

Investigation of mass and nutrient losses during heat treatment of minced meat products

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Abstract. People associate existing fast food establishments not only with hamburgers and french fries, but also with nuggets, especially those enterprises that focus on the production of chicken products. With the classic processing of deep-fried nuggets, there is a rather large loss of product mass, and when using bad oil, the taste of the product is lost. Therefore, it is necessary to consider other types of heat treatment of this product to reduce production costs. The authors of the article conducted an experiment on alternative processing of nuggets in such equipment as a combi steamer and oven. The purpose of the experiment is to establish the weight loss of the product when using these types of heat treatment and to conduct an organoleptic evaluation of the resulting product. Raw materials were used from the manufacturer Meat Master LLC. The study was carried out according to 2 approved technologies on different equipment. The total weight loss of nuggets during processing in a combi steamer averaged 18%, and in an oven 13%. At the same time, processing in a combi steamer, in comparison with an oven, made it possible to better preserve the organoleptic properties of the nuggets. Also, thanks to the experiment, it was revealed that it takes time to bring the nuggets to culinary readiness, since during the experiment, the internal temperature of the product was recorded at intervals of 30 seconds. The product was prepared not by time, but by reaching a temperature in the depth of the product up to 800C. It was found that the average cooking time for nuggets in a combi oven is 6 minutes, and in an oven about 10 minutes. The results were the achievement of the goal of the experiment and the solution of related problems. The simulated cooking model made it possible to identify the time to bring to culinary readiness, the mass of losses and the organoleptic properties of nuggets cooked in a combi steamer and oven.

1 Introduction

Everyone does not want to miss the brightest and most important moments in life, so they often turn to fast food establishments or buy ready-made semi-finished products that just need to be warmed up.

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Many culinary products have such criteria in the modern world, but I would like to pay special attention to nuggets.

Nuggets have special characteristics that help a person get the necessary trace elements. Nuggets is a dish consisting of breaded chicken breast fillet, which is brought to a crunchy state. The creation of this product took place in the 1950s, and this dish gained its popularity in the 1980s [7].

Mironov N.A. claims that people who come to fast food restaurants in more than 60% of cases order nuggets - this indicates a great demand for this type of product. The author of the article also says that this type of product is gaining popularity not only in finished form, but also in the form of a semifinished product sold in a store [5]. The increase in demand for nuggets can be explained by the fact that this type of product is easy to prepare, as it is already sold in the form of a semi-finished product of a high degree of readiness.

In the current food culture, nuggets occupy not the last place. This culinary product is currently in high demand in the domestic market of the Russian Federation. In this regard, many manufacturers are looking for and developing recipes and technologies to improve the characteristics of nuggets in order to increase their production.

Many scientists are considering the possibility of improving technologies and recipes, measurements and experiments are reflected in the works of such scientists as: Prokhorova M.P., Mironov N.A., Potapova A.V., Baidina I.A., Ivashchenko Y.S., Zharikova V.U., Andrusenko M.V., Asfondyarova I.V., Hayrapetyan A A, Glagoleva L E, Shishkina D I, Lavrenova Z I, Shevtsov A A , Vasyukova A T, [2,3, 5,6, 8-13] and other.

In his work on the study of the characteristics of semi-finished products from poultry meat, Liang M.S., in addition to the main goal of studying microbiological activity, studied frozen nuggets to reduce pathogenic microorganisms during heating, while not considering the heat loss of raw materials during processing [4]. As you can see, the author did not pay attention to the mass loss of the product during heat treatment.

From the analyzed articles for the period from 2018 to 2023, it was noticed that when conducting experiments, a small part of the researchers considers losses during the heat treatment of a nugget-type product.

Therefore, the purpose of the work is to establish the loss of mass, nutrients of frozen semi-finished nuggets with various methods of processing from, considering losses and conducting an organoleptic evaluation of the resulting products.

In accordance with the goal, the tasks can be formulated as follows: 1) carry out the study of neg- gets according to the technology; 2) conduct an organoleptic evaluation of products for each type of heat treatment.

2 Materials and methods

Research sample - breaded poultry nuggets, frozen. Manufacturer: Meat Master LLC, 410010 Russia, Saratov, st. Tankistov, d.82 G.

The studies were carried out using the following equipment:

Experiment 1: electric six-burner stove with oven EP-6ZhSh "Abat", combi steamer PKA10-1/1PP2 used No. 224 "Abat" according to TU 28.93.15-017-01439034-2003 (JSC "Chuvashorgtekhnika", Russian Federation), electronic thermometer TP101 "Raylights" (China), culinary thermometer "BEKA" (Germany).

Experiment 2: electric four-burner stove with oven EP-4ZhSh "Abat", combi steamer KEG 0074 "Kuppersbusch Gelsenkirchen" (Germany), electronic thermometer TP101 "Raylights" (China), cooking thermometer "BEKA" (Germany).

