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Investigation of technological parameters of manufacturing meat products from chicken fillet

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Abstract. Compliance with the technological process and production parameters is the key to obtaining a high-quality product. Given the rapid development of the food industry and the needs of consumers for products that have not been subjected to repeated technological processing, where their nutritional value is preserved as much as possible, there is a need to investigate meat products that can meet such requirements. The purpose of the study was to determine and establish the technological parameters of the production of chicken jerky. The study involved experimental research, organoleptic evaluation of finished products, determination of the amount of waste after dressing meat, physicochemical parameters of raw materials, semi-finished products, and finished products: moisture content, pH, fat content by the Soxhlet method and protein content by the Kjeldahl method. Four methods of production of chicken jerky were investigated, namely: marinating with convective drying with a change in temperature conditions during the drying process; marinating with subsequent cooking using sous-vide technology to a temperature in the thickness of meat not less than 72°C and convective drying until ready; pre-salting of chicken meat with a ratio of raw materials to salt of 1/1, followed by marinating and convective drying

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with a change in temperature conditions during the drying process. The final moisture content of the finished jerky was determined to be between 20.8% and 37%, depending on the production method. The study calculated capital (2.33% ± 0.5%) and technical (12.53% ± 1.32%) waste from the preparation of raw materials for the production of jerky, and provided a method for calculating the gross weight of chicken fillet from the required net weight of meat raw materials. Waste after drying for each of the studied methods are shown, which ranged from 46.7%, to 65.03%, 68%, and 74.77%. The results of the study can be used by meat producers and restaurant establishments when planning and developing their own products, improving existing production technologies, and understanding trends in the production of meat delicacies on the Ukrainian market

Keywords: drying; marinating; jerky; snacks; poultry meat; moisture content; sous-vide

Introduction

Consumption of meat and meat products is popular among the population of Ukraine and the world. However, there is a need to develop new methods of processing products and use non-conventional raw materials to ensure a number of desired characteristics: high taste properties, the necessary chemical composition, a longer shelf life without using synthetic preservatives, and high competition among other meat producers.

In the last decade, the development of new meat products with improved nutritional properties has intensified. Consumers demand minimally processed meat products that do not contain preservatives and have a long shelf life. To meet these needs, natural additives are widely used instead of synthetic ones. In addition, research into environmentally friendly packaging materials that improve the shelf life of meat is gaining momentum (Gómez *et al.*, 2020).

Meat snack products are beginning to gain popularity, especially among students and people who lead an intensive, active lifestyle. According to L.P. Zahorui & Y. Mihel (2022), Ukrainian manufacturers occupy only 18% of the market, the rest are imported products. The researchers also note that such a group of products can be classified as healthy products, since it contains the maximum amount of protein and the minimum amount of fat. The analysis of meat snack consumption shows that 92% of respondents consume meat products daily. However, these products can be considered health-improving only if the content of salt, sugar, and preservatives is minimised.

There are a significant number of ways to extend the shelf life of food. One of them is drying. Especially valuable are dried foods that do not require additional recovery or reheating, that is, which can be consumed immediately. Usually, such products are subjected to heat treatment during the production process to undergo certain biochemical transformations, give taste and aroma, and undergo long-term ageing or fermentation. V.O. Skrypnyk & B.H. Ponomarenko (2023) suggests using a two-way heat supply during convective drying of meat, when the temperature of the heated surface does not exceed 130°C. This significantly reduces the development of unwanted flavour compounds and improves the organic properties of dried meat. In different regions of the world, different cutting methods and different recipes are used in the manufacture of products, including meat. This is conditioned by taste preferences, climate, and territory-specific raw materials.

As reported by M.I. Myroshnychenko & A.V. Bolshakova (2020), drying meat is a promising method of preservation that allows to preserve the original properties of meat to a large extent. During drying, meat retains not only its

taste qualities, but also its high biological and nutritional value, nutrients, vitamins, and amino acids. The researchers give their own definition of meat snacks: thin slices of dried meat seasoned with spices that are made from pork, beef, chicken, horse meat, turkey, ostrich, venison, and lamb. It was found that the method of slicing does not affect the drying time and colour of dried meat, but reduces the elasticity of the product in the direction of the fibres. In addition, thicker pieces of meat take longer to dry, and the structure and colour of the finished product are worse compared to thinner pieces. Researchers recommend eating meat snacks for people with an active lifestyle, athletes and tourists, as this type of food is low in fat and carbohydrates, and has high nutritional value.

