

## Bratwurst - different varieties of fried sausage

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### Abstract

Just as no social event in the Czech Republic or Slovakia can do without sausages, it is hardly possible to organise similar events in Germany without offering Bratwurst. The number of Bratwurst varieties available on the market is as high as the total number of sausage varieties that can be found in the Czech Republic. They differ not only from district to district but sometimes also from village to village, and there may even be individual producers, generally traditional butchers, producing different varieties in a single town or village. German-type Bratwurst is unusual for people in Central Europe, because they are not of the traditional red cured colour; they are produced with table salt only, and for that reason the heated sausage batter has a white to grey colour. Bratwurst products come in many varieties, coarse-grained, finely comminuted, or finely comminuted meat emulsion with coarse-grained (4 - 5 mm) visible fatty particles. This article aims to explain the peculiarities, production principles and individual types of this meat product. The results of a sensory evaluation of selected products will be presented in conclusion.

*Bratwurst, coarse-grained, finely comminuted, marjoram, Nuremberg Bratwurst, table salt, Thuringian Bratwurst*

### Introduction

The German word Bratwurst can be loosely translated into English as “fried sausage”. Today it stands for sausage products which are intended for frying, grilling or roasting. Historically, the word is probably derived from the German word “Brät” which comes from an Old High German expression and means lean muscle meat. The first mention of Bratwurst dates back to 1313, when the Council of the Franconian city of Nuremberg, which is generally recognised as the centre of Bratwurst production to this day, described the recipe of this special product. Bratwurst differs at first glance from Czech sausages because of its grey colour. This is unusual for someone from Central Europe, and can lead to the impression that a mistake has been made during the production process, i.e. the product has lost colour and is therefore of poor quality. This is not the case. The grey colour is caused by the use of table salt instead of nitrite curing salt which is commonly used in the Czech Republic and is responsible for the formation of stable colour complexes.

### Legislative regulations

Products have to fulfil decrees that stipulate clear requirements for coarsely ground and finely comminuted Bratwurst. These categories will be described in more detail in the technological section below.

The basic ingredients for the production of various coarsely ground Bratwurst (Grobe Bratwurst) is lean pork meat with a low proportion of fat and pork meat with a higher proportion of fat. If a binder of beef and veal meat is used, this meat should be free of sinews and fascia. The visible particles should have a size of 4 to 5 mm, and the batter should be stuffed in stripped sheep or thin pork casings. The proportion of BEFFE (meat

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protein free of connective tissue protein) in the total muscle protein content should be no less than 65% in histological analyses and a minimum of 75% in chemical analyses; the minimum BEFFE content should then be 8.5%. No colour change reaction may occur in the product (the preservation of red colour with, for example, nitrite) and no colourings may be used in production. Certain coarse-grained Bratwurst is also made with a binder, and similar criteria apply to these products, too.

The basic ingredients for the production of finely comminuted Bratwurst is beef and veal meat free of sinews and fascia, lean pork meat with a low proportion of fat, pork meat with a high proportion of fat (e.g. lean belly) and pork back fat. These products must be finely comminuted, and are generally stuffed in thin stripped pork casings. The proportion of BEFFE in the total muscle protein content should be no less than 65% in histological analyses and a minimum of 75% in chemical analyses; the minimum BEFFE content should then amount to 8.5%. No colour change reaction may occur in the product and no colourings may be used in production (Leitsätze für Fleisch und Fleischerzeugnisse 2010).

In addition to the observation of the given legislation, the individual federal states of Germany also define their own requirements for individual categories. The water/protein ratio should be no more than 4 in coarse-grained Bratwurst, no more than 4.5 in coarse-grained Bratwurst with a fine binder, and no more than 5.0 in finely comminuted Bratwurst. The fat/protein ratio should be no more than 3.2 in coarse-grained Bratwurst and no more than 3.0 in coarse-grained Bratwurst with a finely comminuted binder and in finely comminuted Bratwurst (Beurteilungskriterien für Fleischerzeugnisse von größerer Marktbedeutung für das gesamte Bundesgebiet 2007).

