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Problems in determining the nutrition declaration for unpacked meat products – example of domestic cooked sausage

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Abstract. This study aimed to determine the degree of change that unpacked pasteurized (i.e. cooked) sausages undergo during their shelf-life. For that purpose, unpacked domestic cooked sausages were examined for basic nutritional parameters, as are required to be stated on labels by local and EU legislation, at the beginning (day 1) and end of their shelf-life (day 40). Results showed the examined parameters varied significantly (the % variance range was 41.5-129.4%), which vastly exceeds the tolerance of variation limits allowed in the legislation (20-50%). The results obtained show the responsible authority would be unable to adequately control the nutrition declaration of these unpacked domestic cooked sausages. The inability to maintain the nutritional content according to the declaration of these unpacked meat products during their shelf-life is a great challenge for quality control of this type of meat product at retail.

1. Introduction

Declared nutrition labels need to reflect the nutrient content of the food, be accurate and appropriate for their intended purpose [1]. In accordance with the law in Serbia, a nutrition declaration, indicating nutritional contents, presents information on energy values and quantities of food components, such as: fat (saturated, monounsaturated and polyunsaturated fatty acids), carbohydrate (sugars, polyols, starch), salt, fibre, protein and any vitamins or minerals [2]. The same law lists the mandatory information the declaration must contain, if the nutrition declaration is mandatorily provided. To facilitate implementation of the new legal obligations prescribed for food business operators, the Ministry of Agriculture, Forestry and Water Management published a guide to the declaration of food in June 2018 [3]. They proposed the prescribed deviations, including the measurement uncertainty for the basic nutrition components (Table 1).

Since December 2016, food on the European Union market has been mandatorily labelled with data on the food's nutritional value, and the labelling is the responsibility of food business operators who place food on the market [4]. At the end of 2012, the European Commission prepared a guide [5] on applying unique criteria for acceptable deviations, as provided for by the new European Parliament regulation on the provision of food information and food labelling to consumers [4]. The guide aims to provide consumers with accurate information on food quality through established permitted tolerances,



and to serve both food producers and competent authorities during official food controls. The actual nutritional values of food can differ in relation to the declared values, and therefore, it is essential to define the average nutritional value of the product. The average nutritional value is the one that best represents the amount of nutrients present in the food and takes into account any factors that lead to deviation from the real value.

Unpackaged food is food that is placed on the market without prior packing or is packaged at the point of sale in the presence of the final consumer [2]. In unpackaged foods, the items in the nutrition declaration can be limited to the energy value only, or energy, fat, saturated fat, sugar and salt [5]. However, food business operators are free to implement the full nutrition declaration if they so desire for these unpackaged foods. Moreover, the nutrition declaration for unpackaged foods can be provided either only at delivery of bulk product to retail, or for each consumer unit. Minor deviations in the number of portions and/or consumer units in a product are signalled using the symbol \approx or \sim in front of the number of portions and/or consumer units [3].

Table 1. Allowable food nutrition component deviations (including measurement uncertainty), based on [5]

Basic component	Allowed deviations
Protein, carbohydrate, sugar, fibre	< 10 g na 100 g \pm 2g 10-40 g na 100 g \pm 20
Fat	< 4 g na 100 g \pm 0.8g \geq 4 g na 100 g \pm 20
Fatty acids (saturated, polyunsaturated, unsaturated)	< 10 g na 100 g \pm 1.5g 10-40 g na 100 g \pm 20
Salt	<1.25 g na/per 100 g \pm 0.375 g \geq 1.25 g na/per 100 g \pm 20%
Sodium	<0.5 g na/per 100 g \pm 0.15 g \geq 0.5 g na/per 100 g \pm 20%

The tolerances listed in Table 1 include the uncertainty of measurement associated with a measured nutrition component. No further allowance for uncertainty of measurement is made when deciding whether a measured value is compliant with the declared value [5].

Domestic cooked sausages belong to the group of coarse grated boiled sausages and as products, are marketed under various names. Although there is no legally protected name, cooked sausage is a recognizable product on the local Serbian market.

The Serbian rulebook (law) on the quality of minced meat, semi-finished and meat products states that boiled sausages are produced from meat, fat tissue, connective tissue, intestines, blood products and supplements, in which part of the stuffing can form a meat batter and which, after filling into sheaths or coatings, is treated with heat at pasteurization temperature, with smoke [6]. Salt, brine salts, water, spices, spice extracts, sugars, additives, smoke flavourings and natural flavours can be used in these sausages (Table 2). The pasteurized sausages, termed in this study cooked sausages, are cooled after heat treatment and stored at 0 to 4 ° C. Domestic cooked sausages are perishable meat products, and a controlled cold chain is required during their storage.

Recording and reviewing the complete technological process of domestic sausage production is done by defining the quality of raw materials, technological process of production, pasteurization and cooling treatment. The common composition of domestic cooked sausages is listed in Table 2. The origin of the raw materials is local, produced in Serbia.

Table 2 Common composition of domestic cooked sausages

Raw materials	%	Additives	%
Pork meat, class 2	50	Soybean flour	2
Beef meat, class 2	15	Spices (pepper, onion, garlic, paprika)	2
Pork fat	15	Salt	1.6
Pork offal (liver, heart)	7	Polyphosphate	0.4
Ice	6	TOTAL	100

The aim of this study was to determine the degree of change in declared nutrition contents of unpacked, domestic cooked sausages during their shelf-life.

