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EFFECT OF RAW MATERIAL COMPOSITION ON QUALITY AND NUTRITIONAL VALUE OF MARKET PÂTÉS

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Abstract. The aim of the present work was to characterise the raw material composition and the declared additional substances, chemical composition, fatty acid profile and sensory desirability of market pâtés, available in retail trade in the Capital City of Warsaw. The studies were conducted with 19 assortments of pâtés and included determination of basic chemical composition (water, protein, fat, sodium chloride, starch, ash, phosphorus and collagen content), fatty acid profile, and desirability of sensory quality. It was found that the raw material composition of the evaluated products was differentiated and had a significant effect on chemical composition and fatty acid profile. Content of water in the assessed samples of the pâtés varied from 56.9 to 70.4 %, of protein – from 9.0 to 13.9%, of fat – from 13.4 to 24.7%, of sodium chloride – from 1.4 to 1.5%, of starch – from 2.0 to 6.2%, of ash – from 1.9 to 2.2%, of phosphorus – from 2.5 to 2.7 g kg^{-1} and of collagen – from 1.6 to 1.8%. In the composition of the evaluated pâtés, monounsaturated and saturated fatty acids (FA) were prevailing. High content of liver and egg powder, as added in the raw material recipe, have been reflected in higher content of polyunsaturated fatty acids (PUFA) and *trans* fatty acids. The examined pâtés were characterised by high desirability of sensory quality; none of the tested parameters was disqualified.

Keywords: pâtés, chemical composition, fatty acid profile, sensory desirability, quality

INTRODUCTION

Pâtés are classified as culinary products with an addition of liver and other offals of slaughter animals, being previously scalded, boiled or stewed, and of non-meat raw materials and an addition of seasonings. All components are ground or chopped, mixed into one homogenous mass, appropriately moulded and subjected to baking or scalding (PN-A-82012). They are defined as blocs with differentiated size and weight, depending on the employed mould. The surface, irre-

spectively of the type of thermal treatment, should be clean, smooth and slightly wet. Irrespective of the employed components, the employed products should meet the requirements of the relevant standards, including specification of chemical composition, sensory properties and microbiological requirements concerning health safety.

The requirements of sensory quality of the pâtés cover such discriminants as general appearance, consistence and structure, colour and flavour (taste and smell). Among the physicochemical parameters, the requirements of the particular standards specify precisely the content of sodium chloride which should not exceed – depending on the assortment – 2.2% or 2.5%, and fat up to 35% or up to 45% (PN-A-82012:1996, PN-A-86528:1996, PN-A-82022:1998).

The quality of the pâtés is affected mainly by the composition and proportions of raw materials used in their manufacture, the employed functional additives, technological process, and the way of storage and packaging of the product. The level and quantity of functional additives is very much differentiated, as is the type of packaging. In practice, some of the products are packed in steel tins, glass jars, aluminium and aluminium-propylene containers, films and laminates as well as parched paper. All the mentioned factors have undoubtedly an influence on the quality of the pâtés available for the consumers (Kordowska-Wiater and Łukasiewicz, 2005).

AIM OF THE WORK

The purpose of the work was to evaluate the effect of raw material on the quality and nutritional values of market pâtés being available in the retail trade in the Capital City of Warsaw.

MATERIAL AND METHODS

The research material consisted of 19 assortments of pâtés, being available in the retail trade in the Capital City of Warsaw. The studies were conducted in 2008 and the samples were collected in three series.

