

## INFLUENCE AND ROLE OF FAT ON THE SENSORY CHARACTERISTICS OF MEAT PRODUCTS

Daniela Beličovska<sup>1</sup>, Aleksandra Silovska Nikolova<sup>2</sup>, Petar Petrov<sup>1</sup>

<sup>1</sup>*Institute of Animal and Fishery Science, Ss. Cyril and Methodius University in Skopje, Blvd. Ilinden 92a, 1000 Skopje, North Macedonia*

<sup>2</sup>*Faculty of Agricultural Sciences and Food, Ss. Cyril and Methodius University in Skopje, 16-ta Makedonska Brigada 3, 1000 Skopje, North Macedonia*

daniela.belichovska@istoc.ukim.mk

**A b s t r a c t:** Fat plays a major role in the development of the sensory characteristics of meat and meat products. They affect the change of appearance, smell, aroma, texture, and especially the overall impression of meat products. Aroma is a joint impression of taste and smell that is felt during chewing. The specific aroma of some types of meat depends on the fat composition. Oxidation of pork and beef fat are important factors in creating the right smell and taste in these types of meat. In contrast, sheep fat creates a specific, strongly expressed aroma. The aroma of the product depends on the amount and type of fat (intermuscular, intramuscular, structural and adipose). Fat also affects the texture of meat products. Texture means: softness, juiciness, friability, fine bite sensation, toughness and elasticity, and it is a set of properties that can be evaluated sensory or instrumentally. Fats are important for the rheological and structural characteristics of meat products and for the formation of a stable emulsion. When shaping the texture of meat products, apart from the type and amount of added fat, the interaction of fat with other ingredients is of great importance. Reducing the fat content below 15% contributes to the reduction of textural characteristics in the final meat product. The appearance and color of meat products are very important because they attract consumers the most and give the first visual impression of their quality. The attractiveness of the color depends on the muscle pigment – myoglobin, and its compounds. The fat content of meat affects its color. Marbled meat has a lighter color. A big reason for the reduction of typicality and color intensity of meat products is the replacement of animal fats with vegetable oils.

**Key words:** fat; sensory characteristics; meat products

## ВЛИЈАНИЕТО И УЛОГАТА НА МАСТИТЕ ВРЗ СЕНЗОРНИТЕ КАРАКТЕРИСТИКИ НА ПРЕРАБОТКИТЕ ОД МЕСО

**А п с т р а к т:** Мастите играат голема улога во развојот на сензорните карактеристики на месото и производите од месо. Тие влијаат врз промената на изгледот, мирисот, аромата, текстурата и особено врз севкупниот впечаток на производите од месо. Аромата е заеднички впечаток на вкусот и мирисот кои се чувствуваат при цваќањето. Специфичната арома на некои видови месо е зависна од составот на мастите. Оксидацијата на свинската маст и говедскиот лој е значаен фактор за создавање соодветен мирис и вкус кај овие видови месо. За разлика од нив, овчиот лој создава специфична, силно изразена арома. Аромата на производот е зависна од количеството и видот на маста (интермускулна, интрамускулна, структурна и адипозна). Мастите влијаат и врз текстурата на производите од месо. Под текстура се подразбира: мекоост, сочност, дробливост, фино чувство при загризување, жилавост, еластичност, и е збир на својства кои сензорно или инструментално се оценуваат. Мастите се важни за реолошките и структурните карактеристики на производите од месо и за формирањето на стабилна емулзија. При формирањето на текстурата кај производите од месо, големо значење, покрај видот и количеството на додадената маст, има и интеракцијата на мастите со другите состојки. Намалувањето на содржината на мастите под 15% придонесува за намалување на текстурните карактеристики кај финалниот производ од месо. Изгледот и бојата на производите од месо се многу важни, зашто тие најмногу ги привлекуваат потрошувачите и го даваат првиот визуелен впечаток за нивниот квалитет. Атрактивноста на бојата зависи од

мускулниот пигмент – миоглобинот, и неговите соединенија. Замастеноста на месото влијае врз неговата боја. Мраморираното месо има посветла боја. Голема причина за намалувањето на типичноста и интезитетот на бојата кај производите од месо е замената на животинските масти со растителни масла.

