00 ± 0.05 g of sample was charred and then incinerated in a muffle furnace at a temperature of 625 ºC to obtain white or light grey ash.

The amount of phenolic compounds was estimated using a spectrophotometric method with a Folin-Ciocalteu reagent according to Nogala-Kałucka and Siger [16] with modifications.

The phytic acid level was analysed according to McKie and McCleary [14] with the use of a Phytic Acid / Total Phosphorus Assay Kit K-PHYT (Megazyme), and following the assay procedure.

The content of total carbohydrates was calculated as a difference obtained by subtracting the content of moisture [%], protein [%], fat [%] and ash [%] from 100 %.

The soluble and insoluble dietary fibre was determined based on an AOAC Official Method 991.43 [2] (with modifications) using a Total Dietary Fibre Assay Kit K-TDFR (Megazyme), and following the assay procedure. Total dietary fibre was expressed as a total of soluble and insoluble dietary fibre.

The crude fibre was analyzed according to PN-EN ISO 6865:2002 [18].

Amino acid composition

The UHPLC-ESI-MS/MS amino acid composition analysis was determined according to Żyżelewicz et al. [27] with slight modifications. Briefly the samples were subjected to hydrolysis with 6 M HCl containing 1 % of phenol for 24 h at 110 ºC. The derivatization reaction was performed during a period of 20 min at a room temperature using an acetonitrile-water-triethylamine – PITC mixture (7 : 1 : 1 : 1 v:v:v:v). The D-norleucine was used as an inner standard. At the same time the analysis of amino acid analytical standard was carried out. The formic acid solution (0.05 %) was used as an A mobile phase and 70 % solution of acetonitrile was utilized as a B mobile phase.

Functional properties

The emulsifying activity (EA) and emulsion stability (ES) were studied according to Vioque et al. [23]. Based on the following formula, the emulsifying activity (EA) was calculated:

$$EA\ [\%] = \frac{\text{emulsified layer volume [ml]}}{\text{total emulsion volume (before centrifugation) [ml]}} \cdot 100$$

The emulsion stability (ES) was calculated on the basis of the formula as given below:

$$ES\ [\%] = \frac{\text{volume of the emulsified layer after centrifugation [ml]}}{\text{volume of the emulsified layer before heating [ml]}} \cdot 100$$

The water absorption capacity (WAC) and oil absorption capacity (OAC) were analyzed according to Ostrowska et al. [17]. The water absorption capacity (WAC) and the oil absorption capacity (OAC) were calculated using the following formula:

$$\text{WAC/OAC [g/g of sample]} = \frac{\text{wet sediment weight [g]}}{\text{sample weight [g]}} - 1$$

Statistical analysis

The contents of moisture, crude protein, total fat and ash (crude) were determined in triplicate and the analysis of water and oil absorption capacity was also carried out in triplicate. After the deproteinization step, the phenolic compounds were determined in triplicate too. After neutralizing the extract obtained, the content of phytic acid was determined in duplicate. After the emulsification step, the emulsifying activity and emulsion stability were determined in duplicate. The analysis of amino acid composition was carried out in one repetition. The calculated mean values and standard deviations were quoted. The data collected were subjected to a one-way analysis of variance (ANOVA); a Tukey's Post-hoc test was conducted to determine the significantly different ($p \leq 0.05$) means using a Minitab 18 software.

Results and discussion

The chemical composition of rapeseed protein-fibre concentrate (except for dietary fibre and crude fibre), soy fibre and pea fibre is shown in Tab. 1. The results confirm that the products analysed differ significantly in terms of the contents of moisture, crude protein, ash and phenolic compounds. Compared with SF and the content of crude protein therein (14.09 ± 0.06 %), RPFC is characterized by the highest content of crude protein (42.00 ± 0.45 %), whereas PF by the lowest (8.77 ± 0.22 %); this is directly correlated with the differences in the content of total carbohydrates. Moreover, RPFC contains the highest contents of mineral compounds in the form of ash (3.60 ± 0.15 %) and of phytic acid (2.51 ± 0.02 %). SF and PF have significantly lower quantities of phytic acid: 0.09 ± 0.01 % and 0.13 ± 0.02 %, respectively. With regard to the phenolic compounds PF is characterized by the highest content thereof (0.05 ± 0.00 %) and the SF by the lowest (0.01 ± 0.00 %) in comparison to RPFC (0.03 ± 0.00 %). SF has also the lowest content of fat (< 0.1). PF and RPFC have similar contents of fat: 0.60 ± 0.05 % and 0.49 ± 0.06 %, respectively.

