

# Comparison of selected nutrients for meat products with information on packaging

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## Abstract

The aim of the work was to analyze selected meat products, determine the content of selected nutrients and compare them with the data on the packaging. Nutrients that significantly affect the nutritional value of meat products have been selected for analysis. Total protein, fat and salt content was determined in each product. Due to the negligible amount of carbohydrates in meat products, carbohydrates were not determined. The Kjeldahl method was used to determine the total protein content, the total fat content was determined by Soxhlet extraction and the salt content was determined by the Mohr method. The results of the chemical analysis were then compared with those reported on packaging. The tolerances were calculated using the manual of Ministry of Agriculture (MMA) issued in spring 2018. The results showed that in 10 cases out of 48 (20.8%) the values stated on the packages did not correspond to the stated nutrient content. In the case of total fat content, 7 values did not correspond, in the case of total protein content the values differed in two cases and in the salt content in one case.

*Salt, chemical analysis, labeling, meat products, ham*

## Introduction

Regulation (EC) No 1169/2011 of the European Parliament and of the Council on the provision of food information aims to protect the health and interests of consumers by providing a basis for the final consumer to make informed choices and safe use, with particular reference to health, economic, environmental, social and ethical aspects. Despite criticism of their nutritional profile by nutrition specialists, meat products are still popular among consumers and form a significant part of the consumer basket. Meat products are very diverse, compared to other foods, the nutritional composition and health impact cannot be generalized. With regard to the nutritional value, it is important to monitor the ratio of essential nutrients, macronutrients, including fats, proteins and carbohydrates. When consuming meat products and evaluating their nutritional value, the size of their portions must also be taken into account, for example, a slice of ham may be about 14 g, but a slice of long-lasting salami only 3 g. Meat products are really diverse in protein and fat content, for example, top quality steamed ham can contain on average about 5 % fat and 20 % protein, while sausages around 50 % fat and about 13-16 % of pure muscle protein (Kameník et al., 2014). The maximum permitted amount of fat and the lowest possible content of pure muscle protein or total meat are given by Decree No. 69/2016 Coll. According to requirements for meat, meat products, fishery and aquaculture products and products thereof, eggs and products thereof. The criteria given in this Decree are listed in Table 3 for selected meat products. The amounts of carbohydrates found in meat products are minimal to negligible quantities. Among the micronutrients, we are particularly interested in the sodium content, which is found both in meat products as a natural component of meat, but in particular it is added in the form of table salt or salt mixtures. Salt is essential for the processing of meat products as it ensures the binding, overall maintenance and influences other parameters of meat products. The lowest amount of salt required from the technological point of view is around 1.2 g.100 g<sup>-1</sup> of the product (Kameník, 2012). The maximum permitted amount of salt is not determined by any legislation. The maximum quantities that were valid in 1995 (Steinhauser, 1995) are entered in Table 4.

Thanks to the new nutrition labeling requirements, consumers are able to monitor the content of individual nutrients in the product and the energy value of the product on the packaging.

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These requirements, which have been in force since December 2016, are laid down in Regulation (EC) No 1169/2011 of the European Parliament and of the Council. According to this Regulation, nutrition information consists out of: energy value, total fat, SFA (saturated fatty acids), carbohydrate, sugar, protein and salt content. Basic data can be supplemented with the content of MUFA (monounsaturated fatty acids), PUFA (polyunsaturated fatty acids), polyalcohol, fibers, starch, vitamins and minerals. The nutrient content is determined either by chemical analysis or by calculation (using generally established data or the actual average values of the ingredients used). The energy value is determined by calculation

Table 1. Allowed selected nutrient tolerances for food (Ministry of Agriculture, 2018)

Nutrient	Tolerances for foodstuffs (including uncertainty measurement)	
	<10 g on 100 g:	±2 g
Carbohydrates, sugars, proteins, fiber	10-40 g on 100 g:	±20 %
	>40 g on 100 g:	±8 g
	<10 g on 100 g:	±1,5
Fats	10-40 g on 100 g:	±20 %
	>40 g on 100 g:	±8 g
SFA, MUFA, PUFA	<4 g on 100 g:	±0,8 g
	≥4 g on 100 g:	±20 %
Sodium	<0,5 g on 100 g:	±0,15 g
	≥0,5 g on 100 g:	±20 %
Salt	<1,25 g on 100 g:	±0,375 g
	≥1,25 g on 100 g:	±20 %