A survey on preferences regarding the type of meat used in snacks showed that chicken is the most popular (42.2% of respondents). 37.6% of respondents identified snacks as a healthy diet. Analysis of the results of the survey on choosing the type of meat delicacies shows that sausages are the most popular (45%), dried meat is in second place (14 %) and in third place – meat chips (7%) (Afanasieva, 2023). A. Lohinova *et al.* (2019) investigated the use of dried meat snacks in the diet of Ukrainian military personnel in the field. In combat zones, due to the constant lack of time, soldiers are forced to limit their meals or eat at a faster pace. To improve the quality of food, it was proposed to use dried meat snacks in military rations. According to the researchers, this will save food intake time and at the same time provide the body with the necessary proteins, fats, and carbohydrates for normal functioning. However, with the production of meat delicacies (snacks), there is a problem with standardisation and falsification of production. For example, meat snacks are often falsified in various ways, including assortment, quality, quantity, cost, and information methods.

Relevant today is the need to develop standardised methods of production with the establishment of technological parameters that will not depend on a number of factors, in particular, the volume of production, used raw materials and additional components, types of equipment, etc. This can be used in the future to improve the technologies of meat products and develop regulatory documents to ensure the quality and safety of products. The purpose of this study was to determine and establish the technological parameters of the production of chicken jerky.

Materials and Methods

The research was conducted at the laboratories of the Department of Meat, Fish, and Seafood Technology of the Faculty of Food Technology and Quality Management of the National University of Life and Environmental Sciences of Ukraine in October-December 2023.

Chicken fillet was chosen as the main raw material for the production of meat products. In the course of the study, the moisture content in the raw material and finished product was determined by drying to a constant mass at a temperature of 103°C ± 2°C (DSTU ISO 1442:2005, 2007); capital (not suitable for further processing) and technical waste (can be used for the production of other types of products) after weighting meat; pH in raw materials and semi-finished products (DSTU ISO 2917-2001, 2003); fat content by the Soxhlet method (DSTU ISO 1442:2005, 2007) and protein by the Kjeldahl method in raw materials (DSTU ISO 937:2005, 2007). In addition, during the manufacturing of meat products, the temperature in the thickness of meat was determined during marinating, after cooking using sous-vide technology (DSTU 3143:2013, 2014). The name of the meat delicacy was preliminarily determined – chicken jerky.

The amount of chicken fillet (gross) that must be taken to obtain the required amount of prepared meat raw materials (net) was determined by the equation:

$$x = \frac{n \times 100}{100 - (w_c + w_t)}, \quad (1)$$

where x – amount of chicken fillet (gross), kg; n – required amount of prepared meat raw materials (net), kg; w_c, – capital waste after meat curing, %; w_t – technical waste after meat curing,%.

Production of jerky was carried out according to the methods listed below.

Method 1. Prepared, peeled meat was cut across fibres 5-7 mm thick. The resulting meat slices were placed in a pre-prepared marinade and left for 12 hours at a temperature of 4°C ± 2°C. After marinating, the meat was distributed on special baking sheets and placed in a dehydrator preheated to 70°C. After an hour of drying, the temperature was reduced to 55°C and dried for another 8 hours. Thus, the total production time was 21 hours

Method 2. Prepared, peeled meat was cut across fibres 5-7 mm thick. The resulting meat slices were placed in a pre-prepared marinade and left for 4 hours at a temperature of 4°C ± 2°C. After marinating, the meat was distributed on special baking sheets and placed in a dehydrator preheated to 70°C. After an hour of drying, the temperature was reduced to 55°C and dried for another 6 hours. The total production time was 11 hours.

Method 3. The prepared, peeled meat was vacuumed and cooked using sous-vide technology at a temperature of 75°C for an hour. After cooking, the meat was cut across the fibres into slices 5-7 mm thick, then marinated and kept for another hour at a temperature of 4°C ± 2°C. After marinating, the meat was distributed on special baking sheets and placed in a dehydrator preheated to 55°C, dried for 6 hours. The total production time was 8 hours.

Method 4. Prepared, peeled meat was covered with salt (the ratio of salt to meat – 1: 1) and left for 12 hours. Next, the meat was washed under running water from the remaining salt and placed in ice water for 2 hours, changing the water twice in the process. After that, the meat was cut across the fibres into slices 5-7 mm thick, marinated and kept for another hour at a temperature of 4°C ± 2°C. After marinating, the meat was distributed on special baking sheets and placed in a dehydrator preheated to 70°C. After an hour of drying, the temperature was reduced to 55°C and dried for another 5 hours. The total production time was 21 hours.

Results

The amount of waste during dressing and preparation for meat processing was determined. Thus, the remains of cartilage tissue, veins, films, bruises and the fat part were separated from the chicken fillet. In addition, the chicken fillet was given an oval shape, so that when cutting into flat pieces there were no protruding parts of the fillet, pieces of different shapes, etc. To interpret the results, the % of capital waste (not subject to further processing) during preliminary preparation of chicken meat and the percentage of technical waste, i.e., trimmings that are not conditioned for the production of jerk, but can be used in the production of other products (e.g. in minced systems, etc.) were determined (Table 1).

