DISTRIBUTION OF SOME TRACE ELEMENTS IN SELECTED TISSUES OF HENS *

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The aim of the work was to detect in different tissues of hens the trace elements activated by irradiation with a stream of thermic neutrons, for determining their mutual qualitative and quantitative ratio in particular tissues. In view of too high activity for transport from the reactor, caused by radiation of isotopes with a short half-life, the samples had to be stored for 3 months for cooling, hence the quality of radioactive elements suitable for investigation had to be limited to those of long-life and emitting the gamma and beta rays, i.e. in the given case to caesium, zinc and cobalt.

Material and Methods

For the investigations the samples were used containing by 100 mg of mixed up, incinerated tissues, average for 20 hens, from pectoral and thigh muscles, stomachs, heads, necks, sternums, wings, thigh bones and livers. They were irradiated for 320 hours in the nuclear reactor with a stream of thermic neutrons of $2 \times 10^{13} n/m^2/sec$.

The gamma radiation spectrometry was made on multi-channel analyzer coupled with the Ge/Li counter with the volume of 15 cm^3.

The identification of the detected elements was made basing upon their characteristic energies estimated from the graph calibrated according to the energy of sodium-22, manganese-54 and cobalt-60, measured in the same conditions as the samples.

Quantitative ratio between particular tissues was calculated from the sum of impulse counts in the peak region of the given element (upon substraction of the sum of impulse counts of identical peak in the spectrum of simultaneously irradiated

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empty aluminium casing of samples) and from the comparison with the similar sum of impulse counts of peak of the given element occurring in stomachs, at assumption of the latter value as 100%.

Results and Discussion

Figure 1 suggests the occurrence of three elements in the samples, viz.: zinc (Zn-65), caesium (Cs-134) and cobalt (Co-60) as well as of two peaks pertaining to the energies of 740 and 835 KeV corresponding approximately with the energies of silver (Au-110, T 1/2 235 days) — 743 and 885 KeV. However, in view of divergences in the values of the second energy peak, the element cannot be identified on the basis of the existing material without repeated verification of the results. Separation of the identified elements and their percentage in the tissues investigated are presented in Table 1 and in Fig. 2, worked out basing upon the data of the table.

Table 1

Zinc, caesium and cobalt distribution in tissues of hens

Tissue	Zn—65		Cs—134		Co—60	
	imp/500″	error %	imp/500″	error %	imp/500″	error %
Stomachs	23735	0.6	1938	9.0	1055	2.1
Livers	21100	0.63	695	24.5	2415	1.8
Thigh muscles	21565	0.61	1450	11.5	185	2.5
Pectoral muscles	4075	0.95	1330	9.1	0	—
Necks	5590	0.95	440	26.5	0	—
Heads	2540	1.9	0	—	0	—
Wings	1895	1.1	440	25.2	0	—
Sternums	1845	1.05	0	—	0	—
Thigh bones	1415	1.07	120	8.9	0	—

In all the samples investigated zinc was present, but differently distributed in particular tissues — from relatively high amounts in stomachs, livers and thigh muscles to insignificant ones in bones and scarcely muscled tissues. Oddly enough is its almost sixfold less content in pectoral muscles. This phenomenon could be perhaps explained with an intensified metabolism in thigh muscles, more active than other ones and requiring therefore higher amounts of enzymes, including those containing zinc atoms in their structure.

In accordance with the literature, among the tissues examined the highest physiological cesium accumulation has been found in muscles, particularly in those of stomach, as well as in sciatic and pectoral muscles. This observation confirms also the results of previous own experiments.

The caesium amounts in other tissues depended, as a rule, on their musculature. An exception constituted the liver, which despite a lack

of muscles, showed a rather high percentage of caesium, probably due to its specific function in organism.

Cobalt incorporated into B_{12} vitamin molecule is an index of distribution of the latter in tissues of the organism. In mammals it accumulates in inner organs, particularly in the liver, pancreas, suprarenal glands and bone marrow. In hens the similar highest cobalt accumulation was found in livers, at which its content was thrice higher than that of caesium; nevertheless it occurred also in rather high amounts in the stomach and in traces in thigh muscles.

In the remaining tissues cobalt, and thus the vitamin B_{12} amounts, were undetectable at application of the technique in question.