#### Ingredients, basic additives and seasonings

Historically, primarily pork meat is used in about 80% of Bratwurst production. Veal and beef are also found to a smaller extent, though their use is limited by price. Their proportion in Bratwurst recipes generally represents 10 – 15%. Sometimes, chicken and turkey meat is used, though this is not traditional or typical.

Pork meat intended for production is divided into three basic groups – lean meat (S2, S3), belly (S4, S5, S6) and fat (S9). Lean meat is free of sinews and fascia and its proportion in Bratwurst recipes usually ranges from 25 – 43%. It is used in recipes either as filler (visible particles) or for the production of a fine binder. The use of belly, which is interlaid with fat to various degrees according to individual recipes, falls in a range of 25 – 80% depending on the type of Bratwurst being produced, though is generally around 35 – 50%. Belly is generally used as meat product filler. The fatty component (S9) gives Bratwurst juiciness, tenderness and crispiness and is used, first and foremost, in recipes with a lower proportion of belly, in products with added veal or beef, and in recipes with a high proportion of lean meat (muscle protein). Beef meat is most frequently added in the form of R3, free of sinews and fascia. The proportion of added water (ice) varies. No water at all is added to certain products, while water is added to others at a proportion of usually no more than 15%.

As has been mentioned above, only table salt is used in Bratwurst production. The amounts of table salt added generally range from 1.7 to 1.9%, and may be 2% in raw Bratwurst. The use of phosphates in production is not prohibited, though limits on their use are stipulated by legislation. They are applied both in powder and in liquid form with the aim of increasing the binding capacity and cohesion of the batter. Traditional products and “clean label” products are made without phosphates. Ascorbic acid is added along with phosphate. Preparations improving emulsification may be added to finely comminuted batter, while the use of preparations preventing the release of water may be used in vacuum-packed Bratwurst. Flavour enhancers based on, e.g., mono sodium glutamate may be added to the product to achieve a more balanced flavour. Sugar is often added to these products to support the formation of Maillard compounds during frying or grilling.

However, in recent times there is a trend to the processing of traditional clean label products without E-numbers. The differences in the taste of individual varieties of Bratwurst are due not merely to the differing composition of their ingredients and the technology used, but first and foremost to the character of the high-quality seasonings used in individual regions and individual products. The basic seasonings used are black and white pepper, mace and nutmeg, marjoram, ginger, cardamom and lemon peel. Other seasonings, such as fresh onion and garlic, and sometimes allspice and perhaps cloves, are also popular. Cumin is often added in the federal states of the former East Germany. This seasoning does, however, not go well with lemon peel, and that is the reason why the recipes used in these regions contain less lemon peel than Bavarian recipes. Wine (medium aromatic; up to 3%), milk (up to 5%), bread roll, and eggs (up to 3%) are also frequently used additives to these products. Other ingredients occasionally used in modern varieties of Bratwurst to provide an attractive addition to a company's product range include mushrooms, capsicum, truffles, chilli, curry powder and various vegetables. A comprehensive overview of the seasonings used in the most famous varieties of Bratwurst is given in the Table 1. Two popular Czech products – white sausage and wine sausage – are also given in the table for the sake of interest.

Table 1. Seasonings used in the production of Bratwurst (Fuchs 1990; Koch 1990; Steinhauser 1991; Baumgartner 1995; Schmidt 1996; Thalhammer 1997; THN 1997; Šedivý 1998; Bezděk 1999; Feiner 2006; Wehmeyer 2008)