Table 1. *Waste after meat dressing (n = 10)*

No.	Indicator	Value, X ± Δ
1.	Meat weight before dressing, kg	3.63 ± 0.51
2.	Weight of prepared meat, kg	3.06 ± 0.49
3.	Capital waste, %	2.33 ± 0.50
4.	Technical waste, %	12.53 ± 1.32

Notes: X – arithmetic mean; δ – measurement error
Source: compiled by the authors

The results obtained allow calculating the required amount of meat and controlling the production process of meat products, calculating the economic component of production, and developing standardised technical documentation for the production of chicken jerky. Thus, 1,175 kg of chicken fillet is needed to obtain 1 kg of prepared meat raw materials for the production of jerky. Determination of physical and chemical parameters in raw materials is important for determining the degree of freshness and suitability of meat for further processing. The determination was performed in four repetitions (Table 2).

Table 2. *Basic physical and chemical parameters of raw materials (n = 4)*

Indicator	pH	Content, %		
		moisture	fat	protein
According to regulations*	not more than 6.70	not more than 78.0	not more than 11.0	not less than 17.0
X ± σ	6.20	73.76	1.36	19.17
Cv, %	1.27	0.59	5.54	0.34
Δ, %	0.08	0.44	0.08	0.07

Notes: *DSTU ISO 1442:2005 (2007); Order of the Ministry of Agrarian Policy and Food of Ukraine No. 625 (2023); DSTU 3143:2013 (2014); X – arithmetic mean; δ – measurement error; Cv – coefficient of variation
Source: compiled by the authors

Based on the results of the study of raw materials (Table 2), the obtained values of indicators comply with the current legislation of Ukraine. The average moisture content in the samples of raw materials (chicken fillet) was in the range from 73.34 to 74.04, and the average value was less by 4.24% compared to the maximum permitted concentration. The average pH value of chicken fillet was at the level of 6.2, which is 0.5% less compared to the maximum permitted concentration. The fat content of chicken fillet samples averaged 1.36%, which is 9.64% less compared to the maximum permitted concentration. The protein content of chicken fillet ranged from 19.1 to 19.3, and the average value was 2.17% higher compared to the absolute minimum concentration. The resulting average values will be used for comparison with the indicators of the finished product.

During the production of jerky according to the most common Method 1 (Han *et al.*, 2007; Lonnecker *et al.*, 2010; recipe dried chips (jerks), 2024), according to which cooked, sliced meat was first marinated for 12 hours at a temperature of 4°C ± 2°C. For this reason, the temperature in the thickness of the meat during marinating was set, which was + 2.5°C ± 0.5°C. Then the meat was placed in a dehydrator, where it was dried to a ready state under two temperature conditions (see Method 1). As a result, the indicators were obtained (Table 3), which allowed adjusting the production process to obtain the desired results.

Table 3. *Results of the study of technological parameters of manufacturing of meat products from chicken fillet (n = 4)*

No.	Indicator	Method, X ± Δ	
		1	2
1.	Weight of raw materials*, kg	0.7 ± 0.14	0.38 ± 0.16
2.	Weight of dried product, kg	0.18 ± 0.06	0.13 ± 0.06
3.	Waste after drying, %	74.77 ± 4.10	65.03 ± 0.67

Notes: * – chicken fillet after dressing; X – arithmetic mean; δ – measurement error
Source: compiled by the authors

As can be seen from Table 3, according to Method 1 (with a total drying time of 9 hours), a product with a low yield by weight compared to the product produced by Method 2 was obtained. Reducing the drying time by 2 hours and marinating meat for 8 hours allowed getting a product with better performance. In addition, the error in losses after drying according to Method 2 was only 0.67%, and according to Method 1, on average, 4.1 %. Considering the results of organoleptic evaluation, Method 2 has the best properties of the finished product. By organoleptic properties (Fig. 1) jerky obtained by Method 2 had higher evaluation indicators for such parameters as appearance, consistency, colour, smell, and taste. Thus, it was found that a long drying time is not suitable for obtaining a finished product with high quality indicators, and the production method, where the total drying time of meat from chicken fillet in a dehydrator is 7 hours, is suitable for the production of chicken jerky.

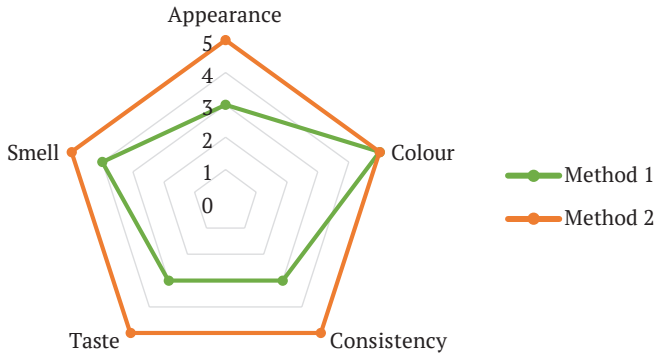

Figure 1. Profilogram of organoleptic evaluation of meat products from chicken fillet produced by methods 1, 2

Source: compiled by the authors

Another method of making meat delicacies that has been investigated is drying pre-cooked sous-vide meat (cooking meat in a vacuum polymer bag at a controlled temperature) (Table 4).