**Клучни зборови:** масти; сензорни карактеристики; производи од месо

## INTRODUCTION

Fats play a major role in forming the texture, juiciness and flavor of meat products. The sensory characteristics of fats make food tastier, different and rich (Drewnowski, 1992). Fats, in addition to increasing their nutritional value, also play a major role in the development of the sensory characteristics of the final product. Reducing the fat content leads to a reduction in textural and sensory characteristics, which is reflected in the overall acceptability of the final product (Miles, 1996). Fats affect the change of appearance, smell, aroma, texture and especially the overall impression (Figure 1). Reducing fat, without implementing other measures, also reduces the nutritional value of the products (Lucca and Tapper, 1994).

Low-fat products must adhere to the same quality standards as other meat products. However, their distinct characteristics necessitate the consideration of specific factors when determining the appropriate specifications. This may involve the establishment of various conditions, which will play

a significant role in shaping strategies for fat reduction (Figure 2) (Colmenero, 2000).

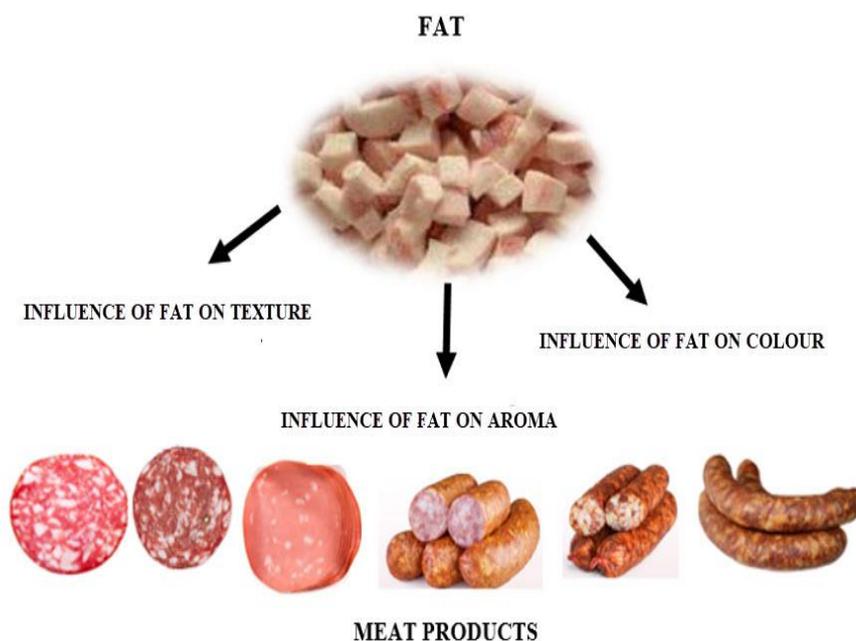
The normal fat content of meat products typically varies depending on the type of product. It ranges from as low as 10% in ham to 50% in salami and fresh pork sausage (Table 1).