Bratwurst	White /black pepper	Garlic	Fresh onion	Lemon peel	Cumin	Nutmeg	Mace	Ginger	Cardamom	Marjoram
Kulmbacher	x						x	x	x	
Nuremberg <sup>1</sup>	x	x	x			x	x	x		
Grobe (coarse-grained) <sup>2</sup>	x	x				x		x		
Franconian <sup>3</sup>	x			x			x	x	x	x
Silesian	x		x	x	x		x	x	x	
Thuringian	x			x	x		x	x	x	x
Coburger <sup>4</sup>	x			x	x		x	x	x	x
Smoked <sup>5</sup>	x		x							x
Fine Tyrol	x	x	x	x		x	x	x	x	
Hamburger	x			x	x		x	x	x	x
Hessian	x		x	x	x		x	x	x	
Munich	x			x			x	x	x	
Palatinate	x			x			x	x	x	x
Regensburg	x			x			x	x	x	
Stuttgart	x			x			x	x	x	
White sausage <sup>5</sup>	x			x		x				
Wine sausage <sup>6</sup>	x			x		x	x	x	x	

<sup>1</sup> parsley; <sup>2</sup> mustard; <sup>3</sup> allspice; <sup>4</sup> egg; <sup>5</sup> bread roll, milk; <sup>6</sup> white wine, bread roll, milk, sometimes cloves

### Production process and methods of consumption

The differences in production reflect the basic distinction between coarse-grained and finely comminuted Bratwurst as well as coarse Bratwurst with a binder, and also between cooked and raw (fresh) Bratwurst.

In coarse-grained products, the ingredients processed in the appropriate way (i.e.

lean meat without sinews or fascia plus fat component) are pre-cooled and ground separately in a meat grinder. These ingredients are then mixed with seasonings and additives and repeatedly ground to a final particle size of around 3 – 5 mm (“pea-sized”). The batter is stuffed into the desired natural casings (stripped intestines from sheep or thin pork) and divided by winding at the desired length, which is between 6 and 9 cm (25 – 35 g) for Nuremberg Bratwurst and 15 to 20 cm for Thuringian Bratwurst. Traditional products are tied into bunches with string in such a way that the individually separated Bratwurst does not unwind. The products are cooked in water (steam) for 10 minutes to 70 – 72 °C core temperature, and subsequently cooled rapidly to a temperature below 10 °C to ensure that no colour reaction caused by the seasonings used (in particular marjoram, etc.) occurs. These products are of firmer consistency than finely comminuted Bratwurst. This group of products is more prevalent compared to finely comminuted products.

Finely comminuted products are made from ingredients prepared in the appropriate manner according to the specific recipe. Their production is simpler. The ingredients are chopped with salt, ice and a chopping preparation to the desired temperature. Seasonings and flavourings are added at the end. The ingredients may be cooled and pre-minced, and ice is added gradually (dividing the addition of ice into individual doses) to improve the quality of the chopped mix. The batter is then stuffed into the desired casings, links separated by winding and, as for coarse-grained Bratwurst, cooked in water (steam) to 70 – 72 °C core temperature for 10 minutes before being cooled immediately in order to prevent colour reactions.

Coarse-grained Bratwurst with a binder is an extremely common group of products. They are prepared in the traditional way with first a fine binder being mixed before the visible particles (filler) are added and chopped to the desired grain size. For better standardisation, it is appropriate to pre-mince the meat and fat filler in a meat grinder, gently cool it and then merely blend it with the batter. The proportion of coarse-grained filler and fine binder is generally around 50:50, though a proportion of 75:25 is possible. The word Rostbratwurst is also used in Germany – Rostbratwurst are coarse-grained products or coarse-grained products with a binder.

Concerning the production of raw (fresh) and cooked Bratwurst, it is obvious that the industrial production of cooked products predominates over raw products.

Cooked Bratwurst is stored in refrigerators at low humidity before packaging to prevent the recontamination with microorganisms and to limit their growth. These products are most often vacuum-packed. Less often they are packed in a protective atmosphere. They are arranged in a single row when packed, and are often re-pasteurised at 85 – 90 °C for 10 – 30 minutes to extend their shelf life. Packages treated in this way must be cooled immediately to a lower temperature. Special preparations are used to limit the release of fat and juice in products subjected to such temperature stresses.