Table 4. *Investigation of technological parameters of production of meat products from chicken fillet by Method 3 (n = 3)*

No.	Indicator	Value, X ± Δ	Cv, %
1.	Meat weight before cooking*, kg	0.32 ± 0.11	34.86
2.	Meat weight after cooking, kg	0.25 ± 0.09	35.12
3.	Temperature in the thickness of the meat after cooking, °C	72.87 ± 0.55	0.76
4.	Weight of dried product, kg	0.08 ± 0.03	33.69
5.	Total losses after drying, %	74.60 ± 0.88	0.88

Notes: * – chicken fillet after dressing; X – arithmetic mean; δ – measurement error, Cv – coefficient of variation

Source: compiled by the authors

According to the results obtained (Table. 4), cooked jerks have a low yield of the finished product. This is due to losses during cooking, and then – drying. However, based on the results of organoleptic evaluation (Fig. 2), the resulting finished product had high taste properties, pleasant aroma, crisp consistency, and satisfactory appearance.

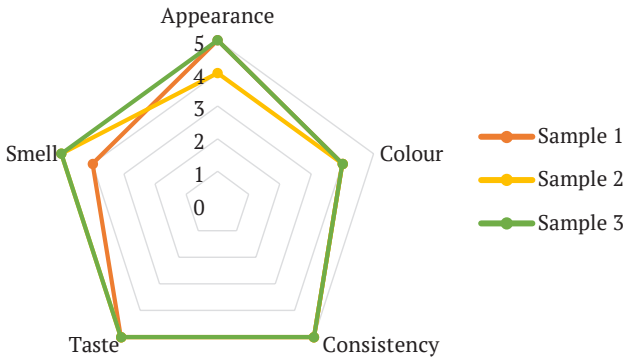

Figure 2. Profilogram of organoleptic evaluation of meat products from chicken fillet produced by Method 3

Source: compiled by the authors

The production of jerky using Method 3 heat treatment technology involves drying from cooked meat, which probably reduces the risks of rapid microbiological spoilage. According to the experimental technology of producing chicken jerky, when the meat was salted and aged for different times, the results were presented in Table 5 and in Fig. 3.

Table 5. *Investigation of technological parameters of production of meat products from chicken fillet by Method 4 (n = 3)*

No.	Indicator	Value, X ± Δ	Cv, %
1.	Weight of meat before salting*, kg	0.94 ± 0.02	1.84
2.	Weight of salt, kg	0.94 ± 0.09	1.84
3.	Meat weight after salting, kg	0.83 ± 0.01	0.7
4.	pH	4.60 ± 0.05	1.13
5.	Weight of dried product, kg	0.45 ± 0.01	2.29
6.	Total losses after drying, %	51.73 ± 0.23	0.45

Notes: * – chicken fillet after dressing; X – arithmetic mean; δ – measurement error, Cv – coefficient of variation

Source: compiled by the authors

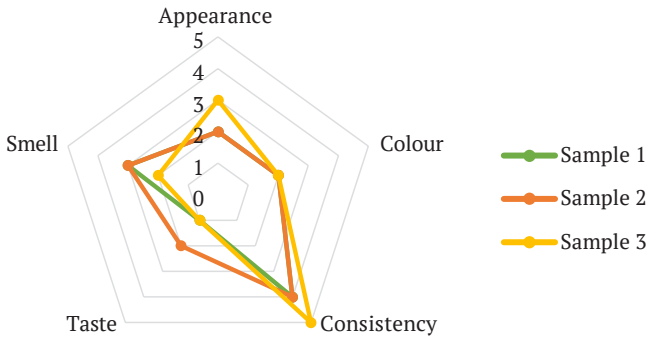

Figure 3. Profilogram of organoleptic evaluation of meat products from chicken fillet produced by Method 4

Source: compiled by the authors

As can be seen from Table 5, samples that were kept for 12 hours, (temperature in the thickness of the meat – 2.5°C ± 0.5°C), have the shortest drying time to the required moisture content of the finished product, compared to other methods under study. In addition, the total weight loss during the production of jerky is the smallest. Regarding organoleptic parameters, in particular taste properties (Fig. 3), the product is declared unfit for consumption due to an excessive amount of salt. The appearance is also unsatisfactory, because the product is covered with a white coating. The consistency is plastic and can be easily divided into smaller pieces. But given the preservative properties of salt, the potentially shorter drying time of meat, and the acquisition of a finished product of excellent consistency, it is necessary to continue exploring this method of producing jerky, using less salt and a shorter salting time.

