

PRODUCT-DETERMINATION AND QUALITY VALUATION
OF MARKET PRODUCTS: FRANKFURTERS
AND FRANKFURTER- RESEMBLING SAUSAGES

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Abstract. The aim of the work was product-determination and quality valuation of selected assortments of meat products offered in retail trade in Warsaw in the years 2005/2006. The research was performed on 16 assortments of frankfurters and frankfurter-like sausages. The research comprised determination of the basic chemical composition (contents of water, total protein, fat, sodium chloride, total phosphorus, starch, collagen), analytic sensory valuation performed "in cold state" based on the requirements contained in the standard, and profile valuation performed "in warm state". The results of chemical tests confirm substantial differentiation of the contents of water, protein, fat, NaCl, total phosphorus, starch, collagen, resulting from the raw materials used for production and from the kind and level (content) of functional additives applied. The evaluated products were characterised by much lower contents of fat and salt than those determined by the limit standards, which should be considered positive from the nutrition point of view. A significant influence of temperature of the evaluated products on the results of sensory valuations was confirmed. In the sensory quality valuation in cold state the evaluated selections were found to be very good (11) and good (5), their quality valuation in hot state, however, was much less positive.

Keywords: frankfurter sausages and frankfurter-like sausages, product-determination valuation, sensory valuation, chemical composition

INTRODUCTION

In the shops, and in particular in supermarkets, the available selection of meat products is very wide. The decision-making customers are driven by various reasons, having at their disposal a certain set of information and guidelines from the manufacturer and the seller. This information comprises, first of all, advertisement data and data available on the packages, and the possible quality valuation of the offered products, usually limited to visual valuation of packed portions. In the literature there is quite a number of models which characterise factors determining consumer's behaviour and their inter-relations. The selection factors for

foodstuffs, and in particular for meat products, are connected with the product, the consumer, and the environment (Babicz-Zielińska 2001, Makąła 2004). As it results from the performed research, the highest influence from among all the factors taken into consideration at the purchase of meat products was that of product freshness, followed by its appearance and price (>60% of responds), and the lowest one was that of the kind and attractiveness of the package, though these are factors which attract our attention in a shop in a special way (Babicz-Zielińska 2001, Dransfield 2001, Kowalczyk *et al.* 2002, Zalewski 2001)

The consumers' preferences and conditions of decision making in purchase of meat products are, to a growing extent, connected with their manufacturer and trade mark and - more and more - with both of them. Good product quality and stability of this quality as well as satisfaction from the purchased products results in confidence in the trade mark-brand, forms a habit, and then causes loyalty of customers to the manufacturer and his trademark. Consumers who always buy products of the same manufacturer or of the same brand are considered as "absolutely loyal" and those who usually buy products of the same manufacturer or of the same brand - "relatively loyal". During the last several years the market of meat products has been characterised with growing customer loyalty, both relative and absolute. The highest absolute loyalty has been observed among the customers who buy luxury smoked products, like ham, sirloin or cured pork shoulder, the lowest one, usually the relative one, among the customers who buy sausages and other smoked meat products (Chmielewska 2003, Górska-Warsewicz 1999).

In the market economy environment, due to the growing competition between foodstuffs producers, including those of meat products, there will be a chance for manufacturers of products which meet consumers' expectations and are characterised with good quality, as well as meet the criteria of current trends in nutrition. The reasons which drive a consumer are - first of all - nutrition needs of his/her own and his/her family, preferences resulting from habit, taste and knowledge about rational nutrition and - a very important one - his/her financial condition.

AIM OF THE WORK

The aim of the work was the product-determination and quality valuation of the selected assortment of meat products: frankfurter sausages and frankfurter-like sausages made of red and poultry meat, offered in Warsaw in the years 2005/2006.

In the presented publication a selected part of results of research works performed within the planned topic of the Institute of Meat and Fat Industry entitled: „Testing of selected assortments of market meat products in order to determine main trends in quality changes and to determine if the nutrition law regulations are observed” is discussed.