\*SFA (saturated fatty acids); MUFA (monounsaturated fatty acids); PUFA (polyunsaturated fatty acids)

using conversion factors from the content of individual nutrients. All nutrition claims are related to food commodities in conditions as they are present in the market (Regulation (EC) No 1169/2011 of the European Parliament and of the Council). When checking the data on the packaging, the product is subjected to chemical analysis and deviations are evaluated according to the manual for food business operators on food labeling according to the EU regulations (MMA, 2018). Deviations are shown in Table 1. It is necessary that rounding rules are observed too. The aim of this experiment was to determine the content of some nutrients in selected meat products.

## Material and methods

Table 2. Analyzed samples

Sample	English name	Czech name
A1	Selected Turkey ham	Krůtí šunka výběrová
A2	Selected steamed ham	Šunka dušená výběrová
A3	Top quality ham	Šunka nejvyšší jakosti
A4	Selected beef ham	Hovězí šunkavý běrová
A5	Smoked ham salami	Šunkový salám zauzený
A6	Junior salami	Junior salám
A7	Gothay salami	Gothajský salám
A8	Gypsy roast	Cikánská pečeně
A9	Debrecen roast	Debrecínská pečeně
A10	Vienna sausage	Videňský párek
A11	Debrecen sausage	Debrecínský párek
A12	Ostrava sausage	Ostravská klobása
A13	Vysočina	Vysočina
A14	Poličan	Poličan
A15	Hunting salami	Lovecký salám
A16	Paprikáš	Paprikáš

A total of 48 samples of 16 different meat products (three batches) from one producer were used to determine the content of selected nutrients (total proteins, fats and salt content). The samples were chosen in the way that they represent the available meat products present on the market. Products grouped by a technological process (ham, sausages, sausages, soft sausages and others), quality (top quality ham, selective ham), but also used meat (beef, turkey, pork and others) were chosen. The samples used in the study and their identification are given in Table 2. The analysis of the products was carried out at the Institute of Food Technology (MENDELU). This work was elaborated in laboratories of biotechnology pavilion M2. The products/samples were analyzed the next day after they were stored. Samples for analysis were homogenized, each sample was analyzed in duplicate. Total protein content was determined by Kjeldahl

method (ISO 937) and using Kjeltec 8400. Total fat content was determined by Soxhlet extraction (ISO 1444), petroleum ether was used as solvent. The salt content was determined by titration using Mohr argentometric method (calculated via chlorides). The results gained by analysis were compared with the values written on the packaging. The permissible deviations between the values were calculated according to the criteria from the manual of the Ministry of Agriculture (MMA, 2018). Standard deviations are shown in figures. Tables and figures were made by MS Excel 2016 (Microsoft Corporation, USA).

## Results and Discussion

Fat contents in analyzed (by Soxlet) meat products were compared with labeling on packaging and shown in (Plate XIII, Fig. 1). Significant difference, according to the manual (MMA, 2018) was found in 7 products, out of which the values stated on the packaging was lower in 4 products and higher in 3 products. The most significant differences in fat content were recorded for hunting sausage (lovecký salám) (A15) and paprika (paprikáš) (A16). The values determined for these two products were on average  $13 \text{ g} \cdot 100 \text{ g}^{-1}$  higher than indicated on the packaging, this value represented  $117 \text{ kcal} \cdot 100 \text{ g}^{-1}$  of the product. Significant differences were also observed in turkey ham (krůtí šunka výběrova) (A1), stewed turkey ham (dušené šunky výběrové) (A2), salami Junior (A6), gypsy roast (cikánské pečeně) (A8) and Viennese sausage (A10). In the case of Ostrava sausage (A12), the amount of analyzed fat exactly corresponded with the lower tolerance limit ( $18 \text{ g fat} \cdot 100 \text{ g}^{-1}$  of the product). However, due to rounding rules, this product meets the requirements. For all products, the criteria for the fat content according to Decree No. 69/2016 Coll. were observed (Table 3). These criteria are not established for ham, but according to the study (Kameník et al., 2016) that analyzed 52 ham samples over 3 years, the fat content of select ham and standard ham varied from 1.4 to 4.4%. Top quality hams were not included in this study. In 2017, the CAFIA (Czech Agriculture and Food Inspection Authority) investigated whether the declared amount of fat in products matches the analyzed fat content. The samples included both domestic and foreign products. All products, 23 batches in total, complied with the analyses (CAFIA, 2017).