The range of the tests included:

- Presentation of raw material composition and the employed functional additives, based on the producers' declarations, given in labels.
- Determination of the content of basic chemical components such as:
- water (W) by drying method acc. to PN ISO 1442:2000;
- total protein (P) by Kjeldahl method, using Kjeltec Analyzer 1026 acc. to PN-75/A-04018;

- fat (T) by Soxhlet method, using Soxtec Fat Analyzer HT-6 acc. to PN ISO 1444:2000;
- sodium chloride (S) acc. to PN ISO 1841-1:2002;
- starch acc. to PN-85/A-82059;
- ash acc. to PN-ISO-936:2000;
- total phosphorus acc. to PN-A 82060:1999;
- collagen (K) acc. to PN ISO 3496:2000

and on the basis of the determined water, protein and sodium chloride content, the following indicators were calculated: Feder Number W/P; BC (Brain Concentration BC=S/W+S) and S/W (Salt Concentration);

- Analysis of fatty acid composition which was performed by gas chromatography method, according to standard PN-ISO PN ISO 5508:1996 and PN-ISO PN-ISO 5509:1996 using an instrument of the Hewlett-Packard company, HP 6890;
- Evaluation of desirability of sensory quality discriminants. The evaluation was carried out in sensory laboratory which satisfied the requirements of the standard PN ISO 8589:1998, by the group of trained judges in two independent repetitions, using the ANALSENS computer system of data collecting and analysing. The results were expressed in points. The range of the employed scale amounted to 0-10 scores.

The obtained results were subjected to statistical evaluation, using statistical software Statgraphics 4.0 plus.

RESULTS AND DISCUSSION

The evaluated products were divided into three groups:

1. scalded pâtés (8 pcs),
2. baked pâtés (7 pcs),
3. baked pâtés és (preserves) (4 pcs).

Raw material composition and basic chemical composition

The raw material composition and the employed additives to the recipe of the market assortment of pâtés based on the producers' declarations placed on the labels of the packages are given in Table 1.

In the group of scalded pâtés, pork, beef, veal or poultry meat, pork or poultry skins were employed as the declared raw material component in a half of the evaluated samples. To all the assortments, pork fat, liver and salt and preserving agents were added. Poultry or pork mechanically separated meat, filler in a form of semolina or grated dry bread, soy protein isolate, flavour enhancers and sea-

sonings constituted also a high percentage share in the composition of the product.

Raw material composition of all or of most of the evaluated baked pâtés offered in retail trade included poultry or pork MSM, pork or poultry skins, pork or poultry liver, soy protein isolate, salt, seasonings and flavour enhancers.

In the group of sterilised pâtés, raw material consisted of poultry or pork MSM, pork or poultry liver, pork or poultry skins, soy protein isolate, salt, seasonings and flavour enhancers and preservatives.

Table 1. Composition of raw materials and additives to basic recipe of the examined assortments of the pâtés, resulting from information placed on the labels of package

Type of assortment	scalded pâtés	baked pâtés	baked pâtés
Number of samples of a given assortment	8	7	4
Pork, beef, veal and poultry meat	4	1	2
Poultry and pork MSM*	3	7	4
Pork fat	8	4	1
Pork and poultry skins	4	6	4
Pork and poultry liver	8	6	4
Offals, poultry stomachs	0	2	1
Semolina, grated dry roll	3	4	2
Soy protein isolate	5	5	4
Animal protein	2	3	3
Egg powder	0	2	1
Salt	8	6	4
Sugar/sugars	4	3	1
Seasonings	7	6	4
Flavour enhancer	5	5	3
Cellulose	1	3	0
Preservative	8	4	3

* MSM – mechanically separated meat.

In the composition of the pâtés, the producers declared an addition of isolate of soy proteins, of animal proteins and egg powder, aimed at improvement of total protein content in the products as well as utilisation of their functional properties. Health-promoting component, i.e. cellulose, was declared only in four among nineteen evaluated products, which indicates its small application in the discussed group of meat products.

The content of raw meat and fat materials as well as of the employed additives within the assortment groups was differentiated, which probably had a significant

influence on the chemical composition, fatty acid profile and their quality evaluation.

The mean results of basic chemical composition, the content of water, protein, fat, NaCl, starch, ash, phosphorus and collagen for the particular assortment groups are given in Table 2.

