

Development of technology and assessment of nutritional value of a delicacy goat meat product

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Abstract: *Goat meat is highly competitive with other livestock meat on nutritional and sensory qualities. The preparation method of a delicacy pressed goat meat product and its proximate, mineral and vitamin compositions are presented. Three variants of curing pickle with variation of salt, sugar, papain and water are prepared and injected to goat meat product. Using of papain enzyme in formulation of curing pickle tenderize the goat meat and cut meat massaging time up to 3 h. The level of minerals and vitamins in goat meat before and after cooking is significantly different.*

Index Terms: *goat meat, curing pickle, papain, vitamin, nutritional value.*

I. INTRODUCTION

The development perspective of goat breeding in Kazakhstan is predetermined by the presence in the republic of significant areas of hard-to-reach mountainous and rocky pastures, a significant increase in the number of goats in a market economy, and an increase in the domestic demand for their products [1]. The first item on the list of useful qualities of goat meat must necessarily be low cholesterol [2]. This circumstance allows us to attribute goat meat to the category of dietary products that are recommended for use for people with diseases of the cardiovascular system and diabetes mellitus of all known types. Goat meat in its nutritional properties is comparable to lamb, but has a lower fat content. It contains a complete set of essential amino acids and is limited only by valine [3]. Goat meat does not belong to the traditional food in the diet of Kazakhstan, so it is almost impossible to meet it on the shelves of our stores. Probably for this reason we know very little about the benefits and harms of such meat as goat meat. Meanwhile, experts in the field of nutrition assert that this product has simply unique properties. As a rule, goat meat can only be purchased on the

market, and even then not always. As for shops, it does not appear on the shelves of ordinary supermarkets at all. This is an excellent product that has a lot of useful properties, while the harmful ones are completely absent.

Goat meat has a high nutritional value due to its good organoleptics, high digestibility, biological and physiological significance. In terms of the content of unsaturated fatty acids required for metabolism, goat meat is close to mutton and beef [4]. A high level of amino acids (including essential ones) ensures normal growth and development. In terms of the content of vitamins A, B1, B2, goat meat is superior to other products of animal origin. But other vitamins are also contained in sufficient quantities - 100 grams of goat meat can provide a daily requirement of 20% in vitamin B6, 70% in vitamin B12. Goat meat contains significant quantity of important macroelements. In goat meat cholesterol levels are significantly lower than in other farm animals. Goat meat can be attributed to a rich source of vitamins of group B, pantothenic, para-aminobenzoic and folic acids, choline [5, 6]. At present, the assortment of small-scale delicacy products from goat meat is practically not developed. The task of the research is the production of a delicacy product from goat meat, which has therapeutic and prophylactic properties. Delicacy products from goat meat are not found on the shelves of Kazakhstan. The delicacy products we represent are based on goat meat. The invention relates to meat processing industry and can be used in the production of delicacy meats [7]. Prospects for the development of goat production in the republic and the production of competitive products from this industry in accordance with the standards of the world market predetermines the need to create new and improve existing breeds through the development and implementation of effective methods of breeding, biotechnology, technology of production and processing of products and the system of feeding goats. In modern conditions, food additives and brines of complex composition are widely used to correct the technological properties of raw materials and increase production volumes, as well as to reduce its cost [8]. Currently, in order to improve the technological characteristics of raw materials and improve the consumer properties of finished products, various technological methods and additives are widely used. In particular, the complex use of a multicomponent brine during the mechanical processing of raw materials will improve the organoleptic properties of the product and intensify the technological process of the production of meat products [9].

Manuscript published on 30 March 2019.

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Development of technology and assessment of nutritional value of a delicacy goat meat product

The aim of the work is to develop a method of obtaining a pressed delicacy product from goat meat, reducing the time of drainage massage after salting raw materials by introducing into the brine the papain enzyme preparation, which has the property to soften meat. The technical result is the expansion of the range of pressed delicacy products from goat meat, reducing the duration of the production process, reducing power consumption, reducing the cost of the product.

II. MATERIALS AND METHODS

The technical result is achieved by the fact that in the method of production of meat product, including the preparation of raw meat, preparation of brine, injection of raw meat with curing brine followed by massaging, aging for ripening, molding and heat treatment, the new approach is that goat meat is used as raw meat, the preparation of raw meat includes the separation of adipose tissue from muscle, the operation of pounding muscle tissue is additionally introduced, an enzyme preparation, for example, papain is included in addition to the traditional components of the curing brine; massaging is carried out for not more than 3 hours, after the end of the massaging operation, raw meat (adipose and muscle tissue) is rubbed with a mixture of spices, including dried garlic, coriander, black and red pepper, and then meat is treated with liquid smoke and ripened for 30 minutes. Then, molding is carried out with the addition of bay leaf and boiling under pressure at a temperature of 100 ° C for 2.5 hours, at which after every 30 minutes the product is additionally subjected to dense pressing. For the preparation of curing brine per 100 kg of raw meat, 2 liters of water, 0.1-0.6 kg of salt, 0.2-0.6 kg of sugar, 0.1-0.4 kg of enzyme preparation are used. For the preparation of a mixture of spices for 100 kg of raw meat, 30-75 g of black pepper, 30-75 g of red pepper, 30-75 g of coriander, 100-300 g of dried garlic are used. Also 25-75 ml of liquid smoke, 5-15 g of bay leaf are used. Three variants of goat meat product were prepared with variation of curing pickle. The method is as follows.