Table 1

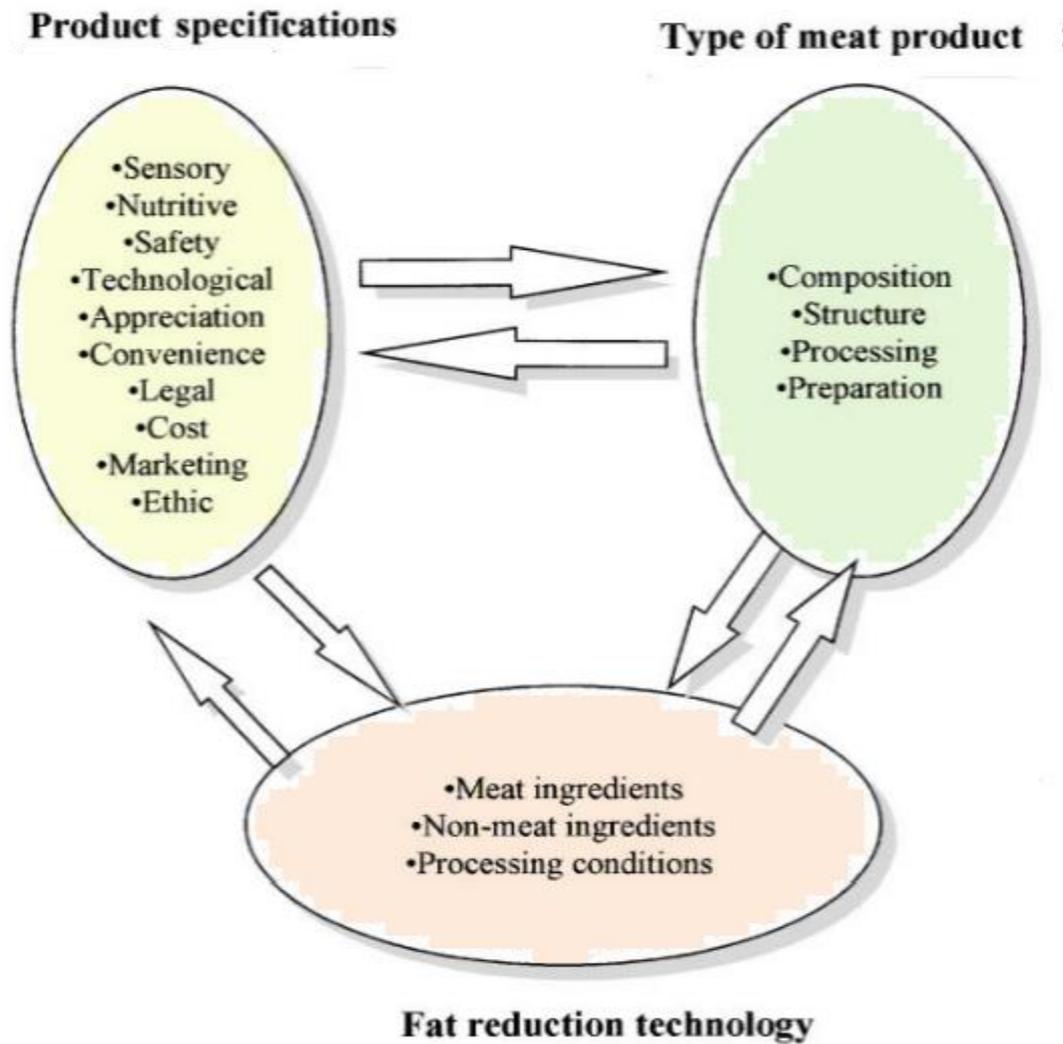
*Normal fat content of meat products (%)*

Meat product	Fat content
Salami	30 – 50
Fresh pork sausages	30 – 50
Liver sausage	30 – 45
Bologna	20 – 30
Frankfurter	20 – 30
Beef patty	20 – 30
Nugget	20 – 25
Ham	< 10

Source: (Colmenero, 2000)



**Fig. 1.** Influence of fat on the sensory properties of meat products



**Fig. 2.** Principal factors affecting the development of low-fat meat products (Colmenero, 2000)

#### INFLUENCE AND ROLE OF FAT ON THE DEVELOPMENT OF AROMA OF MEAT PRODUCTS

Aroma is a joint impression of taste and smell that is felt during chewing (Gandemer, 1998). All types of meat have the same basic flavor. The specific aroma of some types of meat depends on the fat composition. Fats are necessary for the formation of a specific aroma in different types of meat (pork, beef, chicken) (Skvarča, 2001). Hornstein et al. (cit. Raljić-Popov, 1999) give very significant conclusions about the role of fat in the formation of the specific aroma of meat. The oxidation of pork and beef fat is an important factor in creating the appropriate smell and taste of these types of meat, which is not the case with the oxidation of sheep fat. The authors state that sheep fat heated in a vacuum creates a

specific, strongly expressed aroma. Wagner (cit. Raljić-Popov, 1999) points to the connection between fat and the specific aroma of a certain type of meat. The specific difference in flavor between different types of meat can be much more pronounced when pure fat is heated. As a reason for this, the author points out the content of amino acids and carbohydrates in the fatty tissue of different types of meat. Gandemer (1998) states that in dried meat, fat oxidation is one of the main mechanisms that reflect the development of the characteristic aroma.

Fats modify the perception of existing or added components and affect the balance, intensity of aroma release and their distribution and migration (Bennett, cit. Hughes, 1997; Lucca and Tapper, 1994). The aroma of the product depends on the amount and type of fat (intermuscular, intramuscular, structural and adipose). During the production

of lean meat products, the use of subcutaneous and intermuscular fat tissue is reduced. However, fat remains in the muscle fiber due to the impossibility of physical removal. It has been shown that aroma intensity increases with an increase in intramuscular fat, but not with an increase in intermuscular fat (Žlender, 2000). Reduction of fat in meat products, mainly triglyceride components, does not significantly affect the flavor development of meat products. The basis of meat aroma depends mainly on the structural phospholipid fraction. Rarner and Mottaram (cit. Žlender, 2000) stated that the phospholipid fraction is significantly reduced in low-fat meat products. Trout et al. (1992) indicated that changing the fat content between 10 and 30% does not affect the aroma of the product. A significantly weaker effect is observed when the fat content is reduced below 5%.

