

**KAPITEL 7 / CHAPTER 7⁷****CONTROL OF FAT FRESHNESS BY EXPRESS METHOD FOR ESTABLISHING SAFETY AND QUALITY OF CHICKEN-BROILER MEAT***КОНТРОЛЬ СВІЖОСТІ ЖИРУ ЕКСПРЕСНИМ МЕТОДОМ ЗА ВСТАНОВЛЕННЯ БЕЗПЕЧНОСТІ ТА ЯКОСТІ М'ЯСА КУРЧАТ-БРОЙЛЕРІВ***DOI: 10.30890/2709-2313.2022-08-02-013****Introduction.**

Risk-oriented control over the observance of sanitary and hygienic requirements during the implementation of the HACCP system must be carried out at the facilities for the production and circulation of broiler carcasses [1]. The management of the enterprise for the production and storage of chilled carcasses of broiler chickens strives for continuous improvement and implementation of best practices to ensure the production of safe and high quality food products at all stages. Therefore, the development of rapid methods for controlling the safety and quality of fat from broiler carcasses for storage and sale is relevant in the work of veterinary inspectors in the implementation of risk-based control at the facility.

The implementation of the HACCP system is promising for the enterprises of the food industry of Ukraine, as it considers not only the elements of risk identification and analysis, but also the elements of critical point management with evaluation of the results of this management. In poultry meat production enterprises, the development and effectiveness of the HACCP system will provide the population with safe and high-quality food products [2].

In connection with Ukraine's accession to the World Trade Organization and future integration into the European Union, there is a need to bring Ukraine's national standards and regulations in line with European legislation to avoid differences in the assessment of poultry meat when exported to European countries. Commonwealth [3]. The issue of control over the establishment of criteria for safety and quality of poultry meat in accordance with international requirements for the implementation of safety systems (HACCP) in Ukrainian processing plants is relevant globally [4].

When carrying out risk-based controls, veterinary inspectors should use simple rapid tests to establish the safety and quality of broiler meat at poultry production and handling facilities to confirm the appropriate sanitary requirements for the timing and conditions of production and storage. products [5].

Scientists have paid considerable attention to the development of new rapid methods of controlling the safety and quality of food, namely meat and meat products

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to determine their degree of freshness [6], the degree of freshness of minced meat [7], the safety of poultry meat according to the developed express methods [8].

Therefore, our research was to develop an express method for controlling the degree of freshness of broiler chickens and test it in state laboratories of veterinary medicine of the State Food and Consumer Services of Ukraine.

7.1. Methodology for determining the safety and quality of broiler carcasses

The material was chilled carcasses of broiler chickens and their fat in a total of 36 samples of different degrees of freshness for storage in the refrigerator at a temperature of 0–4 °C: fresh carcasses - for 5 days; doubtful freshness - for 6-7 days; stale - for 8 days. Organoleptic evaluation of meat and fat of broiler chickens at different storage times (color, odor, consistency, condition of the carcass surface, muscle and fat, cooking test) was performed. The degree of freshness of broiler chicken fat of chilled carcasses was determined at a temperature of 0–4 °C: fresh - for 5 days of storage; of doubtful freshness - for 6-7 days of storage; stale for 8 days using the express patented method "Method for determining the degree of freshness of poultry fat using neutral red" using a molten sample of poultry fat in the amount of 1.0-1.1 g, which was placed in a porcelain cup and added with a graduated pipette 2.0 -2.5 cm³ of neutral red aqueous solution with a mass concentration of 0.01% and rubbed with a pestle for 1-2 minutes, washed with distilled water and after 1-2 seconds set the absence or presence of pink color of varying intensity depending on the degree of freshness [9].