Variation 1. Goat meat of the first category is used as raw meat. After deboning and trimming, the fatty tissue is separated from the muscular one in the lumpy form, the flesh is cut into layers and pounded. Then the curing brine should be injected. A pickle is prepared for salting, which contains table salt, sugar, an enzyme preparation (papain). Table salt, sugar is diluted in water in a ratio of 100 kg of meat to 2 liters of water, 1.5-2.2 kg of salt, 0.2-0.4 kg of sugar and 0.1-0.4 kg of the enzyme preparation. After preparation of the brine, the raw materials are injected with brine and massaged for 3 hours. Then the layers of meat and fat are rubbed with a mixture of spices, which includes 30-75 g of black pepper, 30-75 g of red pepper, 30-75 g of coriander, 100-300 g of dried garlic. For smoking 25-75 ml of liquid smoke is used.

The processed meat is left for 30 minutes to soak up the spices (ripening). Then, molding into a pre-laid food film of 2.5 kg mass is carried out, alternating between layers of meat and fat with the addition of 5 g bay leaves. Then follows cooking under pressure at a temperature of 100 ° C for 2.5 hours, after which every 30 minutes the product is subjected to dense pressing. Then the product is cooled to 2-4

° C without removing from the forms. After reaching a temperature of 2-4 ° C, the product is removed from the molds and packaged with a vacuum apparatus in plastic bags.

Variation 2. The method is carried out as in example 1, only the injection is carried out by a curing brine of the following composition: 2 liters of water, 1.85 kg of salt, 0.4 kg of sugar, 0.25 kg of papain, rubbing is carried out with a mixture of spices composition: 60 g of black pepper, 60 g of red pepper, 60 g of coriander and 250 g of dried garlic. For smoking 50 ml of liquid smoke is used. 10 g of bay leaf is added.

Variation 3. The method is carried out as in example 1, only the injection is carried out by a curing brine of the following composition: 2 liters of water, 2.2 kg of salt, 0.6 kg of sugar, 0.4 kg of papain, rubbing is carried out with a mixture of spices composition: 75 g of black pepper, 75 g of red pepper, 75 g of coriander and 300 g of dried garlic. 75 ml of liquid smoke is used for smoking. 15 g of bay leaf is added.

Table 1 - Curing pickle formulation

Ingredient	Variants of curing pickle		
	1	2	3
Salt, kg	1,5	1,85	2,2
Sugar, kg	0,2	0,4	0,6
Water, l	2.0	2.0	2.0
Enzyme preparation papain, kg	0.1	0.25	0.4

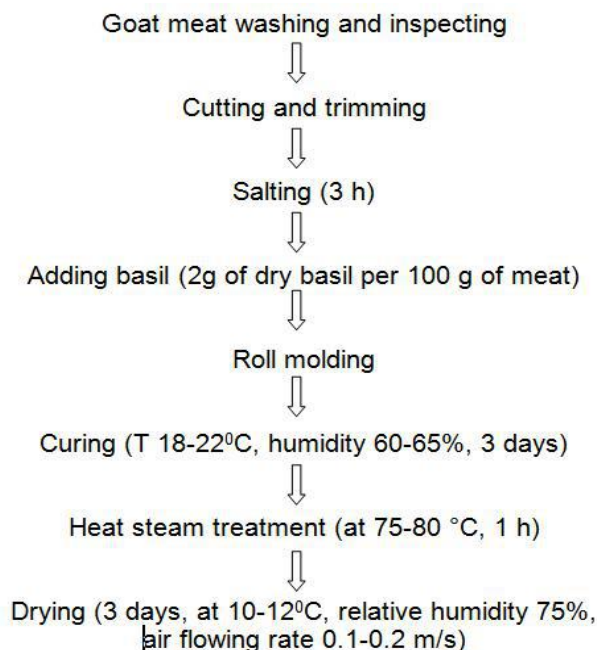


Figure 1: The process flowchart of delicacy goat meat product manufacturing

Determination of proximate composition

The determination of the chemical composition of meat was based on the determination of the following constituents: moisture, fat, ash and protein. The methods were performed as described by [10].



Vitamin composition determination

The vitamins were determined by the method reported by Rudenko and Kartsova (2010) [11]. Liquid chromatography was used to quantify the vitamins. The instrument used was a “Shimadzu LC-20 Prominence” liquid chromatography system (Shimadzu, Japan) equipped with fluorometric and spectrophotometric detectors.

Mineral elements determination

The content of elements in muscle samples was determined with the inductively coupled plasma–mass spectrometric method (ICP-MS, Varian-820 MS, Varian Company, Australia) [12]. All analyses were performed in triplicate.