Table 2. Effect of the type of pâté on basic chemical composition discriminants

Type of pâté	Water content (%)	Protein content (%)	Fat content (%)	NaCl content (%)	Starch content (%)	Ash content (%)	Total phosphorous contents (g kg^{-1})	Collagen content (%)	W/P (-)	BC (-)	S/W (-)
scalded pâtés	60.0^{a}	10.4^{b}	24.7^{c}	1.4^{a}	2.0^{a}	1.9^{a}	2.5^{a}	1.6^{a}	5.89^{b}	5.07^{b}	0.024^{a}
baked pâtés	56.9^{a}	13.9^{c}	18.6^{b}	1.5^{a}	6.2^{b}	2.2^{b}	3.5^{b}	1.8^{a}	4.17^{a}	2.62^{a}	0.026^{a}
baked pâtés	70.4^{b}	9.0^{a}	13.4^{a}	1.5^{a}	4.8^{b}	2.0^{ab}	2.7^{a}	1.8^{a}	7.87^{c}	5.69^{b}	0.021^{a}
NIR	4.36	0.95	3.37	0.22	1.70	0.22	0.42	0.63	0.69	1.82	0.005

$^{a, b}$ – means in the same column marked with various letters differ significantly ($\alpha \leq 0.05$).

The samples of scalded pâtés, as compared to other evaluated assortment groups, were characterised by the highest fat content and the lowest starch content. The lowest water content and the highest level of starch, ash, phosphorus and collagen were characteristic of the baked pâtés. The discussed assortment group had the lowest W/P and BC index. Pâtés in the form of sterilised preserves were characterised by the highest water content and the lowest level of protein and fat. The calculated W/P and BC indices reached the highest values among the examined assortments. The obtained results of the basic chemical composition for sterilised pâtés are similar as the results submitted by Tyburcy *et al.* (2005), being declared as pâtés produced from poultry meat and pork-beef meat.

The examined pâtés met the requirements of the Polish Standards concerning sodium chloride and salt content. The evaluated products were characterised by significantly lower salt (from 1.4% to 1.5%) and fat (from 13.4% to24.7%) level as compared to the values specified in Polish Standards PN-A-82012:1996, PN-A-86528:1996 and PN-A-82022:1998, which from the nutritional point of view should be recognised as positive tendencies. The obtained results have been confirmed by the trends observed by Makała *et al*. (2003) and by Olkiewicz *et al*. (2003), aimed at improvement of nutritional values of meat products *via* lowering of salt and fat content. Low fat content may also result from the use of cellulose additive in the recipe, owing to which it is possible to lower significantly the fat

content in a final product (Makała 2002). On the Portuguese market, products with 12.6-13.6% fat content are considered as low fat pâtés (Tyburcy *et al*. 2005), so they correspond with the evaluated Polish sterilised pâtés.

Fatty acid profile

The fatty acid profiles of the examined assortments of pâtés are given in Table 3. The obtained results are closely connected with the raw material composition, especially with the addition of meat from mechanical separation, animal fats, liver and other offals, and egg powder. High content of liver and egg powder, as added to the raw material recipe, has been reflected in, *inter alia*, higher content of polyunsaturated fatty acids and *trans* fatty acids (FA). In the composition of the evaluated pâtés, monounsaturated and saturated FA prevailed. When striving to increase the value of the unsaturated : saturated acids ratio (UFA: SFA, being also defined as P: S), we may also obtain a usable method for protection of human health. In respect of the mechanisms of effect, n-6 and n-3 are the opposing acids. In many studies it was confirmed that an improper n-6 PUFA/n-3 PUFA ratio is a factor of risk of cancers and heart diseases, especially due to the possibility of forming blood clots leading to heart attacks. It is, therefore, significant to maintain appropriate proportions of the discussed acids in the diet. It is advisable that the mentioned ration should not exceed the value of 4; it should be also mentioned that we are able to achieve a more favourable level of the index of n-6/n-3 acids by using the mentioned above UFA: SFA coefficient (Szostak 2006, Przysławski and Bolesławska 2006, Webb and O'Neill 2008, Makała and Jerzewska 2008).