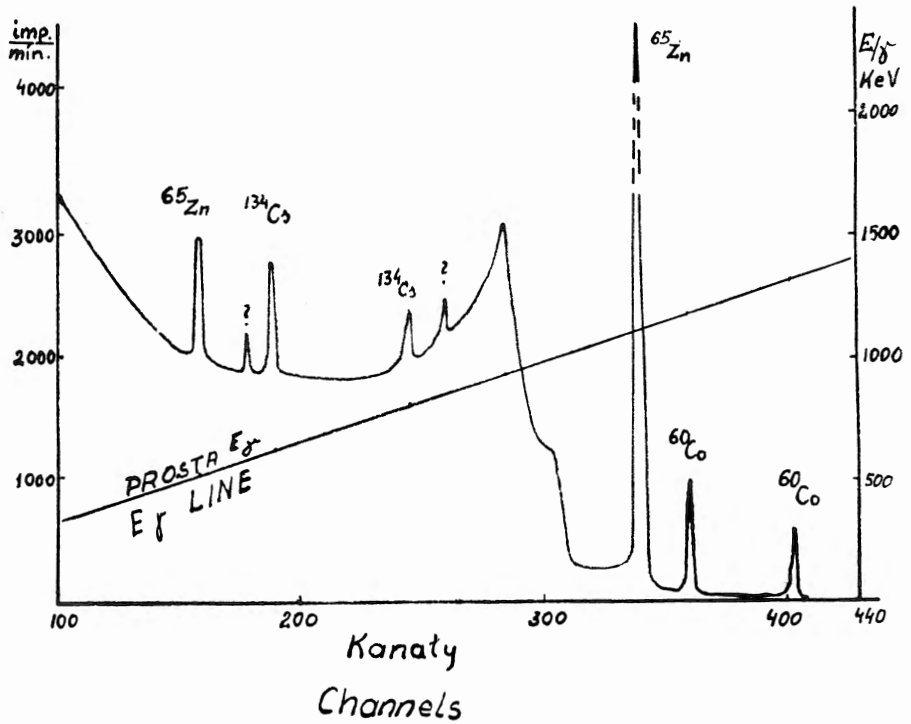

Fig. 1 Spectre of gamma radiation of a sample containing 100 mg of incinerated stomachs

In the light of the above investigations, an attention should be paid to the importance of the applied method of activating analysis. An extraordinary sensitiveness of this method predisposes it for application in the investigations on trace elements, particularly on their availability and distribution in the body of an animal as well as on quantitative differences between physiological and pathological states. It seems that this method could be successfully applied for investigating trace elements deficiencies in an environment or for determining their mutual

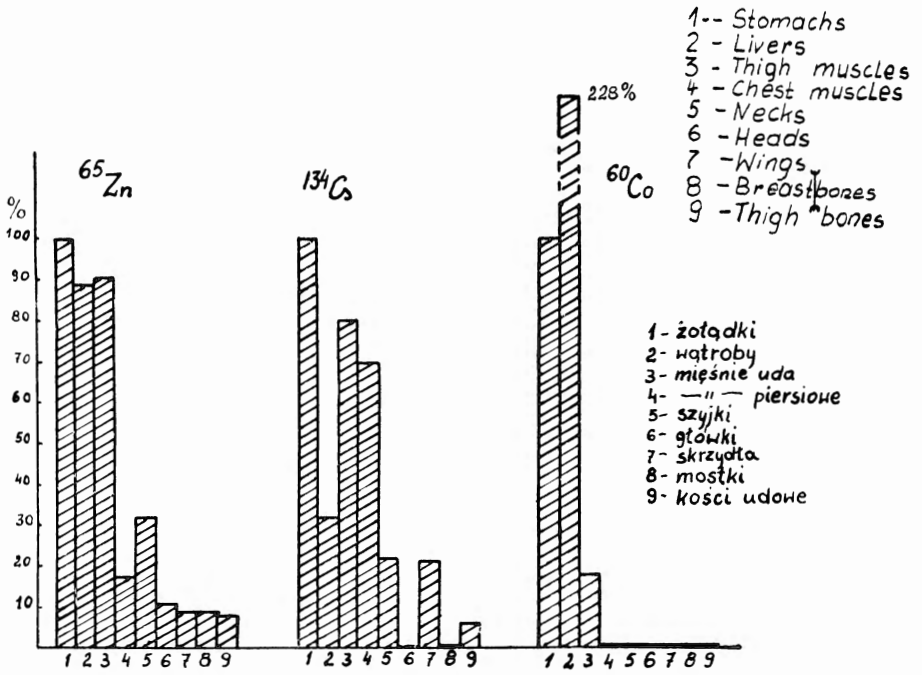

Fig. 2 Distribution of the detected elements in different tissues of hens

dependences in the system: water — soil — fodder — animal — man, under condition of having at disposal a neutron source on the spot, enabling investigation of the elemens with a short half-life, important from biological point of view.