Used technologies:

Technology 1. Baking nuggets in a combi steamer. Preheat the combi steamer to 170°C. We put the semi-finished product on a baking sheet and connect the probe and turn on the

“steam” mode at 180 ° C, bake for 4 minutes, and then turn on the “heat” mode at 200 ° C and bring it to 80 ° C inside (another 3-4 minutes). Record the heat treatment time. Weigh the finished semi-finished product immediately after baking and at 65 ° C.

Technology 2. Baking nuggets in the oven. Preheat the oven to 200°C. We lay the semi-finished product on a baking sheet and connect the probe and bake at 200 ° C for 7 minutes, and then increase the temperature to 250 ° C and bring it to 80 ° C inside (another 3-5 minutes). If multi-portion cooking, then the duration of baking is up to 11-15 minutes at a temperature of 200-250 ° C. Record the heat treatment time. We weigh the finished semi-finished product immediately after baking and at 65 ° C.

The determination of the amount of proteins, fats and carbohydrates, considering the coefficient of their digestibility by the human body, was calculated by the formulas:

for proteins:

$$B (Ku) = B 84.5/100, \tag{1}$$

for fats:

$$F (Ku) = F 94/100, \tag{2}$$

for carbohydrates:

$$Y (Ku) \u003d Y 95.6 / 100, \tag{3}$$

where B (Ku) - Protein digestibility coefficient; F (Ku) - The coefficient of digestibility of fats; U (Ku) - Carbohydrate digestibility coefficient; B - proteins; F - fats; U - carbohydrates

Organoleptic assessment of culinary products from poultry meat for baby food was carried out according to GOST 33337-2015 Culinary products from poultry meat for baby food.

3 Results and discussion

The experiment was carefully prepared, the raw materials used were thawed before cooking to a temperature within 1°C. Defrosting took place at room temperature (20°C). for the experiment, the following parameters were set for the operation of technological equipment:

Combi steamer: convection mode with steam. Temperature regime 170°C, intensity 3 and humidity 40%. Then the convection mode. Temperature regime 200°C, intensity 3.

Oven oven: temperature regime 200°C.

Before and after cooking, the mass of the product was measured and the mass of losses was calculated during the heat treatment of chicken nuggets in breading.

To establish the required indicators, studies were carried out on the development of heat treatment modes when brought to readiness in an oven and combi steamer. In order to ensure the safety of the obtained samples, the heat treatment process in each equipment was continued for another 4-5 minutes. The results obtained are shown in Figure 1.

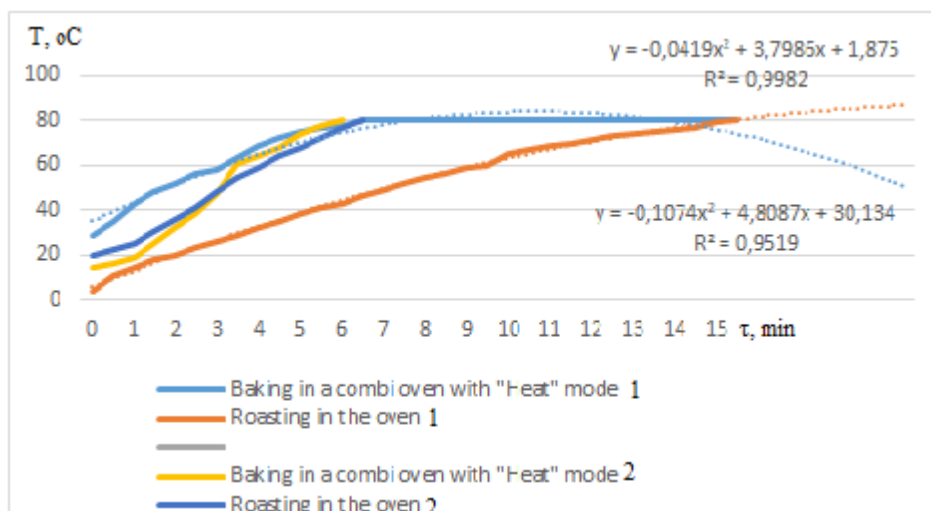


Fig. 1. The duration of the heat treatment of nuggets in the combi steamer and oven.

Studies have been carried out to assess the weight loss of chicken nuggets in brooding. The results are shown in Figure 2. A comparative characteristic of all used samples that were subjected to heat treatment, according to the developed cooking technology, was carried out.

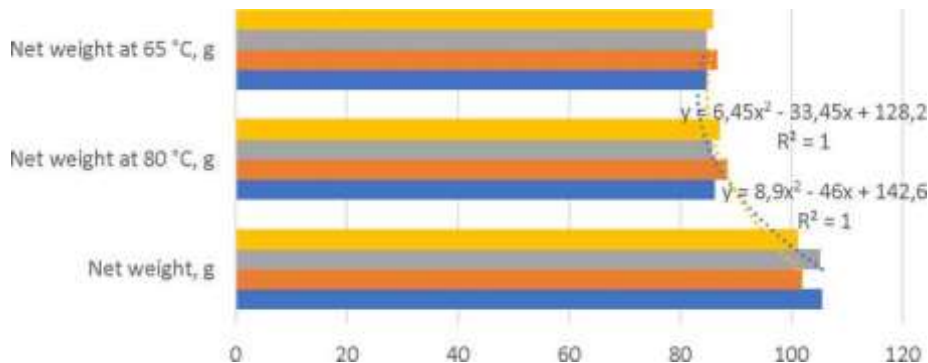


Fig. 2. Mass loss of nuggets during heat treatment.

