Nauka Przyroda Technologie

2012
Tom 6
Zeszyt 2

ISSN 1897-7820 http://www.npt.up-poznan.net
Dział: Nauki o Żywności i Żywieniu

MONIKA MODZELEWSKA-KAPITUŁA, HALINA OSTOJA, MAREK CIERACH

Department of Meat Technology and Chemistry
University of Warmia and Mazury in Olsztyn

INFLUENCE OF RAPE-SEED OIL ON SENSORY AND TEXTURAL PROPERTIES OF MODEL COMMINUTED MEAT PRODUCTS

WPŁYW OLEJU RZEPAKOWEGO NA JAKOŚĆ ORGANOLEPTYCZNĄ I PARAMETRY TEKSTURY MODELOWYCH DROBNO ROZDROBNIONYCH WYROBÓW MIĘSNYCH

Summary. The study was aimed to investigate the effect of partial back fat substitution by rape-seed oil on composition, physical and sensorial properties of comminuted meat products. Four treatments were produced: control (40% of porcine fat) and products in which 12.5, 25 and 37% of back fat was substituted by oil. Modifications in fat composition resulted in changes in water and protein content ($P < 0.05$). Visible fat content differed only between control and the treatment in which 37% of back fat was replaced by rape-seed oil ($P < 0.05$). With the increased level of substitution the production yield decreased. The substitution of back fat by rape-seed oil did not cause changes in pH values and colour parameters of products, but modified hardness, springiness, chewiness and gumminess (TPA test), as well as consistency and binding (sensory evaluated). In conclusion, it is possible to substitute up to 25% of porcine back fat by rape-seed oil in comminuted meat product without any adverse effect on its quality parameters.

Key words: rape-seed oil, back fat, functional meat products, comminuted meat products

Introduction

The term "functional food" refers to the food products that have tertiary functions, which means that they contain components that prevent diseases by modulating physiological system of consumer (ARIHARA 2006, SŁOWIŃSKI and JANKIEWICZ 2011 a). The market of functional food is continuously developing, also in the segment of meat products. However, the development of functional meat products is relatively slower as compared to dairy products. It is caused by "a bad reputation" of meat products, which consumers regard as unhealthy due to high fat, cholesterol and salt content. However, fat in meat products plays an important role because it affects sensory properties such as: juiciness, taste, flavor and texture (HUGHES et AL. 1997, PIETRASIK and DUDA 2000). The most commonly used is porcine back fat, because of its good technological properties. The fatty acids of back fat are composed in 47% of monounsaturated fatty acids (MUFA) (OSPINA-E et AL. 2010) which have a beneficial or at least neutral impact on cardiovascular system (WARNANTS et AL. 1998) and saturated fatty acids (SFA), which contribute to cardiovascular diseases development caused by elevated blood pressure, increased LDL cholesterol and triacyloglicerols content in serum (SERRANO et AL. 2007). One of the possibilities for obtaining functional meat products is changing their fatty acid composition by replacing animal fat by vegetable oils (JIMÉNEZ-COLMENERO 2007, SŁOWIŃSKI and JANKIEWICZ 2011 b). Rape-seed oil is rich in oleic (18:1) and α-linolenic (18:3) acids and the level of saturated acids is lower as compared to all major plant oils (BABA et AL. 1999). Substitution of animal fat by rape-seed oil beneficially changes omega-6:omega-3 ratio (RYCIELSKA and SŁOWIŃSKI 2011) in meat products. Consumption of such products can reduce serum total and LDL cholesterol in humans (MATHESON et AL. 1996, CHISHOLM et AL. 2005). Additionally, plant oils contain sterols, which reduce absorption of cholesterol in human body (GYLLING and MIETTINEN 2005).

