

KAPITEL 7 / CHAPTER 7⁷**RISK-ORIENTED CONTROL OF THE SAFETY OF MEAT OF
SLAUGHTER AND POULTRY DURING PRODUCTION AND
CIRCULATION WHEN ADVERTISEMENT IS DETECTED**

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Introduction.

The Law of Ukraine "On Basic Principles and Requirements for the Safety and Quality of Food Products" obliges market operators to produce safe and high-quality meat raw materials and meat products. The State Service of Ukraine for Food Safety and Consumer Protection implements state policy in the field of veterinary medicine, the areas of safety and individual quality indicators of food products, identification and registration of animals, sanitary legislation, metrological supervision, market supervision within the scope of its responsibility, state control over complying with the legislation on the protection of consumer rights and advertising in this area, must comply with the requirements of the new European regulation on food products, the Codex Alimentarius Commission and the main provisions of the *SPS* and *TBT* trade agreements, and organize its work based on the assessment of risks from the sanitary safety of food products [1–5].

Prevention and detection of falsified food products, which can have a harmful effect on the health of ordinary consumers, is one of the main tasks of veterinary medicine specialists, who carry out state risk-oriented control over the safety and quality of food products, in particular, the meat of slaughtered animals, which is regulated by the Law of Ukraine "On state control over compliance with the legislation on food products, feed, by-products of animal origin, animal health and welfare" [6].

In order to ensure that consumers receive safe and high-quality meat raw materials, it is necessary to develop new express methods for their proper control. Especially relevant are the directions of research on the development of express methods, which make it possible to objectively assess the safety and quality of the meat of slaughtered animals and poultry during storage and sale or use for the production of meat products. In global science and practice, the most sensitive methods of determining the safety and quality of meat raw materials are used in stores, supermarkets, wholesale bases, in agricultural markets for the sale of meat from slaughtered animals and poultry. It is too often possible to detect falsification of meat by processing it with solutions of formaldehyde, chlorine-containing substances,

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hydrogen peroxide, acetic acid, potassium permanganate for long-term storage and elimination of signs of spoilage [7–8].

7.1. Materials and methods of risk-oriented control of falsification of the meat of slaughter animals

The **purpose** of the research was to carry out risk-oriented control of the meat of slaughter animals and poultry when establishing their falsification at the facilities for their production, storage and sale.

Research material and methods. The meat of slaughtered animals and poultry was used for the research: pork, beef, lamb, goat meat, as well as poultry meat carcasses that were delivered to the meat processing plant of the Kyiv region, as well as sold in agricultural markets, supermarkets and stored on wholesale bases. Samples were examined: pork – 50; beef – 48; lamb – 25; goat meat – 21; poultry meat – 46.

Previously, meat samples from slaughtered animals and poultry were examined organoleptically (color, smell, consistency, cooking test, etc.) and in a complex of biochemical studies to determine the degree of freshness and determine the meat obtained from healthy animals and poultry [9–11]. Tests were also conducted according to the developed express methods of determining the adulteration of meat by processing it with solutions of formaldehyde, chlorine-containing substances, hydrogen peroxide, acetic acid, potassium permanganate [12–16].

7.2. Determination of falsification of meat of slaughtered animals and poultry with formaldehyde solution and chlorine-containing substances

The meat of slaughtered animals and poultry according to organoleptic and biochemical indicators corresponded to the fresh degree and was obtained from healthy animals and poultry. In order to determine the adulteration of meat of slaughtered animals and poultry after processing it with a solution of formaldehyde, chlorine-containing substances, hydrogen peroxide, acetic acid, and potassium permanganate, express methods were developed.

The essence of the method of determining the adulteration of the meat of slaughtered animals and poultry due to their intentional treatment with formaldehyde solution is the use of a mixture of concentrated nitric and sulfuric acids and the formation of a yellow-brown or purple-red color [12].

The probability of indicators based on color intensity when establishing



falsification of the meat of slaughter animals and poultry after processing with formaldehyde solution was 99.4% compared to the results of indicators for establishing the safety and quality of meat.

Falsification of meat from slaughter animals and poultry with a formaldehyde solution was determined by color intensity in 42 samples: 8 samples of pork; 9 samples of beef, 6 samples of lamb; 5 samples of goat meat; 14 samples of poultry carcasses (Table 1).