2. Materials and Methods

2.1. Technological production process of sausages

Previously salted meat and fatty tissue (with 2% nitrite salt) were minced through a machine with a grinding plate, 3 mm holes. The mince was placed in a cutter bowl and soybean flour and ice were added. These ingredients were chopped in the cutter for five minutes, until the chopped meat/fat reached 11°C. After that, the mosaic components (class 2 pork meat, pork fat) were minced (5 mm) and added to the cutter bowl along with remaining ingredients. All ingredients were then chopped to properly merge them and produce the sausage stuffing. The stuffing was filled into natural casings (pig small intestine, diameter 32-35 mm) and sausages were placed on stroller sticks. After that, raw sausages were heat-treated for 5 h until they reached a core temperature of 70 °C. Heat treatment was conducted using hot air with intense smoke. Cooled sausages were stored under appropriate cold chain conditions (temperature 0-4°C, relative humidity 50-70%). The storage conditions (temperature and relative humidity) were continuously monitored under the manufacturer's HACCP scheme in place.

2.2. Sausage sampling

Sausages with a predetermined shelf-life (40 days) were studied. Each sausage weighed a minimum of 200 g and all were from the same production lot. Sausages were sampled twice for determination of compliance with their nutrition declaration. The sausage components were determined immediately after production (day 1; n=12) and at the end of their shelf-life (day 40; n=12).

The following parameters and contents related to the nutrition declaration were determined: energy value (kJ/100g; kcal/100g); salts (%); protein (%); sugar (%); carbohydrate (%); fat (%); total monounsaturated fatty acids (g/100g sausage); total polyunsaturated fatty acids (g/100 g sausage); total saturated fatty acids (g/100 g sausage) and sodium (%).

Variation was calculated using Percentage difference calculator [7].

3. Results and discussion

Table 2 presents the average nutritional value and contents of the unpacked sausages at the beginning and end of their shelf-life, as well as the degree of variation among the measured parameters.

Table 3. Average nutritional value of unpacked domestic cooked sausages (n=12) at the beginning (day 1) and end (day 40) of their shelf-life and % variation of each measured parameter

Nutritional value or sausage content	Day 1	Day 40	Variation (%)
Energy value (kJ/100g)	1476.5	2350.0	45.7
Energy value (kcal/100 g)	365.8	568.0	43.3
Salt (%)	1.4	3.0	129.4
Protein (%)	17.7	27.4	42.8
Sugar (%)	0.5	0.8	129.4
Carbohydrate (%)	0.5	0.8	41.5
Total monounsaturated fatty acids (%)	15.7	23.9	51.7
Total polyunsaturated fatty acids (%)	3.9	6.6	49.2
Total saturated fatty acids (%)	12.2	20.2	129.4
Sodium (%)	0.6	1.2	45.8
Fat (%)	31.8	50.6	45.8

The results obtained showed the significant variation that occurred in all the examined parameters (the variations were 41.5-129.4%) during the shelf-life of the sausages. This causes a problem in controlling the declared values provided by the food business operator, since the product parameters change significantly during the shelf-life. The loss of moisture from these unpacked sausages caused drastic changes in the product, such that the sausages were almost a completely different product at the end of their shelf-life; certainly the nutrition declaration would have to be completely different on day 40 than the nutrition declaration on day 1. Each of the examined parameters varied by much more than 20%. This level of variation (20%) is prescribed by legal and professional regulations, but our results show the actual variation occurring in this product would pose a serious problem for the responsible authority, the veterinary inspection services. Since the sausage was stuffed in a natural casing and kept unpacked in palettes, we presume it constantly lost water, which disrupted the parameters according to the nutrition declaration.

All food producers are obligated to ensure a high level of consumer protection, which means that food produced must be safe and properly labelled to ensure consumers receive all relevant information about the foods they buy. From December 2016 in the European Union, foods have to be labelled with nutrition data [8]. Nutrient profiling has been defined as “the science of categorizing foods according to their nutritional composition” [9]. For a number of nutrients and foods (total fat, saturated, unsaturated and *trans* fatty acids, protein, carbohydrates, sugars, dietary fibre, salt, fruit and vegetables), population intake goals established in a number of member states are generally consistent (but not uniform) and aimed at preventing major diet-related public health problems in Europe [10].

4. Conclusion

The results of this study clearly show the enormous level of change that domestic cooked sausages undergo during their shelf-life. The inability of the relevant authority to fairly and adequately monitor unpackaged sausages such as these in terms of their nutrition declarations is an insidious problem. It is recommended that unpacked cooked sausages at retail be sold in the shortest possible time, since they rapidly undergo changes during their shelf-life, thus losing any basis for authentication and quality control. Food business operators producing unpacked cooked sausages for retail cannot rely only on a shelf-life study to fully understand their products, since the degree of change that occurs in such products due to moisture loss is substantial. The results obtained show the profound changes in this type of meat product at the end of the shelf-life compared with the characteristics measured at the start, immediately after production. These changes led to completely different characteristics and nutritional contents in

the sausages at the start and end of their retail sale, and this cannot be explained to consumers reading the current nutrition labelling requirements.

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