Comminuted meat products are consumed all over the world. The production process is so simple that it is possible to produce them at home. Consumers, who pay special attention to the quality of food which they eat, produce meat products on their own avoiding using additions regarded by them as unhealthy. Comminuted meat products can be produced from porcine meat and back fat, which content in the material composition can even reach 40%. Partial substitution of back fat by rape-seed oil could be a good way to obtain products containing lower cholesterol level and more desirable PUFA:MUFA:SFA ratio, as well as omega-6:omega-3 ratio. However, for consumers sensory properties of products are crucial. Consumers will not accept products characterised by high nutritional value if taste and texture of the products are inappropriate. Thus, the aim of the study was to investigate the effect of substitution of back fat by rape-seed oil on physical and sensorial properties of model comminuted meat products to determine maximal level of substitution.

Materials and methods

The materials for comminuted meat products were pork meat class I, pork back fat and additions (Table 1). Four different treatments were prepared: 1 – without any addition of rape-seed oil (control) and three treatments (marked as 2, 3, 4) in which 12.5, 25 and 37% of back fat was replaced by commercial rape-seed oil (Z.T Kruszwica S.A., Kruszwica, Poland). Treatments 1, 2, 3, 4 contained 0, 5, 10, 15% of rape-seed oil, respectively. Meat and back fat were ground in a grinder through a mesh size of 10 mm and then mixed with ice water, spices, gelatin and rape-seed oil. After obtaining a desirable, sticky consistency, batter (approximately 700 g) was placed in a plastic bag in an aluminum vessel for at home production of comminuted meat products (22 cm high, internal diameter 10 cm, Expleo, Cieszyn, Poland) covered with a lid and cooked in

Table 1. Material composition of model comminuted meat products (%)
Tabela 1. Receptura modelowych drobno rozdrobnionych wyrobów mięsnych (%)

Constituent Składnik	Treatment* – Wersja wyrobu*			
	1	2	3	4
Pork meat class I Mięso wieprzowe klasy I	60	60	60	60
Pork back fat Słonina	40	35	30	25
Rape-seed oil Olej rzepakowy	0	5	10	15
Sum – Suma	100	100	100	100
Seasonings and additives** Przyprawy i dodatki**				
curing mixture*** (99.4% NaCl and 0.6% $NaNO_2$) peklosól*** (99,4% NaCl i 0,6% $NaNO_2$)	2	2	2	2
pepper pieprz	0.1	0.1	0.1	0.1
garlic czosnek	0.07	0.07	0.07	0.07
marjoram majeranek	0.1	0.1	0.1	0.1
gelatin żelatyna	2	2	2	2
ice water woda lodowa	9	9	9	9

*1 – no back fat substitution by rape-seed oil (control), 2 – 12.5% substitution of back fat by rape-seed oil, 3 – 25% substitution of back fat by rape-seed oil, 4 – 37% substitution of back fat by rape-seed oil.
**In respect to the mass of meat, fat and oil.
***In respect to the mass of pork meat.
*1 – bez udziału oleju rzepakowego (próba kontrolna), 2 – zastąpienie 12,5% słoniny olejem rzepakowym, 3 – zastąpienie 25% słoniny olejem rzepakowym, 4 – zastąpienie 37% słoniny olejem rzepakowym.
**W stosunku do masy mięsa, tłuszczu i oleju.
***W stosunku do masy mięsa wieprzowego.

water bath (approximately 80°C) until the temperature in the center of meat loaf reached 72°C. After that the vessels were put into cold running water to cool the products to about 35°C. Products were placed in the refrigerator (4°C) in darkness to cool down overnight. Two batches of products were produced. Products were evaluated the next day after production.

Proximate chemical composition: moisture, protein and fat content of meat products was assayed using NIR-T analizator (Food Check, Bruins Instrument, Purchheim, Germany). Samples approximately 300 g were homogenized, placed into plastic dish and subjected to measurements. Three measurements of every sample were performed (n = 24).