Table 1 - Indicators of adulteration of meat with formaldehyde solution by color intensity

Type of meat	Number of samples	Indicators of color intensity for adulteration of meat with formaldehyde solution	Number of samples	Indicators of color intensity in the absence of adulteration of meat with formaldehyde solution
Pork, n= 8	2	The presence of purple-red color (positive reaction)	6	Presence of yellow-brown color (negative reaction)
Beef, n= 9	2		7	
Mutton, n= 6	1		5	
Goat meat, n= 5	2		3	
Poultry carcasses, n= 14	9		5	

The conducted research determined that the largest number of poultry carcasses (n=9) was falsified with a formaldehyde solution sold in supermarkets, which was marked by the intensity of the purple-red color. The lowest amount of falsified meat of slaughter animals with a formaldehyde solution was observed at wholesale bases (pork); at meat production facilities (beef, lamb and goat meat).

The sensitivity of formaldehyde solution detection was up to 0.025% when applied to the surface of the meat of slaughtered animals and poultry.

The essence of the method of determining the adulteration of meat of slaughtered animals and poultry by treatment with a solution of chlorine-containing substances is to establish the presence or absence of a blue color when successively adding solutions of potassium iodide, water-soluble starch and concentrated hydrochloric acid to the meat-water extract [13].

The probability of indicators of color intensity when establishing the falsification of meat of slaughter animals and poultry after treatment with a solution of chlorine-containing substances was 99.5% compared to the results of indicators of establishing the safety and quality of meat.

The falsification of the meat of slaughtered animals and poultry with solutions of



chlorine-containing substances was determined by the intensity of color in 36 samples: 8 samples of pork; 9 samples of beef, 5 samples of lamb; 4 samples of goat meat; 10 samples of poultry carcasses (table 2).

Table 2 - Indicators of meat adulteration with solutions of chlorine-containing substances by color intensity

Type of meat	Number of samples	Indicators of color intensity for adulteration of meat with solutions of chlorine-containing substances	Number of samples	Indicators of color intensity in the absence of adulteration of meat with solutions of chlorine-containing substances
Pork, n= 8	1	Presence of blue color (positive reaction)	7	Absence of blue color (negative reaction)
Beef, n= 9	2		7	
Mutton, n= 5	1		4	
Goat meat, n= 4	1		3	
Poultry carcasses, n= 10	7		3	

The conducted research determined that the largest number of poultry carcasses (n=7) was falsified with a solution of chlorine-containing substances for sale at wholesale bases and supermarkets, which was marked by the intensity of the blue color. The lowest amount of falsified meat of other types of slaughter animals with a solution of chlorine-containing substances was observed at wholesale bases and meat production facilities.

The sensitivity of detection by solutions of chlorine-containing substances was up to 0.031% in the concentration of its application on the surface of the meat of slaughtered animals and poultry.

7.3. Determination of falsification of meat of slaughtered animals and poultry with solutions of hydrogen peroxide and acetic acid

The essence of the method of determining the adulteration of meat of slaughtered animals and poultry by treatment with a hydrogen peroxide solution is to establish the presence or absence of a light blue color using concentrated sulfuric acid and potassium iodide starch [14].

The probability of the color intensity indicators when determining the adulteration



of the meat of slaughter animals and poultry after treatment with a hydrogen peroxide solution was 99.6% compared to the results of the indicators for establishing the safety and quality of the meat.

The probability of the color intensity indicators when determining the adulteration of the meat of slaughter animals and poultry after treatment with a hydrogen peroxide solution was 99.6% compared to the results of the indicators for establishing the safety and quality of the meat (Table 3).

Table 3 - Indicators of adulteration of meat with hydrogen peroxide solution by color intensity

Type of meat	Number of samples	Indicators of color intensity for adulteration of meat with hydrogen peroxide solution	Number of samples	Indicators of color intensity in the absence of adulteration of meat with hydrogen peroxide solution
Pork, n= 10	3	Presence of light blue color (positive reaction)	7	Відсутність світло-синього кольору (негативна реакція)
Beef, n= 10	1		9	
Mutton, n= 5	2		3	
Goat meat, n= 4	0		4	
Poultry carcasses, n= 9	5		4	

The conducted research determined that the largest number of poultry carcasses (n=5) was falsified with hydrogen peroxide solution, which was marked by the intensity of the light blue color, when sold on agro-food markets. The lowest amount of falsified other types of meat from slaughter animals with a solution of chlorine-containing substances was observed at wholesale bases (pork), at meat production facilities (beef) and in supermarkets (lamb). The detection sensitivity of the hydrogen peroxide solution was up to 0.04% in the concentration of its application on the surface of the meat of slaughtered animals and poultry.

The essence of the method of determining the adulteration of meat of slaughtered animals and poultry by treatment with an acetic acid solution is to establish the presence or absence of a pink color using a sodium hydroxide solution with a mass concentration of 0.1 mol/dm³ and an indicator of an alcoholic solution of phenolphthalein with a mass concentration of 1% [15].

