

## **CHARACTERISTICS OF SENSORY QUALITY OF BOLOGNA-TYPE SAUSAGE FROM POLISH AND ITALIAN MARKETS**

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**Abstract.** The aim of the studies was to compare raw material composition, chemical parameters and evaluation of sensory quality of Bologna-type sausage, coming from Polish and Italian market. The studies were conducted on two samples of Polish and Italian sausage and included determination of basic chemical composition (content of water, total protein, fat, sodium chloride, ash, starch, collagen and total phosphorus) and sensory profile analysis. The results of the evaluation of declared raw material composition and of chemical tests indicate a considerable differentiation of raw material as well as of the evaluated parameters of the studied assortments. In the basic raw material composition of Italian sausages, application of meat, stomachs and pork fat was declared whereas Polish sausages were declared as containing pork or beef meat, mechanically deboned poultry meat and pork fat, and in the both discussed assortments – functional additives were declared. Italian Bologna-type sausages were characterized by significantly lower content of water, starch and carbohydrates as compared to Polish products and significantly higher content of protein, fat, chlorides, ash and collagen, resulting from the raw materials, used in production and from the level of the employed functional additives. The evaluated products were characterized by a differentiated sensory profile of texture and desirability of the evaluated discriminants. Italian sausages were characterized by significantly higher hardness, springiness and desirability of consistence as compared to Polish market products from the same assortment group. Significantly higher fat content in Italian Bologna-type sausages has not been reflected in higher sensation of fattiness, sensorily evaluated. In Italian Bologna-type sausages, a rich flavour profile was defined.

**Key words:** Italian Mortadela, Polish Mortadela, raw material composition, sensory profile

### **INTRODUCTION**

In the European Union Member States, we may observe a strong trend to stress their own regional affiliation. Local and regional food products are an excellent promotion of the regions and, quite often, the most important local tourist attraction. Granting of

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“regional marks” increases the competitiveness of the products and may be also then important element of effect on potential customer [Łuczka-Bakuła 2004]. France, Italy, Greece, Portugal and Spain possess the greatest number of regional agricultural and food products what constitutes about 80% of the whole group of the discussed products. Such EU Member States as France, Sweden, Ireland, Denmark, Belgium, Luxemburg or the Netherlands have only 1-5 regional products [Vinaver and Jasiński 2004, [www.arr.gov.pl](http://www.arr.gov.pl)].

The consumers appreciate the quality of these exceptional products, e.g. cheeses, meat products, processed products or original folk art products and they are able to pay much for them. It is prognosed that during the nearest period, the number of the discussed products will increase. The most numerous group of the name-protected products includes cheese, fruits and vegetables, meat and meat products and olive [[www.arr.gov.pl](http://www.arr.gov.pl)]. For example, the number of registered meat products in Italy is 28, including also Bologna-type sausage, Bologna mortadela [UNI 1996].

Mortadela is a popular and commonly consumed meat product, being known on Polish market as well as on the markets of other countries, inter alias, on Italian market. The discussed products are considered as assortment of homogenous scalded products, with a relatively high fat content. Polish Standard PN-A-82007 [1996] states the admitted fat content as equal to 35-40% while fat level in regional Italian Mortadela amounts to 25-35% depending on the type and quality level [Cizzolini et al. 1999]. Italian “Mortadela” sausages are characterized by big diameters, as compared to Polish products. The discussed products are different in respect of commodity. It is also expected that they differ in quality and sensory properties and it is the subject of the studies in the present work.

The aim of the undertaken studies was to compare the composition of raw materials and chemical parameters, and to evaluate sensory quality of mortadela (Bologna-type sausage) derived from Polish and Italian market.

## MATERIAL AND METHODS

The studies were conducted on two products – Polish Mortadela (breakfast-type Mortadela and Mortadela) and Italian sausage (Mortadela of Vismara company and Mortadela of Leoncini company). The products were bought in the second half of 2005 and at the beginning of 2006 in one of Warsaw markets. The assortments subjected to evaluation were different in respect of origin and place of manufacture, raw material composition and external appearance – size of cross-section (Italian Mortadela had twice greater diameter in comparison to Polish product), period of shelf-life and price.