Visible fat content and colour parameters were determined by computer image analysis (CIA). After cooling products were cut on 1 cm thick pieces, which were placed on blue background and photographed with digital camera (Fujifilm Fine Pix M603, Japan) mounted on the photographic bench 30 cm above the sample. The photographs were taken under fluorescent light from two lamps (23 cm long, 11 W, a colour temperature of 4000 K, Dulux S, Osram, Italy). The angle between the camera lens and the lighting source axis was approximately 45°. Flash function of the camera was off. Pictures (1280 × 960 pixels) saved as .jpg were analyzed using CIA program (NIS-Element Br 2.20, Nikon Corporation, Tokyo, Japan). On pictures of cross-section of products the ratio of area occupied by fat, which was white, to the total area of meat cross-section was calculated. Following colour parameters were measured on the area of cross-section of meat products: mean values of red (R), green (G), blue (B), hue, saturation, L*, a*, b*. Visible fat content and colour parameters were measured on three samples from each variant (n = 24).

Before cooking pH value of batters was examined using pehameter (Hanna Instruments, Woonsocket, RI, USA) with FC 200 electrode placed directly in batter.

Production yield was calculated on the basis of mass of the batter before cooking and the mass of the comminuted meat product after cooling. The fat which was not bound in batter was considered as a loss.

The texture profile analysis (TPA) was performed by twofold compression method using TA-XT2i (Stable Micro Systems, Godalming, UK) connected to a PC equipped with Texture Expert Exceed software (SZCZĘŚNIAK 1990). Cylindrical samples of products (10 mm high and 17 mm diameter) were subjected to double compression, to 50% of their height, using a piston 75 mm in diameter, at the head velocity of 5 mm/s. All the determinations were done after production and cooling of products on six samples from every treatment (n = 48).

A comparison between meat samples was conducted according to the Polish Standard PN-ISO 4121:1998. Consistency, juiciness, binding, taste, color of the cross section and overall acceptability of the products were evaluated by 40 panelists who were students of meat technology. The attributes were evaluated using linear scaling method. The panelists were asked to indicate on 100-mm scale with edge marks: "I like very much" (on the right) – "I don't accept" (on the left) their preference of each attribute. The notes were obtained by measuring the distance between left edge of the scale and the mark (KRZYWDZIŃSKA-BARTKOWIAK et AL. 2008).

Data were analysed by Anova and means were compared using Duncan's multiple range test at a significance level of P = 0.05 (Statistica 8.0, StatSoft Inc., Tulsa, OK, USA).

Results and discussion

The proximate chemical composition of products is presented in Table 2. In all products containing rape-seed oil higher moisture content was found as compared to the control sample ($P < 0.05$). The same was noted for protein content with the exception

Table 2. Proximate chemical composition, visible fat content, pH value and production yield of model comminuted meat products
Tabela 2. Podstawowy skład chemiczny, udział powierzchni zajmowanej przez tłuszcz, wartość pH i wydajność produkcji modelowych drobno rozdrobnionych wyrobów mięsnych

Constituent Składnik	Treatment – Wersja wyrobu			
	1	2	3	4
Moisture (%) Woda (%)	50.74 b (4.92)	56.27 a (1.68)	54.32 a (0.29)	55.52 a (2.28)
Fat (%) Tłuszcz (%)	33.14 a (6.31)	26.17 a (2.12)	28.72 a (0.25)	27.18 a (2.98)
Visible fat (%) Udział powierzchni zajmowanej przez tłuszcz (%)	16.17 a (2.28)	14.00 ab (4.76)	16.93 a (3.94)	10.05 b (3.35)
Protein (%) Białko (%)	14.80 b (1.55)	16.43 a (0.48)	15.85 ab (0.08)	16.23 a (0.69)
pH	5.89 a (0.13)	5.70 a (0.12)	5.64 a (0.11)	5.54 a (0.13)
Production yield (%) Wydajność podukcji (%)	93.93 a (2.4)	89.19 b (3.4)	77.84 c (3.8)	73.2 c (2.7)