At the next stage, the produced jerky was examined for moisture content to determine the degree of readiness of the product and as a qualitative indicator for controlling the spoilage process (Fig. 4).

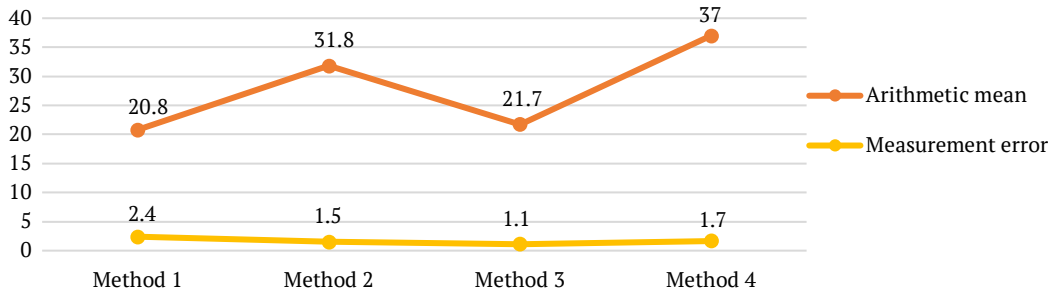

Figure 4. Moisture content in chicken jerky (n = 5)

Source: compiled by the authors

As can be seen from Figure 4, different moisture content is observed in all the obtained samples according to different methods. This is due to the temperature conditions of drying, methods of processing raw materials, and the production process. The moisture content also regulates the organoleptic properties of finished products, namely consistency and appearance. The lower the moisture content, the harder it is to divide the jerky into smaller pieces and chew. In addition, the loss of moisture is associated with total losses in the weight of the product, which implies an increase in the sealing of raw materials for the production of the finished product. The knowledge of the moisture content can be used to determine the degree of readiness of the jerky and can be a qualitative indicator to control the spoilage process.

Discussion

Meat and meat products are important elements of both daily nutrition and during specialised diets (González *et al.*, 2020). In addition, their consumption has been steadily increasing around the world since the 1960s and up to the present day. Ultimately, up to 58% of protein consumed and 30% of total calories come from meat and meat products, and they also provide important nutritional compounds in the diet, especially protein, fat, essential amino acids, minerals and vitamins. Determining the technological parameters of the production of products, and in this case, chicken jerky, will expand the range of meat products offered on the market and support the supply of important elements to the body for its functioning (Biesalski, 2005; Modi *et al.*, 2007).

Innovation activities of meat producers are usually associated with responding to changing consumer preferences and requirements. That is why there is a need to improve various technologies for the production of meat products to meet the needs of consumers and provide the human body with the necessary nutrients. However, if there is a small-scale production of traditional meat products, this leads to heterogeneity of their quality, which is also indicated in the paper by M. Halagarda & K.M. Wójciak (2022). The production methods used and the raw materials used make such products more expensive. Therefore, it is necessary to develop standardised methods and requirements for the products, so that, regardless of the volume of production, it would always be possible to produce a product that meets the established indicators and desired consumer expectations.

As noted by I. Doymaz *et al*. (2016), the drying process as a method of preserving and processing meat is one of the oldest and most common methods, as it is efficient and inexpensive. The researchers also describe the advantage of using this method of production in their study. Drying extends the shelf life of meat and meat products by reducing moisture activity. In addition, the drying process reduces microbial load, volume and weight, thereby reducing storage and transportation costs.

The effect of various drying methods, namely ultrasonic vacuum drying, vacuum drying and sublimation, on the drying kinetics and some quality parameters of dried minced meat was studied (Aksoy *et al*., 2019). The researchers also note that different drying methods and temperatures significantly affected the drying time, and higher drying temperatures increased the overall colour differences of the finished product. To speed up the drying time, ultrasonic treatment and vacuum drying were combined. According to this method, the vacuum process, breaking down the cell walls of food, accelerates the transfer of water, which accelerates drying. Comparing with the findings of this study, it can be recognised that combining different production methods can lead to significantly better results in terms of organoleptic characteristics, time spent on production, and higher product yield.

The combination of different methods of processing and preserving raw materials leads to better results of sensory evaluation. I. Gómez *et al*. (2020) also investigated combinations of different methods, but in such a way that the nutritional value of meat is not disturbed: drying in maturation chambers, high-pressure processing, and sous-vide cooking. The paper also considered chemical and biochemical methods, such as fermentation, smoking, and pickling to enhance the quality indicators of meat products. This study also combined pickling, sous-vide technology, and convective drying with different temperature settings. The results obtained indicate the need to adjust some parameters of the production process to obtain positive final results of the finished product.

According to B.M. Naveena *et al*. (2008), consumers are demanding preservative-free, minimally processed meat products with a longer shelf life. Nowadays, it is also widely accepted to use natural additives instead of synthetic ones. In addition, research on packaging materials that improve the shelf life of meat is gaining momentum. Therefore, drying meat for a long time can be attributed to lean methods of processing raw materials, because with such a production technology, a significant part of nutrients is preserved and the finished product has a long consumption period, which is especially important for consumers.