Statistical analysis

Statistical analysis was performed using Statistica 12.0 (STATIS-TICA, 2014; StatSoft Inc., Tulsa, OK, USA). The differences between samples were evaluated using ANOVA method. The differences were considered to be statistically significant at $p \leq 0.05$.

III. RESULTS AND DISCUSSION

It is mostly conceded that eating an ample amount of red meat can be dangerous for human body in a long run. Nonetheless, many experts are of the view that goat meat has a number of health benefits. As compared to other meat (lamb, pork, beef etc.) goat meat is low in calories, high in iron, low in cholesterol and saturated fat [13, 14]. The low saturated fat level will cause no harm to your heart health, improve blood cholesterol and ease inflammation. It contains high level of iron which is an important nutrient (lack of iron causes anemia). Goat meat is also filled with proteins and vitamins. It also contains high potassium content with low sodium level [15]. Studies have shown that the effect of cooking or other methods of processing reveal no significant alteration in the composition of protein of goat meat [16]. Though, the biological value of goat meat protein decreases if the temperature is kept too high while cooking. The composition of fats and calories can alter considerably depending on cooking time and method. Broiling reduces the fat level as meat is cooked on a rack which makes the fat in meat to drip off as it melts. The frying method increases the fat level as the meat is cooked in added fat and the fat of meat does not drip off.

Table 2 - Chemical composition of goat meat product

Parameter	Goat meat product		
	Sample 1	Sample 2	Sample 3
Protein	13,7	14,0	14,8
Fat	22,1	22,3	22,7
Minerals	2,3	2,4	3,1
Moisture	61,8	61,3	59,4

Studies have shown that vitamin B1 (Thiamin) is one of the least stable vitamins [17, 18]. Data collected have shown the level of different vitamins in goat meat before and after cooking (Table 3). The level of thiamin in raw meat was 0,06 mg and after processing it shows 0,003mg. The retention of thiamin is about 65% in cooked meat. Thiamin retained in meat which is cooked by dry heat instead of moist heat because being water-soluble. The composition of other B-vitamins e.g. B2 (riboflavin), B4 (choline), B5 (pantothenic acid), B6 (pyridoxine), B9 (folic acid) and B12 (cobalamin) in raw goat meat was 0,15 mg, 70 mg, 0,5mg, 0,4mg, 8mcg,

2mcg and in cooked goat meat are 0,09mg, 39mg, 0,08mg, 0,05mg, 5mcg, 0,04mcg respectively. The B-vitamins are heat-stable but can get removed to the drippings while cooking. The composition of other vitamins e.g. H (biotin), E (tocopherol) and PP (niacin) in raw goat meat are 3mcg, 0,67mg, 7,9mg and in cooked goat meat are 0,09 mcg, 0,32 mg, 6,2 mg respectively. The most stable among them is niacin as it is comparatively unaffected by heat, light, oxygen, acids or alkalis.

Table 3 - Vitamin composition of goat meat product, mg/100g

Vitamins	Raw goat meat	Goat meat product (cooked)
B ₁ (thiamine), mg	0,06	0,03
B ₂ (riboflavin), mg	0,15	0,09
B ₄ (choline), mg	70	39
B ₅ (panthothenic acid), mg	0,5	0,08
B ₆ (pyridoxine), mg	0,4	0,05
B ₉ (folic acid), mcg	8	5
B ₁₂ (cobalamin), mcg	2	0,04
H (biotin), mcg	3	0,09
E (tocopherol), mg	0,67	0,32
PP (niacin), mg	7,9	6,2

Minerals such as iron and zinc are heat-stable but the method of food preparation can alter their composition. The composition of minerals e.g. Ca (calcium), Fe (iron), Id (iodine), Zn (zinc) in raw goat meat are 17,0 mg, 3,7 mg, 7,0 mcg, 3,7 mcg and in cooked goat meat are 9,0±0,2 mg, 1,58±0,7 mg, 2,3±0,2 mcg, 0,6 mcg respectively (Table 4). Researchers have shown that the increase in iron level is due to being cooked in cast-iron pots or using iron cookware. Cooking in liquid can cause the major loss of iron as the mineral will dissolve in the liquid. Nutritionists and dieticians suggests that if cooking meat in liquid is the chosen method than to prevent the loss of mineral the liquid should be simmering, not boiling, the pieces should be large and meat should not be over cooked. However, steaming is the most suggested method with respect to mineral loss.

Table 4 – Mineral composition of goat meat product, mg/100g

Minerals	Raw goat meat	Goat meat product (cooked)
Ca	17,0	9,0±0,2
Fe	3,7	1,58±0,7
I, mcg/100g	7,0	2,3±0,2
Zn, mcg/100g	3,7	0,6

IV. CONCLUSION

Production of delicacy goat meat by above mentioned processing method allows expand the assortment of goat meat products, decrease the production time and power consumption. Using of papain enzyme in formulation of curing pickle tenderize the goat meat and cut meat massaging



time up to 3 h. Rubbing meat with spices mixture gives good aroma and attractive appearance.

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