Treatments – as in Table 1.
Mean values in rows designated with different letters differ statistically ($P < 0.05$). In parentheses – values of standard deviation.
Wersje wyrobu – jak w tabeli 1.
Średnie w rzędach oznaczone różnymi literami różnią się statystycznie ($P < 0,05$). W nawiasach – wartości odchylenia standardowego.

for treatment 3, in which protein content did not differ from control. Control (treatment 1) was characterised by the highest fat content, although no significant differences among that and other treatments were observed ($P > 0.05$). Only products containing 15% of rape-seed oil had significantly lower ($P < 0.05$) visible fat content as compared to the control. The composition of products influenced the production yield, which decreased as the amount of rape-seed oil increased and was the lowest in treatment 4 (Table 2). The differences in chemical composition can be partially explained by differences in chemical composition of back fat and rape-seed oil. According to the manufacturer declaration rape-seed oil was entirely composed of fat, whereas back fat besides fat (approximately 88%) contains also moisture (approximately 9%) and protein (approximately 3%) (KRASNOWSKA and SALEJDA 2008). Moreover, animal fat has better binding properties as compared to vegetable oils (YOUSSEF and BARBUT 2009), which was also shown in the present study. Lowered production yield as a result of substitution of back fat by vegetable oil in meat products was also reported by DZUDIE et AL. (2004) and PYRCZ et AL. (2007). Although the fat which was not bound in batter was considered in calculation as a loss, in fact it surrounded the meat batter and could be consumed.

No significant differences in pH values among products were noted (Table 2). Similar results were previously reported by others (DZUDIE et AL. 2004, CHOI et AL. 2010).

Modzelewska-Kapituła M., Ostoja H., Cierach M., 2012. Influence of rape-seed oil on sensory and textural properties of model comminuted meat products. Nauka Przyr. Technol. 6, 2, #32.

The substitution of back fat by rape-seed oil did not cause the modification of colour parameters of meat products (Table 3). PELSER et AL. (2007) noted that 20% replacement of back fat by flaxseed oil changed only yellowness (b*) of fermented sausages, but not lightness (L*) and redness (a*). They concluded that it was caused by the colour parameters of flaxseed oil. In our study rape-seed oil was used, which has lighter and less yellow colour as compared to flaxseed oil, so it did not affect colour parameters of the products.

Table 3. Colour parameters of model comminuted meat products
Tabela 3. Parametry barwy modelowych drobno rozdrobnionych wyrobów mięsnych

Parameter Parametr	Treatment – Wersja wyrobu			
	1	2	3	4
R	159.03 ab (5.34)	164.48 a (2.99)	150.33 b (10.07)	152.53 b (9.36)
G	205.61 a (10.40)	200.62 a (14.30)	191.27 a (15.31)	192.91 a (18.73)
B	157.94 ab (6.48)	166.17 a (2.19)	150.35 b (10.21)	154.29 b (11.48)
Hue – Odcień	113.53 a (3.23)	126.64 b (7.25)	109.38 a (9.98)	110.38 a (15.51)
Saturation – Nasycenie	20.00 a (1.00)	24.70 a (5.58)	21.60 a (3.13)	23.27 a (5.69)
L*	74.29 a (8.03)	59.52 a (14.55)	71.02 a (12.09)	72.29 a (23.97)
a*	84.19 ab (1.39)	85.38 a (0.79)	82.30 b (2.33)	83.00 ab (2.26)
b*	4.64 a (0.69)	2.46 b (1.47)	3.79 ab (1.41)	2.98 ab (2.00)

Treatments – as in Table 1.

R, G, B – colour coordinates in the RGB model: R (red) – values from 0 to 255, G (green) – values from 0 to 255, B (blue) – values from 0 to 255.

L*, a*, b* – colour coordinates in the CIELAB model: L* (brightness) – values from 0 (black) to 100 (white), a* – values from –60 (green) to +60 (red), b* – values from –60 (blue) to +60 (yellow).

Mean values in rows designated with different letters differ statistically ($P < 0.05$). In parentheses – values of standard deviation.