The probability of the color intensity indicators when determining the adulteration of the meat of slaughtered animals and poultry after treatment with acetic acid was 99.8% compared to the indicators for establishing the safety and quality of the meat of slaughtered animals and poultry.



The falsification of the meat of slaughtered animals and poultry with acetic acid solution was determined by the intensity of color in 42 samples: 12 samples of pork; 10 samples of beef, 5 samples of lamb; 4 samples of goat meat; 11 samples of poultry carcasses (Table 4).

Table 4 - Indicators of adulteration of meat with acetic acid solution by color intensity

Type of meat	Number of samples	Indicators of color intensity for adulteration of meat with acetic acid	Number of samples	Indicators of color intensity in the absence of adulteration of meat with acetic acid
Pork, n= 12	3	Presence of pink color (positive reaction)	9	Lack of pink color (negative reaction)
Beef, n= 10	4		6	
Mutton, n= 5	1		4	
Goat meat, n= 4	4		–	
Poultry carcasses, n= 11	9		2	

The conducted research determined that the largest number of poultry carcasses (n=9) was falsified with a solution of acetic acid, which was marked by the intensity of the pink color, in supermarkets. The lowest amount of falsified other types of meat of slaughtered animals with acetic acid solution was observed in wholesale bases, supermarkets (pork, beef, lamb and goat meat). The detection sensitivity of the acetic acid solution was up to 0.043% in the concentration of its application on the surface of the meat of slaughtered animals and poultry.

7.4. Determination of falsification of meat of slaughtered animals and poultry with a solution of potassium permanganate

The essence of the method for determining the adulteration of meat of slaughtered animals and poultry by treatment with a solution of potassium permanganate is to establish the presence or absence of a faint pink color using a solution of sulfuric acid with a mass concentration of 0.5 mol/dm³ in an amount of 0.4–0.5 cm³ [16].

The probability of the color intensity indicators when determining the adulteration of the meat of slaughter animals and poultry after treatment with potassium permanganate solution was 99.9% compared to the results of the indicators for



establishing the safety and quality of the meat.

Falsification of meat of slaughter animals and poultry with a solution of potassium permanganate was determined by color intensity in 42 samples: 12 samples of pork; 10 samples of beef, 4 samples of lamb; 4 samples of goat meat; 12 samples of poultry carcasses (Table 5).

The conducted research determined that the largest number of poultry carcasses (n=6) was falsified with a solution of potassium permanganate, which was marked by the intensity of a faint pink color, at wholesale bases. The lowest amount of falsified meat of other types of slaughtered animals with a solution of potassium permanganate was observed at wholesale bases (pork), supermarkets (lamb and goat meat), and agro-food markets (beef).

Table 5 - Indicators of meat adulteration with potassium permanganate solution by color intensity

Type of meat	Number of samples	Indicators of color intensity for adulteration of meat with potassium permanganate solution	Number of samples	Indicators of color intensity in the absence of adulteration of meat with potassium permanganate solution
Pork, n= 12	4	The presence of a weak pink color (positive reaction)	8	Lack of faint pink color (negative reaction)
Beef, n= 10	3		7	
Mutton, n= 4	1		3	
Goat meat, n= 4	1		3	
Poultry carcasses, n= 12	6		3	

The detection sensitivity of the potassium permanganate solution was in the concentration of its application on the surface of the meat of slaughtered animals and poultry up to 0.05%.

The developed express methods make it possible to establish the falsification of the meat of slaughter animals and poultry after processing with various chemical dangerous factors. These methods can be used to determine the safety and quality of meat for slaughter animals and poultry during their production, storage and sale, in particular in production laboratories at meat processing facilities, supermarkets, wholesale bases, in state laboratories of the State Production and Consumer Service and in veterinary laboratories sanitary examination in agro-industrial markets to prevent detection of falsification and removal from circulation of dangerous meat. In order to obtain safe and high-quality meat from slaughtered animals and poultry, it is necessary to comply with sanitary and hygienic requirements at the facilities for their



production and circulation.

Conclusions

Express patented methods of establishing the safety of meat for slaughtering animals and poultry after their falsification with solutions of formaldehyde, chlorine-containing substances, hydrogen peroxide, acetic acid, potassium permanganate in the concentration of their application up to 0.02–0.05% were proposed. The reliability of indicators according to the developed methods was determined to be 99.4–99.9% compared to indicators of safety and quality of meat of slaughter animals.

In the case of conducting a forensic veterinary examination to establish the falsification of meat of slaughtered animals and poultry due to treatment with chemical hazardous factors, use the developed express methods in the production laboratories of meat processing facilities, slaughterhouses and enterprises for the sale and storage of meat, in state laboratories of the State Production and Consumer Service and in laboratories of veterinary and sanitary examination at agro-industrial markets.