- Roasting in the oven - 2
- Baking in a combi oven with "Heat" mode - 2
- Roasting in the oven - 1
- Baking in a combi oven with "Heat" mode - 1

An assessment was made of the dependence of technology and quality of culinary products on the method and mode of preparation. During the experiment, the ordinal numbering of the modes was determined, according to the cooking technology, technological equipment:

Mode 1 (combi steamer, convection mode with steam).

Mode 2 (combi steamer, "Heat" mode).

Mode 1. The product is placed in the prepared chamber (170°C) and baked for 4 minutes at 180°C in the "steam" mode.

Mode 2. After 4 minutes, the "heat" mode is switched on at 200°C for about 3-4 minutes and brought to reach 80°C inside the product.

Further, during the experiment, indicators were determined when baking nuggets in an oven. A visual change in temperature depending on time can be seen in Figure 1. The initial temperature in the thickness of the product is 4°C.

An organoleptic evaluation of breaded poultry nuggets by independent experts (Table 1) showed that the average score is 4.475 points for cooking nuggets in a steam oven on the “heat” mode and 4.04 points for nuggets cooked in an oven.

Table 1. Organoleptic evaluation (nuggets) by independent experts.

| Sample number/ code | Processing name | Reviewers and average score by | | | uct type |
|------------------------|---------------------------------|--------------------------------|-----------|-----------|-----------|
| | | 1st group | 2nd group | 3rd group | 4th |
| sample 1 | Convection in the combi steamer | 4,4 + 0,2 | 3,7 + 0,1 | 3,3 + 0,1 | 4,1 + 0,2 |
| sample 2 | Roasting in an oven | 4,3 + 0,3 | 4,4 + 0,2 | 2,9 + 0,4 | 4,0 + 0,2 |

When considering the data obtained from the tasting sheets, it was found that the samples have approximately the same ratings. From this it follows that the use of the technologies used (frying in an oven and a combi steamer) is advisable.

In accordance with the regulatory documentation, frozen semi-finished nuggets per 100 g contain: protein, not less than, g - 19.3; fat no more, g - 9.5. The assessment of the nutritional and energy value of culinary poultry products (nuggets) is shown in Table 2.

Table 2. Determination of the nutritional and energy value of cooked nuggets.

| Name of culinary products | Mass of culinary products, g | Amount of proteins | | Amount of fats | | Amount of carbohydrates | | Energy value, kcal |
|----------------------------------|------------------------------|--------------------|------------------|----------------|------------------|-------------------------|------------------|--------------------|
| | | In 100, g | In the sample, g | In 100, g | In the sample, g | In 100, g | In the sample, g | |
| Nuggets baked in a combi steamer | 83,6 | 24,5 | 17,3 | 6,7 | 5,2 | 7,3 | 5,8 | 138,3 |
| | 84,7 | 24,5 | 17,5 | 6,7 | 5,3 | 7,3 | 5,9 | 140,1 |
| Oven baked nuggets | 90,3 | 24,5 | 18,7 | 6,7 | 5,6 | 7,3 | 6,3 | 149,4 |
| | 85,9 | 24,5 | 17,8 | 6,7 | 5,4 | 7,3 | 6,0 | 142,1 |

Analysis of the data obtained shows that baking in a combi oven leads to a loss of protein 2.5-2.9%, fat - 0.3-0.4%, carbohydrates - 0.3-0.4%. Roasting in an oven is gentler on nutrient loss. At the same time, the loss of protein is 0.9-1.8%, fat - 0.3-0.4%, carbohydrates - 0.2-0.3%. Nutrient losses in the manufacture of culinary products in a combi oven seem to increase due to convection, which causes more dehydration of the product compared to traditional baking in an oven.

4 Conclusion

Thus, studies of nuggets according to proven technology were carried out and losses were considered, which averaged 18% for a combi steamer, and 13% for an oven. What speaks about the effectiveness of frying nuggets in the oven.

The organoleptic evaluation of ready-made nuggets shows that a higher score in terms of taste characteristics and appearance was noted for nuggets cooked in a combi steamer.

The assigned tasks were completed. Thus, it can be seen that when processing nuggets in an oven, the organoleptic properties of the product are lost, but at the same time, this type of heat treatment allows for less loss in weight and nutritional value of the product. At the same

time, when processing nuggets in a combi steamer, the opposite result is observed: there is a large loss of mass of the product, but at the same time, a more pronounced taste and structure of the finished product is preserved.

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