In the previous studies the chemical composition was described of both the rapeseed isolates and the various rapeseed products. Ivanova et al. [11] obtained the rapeseed acid soluble protein (ASP) by an alkaline extraction and isoelectric precipitation. This product had 5.25 % of moisture, 28.84 % of crude protein on a dry matter basis (d.m.), 20.55 % d.m. of ash, 1.16 % d.m. of total lipids and 2.15 % d.m. of phenols. The protein content in the albumin and globulin fraction obtained from a *Brassica napus* meal by Tan et al. [22] according to an Osborne method equalled 39.88 % and 37.94 %, respectively. Yoshie-Stark et al. [26] obtained rapeseed concentrates from two different cultivars using steamed and non-steamed meals. The chemical composition of those products was as follows: the moisture content ranged from 8.5 % to 11.3 %, the content of protein – from 58.8 % to 65.4 %, the content of ash – from 7.7 % to 10.3 % and the content of fat – from 0.6 % to 1.2 %.

In the reference literature different fibre products are described too. The commercial pea fibre with a residue protein content amounting to 7.5 % of d.m. was studied by Beck et al. [4]. Nakata et al. [15] described the water soluble soy fibre containing 6.2 % of crude protein and 8.4 % of crude ash.

Table 1. Chemical composition of protein-fibre concentrate from rapeseed, soy fibre and pea fibre
Tabela 1. Skład chemiczny koncentratu białkowo-błonnikowego z rzepaku, błonnika sojowego i błonnika grochowego

Composition / Skład	RPFC	SF	PF
Moisture / Wilgotność [%]	$4.23^{b} \pm 0.10$	$7.47^{a} \pm 0.20$	$3.27^{c} \pm 0.38$
Crude Protein / Białko surowe [%]	$42.00^{a} \pm 0.45$	$14.09^{b} \pm 0.06$	$8.77^{c} \pm 0.22$
Total fat / Tłuszcz całkowity [%]	$0.49^{a} \pm 0.06$	$0.04^{b} \pm 0.03$*	$0.60^{a} \pm 0.05$
Mineral compounds in the form of ash Związki mineralne w postaci popiołu [%]	$3.60^{a} \pm 0.15$	$2.72^{b} \pm 0.08$	$1.90^{c} \pm 0.00$
Phenolic compounds / Związki polifenolowe [%]	$0.03^{b} \pm 0.00$	$0.01^{c} \pm 0.00$	$0.05^{a} \pm 0.00$
Phytic acid / Kwas fitynowy [%]	$2.51^{a} \pm 0.02$	$0.09^{b} \pm 0.01$	$0.13^{b} \pm 0.02$
Total Carbohydrates / Węglowodany ogółem [%]	49.68	75.68	85.46

Explanatory notes: / Objaśnienia:
RPFC – rapeseed protein fibre concentrate / koncentrat białkowo-błonnikowy z rzepaku; SF – soy fibre / błonnik sojowy; PF – pea fibre / błonnik grochowy. Table shows mean values ± standard deviation (except for total carbohydrates) / W tabeli przedstawiono wartości średnie ± odchylenie standardowe (oprócz węglodowanów ogółem); n = 3 (for phytic acid / dla kwasu fitynowego – n = 2), a, b, c – mean values in rows denoted by different letters differ statistically significantly ($p \leq 0.05$) / wartości średnie w wierszach oznaczone różnymi literami różną się statystycznie istotnie ($p \leq 0,05$); *< LOD – limit of detection / granica wykrywalności (LOD < 0,1).

The results of the content analysis of dietary fibre and crude fibre in rapeseed protein-fibre concentrate, soy fibre and pea fibre are shown in Tab. 2. PF has the significantly highest content of total dietary fibre (73.34 %) and crude fibre (27.78 %) than RPFC (50.21 % and 14.31 %, respectively) and SF (54.18 % and 11.98 %). PF exhibited the highest content of insoluble (68.65 %) dietary fibre whereas RPFC exhibited the lowest content of insoluble dietary fibre (47.75 %), and SF showed the lowest content of soluble dietary fibre (0.33 %). Accordingly, in every sample the content of soluble dietary fibre was lower than that of insoluble dietary fibre. Based on the research study it was revealed that in the case of RPFC the contents of total carbohydrates and total dietary fibre were similar; this fact suggests that it is mainly the dietary fibre that makes up carbohydrates profile in this particular product. However in SF and PF the contents of dietary fibre are lower than those of total carbohydrates; this fact may be an indication that those samples contain some other carbohydrates that were not taken into account in the research study.

