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Researches regarding the influence of raw materials on economical, technical and qualitative parameters of a certain semi-smoked sausage assortment manufactured by the traditional and modern technology

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Abstract

The objective of this study was to assess the influence of raw materials and manufacturing technology on the technical, economical and qualitative parameters for the manufacturing of a semi-smoked sausages and comparing the traditional technology with the modern technology.

The results show the influence of raw materials and manufacturing technology on the economical and technological manufacturing processes, but also the influence on the physic-chemical quality parameters of the finished product. Thus, in the current manufacturing technology was observed a reduction in specific consumption of raw material correlated with reduced manufacturing cost and in terms of quality a decrease in protein content and an increase in fat content of the finished product, so that this product has a low nutritional value, but a higher energy value.

In conclusion, the composition of minced meat products can be ensured by establishing the proportion of tissue, taking into account the composition of raw material.

Keywords: sausage, quality, raw material, manufacturing technology, sensorial properties, physic-chemical indicators, technical and economical parameters

1. Introduction

It is known that by grinding and combining technological processes, the sensorial properties of a finished product can vary between wide limits. Also, as the raw material is more finely minced, the final product properties are not so strictly depended on the properties of raw material as in the case of products made from pieces of meat, which are more dependent on raw material quality, determined by the anatomic region from which are taken, by its appearance, by the ratio of different tissue components, the intimate structure of tissues, their color – factors which cannot be modified too much during processing.

Animal species, body weight, age and fattening degree, but also the slaughtering and storage conditions decide whether or not the raw material can be used to obtain a certain type of product. Animal species, body weight and anatomic region determine the external features, age and degree of fattening determines the ration between tissue, color and tenderness.

The taste and smell of raw material contribute to the taste and smell of the finished product, with changes more or less dominant given by the salt and spices used. Apart from products prepared with spice brine or those seasoned on the surface (with paprika or pepper), the taste and smell of products made from

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salted and smoked pieces is given by the smoke. Because the salted taste and smoke flavor can be varied only in tight limits, the quality of products made from pieces is influenced by the defects and smell of the raw material. This defects may come from the animal (sex scent), from feed (fish meal) or a faulty storage after slathering. Raw materials with such defects cannot be used to obtain products made from meat pieces.

The features of products made from minced meat are less influenced by the properties of the raw materials. Excluding special cases, during processing some differences caused by factors like anatomical region, age, fattening degree and to some extent those caused by species, may be compensated.

By mincing, the initial appearance of raw materials disappears and the initial consistence is considerably changed. The ratio of different tissues may be obtained by choosing and mixing different minced raw materials. Color can varied widely based on the composition of the mixture and additives, and the taste and smell can be influenced by species and other additives.

In the production of heat-treated minced meat products, in addition to water binding, it is also important the emulsifying capacity of the fat. A raw material with good water binging properties and good fat emulsifying capacity undoubtedly leads to high quality finished products. But the use of additives and modern emulsifying techniques dose not exclude the possibility to obtain products with good consistencies from raw materials with a low water binding capacity.

Regarding the product durability, the decisive factor is represented by the sanitary status of raw material. In this regard, dried products with no heat treatment are very sensitive; even during processing can appear defects of taste, smell and color. The stability of heat-treated products can be reduced by using raw material with some degree of contamination, as in the case of products with vegetable or made from internal organs.

An important role in meat processing technology is the homogeneity of raw material that has the same origin. Average composition of meat from different carcasses, different properties of the components vary widely depending on the species, age and fattening degree. Smaller differences are between different anatomical regions of the carcass.

The more the anatomical regions are well defined and the meat better separated on tissue type, the more homogenous will be the raw material. For some anatomical regions with higher meat content, this separation may be done in good conditions, resulting in a homogenous raw material. For other anatomical regions, connective tissue and fat tissue form a network that cannot be well separated by current methods, which has a negative influence on the homogeneity.

Because of the above mentioned causes, data on the meat composition and other raw materials can only be informative; companies must monitor through special analysis the composition and properties of raw materials used, and also their fluctuations.