Giese (1992) points out that fats act as reservoirs of flavor components. Reineccius (cit. Žlender, 2000) states that the change in fat affects the change in aroma. 90% of the volatile components of the aroma in meat contribute to this.

#### INFLUENCE AND ROLE OF FAT ON THE DEVELOPMENT OF THE RHEOLOGICAL (TEXTURE) CHARACTERISTICS OF MEAT PRODUCTS

Texture means: softness, juiciness, crumbliness, fine bite sensation, toughness, elasticity, etc. Texture is a set of properties that can be assessed sensory or instrumentally (Bučar, 1997). Žumer et al. (cit. Silovska Nikolova, 2024) define rheological properties as the deformation and reshaping of the product under the influence of mechanical force. Chrystall (1994) states that the sensory properties of tenderness and juiciness, along with other sensory properties such as color, taste and aroma, are the most important sensory characteristics of meat and meat products. According to Keeton (1994) fat is important for the rheological and structural characteristics of meat products and for the formation of a stable emulsion.

The texture of meat products depends on the formation of the matrix and its structure and stability. The formation of the matrix depends on a number of factors, such as: the type, amount and functional properties of proteins and fats, salt concentration, pH-value, the amount of connective tissue, its ability to bind water and a number of other factors.

Huffman (1996) states that proteins are most likely absorbed into the fat-water dispersion system where they spread and stabilize the globules in the matrix. Žlender (2000) states that in the formation of texture in meat products, in addition to the type and amount of added fat, the interaction of fat with other ingredients is of great importance.

When it comes to meat emulsion (cooked sausages), in most cases the ratio of the three basic components plays a decisive role, i.e. the representation of proteins, water and fats. If this relationship is not optimal, despite the representation of all other conditions, it is realistic to expect disturbances related to the thermostability of the homogenate (Radetić, 2000). Reducing the fat content below 15% contributes to the reduction of textural characteristics in the final meat product (Rust and Olson, cit. Yilmaz 2004). The prevailing opinion in the literature is that the melting point and degree of fat separation are the biggest factors for fat retention in the final meat product.

#### INFLUENCE AND ROLE OF FAT ON THE COLOR AND APPEARANCE OF MEAT PRODUCTS

Pejkovski (2000) states that what attracts consumers the most and gives the first visual impression of the quality of meat and meat products is color. The attractiveness of the color depends on the muscle pigment – myoglobin, and its compounds. Skvarča (2001) indicated that the fat content of meat affects its color. Marbled meat has a lighter color.

Žlender (2000) stated when mechanically separated meat (MSM) is used in reduced-fat meat products, product color problems occur due to the high susceptibility of mechanically separated meat to oxidation. On the other hand, reducing the fat in the product by adding water can easily affect the color intensity of the final product. This is related to the solubility of myoglobin in water.

The use of some fat substitutes is a reason for the weakening of the color intensity in meat products. Reitmaier and Prusa (1991) reported that the use of corn cob flour resulted in a yellowish color in the final product. Numerous data can be seen in the literature indicating that the main reason for the reduction in the typicality and intensity of color in meat products is the replacement of animal fats with vegetable oils.

## CONCLUSION

The sensory properties softness and juiciness, along with other sensory properties such as color, taste and aroma, are the most important sensory characteristics of meat and meat products. Fats have a major impact on sensory properties. Aroma is a joint impression of taste and smell that is felt during chewing. The specific aroma of some meat types depends on the fat composition.

Fat also affects the texture of meat products. They are important for the rheological and structural characteristics of the products and for the formation of a stable emulsion. When forming the texture of meat products, in addition to the type and amount of fat added, the interaction of the fat with other ingredients is of great importance. Reducing the fat content reduces the textural characteristics of the final product. Fat also affects the appearance and color of the products. One of the main reasons for reducing the color intensity of meat products is the replacement of animal fats with vegetable oils.