Raw Bratwurst is essentially a semi-finished product. They are made in smaller volumes, though are still made in the traditional way. These products are cooked (fried, grilled) immediately before consumption. The possibility of contamination with microorganisms must be limited to the greatest possible degree during processing. Production generally begins early in the morning before processing products containing curing salt to ensure that no undesirable colour formation occurs. These products should have a special texture so that the batter does not “leak out” of the sausage casings after they have been wound by hand or machine. Raw Bratwurst may still be sold the day after production.

On the market, Bratwurst is not only available in its traditional geometric form, but in many other variations as well. Coils, weaves, various kebabs, rectangles, squares, etc. are also popular. There are also many varied ways in which they are consumed. They are popular in a white bun with mustard or ketchup. In Kulmbach, Germany, Bratwurst is extremely popular with an aniseed bun. This combination is rather aromatic for the

average Czech consumer, though it goes extremely well with beer. Bratwurst with roast potatoes, with cabbage and mashed potato or roast potatoes or with cabbage and a pretzel are other popular ways of consuming Bratwurst. In Bavaria, they are offered individually with sauerkraut and bread. Their consumption as “finger food” has become increasingly widespread in recent times. In the summer, Bratwurst is generally fried or grilled, while they are usually pan-fried in winter.

### Famous types of Bratwurst

More than fifty basic types of Bratwurst are known, the best of which are coming from Franconia – the northern part of Bavaria bordering Thuringia. As stated before, a large number of modern varieties can nowadays be found as an attractive addition to producers’ seasonal product ranges.

Franconian (Fränkische) Bratwurst – the first mention of this type dates back to 1573. This is generally a raw, coarse-grained Bratwurst with a binder whose proportion exceeds 50%, and is stuffed into sheep casings. Its characteristic seasoning is marjoram. It is quite similar to the Nuremberg Bratwurst in taste, though it is juicier and popular for its granularity. This product is traditionally served with sauerkraut and roast potatoes, usually cut into slices. Mustard is not traditionally consumed with this dish (Plate II, Fig. 1).

Nuremberg (Nürnberger) Bratwurst – the oldest mention of this product dates back to 1313 and comes from Nuremberg itself. This is a small Bratwurst, 6 to 9 cm long and weighing 25 to 35 g. Nuremberg Bratwurst is stuffed into thin sheep casings produced largely in Iran where the way in which sheep are fed is so specific that the intestines are more durable and less prone to split during grilling. Because of the 2006 Council (EC) Regulation on the protection of regional foodstuffs, Nuremberg Bratwurst can currently only be produced in Nuremberg. This is a coarse-grained cooked product. The dominant seasonings are marjoram, parsley, pepper and onion. It is usually grilled over beech wood and is traditionally served on tin plates, twelve (Dutzend) or six (halbes Dutzend) to a plate, with sauerkraut or potato salad, sometimes with horseradish or mustard. The street sale of three Bratwurst sausages in a bun with mustard. An interesting and tasty method of preparing them is to cook them in vinegar flavoured with seasonings and onion, which makes an extremely refreshing dish (Plate II, Fig. 2).

Kulmbacher Bratwurst – Kulmbach is an important food industry city in Upper Franconia, known primarily for excellent beer, superior meat products and high-quality bread products. The Bratwurst made here traditionally contains a higher proportion of veal meat. They are finely comminuted and sold largely raw for immediate consumption. They may be thinner and longer than Franconian Bratwurst. In the course of the one-week Beer Festival in Kulmbach, one butcher alone produces and sells approx. 60 000 Bratwurst sausages (Plate III, Fig. 3).

Coburg Bratwurst – the first mention of this Franconian Bratwurst dates back to 1498. It is generally sold raw. This is a grained Bratwurst, optionally with a proportion of fine meat binder, stuffed into special thin pork casings with about 24 mm in diameter. This Bratwurst, 25 cm long, was originally made merely with table salt, pepper, nutmeg and lemon peel. An interesting fact about this Bratwurst is that it is traditionally grilled over pine cones.