Table 2. Dietary fibre and crude fibre of rapeseed protein-fibre concentrate, soy fibre and pea fibre
Tabela 2. Błonnik pokarmowy i włókno surowe koncentratu białkowo-błonnikowego z rzepaku, błonnika sojowego i błonnika grochowego

Composition / Skład	RPFC	SF	PF
Total dietary fibre / Błonnik pokarmowy ogółem [%]	50.21	54.18	73.34
Insoluble dietary fibre / Nierozpuszczalny błonnik pokarmowy [%]	47.75	53.85	68.65
Soluble dietary fibre / Rozpuszczalny błonnik pokarmowy [%]	2.46	0.33	4.69
Crude fibre / Włókno surowe [%]	14.31	11.98	27.78

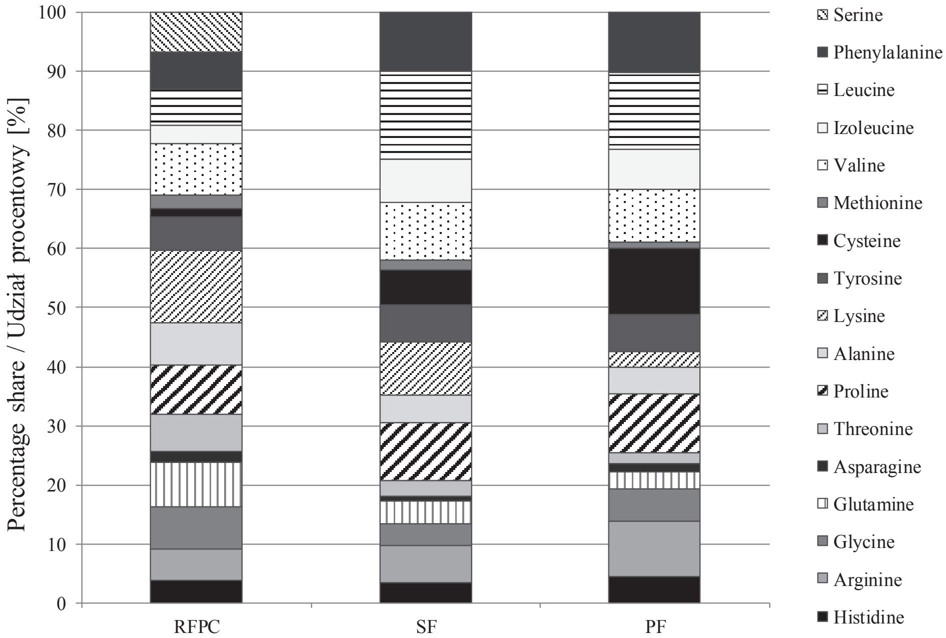
Explanation of symbols as in Tab. 1 / Objaśnienia symboli jak pod tab. 1.

The acid soluble rapeseed protein concentrates obtained by Ivanova et al. [11] had ca. 30.0 % of total fibre. The content of fibre in rapeseed concentrates as described by Yoshie-Stark et al. [26] ranged from 26.2 % to 30.6 %. The commercial pea fibre analysed by Beck et al. [4] contained 53 % d.m. of fibre and ca. 39.5 % d.m. of starch. According to Nakata et al. [15], the soy fibre contained 75.7 % of soluble fibre and various sugars such as galactose, arabinose, galacturonic acid, rhamnose, xylose, fucose and glucose.

The above compilation of data shows that the chemical composition of protein-fibre products depends on the source material, technological processes and the processing conditions applied. Typically the fibre products are characterized by a lower content of protein than the rapeseed product under the study, therefore it is depicted as a protein-fibre concentrate. With regard to the contents of total dietary fibre and crude fibre, RPFC shows the levels of those constituents similar to those in the commercial SF but lower than in the commercial PF. The research results indicate that the commercial fibre products are quite a diverse group of food preparations.