Since the properties of minced meat products are in some way independent from the properties of raw material, the question is if it is possible to replace some raw materials with others. *The possibility of replacement increases with the increase of the mincing degree.* Various technological rules allow substitution of equivalent raw materials with others in large comparative limits. The equivalence means that from a wide range of raw materials must be manufactured finished products with similar nutritional values and sensorial properties.

However, the equivalence principle is contradictory with other considerations, especially economical. In some cases the price for the equivalent raw materials is very different. In calculating the cost of a product, raw material prices represent a significant proportion so that the price differences are reflected in the price of the finished product. Thus, the same product can be produced – depending on the raw material – with a higher or a lower price. Another difficulty regarding equivalence is the fact that until know there are no analysis methods, sensitive enough that can establish the sensorial properties equivalence. A conclusive comparison can be made only if the products made from two kinds of raw materials are analyzed simultaneously.

Replacement by equivalence is applied specially for raw materials from different anatomical regions. Non satisfactory results were obtained by replacing the raw materials from different species. Also, various internal organs can only be processed in products with internal organs, although some of this (the heart) could be used as a paste mixed with meat meal.

Minced meat products composition can be assured by establishing the tissue ration; for this it is important to know the composition of raw materials.

The known chemical analysis methods do not, in general, allow the analysis of all received raw materials, because this would require a large volume of samples so that the solution is not economical. In this case, production organization is possible only by using statistical data from numerous chemical analyses. The method yields results, but compliance with legislation requires the use of a safety factor to compensate the heterogeneity. This means that the product should be brought to a medium content of superior raw materials than that required by the regulations, but this increases the cost.

If for a small production of meat products, the meat as raw material can be separated piece by piece in order to obtain different products, for an industrial production where are used modern technologies, this is impossible. In order to obtain suitable raw materials it is necessary to create breeds of animals for different technological processes and to prepare them before slaughter, in order to meet the specific requirements of these technological processes. In this respect, we aimed to analyze the interdependence between the quality of raw materials and finished products for the production of a semi-smoked sausage.

2. Materials and methods

Sensorial and physico-chemical analyses have been performed on fifteen samples of raw material meat (five samples of pork, five samples of first quality beef and five samples of second quality beef) and ten samples (five samples from each recipe) of sausage manufactured in two technological variants (for each case being used one processing recipe): using the manufacturing technology without protein supplements (recipe A); using the manufacture technology with 5% vegetal protein supplements (recipe B) which replaced 25% of animal raw material (meat, bacon). The two manufacturing recipes are presented in Table 2.

The semi-smoked sausage was produced according to the technological instructions and recipes presented in Table 2, meeting also the laws, sanitary and veterinary regulations. Raw and auxiliary materials used in the process were in accordance with the technological product documents, but also sanitary and veterinary regulations in force.It was monitored the influence of raw materials and manufacturing technology on the technological, economical and qualitative parameters for the production of the mentioned product.

Establishment of technological and economical production indicators aimed to determine the technological losses, the quantities of finished product, the specific consumption of raw materials and production cost of the finished product obtained using the two experimental variants and the two technological manufacturing recipes. Assessment of quality parameters referred to the determination of sensorial and physico-chemical properties (water content, protein, fat, salt and nitrite) of raw material and finished product obtained in the two experimental variants.

The sensorial exam of the finished product consisted in the appraisal of some characteristics like the exterior and slice, the taste and smell, color and consistence.The physical-chemical exam of the raw materials and finished products samples consisted in determination of the indicators presented in table 1.

Table 1. Physico-chemical parameters and method of examination

No.	Indicator	Method of examination
1.	Water	Drying-over at 105 ºC [9]
2.	Protein substances	Kjeldahl method (N_{total} X 6.25) [7]
3.	Fat substances	Soxhlet extraction [8]
4.	Salt	Mohr method [10]
5.	Nitrite	Griess method [11]

3. Results and Discussion

Recipes and material balance for the product obtained in the two experimental variants (A and B) are presented in Table 2.The results (presented in Table 2) show a reduction of raw material specific consumption (kg RM/kg FP) from a value of 1.11 (for experiment A) to 0.81 (for experiment B) with direct influence on final product manufacturing cost (lei/kg FP) that decreases from 13.24 (experiment A) to 0.81 (experiment B). The significant difference for the recoup value between the two manufacturing technologies variants is due to the spray washing of the finished product (applied only for experiment B), and so reducing the recoup produced by the water evaporation from the product. To calculate the manufacturing cost for the sausage produced in the two experiments was used the current pieces (excluding VAT) from Table 3.