The range of the studies included:

*Determination of basic chemical composition*, i.e.: water content, method of drying acc. to PN ISO 1442 [2000], total protein content by Kjeldahl method, using Kjeltec Analyzer 1026 acc. to PN-75/A-04018, fat content by Soxhlet method, using Soxtec Fat Analyzer HT-6 acc. to PN ISO 1444 [2000], sodium chloride content acc. to PN ISO 1841-1 [2002], ash content acc. to PN ISO 936 [2000] starch content in meat products acc. to PN-85/A-82059 and collagen content in meat and meat products acc. to PN ISO 3496 [2000] and total P content acc. to PN-87/A-82060.

*Sensory profile evaluation and desirability evaluation.* Texture profile was characterized using such discriminants as hardness, springiness and fatness feeling; desirability of consistency, smell and taste [PN ISO 11035 1994, PN ISO 41219 1998] was determined. Besides it, evaluation of profile and desirability of flavour (taste and smell) was carried out for Italian assortments. The following parameters of smell were chosen and evaluated: acidic, sterilization, cooked meat; the following discriminants of taste were also selected and evaluated: salty, sweet, seasoning, acidic, both and headcheese. The results of each of the conducted evaluations were expressed in agreed units on graphic scale in the range from 0 to 10 scores. The tests were carried out at Sensory Laboratory of Meat and Fats Research Institute. The mentioned unit satisfies the requirements of standard PN ISO 8589 [1998]; the computerized ANALSENS system was employed.

The experiment was performed in two repetitions, constituting the means from 6-10 unitary tests in each of the experiments. The obtained results of the tests were subjected to statistical analysis, using Statgraphic program.

## RESULTS AND DISCUSSION

### Raw material composition

The basic raw material composition of the examined market Polish and Italian products from the group of finely comminuted and homogenized products, resulting from information placed in the labels, has been given below. On the ground of the producers' declarations, as being inserted on the labels, the formulated raw material composition for the evaluated products was as follows:

**Breakfast Mortadela.** Beef meat, mechanically separated meat of turkey, pork fat, pork collagen tissue, tripolyphosphates, carrageen, sodium citrate, sodium glutamate, L-ascorbic acid, seasonings, soy protein, potato starch, manna grit, curing mixture.

**Mortadela.** Pork meat, mechanically separated poultry meat, vegetal protein concentrate, glucose, polyphosphates, sodium citrate, sodium isoascorbate, sodium glutamate, seasonings, curing mixture.

**Vismara Mortadela.** Fine pork meat, pork stomachs, salt, saccharose, sodium glutamate, sodium ascorbate, sodium nitrate, seasonings, aromas of seasonings, pistachios.

**Leoncini Mortadela.** Pork meat, pork fat, skimmed milk powder, pork stomachs, saccharose, sodium ascorbate, sodium glutamate, potassium nitrate, aromas of seasonings [Olkiewicz et al. 2006].

The evaluated products were different in respect of the type of the meat used in manufacturing. Italian products were manufactured using pork meat while Polish products were manufactured from pork or beef meat and mechanically deboned turkey or poultry meat. In Italian formulations, the application of pork stomachs and – for only one Italian product – of pork fat, was declared. In Polish sausages, the formulated addition of fat was also declared in only one assortment, i.e. in Breakfast Mortadela. Polish requirements acc. to BN-84/8014-05, which are already not obligatory, specify the following formulation of the raw material for "Mortadela": pork meat, beef meat, mechanically deboned meat, fine fat, dewlap, fat-collagen emulsion, sodium caseinate, curing mixture and seasonings.

Apart from different raw materials used in formulations, a high differentiation of seasonings and functional additives was also found for the evaluated Polish as well as Italian products which undoubtedly had some effect on their quality.

### Chemical composition of the products

Basic chemical composition, as given in Table 1, for the evaluated products indicates a considerable differentiation. The Italian 'Mortadela' sausages were characterized by a significantly lower content of water, collagen, carbohydrates and starch and significantly higher level of protein, fat, chlorides and ash, as compared to Polish products. Significant differences which were found between Polish and Italian assortments resulted, first of all, from difference in the raw materials, used in manufacturing and in the type and level of the employed functional additives. In Italian products, significantly lower water content and twice higher protein content, as compared to Polish assortments, caused twice lowering of calculated W/P ratio and, having also significantly higher although not exceeding the allowed value of 3%, level of salt (as specified in PN-ISO), it protected the discussed regional product for the declared shelf-life period of three months. The stability period of Polish products is declared only for 2-3 weeks.

