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STUDIES ON SOME METHODS AND MEANS FOR INCREASED STORAGE LIFE OF FRESHLY COOLED POULTRY MEAT AT TEMPERATURES ABOVE 0°C.

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РЕЗЮМЕ

Было проведено исследование для определения подходящих методов и средств продления срока хранения свеже охлажденного мяса птицы. Для этой цели были испытаны: метод предварительного хлорирования птичьих тушек, облучение бактерицидной лампой и гамма-лучами, вакуумная упаковка и хранение в среде CO_2. Во время исследований определяли микробиологический статус контрольных и опытных птиц, биохимические и органолептические показатели.

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On a effectué des études sur l'établissement de méthodes et de moyens convenables pour le prolongement du délai de conservation de la viande de volaille fraîche refroidie. Dans ce but on a fait des épreuves sur: la méthode de chlorage préliminaire des carcasses de la volaille, l'irradiation - au moyen d'une lampe bactéricide et de rayons gamma, l'emballage sous vide et le stockage dans un milieu de CO_2. Au cours des recherches on a établi l'état microbiologique de la volaille expérimentale et des témoins, ainsi que les indices biochimiques et organoleptiques.

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A study was carried out to determine suitable methods and means to lengthen the storage life of freshly cooled poultry meat. For this purpose the following methods were tested: prechlorination of poultry carcasses, irradiation with a bactericidal lamp or gamma-rays, vacuum packaging and storage in CO_2 atmosphere. During the studies, the microbiological status of control and test birds was determined, as well as biochemical and organoleptic indices.

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Es wurde eine Untersuchung zur Feststellung geeigneter Verfahren und Mitteln zur Verlängerung der Lagerungsdauer von frisch gekühltem Geflügelfleisch durchgeführt. Zu diesem Zwecke wurden das Verfahren der Vorchlorierung der Tierschlachtkörper, die Bestrahlung mit einer bakteriziden Lampe und mit Gamma-Strahlen, die Vakuum-Verpackung und die Lagerung in einem CO_2-Medium untersucht. Während der Untersuchungen wurden der mikrobiologische Status der Kontroll- und Versuchstiere, sowie auch die biochemischen und sensorischen Merkmale, festgestellt.

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Poultry meat takes an ever growing part in mankinds food. To the consumer a significant part of it is offered in frozen state, while in a number of countries, it is prefered only cooled. The fresh cooled poultry meat, however, has a restricted storage life. Spoiling of the meat at plus temperatures is due to the development of microorganisms, which in their life activity spoil the proteins and other substances. That is why the methods for prolongation of the storage life are usualy based on total decreasing the level impact of microorganisms on meat by anihilation or retarding of their development (3, 4, 6, 7).

In our country the increase in the production of cooled meat during all seasons is pending. Following this, there is an underlined interest for applying also some other methods for the treatment of the carcasses, so that they could keep for a longer time their freshness.

The present work has been undertaken to investigate the microflora of freshly slaughtered birds, applying 5 methods for the prolongation of the storage of the slaughtered birds under plus temperatures.

Material and Methodics

The following methods were investigated: 1) chlorination of the slaughtered birds; 2) vacuum packing; 3) keeping in an atmosphere of CO_2; 4) irradiation with bactericidal lamps; 5) irradiation with gamma rays.

The investigations were made using carcasses from one batch, selecting similar in weight and quality carcasses. The whole lot of 355 carcasses was devided in groups of an even number, with one group serving as a control, while each of the rest underwent the respective treatment.

The chlorination of the slaughtered birds was made after the recommended by Vapzarova and Slavkov (2) method. Irradiation with bactericidal lamps was made on both sides from a distance of 25 cm for 0,5 minute. Vacuum packing was made in elastic plastic bags with evacuation of the air by "Cryovac". Storage under CO_2 was madeby use of dry ice. In the bag with the selected weighing each 800 grams birds,was added 1 g dry ice and after the air evacuation the bag was tied with chirurgical thread.