Wersje wyrobu – jak w tabeli 1.

R, G, B – parametry barwy w modelu RGB: R (składowa czerwona) – wartości od 0 do 255, G (składowa zielona) – wartości od 0 do 255, B (składowa niebieska) – wartości od 0 do 255.

L*, a*, b* – parametry barwy w modelu CIELAB: L* (jasność) – wartości od 0 (czerń) do 100 (biel), a* – wartości od –60 (barwa zielona) do +60 (barwa czerwona), b* – wartości od –60 (barwa niebieska) do +60 (barwa żółta).

Średnie w rzędach oznaczone różnymi literami różnią się statystycznie ($P < 0,05$). W nawiasach – wartości odchylenia standardowego.

It was noted that fat substitution influenced the texture profile of products (Fig. 1). Hardness I and hardness II decreased as the content of rape-seed oil increased. Control samples, without any addition of rape-seed oil, had higher springiness and chewiness than treatments 2, 3 and 4 ($P < 0.05$). Only treatment 4 (produced with 15% rape-seed oil) had significantly ($P < 0.05$) lower gumminess as compared to the control. Adhesiveness and cohesiveness were not affected by the level of back fat substitution by rape-seed oil. The results of our study confirm findings of DZUDIE et AL. (2004) who noted that addition of vegetable oils made meat products softer.

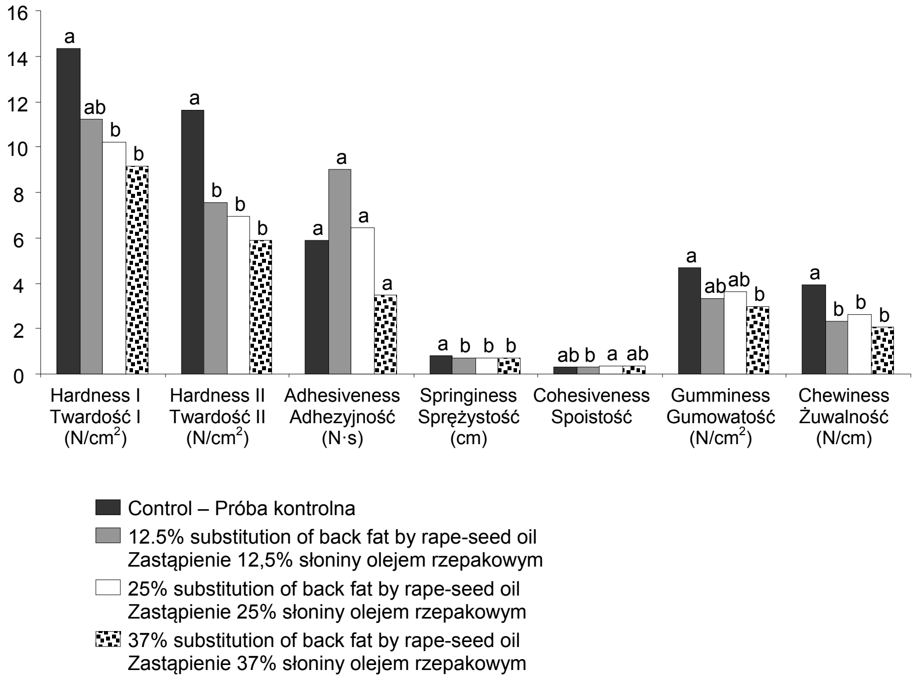

Fig. 1. Texture parameters (TPA test) of model comminuted meat products. Mean values within each attribute designated with different letters differ statistically ($P < 0.05$)
Rys. 1. Parametry tekstury (test TPA) modelowych drobno rozdrobnionych wyrobów mięsnych. Średnie w obrębie poszczególnych właściwości oznaczone różnymi literami różnią się statystycznie ($P < 0,05$)