Thuringian (Thüringer) Bratwurst – is one of the most important Bratwurst products. The first mention of it comes from the town of Arnstadt in 1404. Like the Nuremberg Bratwurst, it has protected geographical indication (PGI) status of the EU since 2004. In 2006, the Society of Friends of Thuringian Bratwurst established the First German Bratwurst Museum in Holzhausen south of Erfurt. This product is sold both raw and cooked. It is a grained Bratwurst, optionally with a proportion of fine meat binder, stuffed into natural casings of 26 – 30 mm diameter and a length of 15 – 20 cm.

The basic seasonings are marjoram of the highest quality grown in the local area and high-quality cumin. This Bratwurst is traditionally grilled on wood charcoal and sold in a bun with mustard (Plate III, Fig. 4).

Silesian (Schlesische) Bratwurst – a grained product with a binder stuffed into natural casings of 26–28 mm diameter. This product is sold either raw or cooked. As much as 2% comminuted fresh onion and ground cumin is added to the product (Plate IV, Fig. 5).

Regensburg Bratwurst – the famous Wurstküche sausage factory, where visitors can taste traditional Regensburg Bratwurst, is located near the famous salt depot and stone bridge not far from the centre of the city of Regensburg. The factory was probably established in the 12<sup>th</sup> century. This Bratwurst is made largely as a raw product. It is a ground product with a fine meat binder possible, and is stuffed into natural casings with 22–24 mm in diameter. The individual Bratwurst weighs 40–50 g.

### Sensory evaluation of selected types of Bratwurst

The aim of this evaluation was to perform a sensory assessment and comparison of selected types of Bratwurst, first and foremost from the viewpoint of their acceptability to the Czech consumer.

### Materials and Methods

Products were purchased in retail markets in Germany, and the products were of superior quality. The majority were cooked vacuum-packed products (Franconian, Nuremberg, Thuringian), while others were purchased raw (Kulmbach and Silesian). One product made of poultry meat (chicken and turkey), which was also vacuum-packed, was also included in the evaluation. A total of six types of Bratwurst were evaluated. The Franconian, Nuremberg, Kulmbach and Silesian Bratwurst were stuffed in sheep casings; the Thuringian and poultry Bratwurst in thin stripped pork casings. The products were stored at a temperature of up to 4 °C before preparation. The Bratwurst was pan-fried with the use of a small quantity of sunflower oil. Sensory evaluation was conducted in a special laboratory at the Faculty of Veterinary Hygiene and Ecology at the University of Veterinary and Pharmaceutical Sciences in Brno. Twelve trained evaluators, half of them men and half of them women took part in the evaluation. The results were recorded on assessment sheets with the use of a 100-mm unstructured graphic scale. The products were evaluated from the viewpoint of their pleasantness (hedonics) and the intensity of the impression they produced. The vector moved from the left (less pleasant, less intense) to the right (pleasant, more intense). The evaluation vector was given as follows for the individual traits: colour hedonic (light to dark), colour intensity (light to dark), aroma hedonic (unpleasant or negative to pleasant without negative aromas), aroma intensity (unpleasant or negative to pleasant without negative aromas), consistency intensity (soft to extremely hard), juiciness intensity (dry to extremely juicy), seasoning hedonic (unsatisfactory or unpleasant to extremely pleasant), seasoning intensity (bland to extremely intense), taste hedonic (unpleasant with an aftertaste to pleasant with no negative aftertaste), overall impression (unpleasant to pleasant). Single-factor variance analysis with a level of significance of  $P < 0.05$  was used for statistical evaluation. An LSD method was used for subsequent testing. The results are given in Table 2 along with average values for the individual traits.

### Results and Discussion

The pleasantness and intensity of colour was given a largely below-average assessment by the evaluators – an excessively light product colour did not appeal to the evaluators. The exception was the Nuremberg Bratwurst, which was the only slightly darker Bratwurst and therefore received the best evaluation ( $P < 0.05$ ).