Table 3. Requirements for pure muscle protein content, meat content and fat content of selected meat products (Decree No. 69/2016 Coll.)

Meat product	Meat content (minimal % in the product)	Pure muscle protein (minimal % in the product)	Fat content (maximum % in the product)
Šunkový salám	55		20
Junior salám	40		35
Gothajský salám	40		40
Vídeňský párek	55		40
Debrecínský párek	60		40
Ostravská klobása	60		35
Výsočina		13	50
Poličan		16	50
Lovecký salám		15	50
Paprikáš		14	50

The comparison of results of protein content gained by Kjeldahl method and protein content written on meat products labeling are shown in (Plate XIII, Fig. 2). Significant difference, according to the manual (MMA, 2018) was found in two products. Gypsy roast (A8) had a significantly lower protein content than indicated on the packaging. To reach the margin of tolerance, the value on the package would have to be reduced by  $3 \text{ g}$  of protein.  $100 \text{ g}^{-1}$  of the product. The Debrecen sausage (A11) also had a significantly lower

protein content than indicated on the packaging. In order to reach the limit of deviation, the product protein content has to be lower by 1 g of protein per 100 g<sup>-1</sup>. Junior sausage (A6) and Viennese sausage (A10) had an amount of protein that exactly corresponds to the upper limit of tolerance. Only total proteins were measured and their amounts in meat products are not subject to any criteria. Decree No. 69/2016 Coll. only gives criteria for the amount of pure muscle protein or meat content (Table 3). Moreover, these entitlements are only fixed for certain meat products. However, the packaging of analyzed meat products shows that the criteria for the quantity of meat were met. Beef ham (A4) was, despite its high protein content, classified in the category of selected ham, not in the category of the highest quality. It can therefore be assumed that it had a higher proportion of connective tissues in meat. The content of pure muscle proteins in meat products is strictly controlled in the Czech Republic. In 2014, 22 ham samples out of 391 samples failed to meet requirements (Brychta et al., 2016). CAFIA inspections in 2016 also revealed the provision of misinformation, when producers illegally used the designation ‘ham’ for other meat products (CAFIA, 2016).

The results of comparing determined salt contents (according to Mohr’s method) with package labeling are shown in (Plate XIV, Fig. 3). The criteria calculated according to the MMA manual were not met only for the one product where turkey ham (A1) contained significantly more salt than indicated on the packaging. The value on the packaging has to be increased by at least 0.2 g NaCl.100 g<sup>-1</sup> of the product to be declared out of criteria. All tested products met the labeling rules for salt levels, according to the Regulation (EU) No 1169/2011 of the European Parliament and of the Council on the provision of food information to consumers, where the manufacturer must indicate the salt content if it exceeds 2,5 g.100 g<sup>-1</sup> product. There are no limits for the maximum amount of salt in meat products. The maximum permissible limits that were in force in 1995 (Steinhauser, 1995) are given in Table 4.

Table 4. Salt content requirements for meat products, valid in 1995 (Steinhauser, 1995)

Meat product	Limit NaCl g.100 g <sup>-1</sup>
Cannedmeat	2
Cookedproducts	2.5
Smokedmeat, bacon	3
Long lastingheattreatedproducts	3.5
Long lastingheat not treatedproducts	4.2

A total of 5526 food batches were inspected within the labeling inspection performed by the CAFIA during 2017, 1598 food batches did not meet the labeling requirements (CAFIA, 2017). The data for individual commodities were not included in the publication, same as deviations among categories.