MATERIAL

The research material consisted of 16 assortments of frankfurter sausages and frankfurter-like sausages made of red and poultry meat, bought in the second half of 2005 and at the beginning of 2006 on the Warsaw market, in three lots. While buying them, special attention was paid to the validity date (the most fresh products were selected, those with the longest validity period). The products bought for the research were of various Polish manufacturers, offered under own manufacturer's name or under a certain brand name, in unit packages of different weights ranging from 0.150 to 0.500 kg. The prices of the products in this assortment group ranged from 5.66 to 19.93 PLN per 1 kg. Correctly marked products only, sold without promotional actions were selected.

METHODS

The scope of the research (tests) covered the determination of the contents of the basic chemical composition, like water content with the drying method according to the Polish Standard PN ISO 1442:2000, content of total proteins with the Kjeldahl method using the Kjeltex Analyzer 1026 apparatus according to PN-75/A-04018, fat content with Soxhlet method using the Soxtec Fat Analyzer HT-6 apparatus according to PN ISO 1444:2000, sodium chloride content according to PN ISO 1841-1:2002, content of total phosphorus according to PN-87/A-82060, starch content in meat products according to PN-85/A-82059, collagen content in meat and meat products according to PN ISO 3496:2000, and calculation of the calorific content of the products.

Analytical sensory valuation was made. The valuation covered the sensory valuation of quality of the tested products performed "in cold state", basing on the requirements contained in PN-A/82007:1996. The valuation was made in a 5-point scale, comprised between 1 and 5 points, using the weight coefficients applicable for this assortment of products, and namely: for general appearance – 0.2, for bar structure and consistency – 0.3, and for taste and smell – 0.5, according to the now obsolete branch standard of 1984. BN-84/8014-05. On aggregation of the partial results, the valuation expressed as a calculated general product valuation was achieved. Then the grades of the valuation of particular elements as well as the calculated general valuation were converted into a 10-point scale (0 to 10 points), in order to unify the scale with that applicable to the sensory profile valuation.

To evaluate the sausages "cold", the products were submitted to evaluation in the form of whole links after their previous coding and removal of artificial casings. Each panellist received the samples, individually coded and in a randomized sequence. Every time during the session, 5-6 different assortments were evaluated. Individual results of evaluation were recorded in the prepared evaluation sheets.

The profile valuation was performed according to the provisions of the standards PN ISO 11035:1994 and PN ISO 41219:1998, with which the following elements were characterised in the scale of 0 to 10 points: impression of fatness and desirability of colour, smell, taste, consistency and general desirability of the product. This valuation was made "in warm state".

To evaluate the sausages "hot", the products were heated in water bath (Bemar) at temperature of 70°C till obtaining the temperature of 55-60°C in the geometric centre of links. Then, each of the panellists received, successively, the individually coded samples, after the previous removal of casings. The mentioned evaluation was conducted using computerised ANALSENS system.

The valuation of sensory and profile quality was performed by a team consisting of 8 qualified panellists in the Sensory Laboratory of the Institute of Meat and Fat Industry which - as regards the general design requirements for a sensory analysis laboratory - meets the requirements of PN ISO 8589:1998, using a computerised system of data collecting and processing - ANALSENS.

Chemical determinations, sensory valuation of the quality of the tested products performed "in cold state" and evaluation of the desirability profile "in warm state" were conducted in two repetitions in each of the experiments .

The obtained research and test results were evaluated statistically using the statistical program Statgraphics for Windows ver. 3.1.

RESULTS AND DISCUSSION

Raw material composition

The basic raw material composition of the tested market products from the group of finely comminuted and homogenised products, as taken from the label information, is given in Table 1, ordered by type of meat used for production. Six raw material groups could be separated: pork meat (5 items), pork and beef meat (2 items), poultry meat (4 items), veal (1 item), pork and poultry meat (4 items) and beef and poultry meat (2 items). Due to the kind of fat applied, a majority of the products were with pork fat (11 item), poultry fat (1 item) or pork and poultry fat (1 item). For one product with intentionally reduced content of recipe fat, the content of fat raw material was not declared, and for one product no information was given. For 16 evaluated assortments, in 12 of them the addition of non-meat proteins was declared (usually soy protein or blood plasma preparation), in 11 ones – an addition of pork skin (as a connective tissue raw material) as well as the use of functional additives like phosphates (in 9 assortments), starch (in 12 assortments) or cellulose (in 3 assortments).