The amino acid composition is shown in Fig. 1, i.e. the percentage share of different amino acids in total amino acids contained in the rapeseed protein-fibre concentrate, soy fibre and pea fibre is illustrated. Seventeen amino acids were screened except tryptophan. The content of sulphur amino acids might be underestimated because of the method-related conditions, thus this content is inconclusive. The amount of lysine in RPFC is the highest (12.15 %) and that of cysteine is the lowest (1.44 %). RPFC is also characterized by a high percentage share percent of valine (8.76 %) and proline (8.32 %). Both in SF and PF, the percentage share of leucine is the highest (14.86 % and 13.17 %, respectively); serine is reported absent. SF has also high percentage shares of phenylalanine (9.93 %), proline (9.92 %), valine (9.74 %) and lysine

(8.93 %), whereas PF has high percentage shares of cysteine (11.22 %), phenylalanine (10.09 %), proline (9.96 %), arginine (9.41 %) and valine (8.97 %). The percentage shares of essential amino acids (histidine, threonine, lysine, methionine, valine, isoleucine, leucine and phenylalanine) are the highest in SF (58.48 %) and the lowest in PF (48.76 %) compared with RPFC (49.02 %). However, as previously mentioned, RPFC is characterized by the significantly highest content of protein. The percentage share of protein branched-chain amino acids (valine, isoleucine and leucine) is the highest in SF (32.03 %) and the lowest in RPFC (17.92 %) compared with PF (28.72 %).



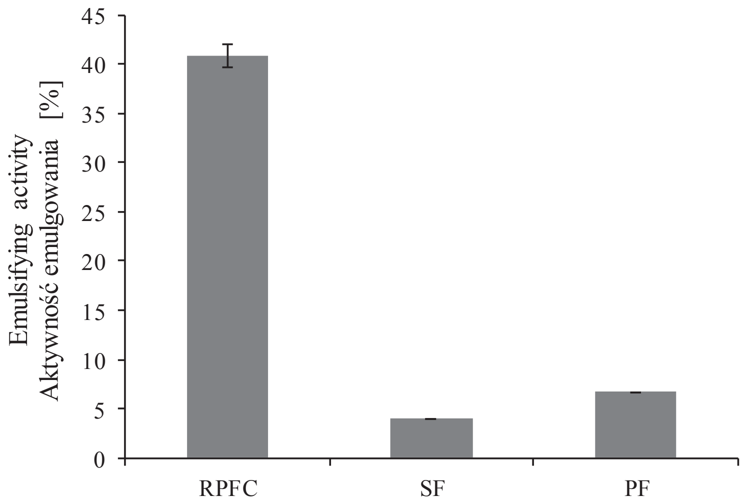
Explanatory notes / Objaśnienia:
Serine / Seryna; Phenylalanine / Fenyloalanina; Leucine / Leucyna; Izoleucine / Izoleucyna; Valine / Walina; Methionine / Metionina; Cysteine / Cysteina; Tyrosine / Tyrozyna; Lysine / Lizyna; Alanine / Alanina; Proline / Prolina; Threonine / Treonina; Asparagine / Asparagina; Glutamine / Glutamina; Glycine / Glicyna; Arginine / Arginina; Histidine / Histydyna.
Explanation of symbols as in Tab. 1 / Objaśnienia symboli jak pod tab. 1.

Fig. 1. Percentage share of amino acids in total amino acids contained in products analysed
Rys. 1 Procentowy udział aminokwasów w sumie aminokwasów zawartych w badanych produktach

The total amounts of amino acids in RPFC, SF and PF were, respectively, 28.85 g/100 g d.m., 9.09 g/100 g d.m. and 5.34 g/100 g d.m., thus they were lower than the crude protein content measured by a Kjeldahl method as shown in Tab. 1. This result could indicate that the samples studied might contain non-protein nitrogen

(NPN). In addition it should be mentioned that the total content level of amino acids might be understated because of an inconclusive content of sulphur amino acids and because of the fact that tryptophan was not analyzed.

The emulsifying properties of rapeseed protein-fibre concentrate, soy fibre and pea fibre are shown in Fig. 2 and 3. The emulsifying activity and emulsion stability was found to be the highest for RPFC (40.83 ± 1.18 % and 81.58 ± 3.42 %, respectively) and the lowest for SF (4.00 ± 0.00 % and 41.67 ± 0.00 %, respectively) compared with PF (6.67 ± 0.00 % and 60.00 ± 0.00 %, respectively).



Explanation of symbols as in Tab. 1 / Objaśnienia symboli jak pod tab. 1.