Table 1. Mean results of determination of basic chemical composition  
Tabela 1. Średnie wyniki oznaczeń podstawowego składu chemicznego

Bologna-type sausages (Mortadela) Mortadele	Water content Zawartość wody %	Protein content Zawartość białka ogólnego %	W/P W/B	Fat content Zawartość tłuszczu %	Chloride content Zawartość chlorków %	Ash content Zawartość popiołu %	Collagen content Zawartość kolagenu %	Carbohydrate content Zawartość węglowodanów %	Starch content Zawartość skrobi %	Total P content P <sub>2</sub> O <sub>5</sub> Zawartość fosforu ogólnego P <sub>2</sub> O <sub>5</sub> mg·kg <sup>-1</sup>
Italian – Włoskie										
“Leoncini” Mortadela	48.7 <sup>a</sup>	18.7 <sup>d</sup>	2.6 <sup>a</sup>	28.7 <sup>c</sup>	2.9 <sup>d</sup>	3.8 <sup>d</sup>	1.8 <sup>b</sup>	2.2 <sup>b</sup>	1.94 <sup>b</sup>	3.3 <sup>a</sup>
“Vismara” Mortadela	50.5 <sup>b</sup>	15.5 <sup>c</sup>	3.2 <sup>b</sup>	28.6 <sup>c</sup>	2.7 <sup>c</sup>	3.6 <sup>c</sup>	1.6 <sup>a</sup>	0.0 <sup>a</sup>	0.0 <sup>a</sup>	3.4 <sup>a</sup>
Polish – Polskie										
Breakfast Mortadela śniadaniowa	64.8 <sup>c</sup>	9.7 <sup>a</sup>	6.7 <sup>d</sup>	19.7 <sup>b</sup>	1.9 <sup>b</sup>	2.6 <sup>a</sup>	1.9 <sup>c</sup>	3.9 <sup>c</sup>	3.5 <sup>c</sup>	3.3 <sup>a</sup>
Mortadela	65.6 <sup>d</sup>	10.7 <sup>b</sup>	6.1 <sup>c</sup>	17.6 <sup>a</sup>	1.7 <sup>a</sup>	2.8 <sup>b</sup>	2.6 <sup>d</sup>	4.2 <sup>d</sup>	3.8 <sup>d</sup>	4.1 <sup>b</sup>
LSD – NIR	0.30	0.32	0.08	0.34	0.13	0.17	0.05	0.13	0.12	0.18

<sup>a, b</sup>Different indices of letters in columns indicate that the results differ statistically significantly at  $P \leq 0.05$ .

<sup>a, b</sup>Różne indeksy liter w kolumnach wskazują, że wyniki różnią się statystycznie istotnie dla  $P \leq 0,05$ .

The evaluated Polish products were characterized by considerably lower boundary content of fat and salts (sodium chloride) as compared to Italian assortments as well as to value, specified in PN-A/82007 [1996]. It may be considered as a positive phenomenon due to nutritional aspects.

### Sensory profile evaluation of the examined products from Italian and Polish market

The following discriminants of sensory profile of texture were characterized: hardness, springiness and fatness feeling; desirability of consistency, smell and taste was evaluated. The mean results of sensory evaluation of the tested assortments were given in Table 2 and in Figure 1. The Italian 'Mortadela' sausages were characterized by significantly higher values of texture parameters such as hardness, springiness and consistency desirability and significantly higher taste desirability as compared to the products from Polish market. It is interesting to notice that impression of fatness of Italian market sausages, as determined by sensory evaluation, was significantly lower in comparison to Polish products, with the simultaneous higher fat content, being determined by analysis. The result obtained by the judges could be affected by highly evaluated consistency desirability (harder, more firm and coherent) which was probably identified by the judges as leaner one.

Table 2. Mean results of evaluating the parameters of sensory profile of texture and desirability, p.  
Tabela 2. Średnie wyniki oceny wyróżników sensorycznego profilu tekstury i pożądalności, p.