The pleasantness of aroma received a positive evaluation that was considerably above average in almost all cases. The intensity of aroma also received a predominantly above-average evaluation, particular in the samples of Franconian and Kulmbach Bratwurst. Silesian Bratwurst was an exception, whose aroma was not given a positive evaluation ( $P < 0.05$ ).

The Franconian Bratwurst was evaluated as the hardest Bratwurst, but texture along with light colour, were generally speaking evaluated as the worst parameters. Juiciness was largely given an above-average evaluation, with the Thuringian Bratwurst being the juiciest ( $P < 0.05$ ). Seasoning was also given a positive evaluation, in terms of both



intensity and pleasantness. The Silesian Bratwurst was an exception to this, being evaluated as the least pleasant ( $P < 0.05$ ). Taste and overall impression were, in most cases, also evaluated as considerably above average. The Kulmbach Bratwurst received a particularly positive evaluation, followed by the Nuremberg, Thuringian and Franconian Bratwurst. The Silesian Bratwurst was found unsatisfactory in the majority of traits. With the exception of juiciness, its evaluation was statistically significantly the worst in all traits ( $P < 0.05$ ).

The products evaluated by the panellists were given very good evaluations in terms of taste, overall impression, pleasantness of aroma and seasoning. The products were given a positive evaluation in spite of the fact that they were largely on the soft side and of average juiciness. The Kulmbach and Franconian Bratwurst received the best evaluations, followed by the Thuringian and Nuremberg Bratwurst. The Silesian Bratwurst did not receive a positive evaluation.

Table 2. Sensory evaluation of selected Bratwurst

Bratwurst type/sensory traits [points]	Franconian	Kulmbach	Nuremberg	Thuringian	Silesian	Poultry
Colour hedonic	51.0 <sup>bc</sup>	45.6 <sup>b</sup>	67.7 <sup>c</sup>	44.1 <sup>b</sup>	25.7 <sup>a</sup>	52.9 <sup>b</sup>
Colour intensity	50.5 <sup>b</sup>	43.2 <sup>b</sup>	66.1 <sup>c</sup>	35.8 <sup>b</sup>	17.4 <sup>a</sup>	46.4 <sup>b</sup>
Aroma hedonic	76.5 <sup>b</sup>	78.8 <sup>b</sup>	72.2 <sup>b</sup>	67.3 <sup>ab</sup>	54.1 <sup>a</sup>	72.3 <sup>b</sup>
Aroma intensity	55.3 <sup>ab</sup>	58.1 <sup>b</sup>	63.3 <sup>b</sup>	63.7 <sup>b</sup>	39.5 <sup>a</sup>	73.2 <sup>b</sup>
Consistency intensity	60.6 <sup>abc</sup>	42.0 <sup>b</sup>	64.3 <sup>c</sup>	29.7 <sup>b</sup>	17.1 <sup>a</sup>	27.1 <sup>a</sup>
Juiciness intensity	39.4 <sup>a</sup>	51.1 <sup>b</sup>	51.4 <sup>b</sup>	70.6 <sup>c</sup>	64.1 <sup>bc</sup>	49.8 <sup>b</sup>
Seasoning hedonic	59.3 <sup>b</sup>	66.8 <sup>b</sup>	60.8 <sup>b</sup>	70.0 <sup>b</sup>	32.8 <sup>a</sup>	61.8 <sup>b</sup>
Seasoning intensity	68.7 <sup>abc</sup>	60.0 <sup>ac</sup>	74.4 <sup>abc</sup>	65.4 <sup>abc</sup>	52.5 <sup>c</sup>	77.6 <sup>b</sup>
Taste hedonic	66.8 <sup>b</sup>	75.4 <sup>b</sup>	72.8 <sup>b</sup>	70.3 <sup>b</sup>	31.0 <sup>a</sup>	58.3 <sup>b</sup>
Overall impression	69.1 <sup>b</sup>	76.8 <sup>b</sup>	64.8 <sup>b</sup>	68.5 <sup>b</sup>	29.9 <sup>a</sup>	60.7 <sup>b</sup>