7.2. Organoleptic evaluation of meat and fat of broiler carcasses

Organoleptic evaluation of broiler carcasses was performed at different storage times. Fresh carcasses of broiler chickens for 5 days at a temperature of 0–4 °C had the following characteristic organoleptic characteristics: the surface of the broiler carcass is clean, dry, without damage and hemorrhage, specific odor, muscles well bled, dense, elastic, pit when pressed with a spatula quickly leveled; plumage completely removed; bone system without fractures and deformities; the color of muscle tissue is pale pink; pale yellow skin color; the color of subcutaneous adipose tissue - light yellow, internal adipose tissue - white; the smell on the surface of the carcass is characteristic of good quality poultry meat, without foreign odors; broth of



a pleasant smell, transparent, on a surface of broth a considerable quantity of balls of fat, without extraneous smells; questionable freshness of broiler carcasses - for 6-7 days at a temperature of 0-4 °C: satisfactory bleeding, slight slipperiness of the carcass surface and sour smell on the carcass surface; the consistency is less elastic - the hole when pressed with a spatula is slowly leveled, flesh color is pinkish-gray; the color of the subcutaneous and internal adipose tissue is pale yellow with a gray tinge, with a slight sour odor; unpleasant-smelling broth, with a foreign sour smell, cloudy, a small number of balls of fat on the surface of the broth; stale carcasses of broiler chickens - for 8 days at a temperature of 0-4 °C: poor bleeding, mucus on the surface of the carcasses and sour odor on the surface of the carcasses; the consistency is not elastic - the hole when pressed with a spatula is not aligned, the color of the flesh is grayish; the color of the subcutaneous and internal adipose tissue is yellow-gray with a significant odor of oxidation; unpleasant-smelling broth, with a foreign musty odor, cloudy, no fat balls found on the surface of the broth.

7.3. Risk-oriented control of safety and quality of broiler meat production for the implementation of the HACCP system at production and circulation enterprises

The production and storage of broiler carcasses was carried out in accordance with the requirements of DSTU 3143: 2013 "Poultry meat. General technical conditions» [10].

For the implementation and application of permanent procedures based on the principles of the food safety management system (HACCP), prerequisite programs have been established: for proper planning of industrial, ancillary and domestic premises; regarding the territory, condition of premises, equipment, repair works, equipment maintenance, calibration; regarding the planning and condition of communications (ventilation, water supply, lighting, etc.); on the safety of water, steam, objects and materials in contact with food; regarding the cleanliness of surfaces, procedures for cleaning production, ancillary premises, etc .; on staff health and hygiene; on waste management; on pest control, prevention and means of prevention and control; on safe storage and use of toxic compounds; regarding the specification and control of suppliers; regarding storage and transportation of poultry meat and auxiliary materials; on control of technological processes of poultry slaughter, cooling of carcasses and their storage; on the labeling and packaging of poultry carcasses.



During the preparation of the model HACCP plan for the production and storage of poultry carcasses, the following types of hazards were identified, which are recorded in the journal of the appropriate form: acceptance and exposure of poultry, pre-slaughter inspection - biological risk substances) where precautionary measures have been taken, such as veterinary inspection of poultry, good farming and veterinary practices; for stunning, slaughter and exsanguination of poultry - biological risk (microorganisms) and physical risk (bone fragments) during preventive actions - control on the line for electrical stunning of birds in water and sterilization of knives; for scalding in a bath at a water temperature of 65 ± 2 ° C - biological risk (microorganisms of the skin and feathers) during preventive actions - control of water temperature, regular water change, chlorination of water, compliance with sanitary requirements of equipment; for consumption of carcasses, removal of internal organs, ox, removal of limbs - biological risk (microorganisms) in preventive actions - control on the lines of technological processes; for cooling carcasses in a water bath at a temperature of $4-12$ ° C, control of feather residues, final washing with precautionary measures - control of safety and water quality, equipment maintenance; for packaging of poultry carcasses - biological risk (microorganisms) and chemical risk (detergent residues) during precautionary actions - control of containers, chlorination of water, loading of containers with carcasses, control of washing and disinfection of containers; for cooling poultry carcasses in the cooling chamber №1 at temperatures from -2 to 4 ° C and relative humidity $78 \pm 2\%$ and storage - biological risk, chemical risk during precautionary measures - control of chamber load, proper maintenance of equipment, temperature control in the m thighs of chilled carcasses from 0 to 4 °C not more than 5 days of storage, adjustment of time and temperature, heat treatment or removal of inappropriate products. At this stage, the CCP (Critical Control Point) has been established, where records on monitoring of temperature, humidity, time, as well as control of washes and product samples of each shift are checked on a monthly basis.