Fig. 2. Emulsifying activity of products studied
Rys. 2. Aktywność emulgowania badanych produktów

As previously mentioned, fibre has the capacity to emulsify fat and to increase emulsion stability [19]. Also proteins are reported to have emulsifying properties [5]. The highest EA (40.83 ± 1.18 %) for RPFC might be correlated with the highest protein content (42.00 ± 0.45 %). Worthy of note is the fact that although the pea fibre has a lower content of protein (8.77 ± 0.22 %), it has a higher emulsion stability (60.00 ± 0.00 %) than SF (41.67 ± 0.00 %). The formation of stable emulsion is significant in various food formulations as lipid-protein interactions are common in different preparations, for example in mayonnaises, ice creams or dressings [23]. RPFC seems to be a potential constituent in such products.

The capacity of rapeseed protein-fibre concentrate, soy fibre and pea fibre to absorb water (WAC) and oil (OAC) is illustrated in Fig. 4. SF has the highest water absorption capacity (9.96 ± 0.03 g/g) and PF the lowest (7.41 ± 0.37 g/g) compared with

RPFC (9.37 ± 0.17 g/g). However SF has the lowest oil absorption capacity (2.89 ± 0.13 g/g) and RPFC the highest (6.49 ± 0.02 g/g) compared with PF (3.40 ± 0.06 g/g).

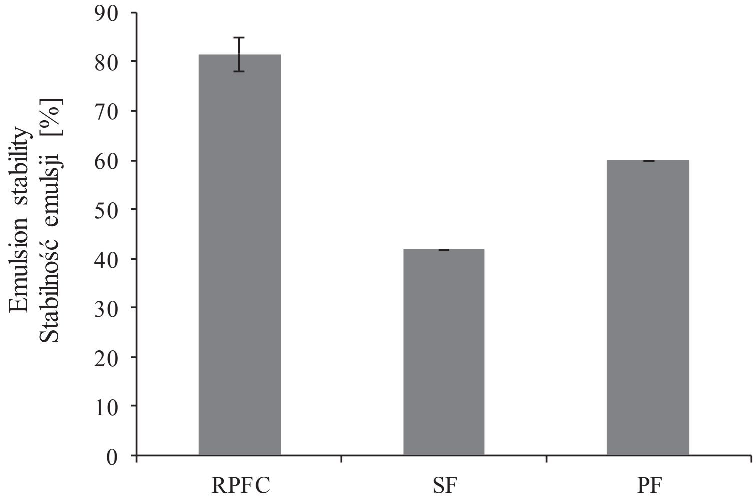


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Fig. 3. Emulsion stability of products studied
Rys. 3. Stabilność emulsji badanych produktów

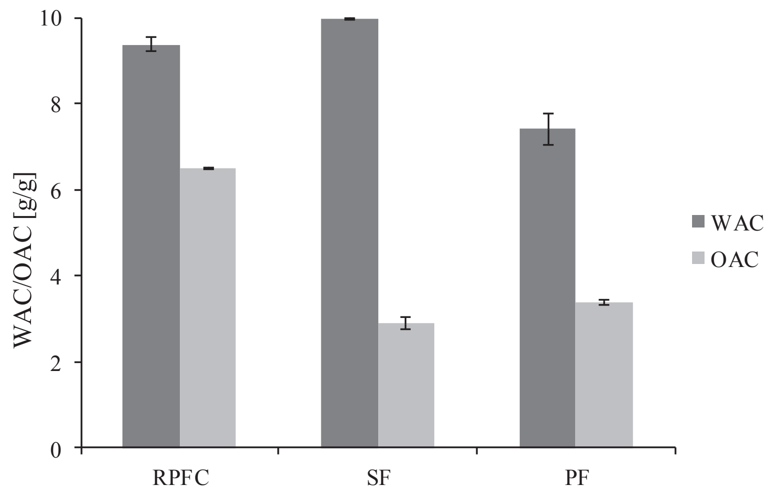

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Fig. 4. Water (WAC) and oil (OAC) absorption capacity of products studied
Rys. 4. Zdolność do absorpcji wody (WAC) i oleju (OAC) badanych produktów

Similarly to the emulsifying properties, both the fibre and the protein exhibited the capacity to absorb water [19, 5]. However the capacity of rapeseed protein isolate (RPI) and soy protein isolate (SPI) to absorb water and oil were lower than those of the rapeseed protein-fibre concentrate and soy fibre. As for RPI, the WAC and OAC values were 0.50 g/g and 1.63 g/g, respectively and as for SPI: 6.42 g/g and 0.99 g/g, respectively [17]. The capacity to absorb water is important in such formulations as cakes and breads for it can diminish the loss of water from a product. It is also important in the formulations, such as canned fish, cured sausages or frozen food, where it can extend the yield [23].

