INVESTIGATION ON RADIOACTIVE CONTAMINATION OF BONE RAW MATERIAL AS ONE OF THE ALTERNATIVE SOURCES OF ORGANIC CALCIUM

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Abstract*: There were examined contents of radionuclides in bone raw material, afforded investigation results of contents of strontium– 90 and caesium– 137 in chicken and pig meat. It was determined that radionuclides contents changes wit the age of bird.*

Key words*: bone, albumen, radionuclides, strontium– 90, caesium– 137, calcium, phosphorus, mineral agents.*

1. Introduction

Among the most important problems that have to be solved by processing industry today, there is a maximum usage of slaughterhouse domestic animals and poultry products for food aims. Special place in slaughterhouse products belongs to bones. During the processing of meat carcasses, bones are from 20% to 30% of the mass of carcasses. Fresh, dietary bones consist of up to 50% of water, up to 15% of fat, up to 13% of albumen and up to 22% of mineral agents.

In food industry bones raw material is only used as a source of albumen and fat. Lately the role of fibrous and bone tissues in the process of digestion of meat products in human organism has been studied.

In human organism mineral bones components has not only supportive, but also take part in exchange trophic processes. Bone tissue provides with stability of calcium and phosphorus contents in blood and tissues of other mammals, by support of pH balance of organism. Calcium and phosphorus play very important role in mechanism of contraction of muscles and cellular membranes. Calcium ions take part in transmission of neural impulses and clotting.

In this connection with that reorganization always takes place in bones. Bones in too labial way take part in vital processes in human organism [1 - 5].

For the replenishment of calcium the person has to consume together with food and drinking water every day from 1000 to 1500 mgr of calcium in assimilative form [2, 5]. Lack of calcium in organism leads to development of osteoporosis metabolism disorder, nervous disorders and other diseases.

At the same time a huge territory of Ukraine is polluted with radionuclides that in an alimentary way get to human organism. Ecological influence of different radioactive isotopes on living tissue also greatly differs. For example, radioactive materials with half-value period of less than 8 days is not considered to be dangerous; since they keep a high level of radiation in the infected bioton just for a small period of and can be easily decreased in human organism. Materials with long half-value period such as, for example, uranium-238 (4,5 billion of years) are also

almost safe because of slight radiation during the certain period of time. However, big danger is presented by radioactive strontium-90 and cesium-137,that accordingly have half-value period of 28 and 33 years. As a result of similarity of chemical qualities accordingly of calcium and potassium, they easily get into human organism, stay there and can be accumulated in such amount that can cause harm for the organism. Radioactive strontium and cesium can cause chemical mutation – irreversible changes of structure of nucleic acids, albumen, lipids especially of cell membranes and appearing of active radicals. Immune system is one of the accessible parts in human organism for radiation influence. As a result of weakening of immune system functioning caused by ionized radiation, leucosis and other oncologic diseases can develop.
That is why in Ukraine after 1986 there is a precaution against bones as a source of getting into organism radionuclides in alimentary way.
It was also investigated that mammal organism assimilates calcium much better than strontium. That is why food that is rich in calcium is one of the best ways of decreasing strontium in human body [6].

2. Experimental

Bones are one of the most accessible and effective sources of mineral agents. Bird and pig breeding is considered to be the most perspective field of cattle breeding on the territory of Ukraine. That is why we conducted some research concerning cesium and strontium contents in chicken and pig bones.
Radionuclide structure of the investigated objects determined on scintillation spectrometers of gamma energy – types of radiation СЕГ-001 „АКП-С" and beta radiation СЕБ-01-70. Methods of investigation are standardized for strontium– 90 МИ12-0,5-99, МУК 2.6.1.717-98. True fault of radiation from ±10% to 50% if the inside expectancy is P=0,95.

3. Results and Discussion

Results of investigation of radionuclide contents are presented in the tables 1,2.
The results of investigation affirm that experimental samples of chicken and pig bones have radionuclide contents that are below the admissible limit, so poultry and pig bones, regardless of their age, can be for food by guaranteeing radioactive safety.

Table 1
Radionuclide contents in chicken and pig bones (n=3; p≤0,05)

Indexes	Contents in the investigated element. Bk/kg		Permi-ssible level. Bk/kg
	Chicken bones	Pig bones	
Cesium–137	15.4	18	50
Strontium–90	< 9.5	<10	200
Radium–226	< 9.5	<18	35 - 50
Potassium–40	< 47	<64	125- 180
Thorium–232	< 6	<10	20- 30

Table 2
Contents of cesium and strontium in chicken bones (n=3; p≤0.05)

Age of bird. days	Contents of ^{90}Sr. Bk/kg	Contents of ^{127}Cs. Bk/kg	Permissible levels . Bk/kg	
			^{127}Cs	^{90}Sr
90	< 9.5	18.0	200	50
120	< 9.3	18.6		
150	< 12.0	17.4		
180	< 12.5	15.4		
210	< 15.54	15.6		
300	< 16.0	15.8		

The next stage was to find out toxic elements in poultry and pig bones. The results of toxic elements contents in bones are presented in the table 3.
As it can be noticed in the table. in pig and chicken bones the level of zink. copper. plumb and mercury is minimal and according to maximum permissible level is (%):3.5..5.65. 12.8..15. 10..12. 5..10. Level

of Cadmium and arsenic – about 40..60 %. however. neither toxic element from table 3 does not exceed limits provided by hygiene requirements of quality and safety of provision raw materials and food products [4].

That is why by taking into consideration the results of investigation of radioactive and toxic safety. and also taking into consideration literary facts [5] about high degree of assimilation of bone calcium and phosphorus by human organism. their prophylactic action. role of calcium in decreasing level of strontium. a conclusion can be made that after accurate initial control chicken and pig bones can be used for preparing bone food paste.

Table 3

Toxic elements contents in chicken and pig bones (n=3; p≤0.01)

Indexes	**Contents in the investigated object. mg/kg**		**Permi-ssible level. mg/kg**
	Chicken bones	Pig bones	
Mercury	< 0.0015	< 0.003	0.03
Cadmium	< 0.02	< 0.03	0.05
Plumb	< 0.06	< 0.05	0.5
Zink	3.96	4.26	70
Arsenic	0.062	0.062	0.1
Copper	0.64	0.75	5.0
Mikotoxins. aflatoxin B_1	0.002	0.003	0.005

For effective utilization of bone raw material and providing balanced nutrition in Japan (patent №51-57681). France (patent №2505131. etc.) and the USA (patent №3873760. etc.) fresh dietary bones are processed into paste with element size 10 mkm. The paste has soft consistence of white and yellow colour and specific pleasant taste provided by cerebrum. It is absolutely digested in gastrointestinal tract and contains. %: albumen from 10 to 18. fat from 12 to 14 and mineral agents from 20 to 26 (mostly calcium. phosphorus and magnesium). Bone paste can be utilized while making boiled and liver sausages. other sausages. meat bread. paste. etc [3].

By means of thermal treatment of bones and working in the electromagnetic field in the labaratory we managed to get bone paste that has similar organoleptic characteristics and chemical structure.

4. Conclusion.

1. Contents of radioactive strontium-90 and cesium-137 in chicken bones does not greatly depend on their age; however. concerning radioactive strontium-90 and cesium-137 chicken bones have permissible level of these radionuclides in food products.

2. Taking into consideration high degree of assimilation of bone calcium and phosphorus by human organism. their effect on radiation and their prophylactic effect. presence of albumen and fat in big quantity. it is possible to utilize reduced to fragments colloidal bone raw material as a food additive for producing balanced food products including for prophylactic nutrition.

5. References

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