A given number of the packed bags were checked for chermeticity by dipping into water. Irradiation with 0,1 Mrad gamma rays was made in the Radiologic Laboratory of the Institute for Radiology and Radiational Hygiene, on a gamma source PHM - gamma - 20 on packed half carcasses.

The treated carcasses were kept under temperature of 0 - +4°C, and wereinvestigated on the 1, 7, 10, 15, 17, 19, 21, 23, and 25 days. The microbiological investigations envolved total count of microorganisms, caseolites, E;coli, salmonella, pathogenic staphylococci, enterococci, Proteus, and anaerobes. Further to that biochemical analyses were made, following the requirements of the Bulgarian Standart 1323-67. For this reason material was studied from the total smear as well as from white and red meat. The total smear was made after the method of Leistner and Szentkuti (5),but without the addition of pepton. The degustation panel of judges evaluated anonimously the changes inflicted on the carcasses following their storage.

Results and Discussion

The obtained results from the microbiological investigations (table 1) show, that total bacterial count of the control carcasses of 34,019 in ml, during the storage was increased reaching 1,726,111 on the 7th, and 3,879,000 on the 10th day. On the 7th day was felt a slight smell of chafe, and on account of this these carcasses were eliminated from the investigations.

Treatment of the carcasses after the pointed methods decreases their total microorganisms count. To a highest degree this effect is obtained with carcasses irradiated by gamma rays (1.980 microbial bodyes in 1 ml), followed by the chlorinated (3.963), in CO_2 (11.000), in vacuum packings (13.430) and the irradiated by a bactericidal lamp (28.625).

Shortest storage life is encountered with the vacuum packed carcasses. The first signs of chafe with them is obtained on the 15th day of storage, while on the 17th they were totally spoiled.

With chlorination and irradiation with bactericidal lamp, the carcasses are well preserved without any significant changes to the 15th day, while on the 17th day they showed signs of moistening and an unpleasant odour.

Storage in an atmosphere of CO_2 prolongs the storage life of the carcasses to the 19th day, while with 3 carcasses no organoleptic changes were encountered even on the 21st day.

Longest storage is obtained when the carcasses are irradiated by gamma rays. Carcasses treated this way, preserved their fresh appearance and specific taste and flavour to the 23rd day, while a slight unpleasant odour and moistening appeared only on the 25th day.

Irradiation of carcasses with gamma rays and a dose of 0,5 Mrad (Jdziak and Incze /3/) prolongs the storage at +5°C to 14 days. In analogous investigations Kiss and Fatcas (4) prolong the storage of carcasses 2 to 3 times.

Analyses of these results demonstrate that while in the controls spoiling appears between the 7th and 10th day and the total count of the microorganisms attains a mean of

3.879.000, with the rest, this phenomen is observed with much lower bacterial counts? Thus, with chlorinated carcasesss, this number is almost 3 times lower, with the irradiated by bactericidal lamp 5 tiihes, with vacuum packing 2,5 times, with CO_2 atmosphere 6 times and with irradiation by gamma rays almost 12 times.

The obtained results demonstrate that proteolytic microorganisms and E. coli are also sensitive to the described treatment. The changes in these microbial groups follows almost the same pattern as the total microbial count. E.coli are extremely sensitive to gamma rays. Thus while the microflora of the controls is almost exclusively represented by them, in the carcasses treated by gamma rays they are not present at all.

Chlorination, vacuum packing and irradiation with bactericidal lamp, do not exhibit any effect on anaerobic microorganisms, as 100% of the investigated carcasses are inseminated with them.

A reduction in the number of carcasses contaminated with Proteus is obtained with chlorination, keeping in an atmosphere of CO_2 and irradiation by gamma rays.

With the gamma irradiation is attained almost a complete elimination of the enterococci. In about 80% from the samples, they also disappear with the chlorination. Results from the physicochemical investigations demonstrate that they completely follow the microbiological pattern. These investigations proved as most precise indexes pH, the Nessler reaction, the copper sulphate test and the determination of aminoammonia nitrogen. Investigations og the total smear and extracts of white and red meat exhibits some pecularities. The pH value of white meat in the controls was within the limits of 6.00 to 6.47, in the red meat of 6,2 to 6.8, while the obtained high values were determined during the interval between the 7th and 10th day of storage.