Table 1. Basic raw material composition of the tested selection as given in the information on labels

Item	Sample code	Raw material		Pork skin	Non-meat proteins	Starch	Cellulose	Addition of phosphates	Price PLN/kg
		Meat	Fat						
1	7	Veal	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	19,93
2	5	Pork	Pork	+	+	+	-	-	18,90
3	10	Pork	Pork	+	+	+	-	+	18,40
4	3	Pork	Pork	-	-	-	-	-	18,36
5	9	Pork	-	-	+	+	+	+	16,48
6	6	Pork	Pork	n.a.	n.a.	-	-	-	14,36
7	14	Poultry	Pork	+	+	+	-	+	12,99
8	12	Poultry	Poultry	+	+	+	-	-	9,09
9	2	Poultry	Pork	+	+	-	-	-	8,73
10	16	Poultry	Pork	+	+	+	-	+	7,98
11	11	Poultry	Pork, poultry	+	+	+	-	+	13,70
12	1	Pork, beef	Pork	+	+	+	+	+	16,90
13	15	Pork, beef	Pork	+	+	+	-	+	16,40
14	8	Poultry, beef	Pork	+	+	+	-	+	10,80
15	13	Poultry, pork	n.a.	+	+	+	-	+	5,99
16	4	Poultry, pork	Pork	-	-	+	+	-	5,66

+ declaration of additive, - no declaration, n.a. information not available.

Price

A substantial variety of prices of the tested selection of frankfurter sausages and frankfurter-like sausages was observed, ranging from 5.66 PLN kg⁻¹ to 19.93 PLN kg⁻¹. The highest price was that of veal sausages, which seems reasonable due to the influence of the raw material price on the product price. In the lowest price assortments, ranging from 5.66 to 9.09 PLN kg⁻¹, in the declared meat raw material composition there was a majority of poultry meat, the cheapest on the market. In other evaluated samples there were no data allowing for explaining the reason for the price difference. The application of promotional or even dumping prices could not be excluded, either. A certain explanation regarding the factors affecting the prices of the tested products basing on the estimated production efficiency and multi-factor analysis of relations has been presented in the publication (Tyszkiewicz *et al.* 2006).

Chemical composition of products

In the product-determination valuation the most valuable are the results coming from the comparison of the quality state of the tested products with the standards described in the manufacturers' standards or declarations. According to the requirements contained in the standard PN-A/82007:1996, though not an obligatory one, for this group of meat products (homogenised and finely comminuted) the protein content should not be less than 9 and 10%, respectively, and that of fat not higher than 40 and 35%, respectively, that of water not higher than 69 and 68%, respectively, and that of salt not higher than 3%. In the performed chemical tests substantial differences in the contents of the following elements were observed: water (48.6-74.7%), proteins (8.6-16.2%), fat (2.9-32.8%), NaCl (1.5-2.3%), phosphorus (2.6-5.0 g kg⁻¹), starch (0.4-6.5%) and collagen (1.0-2.3%). The obtained average results of the evaluated basic data of chemical composition and of the calculated calorific value are presented in Table 2.