Bologna-type sausages (Mortadela) Mortadele		Hardness Twardość	Springiness Sprężystość	Consistency desirability Pożądal- ność konsy- stencji	Feeling of fatness Wrażenie tłustości	Smell desirability Pożądal- ność zapa- chu	Taste desirability Pożądal- ność smaku
Italian Włoskie	Mortadela "Leoncini"	5.9d	6.0d	6.9c	3.4a	6.7c	6.8c
	Mortadela "Vismara"	4.9c	5.9c	6.6c	3.6a	5.3a	5.3b
Polish Polskie	Breakfast Mortadela	4.6b	5.1b	5.9b	3.8b	5.7b	6.0b
	Mortadela śniadaniowa						
	Mortadela	2.8a	2.9a	3.8a	4.9c	5.4a	4.5a
LSD – NIR		0.25	0.25	0.38	0.19	0.18	0.71

<sup>a, b, c, d</sup>Different indices of letters in columns indicate that the results differ statistically significantly at  $P \leq 0.05$ .

<sup>a, b, c, d</sup>Różne indeksy liter w kolumnach wskazują, że wyniki różnią się statystycznie istotnie dla  $P \leq 0,05$ .

For Italian 'Mortadela' products, the evaluation, allowing to characterize the flavour (taste and smell) profile was also carried out. The discriminants, describing smell profile such as that of cooked meat, sterilization and acidic and the parameters, describing taste profile such as sweet, salty, seasoning-like, acidic, broth and headcheese were selected and defined (Fig. 2). A very rich flavour profile, occurring in Italian products was found; it was, however, different for each of the examined samples. "Leoncini" Mortadela

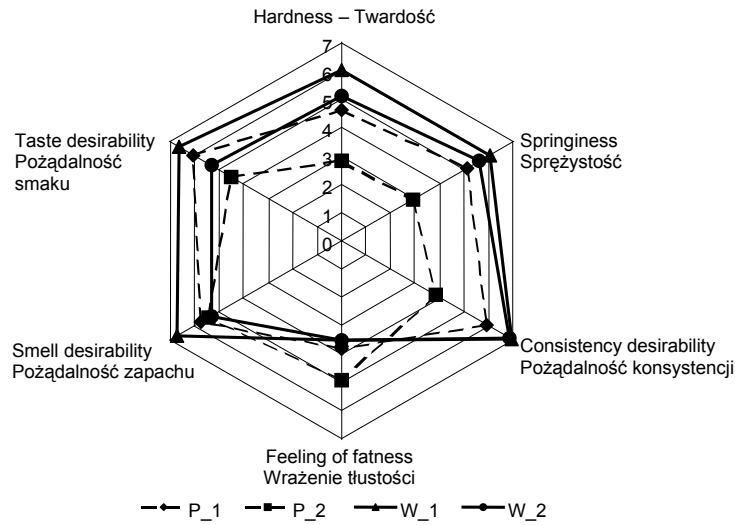


Fig. 1. Characteristics of parameters of texture and desirability parameters in Polish and Italian mortadela. Explanations: P\_1 – Polish breakfast Mortadela, P\_2 – Polish Mortadela, W\_1 – Italian “Leoncini” Mortadela, W\_2 – Italian “Vismara” Mortadela

Rys. 1. Charakterystyka wyróżników sensorycznego profilu tekstury i pożądalności w mortadeli polskiej i włoskiej. Oznakowanie: P\_1 – polska mortadela śniadaniowa, P\_2 – mortadela polska, W\_1 – włoska mortadela „Leoncini”, W\_2 – włoska mortadela „Vismara”

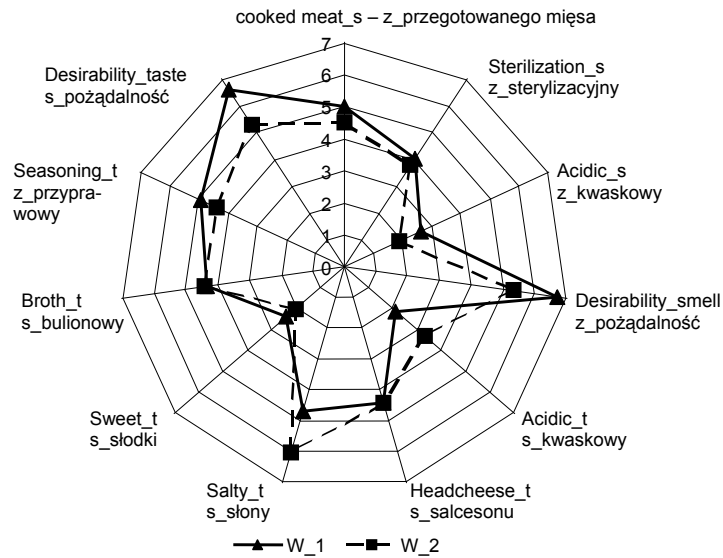


Fig. 2. Flavour (taste and smell) profile in Italian Mortadela sausages. Explanations: W\_1 – Italian “Leoncini” Mortadela, W\_2 – Italian “Vismara” Mortadela