The results obtained prove that the rapeseed protein-fibre concentrate has a potential to be used as a protein and fibre enriching additive to develop protein- and fibre-rich formulations or as a typical replacement for different compounds, for example to replace animal proteins. As previously mentioned, the emulsifying properties are important in such food systems as dressings, mayonnaises or ice creams. Water absorption capacity plays then a role in the formation of bakery products, for example breads or cakes, frozen foods or meat preparations [23]. Wanasundara et al. [24] presented a review of reported food applications of canola protein products. They portrayed several types of applications, such as bakery products, beverages, dairy and egg substitutes, processed meat products, salad, dressings and sauces and flavourings. It was confirmed that the canola protein concentrate could be added to bread dough (in the amount not exceeding 18 %) as a wheat flour protein replacement. Canola protein concentrate could also be used in wieners (up to 3.8 %) to improve casing peelability; in beef patties (up to 3 %) to retain liquids; in bologna (up to 3 %) to provide for a better water absorption capacity and to extend the yield; or in sausages to replace casein that improves taste and aroma, but it causes the texture properties to deteriorate. The results as presented in this research study appear to be consistent with the previously reported data on the potential uses of canola protein in food applications.

Conclusions

1. The research conducted shows that, compared with the commercial fibre products, the rapeseed protein-fibre concentrate (RPFC) is characterized by a significantly higher content of protein and exhibits a total dietary fibre content similar to that of soy fibre (SF).
2. Commercial fibre preparations are a differentiated group of products in terms of the content of fibre fractions therein and functional properties thereof.
3. RPFC has a higher percentage share of essential amino acids than PF, but lower than SF.
4. Besides its nutritional value, the rapeseed protein-fibre concentrate has highly desirable functional properties, such as emulsifying activity and emulsion stability,

and the water and oil absorption capacity that suggests its potential use as a functional and nutritional component in various food formulations.

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The employee of NapiFeryn BioTech Sp. z o.o. (Anna Ostrowska) is carrying out the PhD programme (as a part of the Polish Ministry of Science and Higher Education programme called "Doktorat wdrożeniowy") "The properties of Polish rapeseed protein preparations and their applications in chosen food products" in cooperation with Department of Starch Technology and Confectionery, Institute of Food Technology and Analysis, Faculty of Biotechnology and Food Sciences, Lodz University of Technology.

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KONCENTRAT BIAŁKOWO- BŁONNIKOWY Z RZEPAKU – SKŁAD CHEMICZNY I WŁAŚCIWOŚCI FUNKCJONALNE

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

Błonnik pokarmowy wywiera pozytywny wpływ na zdrowie człowieka, który przejawia się m.in. zmniejszaniem ryzyka otyłości, cukrzycy czy nowotworów. Jego właściwości funkcjonalne sprawiają, że jest pożądanym dodatkiem do żywności.

Celem pracy była ocena właściwości odżywczych i funkcjonalnych nowatorskiego koncentratu białkowo-błonnikowego z rzepaku (RPFC), opracowanego przez firmę NapiFeryn BioTech. Skład chemiczny, w tym skład aminokwasowy oraz właściwości funkcjonalne RPFC zostały porównane z dostępnym na rynku błonnikiem sojowym (SF) i błonnikiem grochowym (PF) w celu oceny potencjału RPFC jako innowacyjnego składnika do zastosowania w żywności. W badaniach wykazano, że RPFC zawierał znacznie więcej białka niż SF i PF. Jednocześnie stwierdzono, że poziom całkowitego błonnika pokarmowego w RPFC był zbliżony do poziomu tego składnika w SF. RPFC cechował się także największą zawartością popiołu i kwasu fitynowego. Na podstawie wyników analizy aminokwasów dowiedziono, że w RPFC na najwyższym poziomie występowała lizyna. Koncentrat RPFC charakteryzował się większym udziałem niezbędnych aminokwasów niż PF, ale mniejszym – niż SF. RPFC odznaczał się dobrymi właściwościami funkcjonalnymi, takimi jak: aktywność emulgowania, stabilność emulsji, jak również zdolnością do absorpcji wody i oleju. Wykazano, że RPFC ma odpowiednie cechy do wykorzystania go jako funkcjonalnego składnika żywności w produktach żywnościowych.

Słowa kluczowe: koncentrat białkowo-błonnikowy z rzepaku, błonnik pokarmowy, dodatki do żywności, funkcjonalność