Table 2. Average results of determination of the basic chemical composition

Item	ID	Water content	Protein content	Fat content	Collagen content	Starch content	NaCl	Total phosphorus content	Calorific value
	Sample code/ Measure	(%)	(%)	(%)	(%)	(%)	(%)	(g kg ⁻¹)	(kJ)
1	7	59.8	12.2	19.7	2.3	3.0	1.7	2.3	1001
2	5	62.6	12.4	22.2	2.1	0.4	1.6	3.4	1052
3	10	48.6	11.7	32.8	1.0	3.2	2.3	4.4	1492
4	3	59.0	14.5	23.4	2.2	0.6	2.0	2.9	1131
5	9	74.7	11.3	2.9	2.0	6.5	1.8	4.5	419
6	6	61.6	16.2	19.1	2.1	2.4	2.2	4.0	1035
7	14	59.7	11.2	23.7	2.0	2.7	2.1	3.1	1131
8	12	64.4	12.7	18.1	1.2	2.5	1.7	2.8	943
9	2	64.0	12.6	20.7	1.0	0.4	1.5	3.0	989
10	16	59.8	8.6	24.5	1.8	2.7	2.0	2.7	1119
11	11	58.8	9.7	25.9	1.9	2.6	1.9	2.9	1144
12	1	58.7	10.8	26.6	1.9	1.6	1.6	3.5	1207
13	15	57.8	10.7	24.5	1.8	2.8	2.0	3.1	1156
14	8	62.2	10.7	21.0	2.1	3.3	1.8	3.8	1035
15	13	65.6	10.6	16.9	2.0	4.0	2.3	3.3	888
16	4	59.7	8.6	26.9	1.3	2.0	1.7	2.6	1194
	\bar{X}	61.1	11.5	21.8	1.8	2.5	1.9	3.3	1060
	s	5.1	1.9	6.2	0.4	1.5	0.2	0.6	212

The evaluated market products showed their conformity with the standard, especially as regards salt and fat contents, in spite of big deviations and differences within the tested group. The lowest fat content, of 2.9% fat only, was in the so-called fitness type parboiled sausages. The veal products were characterised by fat content of 19.7%, the beef and poultry products contained slightly more fat – 21.0% on average, and the purely poultry sausages contained 22.6% fat on average, while the typical pork and beef sausages – an average of 25.6% fat.

The standard requirements provide for salt content not exceeding 3%, and in the tested selection the salt content was substantially lower, at the level of 1.9% and not exceeding 2.3% in the highest case. The trend of lowering of the salt content has been observed for several years in various groups of meat products, including smoked products and sausages (Makala *et al.* 2003, Olkiewicz *et al.* 2003).

On the labels of 11 products connective tissue proteins were declared in their recipe compositions. The analytically determined collagen contents ranged from 1.0 to 2.3%. The obtained results, compared to the results of determination of total proteins, do not indicate that in the meat raw material the share of collagen protein has been exceeded, which would result in the obligation of declaring an addition of raw material of connective tissue proteins (Regulation of the Minister of Agriculture and Rural Development of 16th December 2002 on marking of foodstuffs and permissible additional substances, Tyszkiewicz 2004, 2005). Similar results regarding the collagen share coefficient in total proteins in the evaluated poultry and pork parboiled sausages have also been shown in the research made by Tyburcy *et al.* (2005).

Other components, as described above, showed big variety resulting from the raw materials used for production, kind and level of functional additives, and technologies applied.

Calorific content

In Table 2 the calculated values of calorific content of tested products are given. They show a substantial variety ranging from 419 kJ to 1492 kJ, mostly due to fat-free fitness type parboiled sausages with calorific content of ca 419 kJ (100g)⁻¹ and one product with fat content over 30% and calorific content of about 1492 kJ (100g)⁻¹. The calorific content of other products ranged from 888 to 1207 kJ (100g)⁻¹. Since there were no manufacturers' declarations on the calorific content of the evaluated products on their labels, the conformity or non-conformity of the analysed factual state with that provided for could not be confirmed.

Valuation of sensory quality

Apart from the product-determination valuation, the sensory valuation forms an important quality criterion. Two valuations of sensory quality of the tested selection of parboiled sausages were performed. One in cold state, basing on the standard for smoked products PN-A/82007:1996, the second one in warm state, since parboiled sausages are products usually consumed warm. The results obtained in the performed valuations are presented in Tables 3 and 4.

Table 3. Average results of sensory quality valuation for conformity with the standard PN-A/82007:1996 in cold state