Sous-vide processing, which was used in one of the jerky production methods, makes the meat juicier and more tender, and at the same time, this technique improves the digestibility of meat, according to studies conducted on digestion in vitro (Ingham *et al*., 2006; Kehlet *et al*., 2017). This technique maintains the same quality of meat and improves the organoleptic

characteristics of cooked meat. Sous-vide technology can be combined with other methods of processing and manufacturing products. Therefore, the next step was convective drying before the jerky were ready. Such a product is less vulnerable to microbiological spoilage, because drying took place already from a fully prepared product. Jerky, in turn, acquired specific organoleptic properties, which was highly appreciated.

S. Sorapukdee *et al*. (2016) investigated whether chicken meat can be used as a potential raw material for dried meat. The production was carried out using a hot air convection oven at a temperature of 85°C,until the temperature of the centre of the piece of meat reached 71.1°C. The temperature was then lowered to 60°C and left until further dehydration. The technology considered in this paper differs in temperature conditions, and in the fact that a whole piece with a thickness of 5-7 mm was dried, and these researchers used rectangular pieces with a thickness of 3-5 mm from crushed meat in a meat grinder for drying. Using another well-known technology, all subcutaneous fat and visible connective tissue were first removed from fresh chicken breast meat. Then drying (55°C, 30 min), smoking (65°C, 30 min), slow drying (65°C, 70 min), slow drying (75°C, 60 min), and dry cooking (75°C, 10 min) were performed. After cooling with chilled air (5°C, 30 min), the semi-dried chicken was individually vacuum packed with a plastic/nylon film and stored in the refrigerator at 4°C for subsequent studies (Choi, 2008; Song *et al.*, 2014). In this way, the authors of the article have obtained another variant of the jerky offered on the market.

Considering this study and the researchers mentioned above, it can be stated that the results obtained by the authors of this study are relevant, can be considered as fundamental in the creation of meat products according to the developed methods. Moreover, when developing new meat products, it is necessary to apply a comprehensive approach, including an evaluation of sensory characteristics and nutritional value, because consumers today are looking for minimally processed products with high nutritional value and extended shelf life.

Conclusions

Over the past decade, the number of new meat products with improved nutritional characteristics has increased. However, the choice of processing and canning technologies requires a comprehensive, global strategy that considers not only the impact on product quality, but also changes in sensory and nutritional characteristics, and consumer attractiveness.

According to experimental studies of the production of chicken jerky, it can be concluded that production according to Method 1 is impractical. A long pickling time and the longest drying time lead to high product losses – up to 79%. In addition, organoleptic parameters were also not satisfactory, since jerky were brittle, difficult to chew, and the smell and taste were not very noticeable. Production of jerky according to Method 2 provides high organoleptic indicators. Drying losses are significantly lower compared to Method 1 – 65.2%, which is quite acceptable for this type of product. Production of jerky by a combination of *sous-vide* technology, vacuum pickling, and convective drying is promising. The product obtained specific organoleptic properties, in particular a crisp, porous consistency, attractive appearance, and pleasant taste and smell. Additionally, variable drying parameters can be investigated to increase the yield of the finished product. The subsequent studies of the advantages of this method will be a comparison of shelf life and the level of microbiological spoilage, because drying took place already from pre-cooked meat, which should reduce these risks.

Results of the production of chicken jerky by Method 4 – salting – did not bring the expected results. Excessive amounts of salt and a white coating on the surface make the product unusable. Although the cooking time and yield of the finished product was better compared

to other methods. In further experiments, the salt-to-meat ratio will be changed and additional studies of the efficiency of jerky production will be conducted using pre-salting of raw materials. Summing up the conducted research, the authors have established the main technological parameters for which chicken jerky will be produced, namely marinating for at least 4 hours at a temperature of 4°C ± 2°C followed by convective drying for 1 hour at a temperature of 70°C, then 6 hours at a temperature of 55°C. Other ways to produce jerky require more research.

Promising research will be the development of recipes for the production of chicken jerky, in particular with the use of bee products that will serve as substitutes for preservatives and natural components to increase biological value. The combination of these components will expand the range of meat products developed from original raw materials, preserving and improving their nutritional and sensory characteristics for long periods of time.

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Conflict of Interest

None.

References

[1] Afanasieva, O.P. (2023). *Potential demand for low-salt meat snacks*. Retrieved from https://repo.btu.kharkov.ua/bitstream/123456789/38826/1/SUSTAINABLE%20FOOD%20CHAIN_23-227-228.pdf.

[2] Aksoy, A., Karasu, S., Akcicek, A., & Kayacan, S. (2019). Effects of different drying methods on drying kinetics, microstructure, color, and the rehydration ratio of minced meat. *Foods*, 8(6), article number 216. doi: 10.3390/foods8060216.