Table 2. Technological manufacturing processes for semi-smoked sausage obtained in the two experimental variants and the obtained results

No.	Recipe composition	Recipe A	Recipe B
Raw materials (RM)			
1.	Beef meat of 1st quality, kg	30	-
2.	Beef meat of 2nd quality, kg	-	15
3.	Pork meat 70/30, kg	70	30
4.	Bacon, kg	-	30
Auxiliary materials			
1.	Salting mixture, kg	2	1,8
2.	Garlic, kg	0.3	-
3.	White pepper, kg	0.25	-
4.	Allspice, kg	0.05	-
5.	Sugar, kg	0.15	-
6.	Spice mix + additives*, kg	-	1.4
7.	Ice flakes, kg	10	10
Vegetable protein supplements			
1.	Soy protein isolate (powder**), kg		2
2.	Soy protein isolate (gel***), kg		15
Other materials			
1.	Membrane, m	280	260
Total composition, kg		112.75	105.2
Recoup****, %		20	12
Finished product (FP), kg		90.2	92.57
Specific consumption, kg RM/kg FP		1.11	0.81
Manufacturing cost, lei/kg FP		13.24	8.5

*Spice mix + additives contains: spices (white pepper, garlic, allspices), preservatives (ascorbic acid), dyes (carmine, carnisol), polyphosphates, sugar.

** Soy protein isolate (powder) is used to obtain the bradt (from beef meat of 2nd quality) and has a hydratation ratio of 1:4 (at the cutter).

*** Soy protein isolate (gel) was obtained by hydration of soy protein isolate (powder) to a ratio of 1:4. The fresh obtained gel is stored for ripening at 4...6 ºC, 24 hours. It is used to replace the raw material (meat) in maximum proportion of 15%.

Table 3. Unit prices for raw materials, auxiliary materials and others

No.	Product	M.U.	Unit price, lei/M.U.
1.	Beef meat of 1st quality	kg	14
2.	Beef meat of 2nd quality	kg	12
3.	Pork meat 70/30	kg	8.5
4.	Bacon	kg	4
5.	Salting mixture	kg	0,6
6.	Garlic	kg	20
7.	White pepper	kg	18
8.	Allspice	kg	27
9.	Sugar	kg	3.5
10.	Spice mix + additives	kg	22
11.	Soy protein isolate	kg	9
12.	Membrane	m	0.6

Table 4. Sensorial and physico-chemical characteristics for the sausage manufactured in the two experiments

No.	Parameter	Sausage variant A	Sausage variant B	
Characteristics/Conditions of eligibility				
1.	Shape	Pieces of 40-50 cm long, membrane diameter of 16-20 mm, obtained by twisting the sheep intestine/collagen membranes		
2.	External appearance	Yellow-brown to red, specific for products subjected to a pasteurization and double smoking treatment		
3.	Appearance by section	Mosaic mass with meat pieces of about 8 mm, pink and bacon pieces of about 8 mm incorporated in the bradt		
4.	Taste and smell	In accordance to the components and spices used		
5.	Consistency	Semi-hard		
Physico-chemical properties				
No.	Parameter	Values determined		Reference values [7]
1.	Water, g%	62.5	52	max 63
2.	Fat, g%	16.50	31.40	max 40
3.	Total protein, g%	18.30	14.20	min 12
4.	Nitrites, mg/100 g	6	4	max 10
5.	NaCl, g%	2.20	2.10	max 3

Table 5. Physico-chemical composition of raw materials used for sausage production (mean values)