Item	ID/ Sample code	General appearance (aspect)	Bar consis- tency	Colour	Taste and smell	Calculated general valuation of the product
	Sample code/ Measure	p.	p.	p.	p.	p.
1	7	9.0	8.6	8.6	7.4	8.0
2	5	8.2	7.8	8.2	7.8	8.0
3	10	8.2	7.4	7.6	6.8	7.4
4	3	8.6	8.6	8.6	8.6	8.6
5	9	8.2	7.0	6.8	5.8	6.8
6	6	9.2	8.6	9.0	8.8	9.0
7	14	8.4	7.8	7.6	7.8	8.2
8	12	8.8	8.2	7.8	8.0	8.0
9	2	8.8	8.8	8.4	8.2	8.6
10	16	8.4	7.4	6.8	6.6	7.0
11	11	8.2	8.0	7.4	5.8	8.0
12	1	9.2	8.6	8.8	7.8	8.4
13	15	8.2	8.8	7.8	8.2	8.4
14	8	8.4	7.2	8.0	7.2	7.4
15	13	8.8	8.4	8.4	7.8	8.4
16	4	7.8	6.4	7.0	5.6	6.2
	\bar{X}	8.4	8.0	8.0	7.6	8.0
	s	0.4	0.8	0.6	0.8	0.8

In the quality valuation in cold state, very good results of calculated general valuation were obtained, which testifies to the good and very good quality of the tested products. Assuming the division of the scale into five equal parts corre-

sponding to 2 points each, and describing them with the words determining the level of quality, basing on BN-84/8014-05:

- very good from 8 to 10 points
- good from 6 to 7.9 points
- average from 4 to 5.9 points
- satisfactory from 2 to 3.9 points
- and unsatisfactory from 0 to 1.9 points

we could find that all the assortments, while tested in cold state, had very good (11 samples for a total of 16) or good quality (5 samples for a total of 16).

Table 4. Average results of sensory profile valuation in hot state

Item	ID	Colour desirability	Smell desirability	Taste desirability	Consistency desirability	Impression of fatness	Valuation of general desirability of product in hot state
	Sample code/ Measure	p.	p.	p.	p.	p.	p.
1	7	5.9	4.9	4.2	4.7	4.4	4.8
2	5	5.3	4.9	4.8	4.3	4.1	5.1
3	10	5.2	5.0	5.4	5.5	3.4	6.0
4	3	6.0	6.2	6.5	6.6	3.5	6.9
5	9	3.9	2.6	2.3	3.3	2.5	2.8
6	6	6.5	6.7	7.0	6.6	3.9	7.5
7	14	5.7	5.7	5.8	6.1	4.3	6.4
8	12	5.6	4.1	3.6	4.9	3.6	4.5
9	2	6.5	4.8	5.2	5.9	4.9	5.9
10	16	3.7	3.1	2.7	2.0	5.5	2.8
11	11	5.1	5.1	4.5	4.3	5.2	4.8
12	1	6.2	5.2	4.5	3.2	4.5	4.4
13	15	5.0	5.1	5.2	5.4	4.2	5.5
14	8	5.2	4.1	3.9	3.2	5.4	3.5
15	13	5.2	4.0	3.5	4.3	4.4	4.1
16	4	4.9	3.3	2.9	3.4	5.8	4.0
	\bar{X}	5.4	4.7	4.5	4.6	4.4	4.9
	s	0.8	1.1	1.3	1.3	0.8	1.3

Much less satisfactory for the manufacturers of the tested meat products were the results of testing in cold state. A majority of the tested assortments (9) were ranked in the range of average quality and only 4 products were found to be of good quality. The selection which obtained the satisfactory general result only are the parboiled sausages with reduced fat content (fitness type – code 9) and poultry sausages (code 16) and poultry and beef sausages (code 8). The critical points for the sausages of codes 16 and 8 were the low valuation of desirability of consistency, and for fitness type sausages (code 9) - low valuation of desirability of taste and smell. For the two latter assortments included in the group of satisfactory quality, their rather low quality was partly compensated for with their relatively low prices, 7.98 and 10.80 PLN/kg respectively. For the sausages with reduced fat content, the price did not make for low quality but one may assume that their consumers, guided by nutrition reasons, would probably accept a product which was less tasty but definitely less calorific, too. It is a matter of common knowledge how important for the tastiness of meat products are the substances not soluble in water contained in fat, and this is probably the reason for low valuation of this assortment. In high temperature fat is liquefied and its components are thus made perceivable to our smell and taste senses. The substances contained in fat of this assortment, not perceivable in the valuation in cold state, were revealed and lack of fat other than the in-muscle pork fat could have changed the expected taste and smell profile of the product. One may not exclude that the discussed assortment, as a new one, not known in the market before, has its spicing method not fully elaborated yet, which would compensate for the lack of taste and smell notes contributed by the lipid component of the product matrix, so much desirable by the evaluating persons.