Table 3. Effect of the type of pâté on fatty acid profile

Type of pâté	SFA (sum of saturated fatty acids)	MUFA (sum of monounsaturated fatty acids)	PUFA (sum of polyunsaturated fatty acids)	TRANS (trans fatty acids)	MUFA/ PUFA	UFA/SFA (sum of unsaturated fatty acids /sum of saturated fatty acids
scalded pâtés	38.5^{b}	46.6^{a}	14.2^{a}	0.33^{a}	3.49^{b}	1.58^{a}
baked pâtés	34.6^{a}	46.1^{a}	18.5^{b}	0.33^{a}	2.57^{a}	1.87^{b}
baked pâtés	35.6^{a}	49.6^{b}	14.2^{a}	0.28^{a}	3.65^{b}	1.79^{b}
NIR	2.00	2.43	3.64	0.14	0.48	0.12

$^{a, b}$ – means in the same column marked with various letters differ significantly ($\alpha \leq 0.05$).

The highest participation of saturated fatty acids in the examined assortments was found in the case of the scalded pâtés. Baked pâtés were characterised by the highest content of *trans* unsaturated FA and the lowest index of MUFA/PUFA. Sterilised preserved products were characterised by the highest level of monounsaturated FA and MUFA/PUFA index, and the lowest content of *trans* acids. The most favourable UFA/SFA index in the evaluated assortments was recorded in the case of the baked pâtés and in the sterilised preserves.

Desirability of sensory quality discriminants

The mean results of desirability of sensory quality discriminants are given in Table 4. Baked pâtés were characterised by the highest desirability of the evaluated quality parameters: external appearance desirability, colour desirability, consistence desirability, flavour desirability, taste desirability and general desirability. In the group of scalded pâtés, desirability of flavour and general desirability were equally highly evaluated as in the assortment of baked pâtés. The lowest values of the assessed discriminants were found in the group of sterilised preserves.

On the basis of the conducted studies it can be stated that the highest values of general desirability were obtained by the baked pâtés, then by the scalded pâtés, and the lowest results were obtained by the group of sterilised pâtés in tins. The obtained results of the lowest desirability of sterilised pâtés are a result of the application of relatively cheap raw meat, offals and fat in the formulation of the product, which is illustrated in Table 1. The raw material composition of the discussed assortment is, first of all, composed of mechanically separated meat. The obtained results of desirability, especially of colour, consistence and flavour, are undoubtedly affected by the type of packaging and the highest temperature of heat treatment, which was confirmed, *inter alia*, by the results of tests submitted by Pyrcz *et al.* (1996).

Table 4. Effect of the type of pâté on its sensory desirability

Type of pâté	External appearance desirability	Colour desirability	Consistence desirability	Flavour desirability	Taste desirability	Total desirability
	p.	p.	p.	p.	p.	p.
scalded pâtés	7.7[a]	7.0[a]	6.1[a]	5.8[b]	5.6[ab]	6.2[b]
baked pâtés	7.9[a]	7.4[b]	6.8[b]	5.9[b]	5.9[b]	6.6[b]
baked pâtés	7.6[a]	6.8[a]	5.9[a]	5.1[a]	4.9[a]	5.4[a]
NIR	0.31	0.36	0.49	0.53	0.64	0.61

[a, b] – means in the same column marked with various letters differ significantly ($\alpha \leq 0.05$).

As a result of the conducted statistical analysis, a negative linear relationship between the calculated W/P index and desirability of consistence (points) of the pâtés was found; it is illustrated in Figure 1.