## REFERENCES

- Bučar, F. (1997): *Meso – poznavanje in priprava*. ČZD Kmet-ski glas, Ljubljana, 216.
- Chrystall, B. (1994): *Meat Texture Measurement. Quality Attributes and their Measurement in Meat, Poultry and Fish Products*. Blackie Academic & Professional, London, Chapter 4.
- Colmenero, F. J. (2000). Relevant factors in strategies for fat reduction in meat products. *Trends in Food Science & Technology*, **11** (2), 56–66. [https://doi.org/10.1016/s0924-2244\(00\)00042-x](https://doi.org/10.1016/s0924-2244(00)00042-x)
- Drewnowski, A. (1992): Sensory properties of fats and fat replacement. *Nutrition Reviews*, **50** (4), 17–20.
- Gandemer G. (1998): Lipids and meat quality – lipolysis-oxidation and flavor. V: *Meat Consumption and Culture. Congress Proceedings, 44<sup>th</sup> International Congress of Meat Science and Technology*, Barcelona, Institute for Food and Agricultural Research and Technology, 106–109.
- Giese, J. (1992): Developing low-fat meat products. *Food Technology* **46** (4), 100–108.
- Huffman, L. M. (1996): Processing whey protein for use as a food ingredient. *Food Technology*, **50** (2), 49–52.
- Hughes E., Cofrades S., Troy D. J. (1997): Effect of fat level, oat fibre and carrageenan on frankfurters formulated with 5, 12 and 30% fat. *Meat Science*, **45** (3), 273–281.
- Keeton, J. T. (1994): Low-fat meat products technological problems with processing. *Meat Science*, **36** (1–2), 261–276.
- Lucca, P. A., Tapper, B. J. (1994). Fat replacers and the functionality of fat in foods. *Trends in Food Science and Technology*, **5**, 12–19.
- Miles, R. S. (1996): Processing of low fat meat products. *Proceedings of Reciprocal Meat Conference*, **49**, 17–22.
- Пејковски, З. (2000): *Можности за сувишћујуција на нићрићиће во барени колбаси*. Докторска дисертација, Земјоделски факултет, Скопје.
- Radetić, P. (2000): *Barene kobasice*. Institut za higijenu i tehnologiju mesa, Beograd. 60.
- Raljić-Popov J. (1999): *Tehnologija i kvalitet gotove hrane*. Tehnološki fakultet, Novi Sad. ISBN 9788680995267.
- Reitmaier, C. A., Prusa, K. J. (1991): Composition, cooking loss, colour and compression of ground pork with dry-and-wet-milled corn germ meals. *Journal of Food Science*, **56**, 216. <https://doi.org/10.1111/j.1365-2621.1991.tb08014.x>
- Силовска Николова, А. (2024): *Сува свинска ћеченица ћроизведена во индустријски услови со и без нићрићина сол*. Докторска дисертација, Факултет за земјоделски науки и храна, Скопје.
- Skvarča, M. (2001): Senzorične lastnosti mesa. *Sodobno kmetijstvo* **34**, 3, 126–130.
- Troutt, E. S., Hunt, M. C., Johnson, D. E., Kanstner, C. L., Kropf, D. H. (1992): Characteristics of low-fat ground beef containing texture-modifying ingredient. *Journal of Food Science* **57** (1), 19–24. <https://doi.org/10.1111/j.1365-2621.1992.tb05415.x>
- Yilmaz, I. (2004): Quality characteristics and fatty acid composition of Turkish tupe frankfurter made with sunflower oil addition. *Fleischwirtschaft International: Journal for Meat Production and Meat Processing*, Number 1, pp. 52–54.
- Žlender, B. (2000): Kakovostni in tehnološki vidiki zmanjšanja maščob in holesterola v predelavi mesa. In: *Meso in mesnine za kakovostno prehrano*, 2. Posvet o vlogi in pomenu mesa v normalni – zdravi in dietni prehrani. Portorož, 10–11 februar 2000. Žlender B., Gašperlin L. (eds.) Ljubljana, Biotehniška fakulteta, Oddelek za živilstvo, 67–77.
- Žumer, M., Zupančič-Valant, A., Florjančič, U., Mesec, A. (1997): *Seminar iz aplikativne reologije. Reološka dneva, 24–25 september 1997*, Fakultet za kemijo in kemijsko tehnologijo, Katedra za kemijsko inženjstvo, Ljubljana, 80.