CONCLUSIONS

1. As a result of the performed tests of chemical composition and sensory valuations it was found that the tested 16 assortments of frankfurter sausages and frankfurter-like sausages showed big variety of quality, resulting from the raw materials used for their production, kind and level of functional additives applied, and differentiated efficiency in relation to the protein input, as it results from more detailed analysis of chemical composition.

2. The results of chemical tests show a substantial variety of contents of water (48.6-74.7%), proteins (8.6-16.2%), fat (2.9-32.8%), NaCl (1.5-2.2%), total phosphorus (2.6-5.0 g kg⁻¹), starch (0.4-6.5%) and collagen (1.0-2.3%).

3. The evaluated products were characterised by a content of fat and salt (sodium chloride) much lower than the limit ones as determined in PN-A/82007:1996, which should be considered as a positive factor from the nutrition point of view.

4. In the sensory valuation of quality in cold state, the tested selection was evaluated very positively, as very good ones (11 selections) and good ones (5 selections). Much less satisfactory was the valuation of quality in warm state. Only 4 selections received a good note, 9 – i.e. the majority – an average one, and 3 selections – a satisfactory one. Among the worse selections, there was a single in the group product of very low fat content (fitness), the poor sensory quality in warm state of which may be compensated for by its low calorific value, much valued by consumers on a diet and by those caring for their health.

5. The tested assortments of frankfurter sausages and frankfurter-like sausages differed substantially in their retail prices. The most expensive were the veal sausages, which is reasonable in view of the price of the raw material, and the cheapest ones were the poultry and pork sausages, at 5.66 PLN/kg. Among the cheapest selections offered at prices below 10 PLN/kg, there were the sausages of poultry and beef meat and poultry meat, with the lowest valuation notes in the sensory tests in cold state.

6. A fairly reasonable share of connective tissue raw materials in the raw material composition of the tested assortments was observed. The contents of collagen did not exceed 2.3%.

7. No irregularities in the marking (labelling) of the tested assortments was found.

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CHARAKTERYSTYKA TOWAROZNAWCZA WYBRANEJ GRUPY
RYNKOWYCH PRZETWORÓW MIĘSNYCH
NA PRZYKŁADZIE PARÓWEK I KIEŁBASEK PARÓWKO-
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Streszczenie. Celem pracy była towaroznawczo-jakościowa ocena wybranego sortymentu przetworów mięsnych oferowanych w handlu detalicznym m.st. Warszawy w latach 2005/2006. Badania przeprowadzono na 16 sortymentach parówek i kiełbasek parówko-podobnych. Przeprowadzone badania obejmowały oznaczenie podstawowego składu chemicznego (zawartości wody, białka ogólnego, tłuszczu, chlorku sodu, fosforu ogólnego, skrobi, kolagenu), analityczną ocenę sensoryczną, przeprowadzoną „na zimno” w oparciu o wymagania zawarte w normie i ocenę profi-

lową wykonaną „na ciepło”. Wyniki badań chemicznych wskazują na znaczne zróżnicowanie zawartości wody, białka, tłuszczu, NaCl, fosforu ogólnego, skrobi i kolagenu, wynikające z użytych do produkcji surowców, rodzaju i poziomu zastosowanych funkcjonalnych dodatków. Oceniane wyroby charakteryzowały się znacznie niższą od określonej w normie granicznej zawartością tłuszczu i soli, co należy uważać za zjawisko pozytywne ze względów żywieniowych. Stwierdzono istotny wpływ temperatury ocenianych wyrobów na uzyskane wyniki ocen sensorycznych. W sensorycznej ocenie jakości przeprowadzonej na zimno badane sortymenty zostały ocenione jako bardzo dobre (11) i dobre (5), dużo mniej pozytywna była ocena jakości sortymentów uzyskana w badaniach na ciepło.

Słowa kluczowe: parówki i kiełbaski parówko-podobne, ocena towaroznawcza, sensoryczna, skład chemiczny