The back fat substitution by rape-seed oil affected some sensory attributes of products (Fig. 2). With the increase of back fat substitution the consistency of products was less desirable. The most desirable consistency possessed control samples whereas the least treatment 4. Juiciness and color of products were not affected by rape-seed oil content. Binding of meat and fat in the products was better in treatments 1 (control) and 2 as compared to treatments 3 and 4 ($P < 0.05$), which indicates that binding decreased when level of back fat substitution by oil was higher than 12.5%. In terms of taste panelists assigned lower ($P < 0.05$) scores to treatment 4 as compared to the control. Back fat substitution by rape-seed oil influenced also overall acceptability of products. Products in which oil content was in the range 0 to 10% gained similar notes, whereas treatment 4, in which oil content was 15%, gained significantly lower score ($P < 0.05$). As shown by PYRCZ et AL. (2007) 50% substitution of back fat by rape-seed oil in formulation of frankfurters did not change sensory attributes such as taste, aroma, colour and consistency of products. However PELSER et AL. (2007) noted that higher scores for overall acceptability gained control sausages as compared to the products in which 20% of back fat was replaced by flaxseed oil.

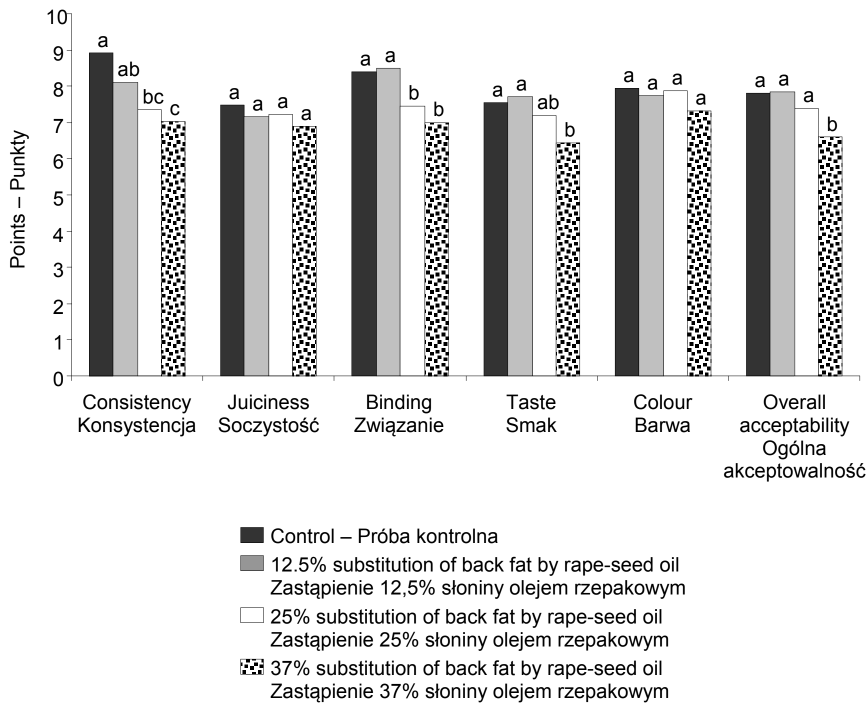

Fig. 2. Results of sensory analysis of model comminuted meat products. Mean values within each attribute designated with different letters differ statistically ($P < 0.05$)
Rys. 2. Wyniki oceny organoleptycznej modelowych drobno rozdrobnionych wyrobów mięsnych. Średnie w obrębie poszczególnych właściwości oznaczone różnymi literami różnią się statystycznie ($P < 0,05$)

Conclusions

1. It is possible to substitute up to 25% of porcine back fat with rape-seed oil in comminuted meat products without any adverse effect on the quality parameters.
2. Substitution of 37% of back fat by rape-seed oil changes unfavourably consistency and overall acceptability of products. Moreover, it reduces the area occupied by fat (visible fat) on the cross-section of the products.
3. Partial substitution of back fat by rape-seed oil lowers the production yield.
4. Due to easy technology of production, comminuted meat products with rape-seed oil as a substitute for back fat can be made at home.