[3] Biesalski, H.K. (2005). Meat as a component of a healthy diet – are there any risks or benefits if meat is avoided in the diet? *Meat Science*, 70(3), 509-524. doi: 10.1016/j.meatsci.2004.07.017.

[4] Choi, J.H., Jeong, J.Y., Han, D.J., Choi, Y.S., Kim, H.Y., Lee, M.A., Lee, E.S., Paik, H.D., & Kim, C.J. (2008). Effects of pork/beef levels and various casings on quality properties of semi-dried jerky. *Meat Science*, 80(2), 278-286. doi: 10.1016/j.meatsci.2007.11.028.

[5] Doymaz, I., Karasu, S., & Baslar, M. (2016). Effects of infrared heating on drying kinetics, antioxidant activity, phenolic content, and color of jujube fruit. *Journal of Food Measurement and Characterization*, 10(2), 283-291. doi: 10.1007/s11694-016-9305-4.

[6] DSTU 3143:2013. (2014). *Poultry meat. General specification*. Retrieved from https://online.budstandart.com/ua/catalog/doc-page.html?id_doc=81578.

[7] DSTU ISO 1442:2005. (2007). *Meat and meat products. Determination of moisture content (reference method)*. Retrieved from https://zakon.isu.net.ua/sites/default/files/normdocs/dstu_iso_1442_2005.pdf.

[8] DSTU ISO 2917:2001. (2003). *Meat and meat products. Measurement of pH (reference method)*. Retrieved from https://online.budstandart.com/ua/catalog/doc-page.html?id_doc=89528.

[9] DSTU ISO 937:2005. (2007). *Meat and meat products. Determination of nitrogen content (Reference method)*. Retrieved from https://zakon.isu.net.ua/sites/default/files/normdocs/dstu_iso_937_2005.pdf.

[10] Gómez, I., Janardhanan, R., & Ibañez, F. (2020). The effects of processing and preservation technologies on meat quality: Sensory and nutritional aspects. *Foods*, 9(10), article number 1416. doi: 10.3390/foods9101416.

[11] González, N., Marquès, M., Nadal, M., & Domingo, J.L. (2020). Meat consumption: Which are the current global risks? A review of recent (2010-2020) evidences. *Food Research International*, 137, article number 109341. doi: 10.1016%2Fj.foodres.2020.109341.

[12] Halagarda, M., & Wójciak, K.M. (2022). *Health and safety aspects of traditional European meat products. A review*. Retrieved from http://surl.li/segvo.

[13] Han, D.J., Jeong, J.Y., Choi, J.H., Choi, Y.S., Kim, H.Y., Lee, M.A., Lee, E.S., Paik, H.D., & Kim, C.J. (2007). Effects of drying conditions on quality properties of pork jerky. *Korean Journal for Food Science of Animal Resources*, 27(1), 29-34. doi: 10.5851/kosfa.2007.27.1.29.

[14] Ingham, S.C., Searls, G., Mohanan, S., & Buege, D.R. (2006). Survival of *Staphylococcus aureus* and *Listeria monocytogenes* on vacuum-packaged beef jerky and related products stored at 21 degrees C. *Journal of Food Protection*, 69(9), 2263-2267. doi: 10.4315/0362-028x-69.9.2263.

[15] Kehlet, U., Mitra, B., Ruiz Carrascal, J., Raben, A., & Aaslyng, M.D. (2017). The satiating properties of pork are not affected by cooking methods, sousvide holding time or mincing in healthy men – A randomized cross-over meal test study. *Nutrients*, 9(9), article number 941. doi: 10.3390%2Fnu9090941.

[16] Lohinova, A., Atanova, J., Marynin, A., & Pasichnyi, V. (2019). *The use of dried meat snacks in the nutrition of military personnel of Ukraine in field conditions*. Retrieved from https://dspace.nuft.edu.ua/server/api/core/bitstreams/0f7b3bf6-917c-44bf-8094-ec320e5a3c01/content.

[17] Lohinova, A.O., Atanova, Y.O., Marynin, A.I., & Pasichnyi, V.M. (2019). Methods of falking meat snacks. In *VIII International scientific and technical conference "Scientific problems of food technology and industrial biotechnology in context European integration"* (pp. 266-267). Kyiv: National University of Food Technologies.

[18] Lonnecker, S.M., Boyle, E.A., Getty, K.J., Buege, D.R., Ingham, S.C., Searls, G.I., & Harper, N.M. (2010). Production methods and product characteristics of jerky produced by small and very small meat processing businesses. *Journal of Muscle Foods*, 21(4), 826-833. doi: 10.1111/j.1745-4573.2010.00222.x.

