DETERMINATION OF STARCH SUPPLEMENT IN MEAT PRODUCTS (SALAMI)

Neculai Doru Miron, Alina Davidescu,
Nicoleta Artenie, Paul Ionuț Dron

University of Bacau, Marasesti 157, RO-600115 Bacău,
dmiron@ub.ro , dron@ub.ro

Abstract: The goal of the present work was to determine the starch supplement in salami type meat products. A percent higher than 0.5% starch in these products shows a supplement with a fraud intention. The analyzed samples were bought from the free market and the experimental protocols that were applied are known from the specialized literature.

Keywords: *starch, salami, hydrolyze, storage, water holding capacity*

INTRODUCTION

By definition, meat is any eatable part resulted after slaughtering the animal. In a commodity sense, meat is the carcass or parts detached from this in which prevail the muscles from the skeleton with all the corresponding tissues.
In the structure of meat, muscular tissue is the largest part. Beside it meat has various proportion of other tissues (lax tissue, fat tissue, fiber tissue, and bone tissue) as well as nerves, blood vessels and lymphatic ganglions.
From the chemically point of view, meat contains water, nitric protein and nonprotein substances, sugars, lipids, vitamins, mineral substances and enzymes.
From all the carbohydrates present in meat, we mention *glycogen* (also called animal starch) which makes deposits in the human organism, especially in the liver. The glycogen quantity from the liver depends on the fodder quality that was used to feed the animal. The glycogen quantity from muscles has serious variations (that quantity

increases when the organism rests and is well fed; it decreases during work and cumulated with a bad nutrition). Low content of glycogen is found in lungs, kidneys, in the nervous system. Because it has a vegetal origin, starch is in little proportion (approx. 0.5%) in meat products, mainly due to spices (pepper). Finding higher content of starch indicates a fraud intention.

Under de name of meat products we understand those products in which meat prevails.

Meat products have a high nutritive value and are obtained from hashed meat or meat shaped pieces. They are mainly consumed without cooking.

Meats products are a category of products differentiated by technological particularities and are known as *fresh meats, salami specialties, etc.*

Fresh meat type products have a shorter fabrication cycle; their components have a very high degree of hashing and the thermal treatment is short. The final content of water is pretty high and in section, the composition has a uniform aspect and is brick-colored.

Raw smoked salami type products are superior products with a highly nutritive value, a nice aroma, and are made from pork meat, beef meat and hard bacon. Beside salt, potassium ammonium, sugar, white pepper, juniper and garlic are used as auxiliary materials. From this category, we can mention *Sibiu* salami (from pork) and *Swiss* salami (with beef supplement).

EXPERIMENTAL

Starch determination

Qualitative determination [1]

From the analyze sample, 5 - 6 g are treated with boiled water. Then is left for cooling and the superior liquid portion is treated with Lugol solution (obtained by solving 0.5 g iodine and 1.5 g KI in water and then completed with water till 25 mL volume is obtained).

In case that a blue color appears, the probe is considered positive. If the color is very strong, this may be a clue that there is a high starch or other cereal products supplement (with a fraud intention). To verify this fact, from the obtained sediment a small part is taken and a microscopic exam is made in order to determine the type of added starch.

Quantitative determination of starch [1]

The principle of this determination lies on the starch hydrolyze till simple reducing sugar (glucose) is obtained. This one is than determined by the Bertrand method.

Operating protocol [1]

At a technical balance 20 g of the analyze probe are taken and 100 mL of KOH alcoholic solution (obtained by solving 80 g of KOH to 1000 mL ethylic alcohol 97 – 98%) is added. The alcoholic solution will be firstly heated to 70 – 80 °C. After mixing with the KOH alcoholic solution, the probe is refluxed for 30 – 40 minutes, till dissolution. It is left for cooling and then is quantitatively passed in a big centrifuge vial and then centrifuged 5 minutes at 2000-2500 rpm. It is left for decanting and the superior liquid portion is discarded. The precipitate and the centrifuge vial are washed for 2 or 3 times with 15 – 20 mL ethylic alcohol which is then eliminated by centrifugation or filtration. The insoluble residue that remained by centrifugation is quantitatively reintroduced in the initial flask along 100 mL of hydrochloric acid 1 N. An ascending refrigerant is attached and the mix is cooled on the water bath for 2,5 hours, to ensure starch hydrolyze. After this, the flask is cooled at the water tap. The hydrolyzed product is neutralized with NaOH in the presence of bromthymol blue indicator till green color is reached (pH = 6.3). The mix is quantitatively passed in a 250 mL flask and 3 mL of potassium iron cyanide solution with 3 mL of zinc acetate solution are added. In this way, protein removal is assured. In order to facilitate this operation we must agitate after each supplement. The mix is left 30 minutes to rest and then is completed with water till 250 mL volume is reached. Then a filtration is made through a funnel and a filter with low porosity. From the solution thus obtained we can determine the reducing sugar (glucose) by Bertrand method.