References

ARIHARA K., 2006. Strategies for designing novel functional meat products. Meat Sci. 74: 219--229.

BABA N.H., ANTONIADES K., HABAL Z., 1999. Effects of dietary rape-seed, olive and linolenic acid enriches olive oils on plasma lipids, lipid peroxidation and lipoprotein lipase activity in rats. Nutr. Res. 19: 601-612.

CHISHOLM A., MCAULEY K., MANN J., WILLIAMS S., SKEAFF M., 2005. Cholesterol lowering effects of nuts compared with a rape-seed oil enriched cereal of similar fat composition. Nutr. Metab. Cardiovasc. 15: 284-292.

CHOI Y.-S., CHOI J.-H., HAN D.-J., KIM H.-Y., LEE M.-A., KIM H.-W., LEE J.-W., CHUNG H.-J., KIM C.-J., 2010. Optimization of replacing pork back fat with grape seed oil and rice bran fiber for reduced-fat meat emulsion systems. Meat Sci. 84: 212-218.

DZUDIE T., KOUEBOU C.P., ESSIA-NGANG J.J., MBOFUNG C.M.F., 2004. Lipid sources and essential oils effects on quality and stability of beef patties. J. Food Eng. 65: 67-72.

GYLLING H., MIETTINEN T.A., 2005. Cholesterol absorption: influence of body weight and the role of plant sterols. Curr. Atherosclerosis Rep. 7: 466-471.

HUGHES E., COFRADES S., TROY D.J., 1997. Effects of fat level, oat fiber and carrageenan on frankfurters formulated with 5, 12 and 30% fat. Meat Sci. 45: 273-281.

JIMÉNEZ-COLMENERO F., 2007. Healthier lipid formulation approaches in meat based functional foods. Technological options for replacement of meat fats by non-meat fats. Trends Food Sci. Technol. 18: 567-578.

KRASNOWSKA G., SALEJDA A., 2008. Wybrane cechy jakościowe tłuszczu pochodzącego z tusz tuczników różnych grup genetycznych. Żywn. Nauka Technol. Jakość 2: 95-105.

KRZYWDZIŃSKA-BARTKOWIAK M., DOLATA W., PIĄTEK M., MICHALSKI K., 2008. Wpływ wymiany tłuszczu zwierzęcego tłuszczem roślinnym i błonnikiem pokarmowym na jakość farszów i kiełbas drobno rozdrobnionych. Żywn. Nauka Technol. Jakość 4: 61-67.

MATHESON B., WALKER K.Z., TAYLOR D.M., PETERKIN R., LUGG D., O'DEA K., 1996. Effect on serum lipids of monounsaturated oil and margarine in the diet of an Antarctic Expedition. Am. J. Clin. Nutr. 63: 933-938.

OSPINA-E J.C., CRUZ-S A., PÉREZ-ÁLVAREZ J.A., FERNÁNDEZ-LÓPEZ J., 2010. Development of combinations of chemically modified vegetable oils as pork backfat substitutes in sausages formulation. Meat Sci. 84: 491-497.

PELSER W.M., LINSSEN J.P.H., LEGGER A., HOUBEN J.H., 2007. Lipid oxidation in n-3 fatty acid enriched Dutch style fermented sausages. Meat Sci. 75: 1-11.

PIETRASIK Z., DUDA Z., 2000. Effects of fat content and soy protein/carrageenan mix on the quality characteristics of comminuted, scalded sausages. Meat Sci. 56: 181-188.

PN-ISO 4121:1998. Analiza sensoryczna – Metodologia – Ocena produktów żywnościowych przy użyciu metod skalowania. PKNMiJ, Warszawa.

PYRCZ J., KOWALSKI R., DANYLUK B., 2007. Jakość kutrowanych kiełbas parzonych produkowanych z udziałem tłuszczów roślinnych Med. Wet. 63: 118-122.