Physico-chemical parameter	Raw material				
	Soy protein isolate	Beef meat 1st quality	Beef meat 2nd quality	Pork meat	Bacon
Water content, %	4.73	66.40	70.60	65.10	7.2
Protein, %	91.5	18.60	20.02	18.2	6.30
Fat, %	0.5	14	8.30	16.10	86

Table 6. Weight in the final product of protein and fat substances from the raw material

Physico-chemical parameter	Variant	Indicator	Raw materials					Total
			Beef meat 1st quality	Beef meat 2nd quality	Pork meat	Bacon	Soy protein content	
Protein	Variant A	%/RM	5.58	-	12.61	-	-	18.19
		%/ FP	30.49	-	68.91	-	-	99.4
		Total/FP, %	18.30					
	Variant B	%/RM	-	3	5.41	1.89	4.58	14.88
		%/ FP	-	21.13	38.10	13.31	32.25	104.79
		Total/FP, %	14.20					
Fat substances	Variant A	%/RM	4.20	-	11.27	-	-	15.47
		%/ FP	25.45	-	68.30	-	-	93.75
		Total/FP, %	16.50					
	Variant B	%/RM	-	1.25	4.83	25.80	0.03	31.91
		%/ FP	-	3.98	15.38	82.17	0.10	101.63
		Total/FP, %	31.40					

*RM – raw material; ** FP – finished product

Table 7. Chemical composition (protein and fat content) for the product made in the two experimental variants and the RDA for these components

Physico-chemical indicator	variant A		variant B		RDA*
	%	%/RDA x 100	%	%RDA x 100	
Protein, g	18.30	36.60	14.20	28.40	50 g
Fatty substances, g	16.50	25.38	31.40	48.31	65 g

* RDA – recommended daily dose for an adult with a diet of 2000 kcal

The chemical composition of the sausage produced in both experimental variants, more exactly the recommended daily allowance (RDA) for nutrients components (for one adult with a diet of 2000 kcal) are presented in Table 7.

The column "RDA x 100" represents the percentages from the recommended daily allowance, covered by the protein and lipids from 100 g product made in the two experimental variants.

The data shows that the product manufactured according to variant A covers, in terms of protein content, a higher percentage (36.60%) from the RDA compared to the product made according to the variant B (28.40%), and so being with about 30% more valuable. Regarding the fatty substances, the product made according to variant B covers a higher percentage from the RDA (48.31%) and so having a higher energy value.

4. Conclusions and recommendations

After the comparative study regarding the influence of raw materials and manufacturing technology on the technical, economical and qualitative parameters for the manufacturing of the product in the two experimental variants, in the case of the product from variant B (comparred to the product from variant A) can be noted the following: a reduction of specific consumption of raw materials and manufacturing cost; organoleptic characteristics similar in both variantes, less dependent on the raw material quality, color can be varied widely by the raw material composition and additives, and the taste and smell may be influenced by spices and other additives; a lower water content correlated with a lower protein content; a higher fat content; covers a lower protein content / higher fat content in the RDA.

It was also observed that the composition, respetively the weith in the final product of the main nutrients (proteins and lipides) are directly correlated wit raw material quality used in the production, due to the origin (bovine, pig), tissue ration (fatty/connective/muscle), their nature (animal/vegetable), chemical composition (protein and fat content) of raw materials, and not least, their weith in the manufacturing reciper (manufacturing technology). It was observed also a influence of the specific consumption of raw materials, the subunit value (recipe B) being corelated with the lower values of the main nutrients in the finished product compared with those from the raw material (economical efficiency in yhe disadvantage of the nutritive quality).

In conclusion, minced meat product composition can be ensured by establishing the tissue proportion, taking into account the raw material composition.

Putting all these nutritional characteristics together, appears that the product made according to recipe A is more valuable in terms of nutrition compared with the one made according to recipe B (more valuable in terms of energy values), and regarding the priece, the product made with the recipe A is about 55% more expensive.

In conclusion, cheap meat products from today have a low nutritional quality, can cause vitamin and essential aminoacids deficiencies, and because of their high fat content and additives can cause heart diseases and different types of cancer.

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