With the carcasses treated by the different methods, this was observed after the 15th day, without significant diversions.

Results from the investigated total smear and extracts of white and red meat show, that the Nessler and copper sulphate

reactions are most clearly expressed with the smear from the carcasses. The appearance of these reactions coincides with the time, when the organoleptic degustation reveals the processes of spoilage. Worthwhile is noticed the fact, that while the pH value of the white meat, during all investigated intervals of carcass storage is always lower than that of the red meat, the aminoammonia nitrogen shows a reverse tendency.

Conclusions

1. With vacuum packing of poultry carcasses, the microflora is reduced 2,5 times, with chlorination 3 times, with bactericidal lamp irradiation 5 times, in CO_2 atmosphere 6 times, and by gamma rays irradiation 12 times.

2. Vacuum packing, chlorination, irradiation with bactericidal lamp and storage in CO_2 atmosphere, prolong the storage of slaughtered poultry at 0°, +4°C from the 15th to the 19th day.

3. Longest prolongation (23-25 days) of storage under the said conditions is obtained when carcasses are irradiated by gamma rays with a dose of 0,1 Mrad.

4. In irradiation with gamma rays, there appears a marked decrease in the carcasses contaminated with E. coli, Proteus, enterococci and anaerobic microorgznisms.

Table 1

CHANGES IN THE MICROFLORA OF TREATED BY DIFFERENT MEANS CARCASSES STORED AT 0°, +4°C

Samples	Days	Total count	Caseo-lytic	Esch.coli	Salmon.	path. Staph.	Entero-cocci	Proteus	Anae-robes
1	2	3	4	5	6	7	8	9	10
Controls	1	34,019	2,761	6,857	2	12	20	10	26
	7	1,726,111	103,944	457,222	-	10	21	9	26
	10	3,879,000	344,294	1,255,176	1	10	21	9	26
	15	-	-	-	-	-	-	-	-
Chlorination	1	3,963	247	174	-	1	2	-	10
	7	14,375	1,254	13,037	-	-	2	-	11
	10	117,927	1,795	112,455	-	2	1	-	11
	15	240,750	104,375	139,250	-	-	3	-	11
	17	1,280,000	242,400	1,036,000	-	-	5	-	11
	19	-	-	-	-	-	-	-	-
Irradiation by bact.lamp	1	28,625	762	2,660	-	-	2	2	8
	7	56,375	1,901	21,925	1	-	4	1	8
	10	220,875	17,788	191,111	-	-	4	2	8
	15	342,333	146,516	192,666	-	-	1	1	8
	17	624,000	201,200	380,200	-	-	1	1	8
	19	-	-	-	-	-	-	-	-

Table 1 (continued)

1	2	3	4	5	6	7	8	9	10
Vacuum packing	1	13,430	1,140	6,820	-	10	10	6	10
	7	276,900	13,380	52,500	-	-	10	6	10
	10	346,900	96,100	244,300	-	-	10	9	10
	15	1,570,000	122,950	1,253,000	-	-	10	7	10
	17	-	-	-	-	-	-	-	-
CO_2 atmosphere	1	11,000	600,000	3,480	-	-	7	2	8
	7	14,000	2,100	7,200	-	-	3	-	8
	10	19,000	2,850	3,440	-	-	4	-	8
	15	53,400	8,060	17,200	-	-	3	-	8
	17	25,600	11,000	19,600	-	2	8	-	8
	19	60,400	35,400	35,200	-	-	8	-	8
	21	-	-	-	-	-	-	-	-
Gamma rays irradiation	1	1,980	40	-	-	-	-	-	-
	7	5,000	196	-	-	-	-	-	-
	10	1,464	64	-	-	-	-	-	-
	15	3,300	298	-	-	-	-	-	-
	17	2,140	412	-	-	-	-	-	-
	19	2,298	470	-	-	-	-	-	-
	21	2,906	481	-	-	-	-	-	-
	23	2,972	485	-	-	-	-	-	-
	25	-	-	-	-	-	-	-	-

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