Rys. 2. Profil smakowo-zapachowy w mortadela włoskich. Oznakowanie: W\_1 – włoska mortadela „Leoncini”, W\_2 – włoska mortadela „Vismara”

was characterized by higher desirability of taste and smell, higher intensity of the selected smells and seasoning and sweet taste and lower intensity of salty and acidic taste as compared to "Vismara" Mortadela. Similarly as in case of discriminants of basic composition and texture profile, being assessed by sensory analysis, the characteristics of a rich flavour profile was undoubtedly affected by different formulations of raw materials as well as methods of production. Although such analysis was not performed for assortments from Polish market, the profile of taste and smell "shades" is considerably poorer.

The analysis of correlation between the discriminants of basic composition and attributes of texture and desirability profile was carried out (Table 3). For most of the evaluated parameters, very highly significant and highly significant correlations were found. The sensory profile of texture and desirability was affected, first of all, by the content of water, protein, fat, sodium chloride, collagen and starch and, to a smaller degree – by phosphorus level. The content of sodium chloride (carrier of taste) and water decided on desirability of taste to the highest degree and phosphorus level had a significant influence.

Table 3. Correlations between parameters of basic chemical composition and the selected attributes of texture profile, being determined by sensory evaluation

Tabela 3. Korelacje pomiędzy wyróżnikami podstawowego składu chemicznego a wybranymi atrybutami profilu tekstury oznaczanymi sensorycznie

Attributes Atrybuty	Water content Zawartość wody %	Protein content Zawartość białka ogólnego %	W/P W/B	Fat content Zawartość tłuszczu %	Chloride content Zawartość chlorków %	Collagen content Zawartość kolagenu %	Starch content Zawartość skrobi %	Total P content P <sub>2</sub> O <sub>5</sub> Zawartość fosforu ogólnego P <sub>2</sub> O <sub>5</sub> mg·kg <sup>-1</sup>
Hardness Twardość	-0.9168*	0.7553**	-0.7496**	0.8820*	0.9592*	-0.6819***	-0.7469**	-0.5229***
Springiness Sprężystość	-0.9787*	0.7690**	-0.7850**	0.9418*	0.9342*	-0.7465**	-0.7801**	-0.6032***
Consistency desirability Pożądalność konsystencji	-0.8936*	0.7513**	-0.7348**	0.8642*	0.9414*	-0.7254**	-0.7660**	-0.4515
Fatness Tłustość	0.9522*	-0.7289**	0.7586**	-0.9331*	-0.9114*	0.7698**	0.7965**	0.6180***
Smell desirability Pożądalność zapachu	-0.5241	0.2660	-0.2649	0.2216	0.4857	-0.0425	0.0214	-0.3670
Taste des. Pożądalność smaku	-0.7496**	0.4099	-0.3986	0.5283	0.6957*	-0.3069	-0.3410	-0.5972***

\*Correlations statistically very highly significant, \*\* correlations statistically highly significant, \*\*\* correlations statistically significant, ns – correlations statistically insignificant.

\*Korelacje statystycznie bardzo wysoko istotne, \*\*korelacje statystycznie wysoko istotne, \*\*\* korelacje statystycznie istotne, ns – korelacje statystycznie nieistotne.

## CONCLUSIONS

The results of evaluation of declarations concerning raw material composition and of chemical tests indicate the considerable differentiation of raw materials as well as of the evaluated parameters of the tested assortments.

In basic raw material composition of Italian 'Mortadela' products, the application of pork meat, stomachs and fat was declared while in Polish products, the use of pork or beef meat, mechanically deboned poultry meat and pork fat was declared; declaration of applying functional additives included both assortments.