As well as the establishment of hazards for packing poultry carcasses in transport containers - biological risk (microorganisms), chemical (detergents) and physical (impurities) in precautionary measures - control of packaging, proper washing, disinfection and storage of packaging, documents, contracts for precautionary actions - constant control by the responsible employee, daily report on the implementation (sanitary condition of vehicles).



7.4. Development of a methodology for determining the degree of fat to assess the safety and quality of broiler meat

One of the elements of the HACCP system is to control the safety and quality of meat and fat of broiler chickens for production and circulation for the implementation of good laboratory practice (GLP) due to the development of simple rapid tests by state veterinary inspectors.

In developing an express method for determining the degree of freshness of broiler chicken fat used an analogue of the developed method - determining the acid number of poultry fat [11] when processing poultry fat using a mixture of diethyl ether and ethyl alcohol with a mass fraction of 96.0% and subsequent titration of free fatty acids potassium hydroxide. The disadvantage of this method is that it is cumbersome, requires two parallel determinations and calculation of results by formula. In addition, this method gives an error of 30-35%.

The prototype of the developed method is a method for determining the degree of freshness of animal fat for the presence of aldehydes for the formation of red color [12] using solutions: phloroglucin in acetone with a mass fraction of 1.0% and concentrated sulfuric acid. The disadvantage of this method is that a solution of phloroglucin in acetone is not stable, used immediately. In addition, the method gives an error in determining 20-25%.

The basis of this express method was to determine the degree of freshness of broiler fat for the accumulation of free fatty acids during spoilage of poultry meat, which allowed to establish the safety and quality of broiler meat, as poultry fat is fusible and spoils faster than poultry meat for violation of sanitary and hygienic conditions and storage times, using an aqueous solution of neutral red with a mass concentration of 0.01% for the establishment of yellow or yellow-brown or pink color of varying intensity depending on the degree of freshness. which will ensure the reliability of the results for determining the safety and quality of broiler fat.

Comparative evaluation of the test results of the developed express method for determining the degree of freshness of broiler chicken fat using neutral red to the prototype is presented in table 1.

From the data of table 1 it is established that the reliability of qualitative indicators in determining the degree of freshness of broiler chicken fat using neutral red according to the developed express method was 99.9%. The results of the research showed that more reliable data in comparison with the results of studies for the determination of peroxide content of poultry fat - in 99.2-99.9% and in the acidic number of poultry fat - in 99.5-99.8% were obtained at application of the developed



Table 1 - Comparison of methods for determining the degree of freshness of broiler fat using neutral red to the prototype

Comparable indicators	Prototype	Developed express method
Sample of melted poultry fat, r	3–5	1.0–1.1
Adding reagents: A solution of phloroglucin in acetone concentration, % quantity, cm ³	1.0 3–5	– –
aqueous solution of neutral red concentration, % quantity, cm ³	– –	0.01 2.0–2.5
Exposition of rubbing with a pestle, min	–	1–2
Color exposure, minutes / seconds	10–12 min	1–2 sec
Intensity of color in the presence of spoilage of poultry fat	red	light pink (doubtful freshness) or bright pink (stale)
Intensity of color in the absence of spoilage of poultry fat	brown	yellow or yellow-brown
The speed of determination of the experiment, min	18–20	4–5
Stability of color intensity indicators during tests, %	78.9	99.9
% of the ratio of research results to the peroxide value of poultry fat	79.0–81.1	99.2–99.9
% ratio of research results to the acid number of poultry fat	79.9–82.5	99.5–99.8

express method for determining the degree of freshness of broiler chicken fat using neutral red. At present, the acid number of fresh poultry fat was up to 1.0 mg *NaOH*; questionable freshness - from 1.1 to 2.5 mg of *NaOH*; stale - more than 2.5 mg of *NaOH*, and the peroxide value of fresh fat was up to 0.010% iodine; questionable freshness - from 0.010 to 0.040% iodine; stale - more than 0.040% iodine [13].