### Conclusion

In the framework of the study, the contents of nutrients in selected meat products of one producer were compared with the contents indicated on the packaging. A total of 16 samples of meat products were analyzed, monitoring the amount of protein, fat and salt for each product. As a result, a total of 48 values were compared. A total of 10 values did not meet the criteria stated in the Ministry of Agriculture manual. Two products did not meet the labeling limits immediately in two nutrients. The sample A1 (turkey ham) did not meet requirements for fat and salt, and the sample A8 (gypsy roast) was misleadingly labeled for fat and protein. It can be concluded that 8 out of 16 samples did not meet the criteria in total. Values indicating the amount of fat in evaluated meat products were the most critical (7 values did not meet the criteria). Significant differences were observed, especially for some long-lasting sausages and soft sausages that contain more fat than other selected meat products. Fluctuations in fat content labeling can be problematic in terms of their energy value. Protein content differed according to the criteria in two cases when

the value on the package was higher. The amount of NaCl analyzed in one product did not correspond with labeling. From these results, a total of 20.8 % of measured values did not correspond to the values labeled on the packaging. This high percentage of unsatisfactory samples is the consequence of used ingredients in the processed meat and not possibility to react immediately and change meat products labeling. Manufacturers do not analyze each batch of product due to expenses, but their labeling is based on average values that may not always be appropriate for the certain batch. This should be taken into account when assessing differences in nutrient content and the study is also emphasizing the importance of standardizing raw materials and the entire production control process.

### References

- Brychta J, Honzlová A, Klímová E, Bulawová H, Čurdová H, Šimek B 2016: Control of meat products in 2014 - selected quality indicators (Kontrola masných výrobků v roce 2014 – vybrané jakostní ukazatele). *Veterinářství* **66**: 917-921
- CAFIA 2016: Activity report (Zpráva o činnosti SZPI 2016. 24. 04. 2017). [on-line]. [cit. 2019-14-01]. Dostupné z: <http://www.szpi.gov.cz/clanek/zprava-o-cinnosti-szpi-za-rok-2016.aspx>
- CAFIA 2017: Activity report (Zpráva o činnosti SZPI 2017. 19. 04. 2018). [on-line]. [cit. 2019-14-01]. Dostupné z: <http://www.szpi.gov.cz/clanek/zprava-o-cinnosti-szpi-za-rok-2017.aspx>
- ČSN ISO 1444. Meat and meat products - Determination of free fat content (Maso a masné výrobky - Stanovení obsahu volného tuku). Praha: Český normalizační institut, 1998
- ČSN ISO 937. Meat and meat products - Determination of nitrogen content – Referent method (Maso a masné výrobky - Stanovení obsahu dusíku – Referenční metoda). Praha: Český normalizační institut, 2002
- Decree No. 69/2016 Coll. of 17 February on requirements for meat, meat products, fishery and aquaculture products and products thereof, eggs and products thereof. Collection of laws of the Czech Republic. 4. 3. 2016, part 26. ISSN 1211-1244
- Kameník J 2012: Meat Hygiene and Technology: Long lasting meat products (Hygiena a technologie masa: Trvanlivé masné výrobky). Brno: Veterinární a farmaceutická univerzita Brno. ISBN 978-80-7305-608-7
- Kameník J, Janštvová B, Saláková A 2014: Technology and hygiene of food of animal origin (Technologie a hygiena potravin živočišného původu). Brno: Veterinární a farmaceutická univerzita Brno. ISBN 978-80-7305-723-7
- Kameník J, Saláková A, Pavlík A, Steinhauserová I 2016: Evaluation of physico-chemical parameters of ham in the Czech Republic during 2011 and 2014/2015 (Hodnocení fyzikálně-chemických parametrů šunek v České republice v průběhu let 2011 a 2014/2015). *Maso*, **27**: 20-24
- Ministry of Agriculture 2018: Handbook for food business operators on EU food labeling (Příručka pro provozovatele potravinářských podniků k označování potravin podle předpisů EU). Praha: Ministerstvo zemědělství, 176 s. ISBN 978-80-7434-417-6
- Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council and repealing Commission Directive 87/250 / EEC, Council Directive 90/496 / EEC, Commission Directive 1999/10 / EC, Directive 2000/13 / EC of the European Parliament and of the Council, Commission Directives 2002/67 / EC and 2008/5 / EC and Commission Regulation (EC) No 608 / 2004 Official Journal of the European Union
- Steinhauser L 1995: Hygiene and technology of meat (Hygiena a technologie masa). Brno: LAST. ISBN 80-900 260-4-4