Italian sausages were characterized by lower content of water, starch and carbohydrates and higher level of protein, fat, chlorides and ash as compared to Polish products. It resulted from different composition of raw materials employed in manufacture and different physico-chemical properties, type and level of the applied functional additives.

The evaluated Polish products were characterized by considerably lower boundary content of fat and salt (sodium chloride) as compared to Italian assortments as well as to value, being specified in PN-A/82007 [1996]; it should be recognized as a positive phenomenon due to nutritional aspects.

The examined products from Polish as well as from Italian market were characterized by a differentiated profile of texture and desirability of the evaluated parameters. Italian products were characterized by higher values of texture parameters such as hardness, springiness, desirability of consistency and taste desirability as compared to the assortments from Polish market; feeling of fatness as being evaluated by sensory analysis, was significantly lower.

Italian "Mortadela" products were characterized by significantly lower (more than twice) W/P ratio in comparison to Polish sausages which was reflected in higher evaluation of hardness, springiness and consistency desirability as compared to Polish market product from this assortment group.

Significantly higher levels of fat (9-11%) in the evaluated Italian products as compared to Polish ones did not find reflection in higher feeling of fatness, determined by sensory analysis. The obtained result was probably affected by a highly evaluated desirability of consistency which was probably considered by the judges as leaner.

Very highly significant and highly significant correlations were found between the discriminants of basic chemical composition and the selected attributes, characterizing sensory profile of texture in the evaluated products.

Significant differentiation between the selected assortments from Polish and Italian markets in respect of chemical composition parameters as well as profile of texture, profile of taste and smell and desirability was a result of differences in raw materials used in manufacturing and in type and level of the employed functional additives.

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## CHARAKTERYSTYKA JAKOŚCI SENSORYCZNEJ MORTADELI Z RYNKU POLSKIEGO I WŁOSKIEGO

**Streszczenie.** Celem badań było porównanie składu surowcowego, wyróżników chemicznych oraz ocena jakości sensorycznej mortadeli z rynku polskiego i włoskiego. Badania

przeprowadzone na dwóch próbach mortadeli polskiej i włoskiej obejmowały oznaczenie podstawowego składu chemicznego (zawartości wody, białka ogólnego, tłuszczu, chlorku sodu, popiołu, kolagenu, węglowodanów, skrobi i fosforu ogólnego) oraz sensoryczną ocenę profilową i ocenę pożądalności. Wyniki oceny deklaracji składu surowcowego oraz badań chemicznych wskazują na znaczne zróżnicowanie surowcowe i ocenianych wyróżników badanych sortymentów. W podstawowym składzie surowcowym w mortadelach włoskich deklarowano użycie mięsa, żołądków i tłuszczu wieprzowego, a w polskich – mięso wieprzowe lub wołowe, mięso drobiowe mechanicznie odkostnione i tłuszcz wieprzowy, natomiast w obu sortymentach – dodatków funkcjonalnych. Mortadele włoskie, w porównaniu z wyrobami polskimi, charakteryzowały się istotnie mniejszą zawartością wody, węglowodanów, skrobi i kolagenu, a istotnie większą zawartością białka, tłuszczu, chlorków i popiołu, wynikającą z użytych do produkcji surowców, rodzaju i poziomu zastosowanych funkcjonalnych dodatków. Wyroby cechowały się zróżnicowanym sensorycznym profilem tekstury i pożądalnością ocenianych wyróżników. Badane mortadele włoskie charakteryzowały się istotnie większą twardością, sprężystością i pożądalnością konsystencji w porównaniu z polskimi wyrobami rynkowymi z tej grupy sortymentowej. Istotnie większa zawartość tłuszczu w mortadelach włoskich nie znalazła odzwierciedlenia w większym odczuciu tłustości, oznaczanym sensorycznie. W mortadelach włoskich zdefiniowano bogaty profil smakowo-zapachowy.

**Słowa kluczowe:** mortadela włoska, polska, skład surowcowy, profil sensoryczny

*Accepted for print – Zaakceptowano do druku: 17.10.2006*

*For citation – Do cytowania: Makala H., Olkiewicz M., Moch P., 2006. Characteristics of sensory quality of Bologna-type sausage from Polish and Italian markets. Acta Sci. Pol., Technol. Aliment. 5(2), 107-116.*