Studies have established the degree of freshness of meat of broiler chickens



chilled carcasses and their fat by the developed express method using a solution of neutral red with a mass concentration of 0.01% for 5 days at a temperature of 0-4 °C - fresh in the presence of yellow or yellow. brown; doubtful freshness for 6-7 days of storage (0-4 °C) - in the presence of light pink color (up to 1.5% of free fatty acids); stale for 8 days (0-4 °C) - in the presence of bright pink color (from 1.6 to 3.5% of free fatty acids).

Using the developed express method, we determined the degree of freshness of broiler chicken fat of chilled carcasses at different times and storage temperatures of poultry carcasses by color intensity on 36 samples.

The results are presented in table 2.

Table 2 - Indicators of the degree of freshness of poultry fat by color intensity

The total number of researchers poultry fat samples, n=36	Indicators of color intensity according to the developed express method when determining the degree of freshness of poultry fat using neutral red with a mass concentration of 0.01%
for storage of broiler carcasses in the refrigerator at a temperature of 0-4 °C for 5 days	
The number of fresh poultry fat samples, n=17	no pink color of varying intensity, but the presence of yellow or yellow-brown color
for storage of broiler carcasses in the refrigerator at a temperature of 0-4 °C for 6-7 days	
The number of samples of poultry fat of questionable freshness, n = 12	presence of light pink color (up to 1.5% of free fatty acids)
for storage of broiler carcasses in the refrigerator at a temperature of 0-4 °C for 8 days	
The number of samples of stale poultry fat, n=7	presence of bright pink color (from 1.6 to 3.5% of free fatty acids)

The quality of broiler chicken fat can be used to determine the freshness of broiler carcasses. The research showed (Table 1) that of the 36 studied samples of broiler fat: 17 samples of broiler carcasses - corresponded to the fresh degree of broiler carcasses - the presence of yellow or yellow-brown color; 12 samples of broiler carcasses - corresponded to the questionable freshness - the presence of light pink color with the use of neutral red (up to 1.5% of free fatty acids); 7 samples of broiler carcasses - corresponded to stale - the presence of bright pink color (from 1.6



to 3.5% of free fatty acids).

In addition, it should be noted that the developed rapid new method of determining the degree of freshness of fat using neutral red are effective and economical in the preparation of reagents, and their results gave specific quantitative indicators of safety and quality of poultry carcasses, as fat is fusible and hygienic requirements and temperature regimes deteriorate faster, which is a sign of poor quality poultry carcasses.

We have developed an express method for determining the degree of freshness of poultry fat using neutral red in state laboratories of the State Food and Consumer Service of Ukraine, as a quality way to establish the safety and quality of broiler meat, along with other common methods - organoleptics of broiler carcasses and determination of acid and peroxide levels of fat [14].

Conclusions

1. The safety and quality of meat of broiler chickens according to organoleptic parameters and the degree of freshness of fat from chilled carcasses by the express method using a neutral red solution with a mass concentration of 0.01% during storage at 0-4 ° C: fresh - 5 day in the presence of yellow or yellow-brown color; doubtful freshness - for 6-7 days in the presence of light pink color (up to 1.5% of free fatty acids); stale - for 8 days in the presence of bright pink color (from 1.6 to 3.5% of free fatty acids). The reliability of the developed express method was 99.9%.

2. The developed express method for determining the degree of freshness of poultry fat can be used in production laboratories of facilities for production and processing of poultry meat and meat products, wholesale bases, supermarkets, state laboratories of the State Food and Consumer Services of Ukraine and state laboratories of veterinary and sanitary examination. with generally accepted methods of controlling the safety and quality of poultry meat during production and storage.