*a, b, c – statistically significant difference ( $P < 0.05$ ); XX.X – the most pleasant/most intense sample*

## Conclusions

Bratwurst sausages are an extremely interesting and diverse group of products made without curing salt, only with table salt, seasonings and other additives. They are, in the majority of cases, products made from high-quality ingredients that are consumed grilled, fried or roasted at all times of the year. The most famous types can be found just over the western borders of the Czech Republic in Bavaria and Thuringia. The results of the sensory evaluation of Bratwurst conducted at the Faculty of Veterinary Science and Ecology at the University of Veterinary and Pharmaceutical Sciences in Brno indicate that products of this type may also be positively perceived by Czech consumers.

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Fig. 1. Franconian Bratwurst (Ovísková V)



Fig. 2. Nuremberg Bratwurst (Ovísková V)

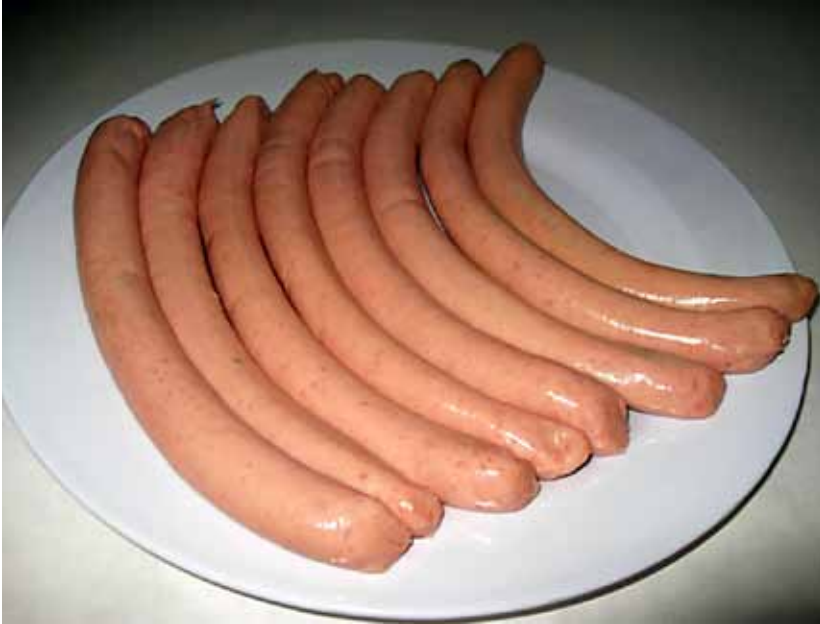


Fig. 3. Kulmbacher Bratwurst (Ovísková V)

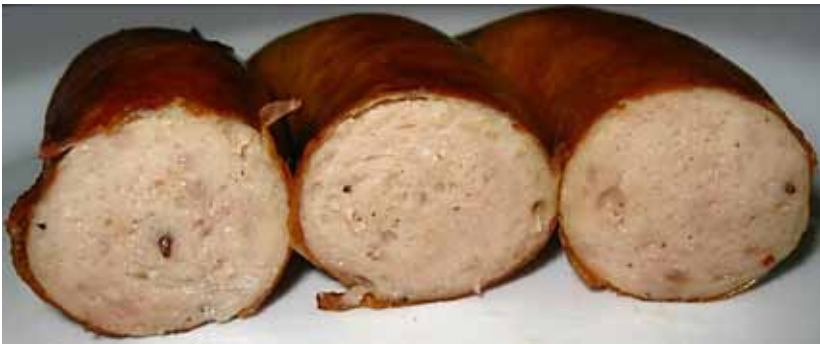


Fig. 4. Thuringian Bratwurst (Ovísková V)



Fig. 5. Silesian Bratwurst (Ovísková V)