RYCIELSKA J., SŁOWIŃSKI M., 2011. Przetwory mięsne wzbogacone w kwasy tłuszczowe omega--3. Przem. Spoż. 65, 3: 32-34.

SERRANO A., LIBRELOTTO J., COFRADES S., SANCHEZ-MUNIZ F.J., JIMÉNEZ-COLMENERO F., 2007. Composition and physicochemical characteristics of restructured beef steaks containing walnuts as affected by cooking method. Meat Sci. 77: 304-313.

SŁOWIŃSKI M., JANKIEWICZ L., 2011 a. Mięso i przetwory mięsne żywnością funkcjonalną. Część I. Gosp. Mięsna 04: 10-13.

SŁOWIŃSKI M., JANKIEWICZ L., 2011 b. Mięso i przetwory mięsne żywnością funkcjonalną. Część II. Gosp. Mięsna 05: 18-22.

SZCZĘŚNIAK A.S., 1990. Texture: is it still an overlooked food attribute. Food Technol. 44: 86-95.

WARNANTS N., VAN OECKEL M.J., BOUCQUI C.H.V., 1998. Effect of incorporation of dietary polyunsaturated fatty acids in pork backfat on the quality of salami. Meat Sci. 49: 435-445.
YOUSSEF M.K., BARBUT S., 2009. Effects of protein level and fat/oil on emulsion stability, texture, microstructure and color of meat batters. Meat Sci. 82: 228-233.

WPŁYW OLEJU RZEPAKOWEGO NA JAKOŚĆ ORGANOLEPTYCZNĄ I PARAMETRY TEKSTURY MODELOWYCH DROBNO ROZDROBNIONYCH WYROBÓW MIĘSNYCH

Streszczenie. Celem pracy było zbadanie wpływu częściowego zastąpienia słoniny olejem rzepakowym na skład chemiczny, właściwości fizyczne i organoleptyczne modelowych drobno rozdrobnionych wyrobów mięsnych. Przygotowano cztery wersje wyrobów: kontrolną, zawierającą 40% słoniny, oraz eksperymentalne, w których 12,5, 25 i 37% słoniny zastąpiono olejem rzepakowym. Częściowe zastąpienie tłuszczu zwierzęcego olejem roślinnym spowodowało zmiany w zawartości wody i białka w wyrobach ($P < 0,05$). Różnice w udziale powierzchni zajmowanej przez tłuszcz na przekroju mielonki odnotowano jedynie pomiędzy wersją kontrolną a wyrobami, w których 37% słoniny zastąpiono olejem rzepakowym ($P < 0,05$). Wraz ze wzrostem poziomu substytucji słoniny olejem zmniejszała się wydajność produkcji. Zamiana tłuszczu zwierzęcego na olej rzepakowy nie spowodowała zmian wartości pH wyrobów ani parametrów barwy, wpłynęła natomiast na twardość, sprężystość, żuwalność i gumowatość (test TPA) oraz konsystencję i związanie wyrobów (ocena organoleptyczna). Stwierdzono, że bez niekorzystnego wpływu na parametry jakościowe wyrobów możliwe jest zastąpienie słoniny olejem rzepakowym w ilości do 25%.

Słowa kluczowe: olej rzepakowy, słonina, funkcjonalne przetwory mięsne, drobno rozdrobnione wyroby mięsne

Corresponding address – Adres do korespondencji:
Monika Modzelewska-Kapituła, Katedra Technologii i Chemii Mięsa, Uniwersytet Warmińsko-Mazurski w Olsztynie, pl. Cieszyński 1, 10-718 Olsztyn, Poland, e-mail: monika.modzelewska@uwm.edu.pl

Accepted for print – Zaakceptowano do druku:
13.01.2012

For citation – Do cytowania:
Modzelewska-Kapituła M., Ostoja H., Cierach M., 2012. Influence of rape-seed oil on sensory and textural properties of model comminuted meat products. Nauka Przyr. Technol. 6, 2, #32.