[19] Modi, V.K., Sachindra, N.M., Nagegowda, P., Mahendrakar, N.S., & Narasimha Rao, D. (2007). Quality changes during the storage of dehydrated chicken kebab mix. *International Journal of Food Science & Technology*, 42(7), 827-835. doi: 10.1111/j.1365-2621.2007.01291.x.

[20] Myroshnychenko, M.I., & Bolshakova, A.V. (2020). Justification of technological parameters during the production of meat snacks. In *All-Ukrainian scientific and practical conference students of higher education and young scientists "Innovative development technologies in the field of food production, hotel and restaurant business, economy and enterprises: scientific research of youth"* (p. 60). Kharkiv: Kharkiv State University of Food Technology and Trade.

[21] Naveena, B.M., Sen, A.R., Vaithiyanathan, S., Babji, Y., & Kondaiah, N. (2008). Comparative efficacy of pomegranate juice, pomegranate rind powder extract and BHT as antioxidants in cooked chicken patties. *Meat Science*, 80(4), 1304-1308. doi: 10.1016/j.meatsci.2008.06.005.

[22] Order of the Ministry of Agrarian Policy and Food of Ukraine No. 625 "Requirements for Individual Quality Indicators for Poultry Meat". (2023, March). Retrieved from https://zakon.rada.gov.ua/laws/show/en/z0580-23?lang=en#Text.

[23] Recipe dried chips (jerks). (2024). Retrieved from https://kovbasnyk.com.ua/retsepty/jerky.htm.

[24] Skrypnyk, V.O., & Ponomarenko, B.H. 2021. Results of study of temperature kinetics during convective drying of meat. In *All-Ukrainian scientific and practical conference "Problems of energy efficiency and quality in drying processes food raw materials"* (pp. 43-44). Kharkiv: State Biotechnological University.

[25] Song, D.H., Choi, J.H., Choi, Y.S., Kim, H.W., Hwang, K.E., Kim, Y.J., Ham, Y.K., & Kim, C.J. (2014). Effects of mechanically deboned chicken meat (MDCM) and collagen on the quality characteristics of semi-dried chicken jerky. *Korean Journal for Food Science of Animal Resources*, 34(6), 727-35. doi: 10.5851/kosfa.2014.34.6.727.

[26] Sorapukdee, S., Uesakulrungrueng, C., & Pilasombut, K. (2016). *Effects of humectant and roasting on physicochemical and sensory properties of jerky made from spent hen meat*. Retrieved from http://surl.li/sedxg.

[27] Zahorui, L.P., & Mihel, Y. (2022). Analysis of consumption of meat snack products by students. In *The 8 th International scientific and practical conference "Topical issues of modern science, society and education"* (pp. 54-57). Kharkiv.

Дослідження технологічних параметрів виробництва м'ясних продуктів з курячого філе

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Анотація. Дотримання технологічного процесу та параметрів виробництва є запорукою отримання високоякісного продукту. Через стрімкий розвиток харчової промисловості та врахування потреб споживачів у продукції, яка не піддавалася багаторазовому технологічному обробляню, де максимально можливо збережено її поживну цінність, – виникає потреба дослідження м'ясних виробів, які зможуть забезпечити такі вимоги. Метою роботи було визначити та встановити технологічні параметри виробництва джерок курячих. Виконання роботи здійснювали експериментальними дослідженнями, проводили органолептичне оцінювання готової продукції, визначали кількість відходів після жилування м'яса, фізико-хімічні показники сировини, напівфабрикату та готових виробів: вміст вологи, pH, вміст жиру за методом Сокслета та вміст білку за методом К'єльдаля. В процесі виконання роботи досліджено чотири способи виробництва курячих джерок, а саме маринування з конвективним сушінням зі зміною температурних режимів в процесі сушіння; маринування з подальшим варінням за технологією sous-vide до температури в товщі м'яса не менше 72°С та конвективним сушінням до готовності; попереднє засолювання курячого м'яса зі співвідношенням сировини до солі 1/1 з подальшим маринування та конвективним сушінням зі зміною температурних режимів в процесі сушіння. В готових джерках визначали кінцевий вміст вологи який становив від 20,8 % до 37 % в залежності від способу виробництва. Розраховано капітальні (2,33 % ± 0,5 %) та технічні (12,53 % ± 1,32 %) відходи від підготовлення сировини до виробництва джерок, а також наведено методику розрахунку маси брутто курячого філе, від необхідної маси нетто м'ясної сировини. Наведено втрати після сушіння за кожним з досліджуваним способом, що становило від 46,7 %, до 65,03 %, 68 % та 74,77 %. Результати дослідження можна використовувати виробникам м'ясних виробів, закладам ресторанного господарства під час планування та розробленнями власної продукції, удосконалення існуючих технологій виробництва, а також для розуміння тенденцій виробництва м'ясних делікатесів на ринку України

Ключові слова: сушіння; маринування; джерки; снеки; м'ясо птиці; вміст вологи; sous-vide