RESULTS

In order to determine the presence of starch, three samples were taken:

- sample 1 – 5.37 g
- sample 2 – 5.23 g
- sample 3 – 5.95 g

Treated with Lugol solution, sample 1 gives a blue color which denotes the presence of starch; sample 2 doesn't gives a blue color, which means that it does not contains starch in its composition; sample 3 gives a blue color so it has a starch supplement.
For each of the two samples detected with a significant starch supplement, the quantitative determination of starch was made, using the method presented above.
From each sample 20 g are taken and the presented experimental protocol is applied. At the end, a content of 1.250% of starch for the first sample and 1.375% of starch for the second one was found.

DISCUSSION

In this section we present some of the effects [2] of starch supplements, effects that could determine some producers to add starch with a fraud intention.
The percentage of fluid released by the unfrozen samples of salami was reduced by the presence of starch [3] (Table 1). This was not surprising, as there is generally a reduction of cooking and purges losses in the presence of starch (Dexter et al**.,** 1993; Carballo et al., 1995) although Claus & Hunt (1991) reported that salami containing wheat starch (3.5%) did not differ in cooking loss from a low-fat control. Salami containing starch exhibited a smaller loss of binding properties as a result of freezing-thawing (Table 1).
This improved freeze-thaw stability, which relates directly to the amount of starch added (Table 1), was also noted by Dexter et al. (1993). Addition of starch generally caused an increase in penetration force (PF) and a decrease in elasticity of the salami [3] (Tables 2 and 3).

Table 1. Influence of levels of added starch on water holding capacity (%) of fresh and frozen salami

	Fresh	Frozen storage (Months)	
		2	4
No Starch	83.6	76.0	49.53
Medium Starch	92.5	92.0	71.60
High Starch	90.9	94.6	84.90
Sem (2.0)			

Sem, standard error of the mean

Table 2. Influence of proportion of added starch on penetration force (n) of fresh and frozen salami

	Fresh	Frozen storage (Months)	
		2	4
No Starch	3.26	2.76	1 .243
Medium Starch	3.74	4.04	4.080
High Starch	4.74	5.02	5.640
Sem (0.16)			

Sem, standard error of the mean

Table 3. Influence of proportion of added starch on parameter distance (mm) of fresh and frozen salami

	Fresh	Frozen storage (Months)	
		2	4
No Starch	6.13	4.821	4.08
Medium Starch	7.642	5.432	4.34
High Starch	3.363	5.212	4.30
Sem (0.12)			

Sem, standard error of the mean

Table 4. Influence of proportion of added starch on work of penetration (x 10 m^2) (j) of fresh and frozen salami

	Fresh	Frozen storage (Months)	
		2	4
No Starch	1.00	1.12	1.20
Medium Starch	1.14	1.16	1.18
High Starch	0.222	1.08	1.32
Sem (0.07)			

Sem, standard error of the mean

As a result of freezing and frozen storage, while the penetration force of emulsions declined in the absence of starch (NS), with 5% starch (MS) no such decline occurred and with higher proportions of starch (HS) PF increased. The elasticity of the freeze thaw samples was similarly affected by the presence or otherwise of starch [3] (Table 3). Starch had no effect on the work of penetration (WP) in unfrozen samples and frozen samples stored for 2 months (Table 4) but WP decreased significantly after 4 months' frozen storage in salami not containing starch (NS), but not in those containing starch (Table 4).

The effect of starch on texture (Tables 4 and 5) is consistent with the findings of a number of authors (Shand et al., 1990; Chen et al., 1993; Carballo et al., 1995) but such an effect was not found in low-fat meat emulsions by other workers (Claus & Hunt, 1991; Hull et al., 1992; Dexter et al**.,** 1993). The effect of added starch may be because starch favors the formation of stronger heat-induced structures through swelling of the starch granules embedded in the protein gel matrix. This increased pressure and water binding in the gel matrix causes a more compact and firm structure in the casing (Chen et al., 1993).
Although some of the water in the meat emulsions will be taken up by the starch on gelatinization, it is not possible to estimate the contribution this makes to increasing effective protein concentration, and thus the properties of the salami.
As indicated previously, freezing and frozen storage lead to disruption of the product's internal structure, and this affects both binding properties (Table 1) and texture (Tables 2-4). Loss of product consistency as a result of the freeze-thaw process (Tandler, 1992) is limited by the cryoprotectant effect of starch, and thus textural changes of this kind were particularly pronounced in the absence of starch (NS) (Tables 2 - 4). Similar results were reported by Skrede (1989) who found that salami containing several different starches and subjected to various cooking regimes generally had increased firmness at the end of 3 months' frozen storage, but reduced binding properties. Studies on other products indicate that starch improves freeze-thaw stability which has been attributed to resistance to retrogradation and thus high water-binding capacity during freezing and thawing (Lee et al., 1992).

CONCLUSIONS

The goal of this paper was to determine if there was a fraud intention in the addition of starch in the three studied probes, knowing some of the effects of adding starch in meat products [4].
As we presented, we worked with experimental protocols described in the literature to determine qualitatively and quantitatively the starch.
From the initial three samples, only one has no starch supplement. The other two gave a blue color, indicating a starch supplement. This supplement was quantitatively determined. The results were 1.250% in the first probe and 1.375% in the last one. The "allowed" value of starch supplement in meat products is 0.5% [4] and is due to used spices. So, the found values are almost three times greater. Applying the found percent for starch supplement to an industrial producer, it results that adding starch in meat products can be a "profitable tool" if ruling a fraud business.

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