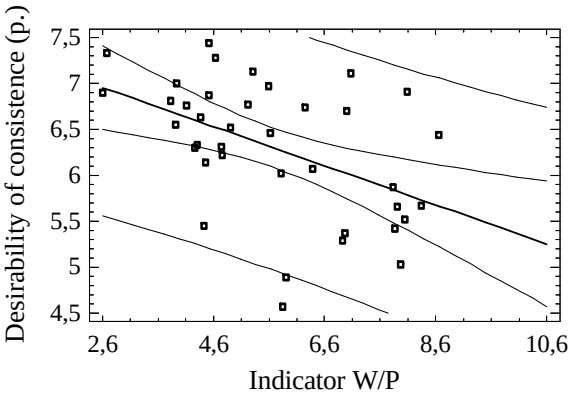

Fig. 1. Relationship between the desirability of consistence of pâtés and the calculated W/P indicator

$$\text{desirability of consistence} = 7{,}507 - 0{,}213 \cdot \text{indicator W/P}$$

Together with the increase of W/P index, the desirability of the consistence of the evaluated pâtés was linearly decreasing.

CONCLUSIONS

1. As a result of the conducted studies with 19 assortments of market pâtés, the effect of the raw material composition on their quality and nutritional values was found. The differentiation of the quality of market pâtés results, as it may be supposed, from a big variety of raw materials employed in manufacture, and from the type and level of the applied functional additives as well as type of the conducted heat treatment (scalding, baking, and sterilisation).
2. The results of chemical tests indicate a considerable differentiation of the following components in the evaluated products: water: 56.9- 70.4%, protein: 9.0-13.9%, fat: 13.4-24.7%, total phosphorus: 2.51 g kg^{-1} – 3.54 g kg^{-1}, starch: 2.0-6.2%, collagen: 1.1-2.3% and ash: 1.86-2.24%.
3. The evaluated products were characterised by significantly lower salt and fat content as compared to values specified in the relevant standards, which from the nutritional viewpoint should be considered as positive tendencies.

4. The examined pâtés were characterised by a high content of monounsaturated and saturated fatty acids and low level of polyunsaturated FA. The addition of liver and egg powder in the formulation of the product were reflected in FA profile, higher content of polyunsaturated fatty acids and *trans* FA. In the nutritional aspect, the pâtés constitute a source of monounsaturated and saturated FA, which is a result of the employed raw material components (pork fat, MSM and liver).

5. The examined pâtés were characterised by high sensory desirability; none of the tested assortments was disqualified.

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WPŁYW SKŁADU SUROWCOWEGO NA JAKOŚĆ I WALORY ŻYWIENIOWE RYNKOWYCH PASZTETÓW

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Streszczenie. Celem pracy była charakterystyka składu surowcowego oraz deklarowanych substancji dodatkowych, składu chemicznego, profilu kwasów tłuszczowych oraz pożądalności sensorycznej rynkowych pasztetów, dostępnych w handlu detalicznym m.st. Warszawy. Badania przeprowadzone na 19 sortymentach pasztetów obejmowały oznaczenie podstawowego składu chemicznego (zawartości wody, białka, tłuszczu, chlorku sodu, skrobi, popiołu, fosforu i kolagenu), profilu kwasów tłuszczowych oraz pożądalności jakości sensorycznej. Stwierdzono, że skład surowcowy ocenianych wyrobów był zróżnicowany i miał istotny wpływ na skład chemiczny i profil kwasów tłuszczowych. Zawartość wody w ocenianych próbach pasztetów wahała się od 56,9 do 70,4%, białka od 9,0 do 13,9%, tłuszczu od 13,4 do 24,7%, chlorku sodu od 1,4 do 1,5%, skrobi od 2,0 do 6,2%, popiołu od 1,9 do 2,2%, fosforu od 2,5 do 2,7 $g \cdot kg^{-1}$ i kolagenu od 1,6 do 1,8%. W składzie ocenianych pasztetów przeważają kwasy tłuszczowe jednonienasycone i nasycone. Duża zawartość wątroby oraz dodany w recepturze surowcowej proszek jajowy znalazły odzwierciedlenie w wyższej zawartości wielonienasyconych kwasów tłuszczowych oraz kwasów tłuszczowych trans. Badane pasztety charakteryzowały się wysoką pożądalnością jakości sensorycznej, żaden z badanych sortymentów nie został zdyskwalifikowany.

Słowa kluczowe: pasztety, skład chemiczny, profil kwasów tłuszczowych, pożądalność sensoryczna, jakość