# COEFFICIENTS OF DISTRIBUTION AND ACCUMULATION OF K,Rb,Cs AND $^{137}Cs$ IN THE INTENSIVE POULTRY BREEDING CYCLE

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ABSTRACT

The concentration of K,Rb,Cs and the activity level of Cs-137 in samples from the intensive poultry breeding cycle (feed,meat,eggs), under the condition of chronic alimentary contamination is presented. Concentrations of Cs and Rb were determined by non-destructive neutron activation analysis,concentration of K by atomic absorption flame photometry and activity of Cs-137 by gamma spectrometric analysis. On the basis of these results,coefficients of distribution and accumulation were calculated. The distribution coefficients of the analysed stable isotopes in meat have values close to 1,whereas for various parts of egg these coefficients vary between 0.5 and 1.5. Significant differences in Cs-137 distribution in various parts of egg were established. The values of accumulation coefficients indicate that all analysed elements selectively accumulate in the meat of young birds (broilers), and Cs-137 accumulates in the egg white as well.

## INTRODUCTION

Using the accumulation coefficients of microelements and radionucleides in the poultry and eggs,but depending on the category of poultry and kind of feed,it is possible to predict the concentration of microelements and activity of radionucleides in the meat and eggs. This prediction is achieved in a relatively fast way by measuring the microelements and activity of radionucleides in the feeds only. Besides other factors,the accuracy of this prediction depends mostly on the accuracy of measurements in the feeds. In addition,using the coefficients of distribution and accumulation, we learn about chemical and metabolic behavior of radionucleides and their isotopic and non-isotopic analogs within the organism. Having this in view, the purpose of our work was to determine the coefficients of distribution and accumulation of fission product Cs-137,its stable isotope and its two chemical analogs Rb and K in the meat and eggs of poultry in intensive breeding.

## METHODS AND RESULTS

The method of collection,preparation of samples and determination of content of stable elements (NNAA,AA) and activity of Cs-137 (gamma spectrometric analysis) are given in previous papers (Djurić

and Ajdačić,1980;Djurić,1979). Using the obtained concentrations of K,Rb,Cs i.e. activity of Cs-137 in poultry meat,eggs and feeds, given in Table 1, we evaluated the following:

a) Distribution coefficients (Cd), which are the concentration ratios of K,Rb or Cs /g $kg^{-1}$ f.s./, i.e. activity of Cs-137 /Bq $kg^{-1}$ f.s./, in particular kinds of meat of the same category of poultry or parts of eggs; in the other case this was the concentration ratio of these elements i.e. activity of Cs-137 in the same kinds of meat of various categories of poultry (Fig.1);

b) Accumulation coefficients (Ca), which are the concentration ratios of K,Rb,Cs /g $kg^{-1}$ f.s./ or activity of Cs-137 /Bq $kg^{-1}$ f.s./, in different kinds of meat or in the edible parts of eggs and in the feeds used in the breeding process, or in production of eggs (Fig.2).

## DISCUSSION AND CONCLUSIONS

On the basis of our results it follows that:

-the distribution of K is uniform for both kinds of meat at the broilers and at the laying hens, as it was expected;

-the distribution of Rb depends on the age of the birds and kind of meat: Rb is retained more in the white meat of the broilers than in the dark meat, whereas the hens the retention of Rb is stronger in the dark meat;

-the distribution of the stable Cs in the poultry meat is the same as the distribution of Rb; however, the retention of Cs in the white meat of broilers is more prominent with respect to Rb and to K. This is in agreement with the data in the literature on different metabolic behavior of these elements (Comar and Bronnen,1962; Phipps,1976);

-the retention of Cs-137 in the white meat is slightly larger than in the dark meat in both categories of poultry;

-the retention of Cs-137 is largest in the eggwhite, contrary to the stable Cs which is least retained in the eggwhite, among all three chemical elements.

Selective accumulation of K,Rb,Cs and Cs-137 is confirmed also by the accumulation coefficient (Fig.2). The accumulation of the studied elements from the feeds is more prominent in both kinds of meat at the younger birds (broilers), in agreement with more intensive metabolic processes. In this way, e.g., the Cs-137 is being accumulated about 5-6 times more in the meat of the broilers than in the meat of the hens. Most accumulation of all studied elements is in the eggs.

However, it should be pointed out that the largest accumulation of Cs-137 from the feed we find in the eggwhite, whereas we find most concentration of the stable Cs in the eggyolk . This points out different chemical forms of the stable and of the radioactive Cs-137.

Our results show that the eggwhite can be used as an indicator for the level of radioactive cintamination of poultry by the radionucleide Cs-137 introduced in the alimentary way during the intensive breeding .

REFERENCES

Comar C., Bronnen (1962) : Mineral Metabolism; Academic Press, New York.

Djurić G.,Ajdačić N. (1980) :Journal of Radioanalytical Chemistry, Vol.59, No. 2, p.435-443.

Djurić Gordana (1979) : Doctoral Thesis; Faculty of Veterinary Medicine, University of Beograd.

Phipps D.A. (1976) : Metals and Metabolism; Clarendon Press,Oxford.

TABLE 1. THE CONCENTRATION OF K,Rb,Cs [$g \cdot kg^{-1}$ FS] AND THE LEVEL OF ACTIVITY OF $^{137}Cs$ [$Bq \cdot kg^{-1}$ FS] IN FEED, MEAT AND EGGS

| CHEMICAL ELEMENTS | OATS | FEED MIXTURE | | | | POULTRY MEAT | | | | EGGS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | S | FMB | FMH | F | DB | WB | DH | WH | WHITE | YOLK |
| K | 7,92 ±0,49 | 9,38 ±0,17 | 7,99 ±0,63 | 10,61 ±0,46 | 7,87 ±0,48 | 2,89 ±0,17 | 3,23 ±0,15 | 2,77 ±0,16 | 3,03 ±0,14 | 1,41 ±0,08 | 0,91 ±0,06 |
| Rb $\times 10^{-3}$ | 7,4 ±0,9 | 7,5 ±0,9 | 9,1 ±0,8 | 10,4 ±0,7 | 7,6 ±0,9 | 4,3 ±0,6 | 5,7 ±0,7 | 5,1 ±0,8 | 4,5 ±0,6 | 1,0 ±0,2 | 0,98 ±0,15 |
| Cs $\times 10^{-6}$ | 24 ±4 | 90 ±8 | 55 ±9 | 53 ±8 | 110 ±10 | 10 ±2 | 16 ±3 | 13 ±2 | 12 ±2 | 7 ±1 | 13 ±2 |
| $^{137}Cs$ | 1,5 ±0,2 | 2,4 ±0,2 | 1,8 ±0,2 | 2,3 ±0,2 | 2,3 ±0,2 | 0,3 ±0,03 | 0,4 ±0,02 | 0,2 ±0,04 | 0,3 ±0,03 | 0,37 ±0,04 | 0,15 ±0,05 |

S - COMMERCIAL FEED MIXTURE „STARTER"
FMB - " " " " FOR BROILERS
FMH - " " " " LAYINGHENS
F - " " " „FINISHER"

DB - DARK MEAT OF BROILERS
WB - WHITE " " "
DH - DARK MEAT OF LAYINGHENS
WH - WHITE " " "

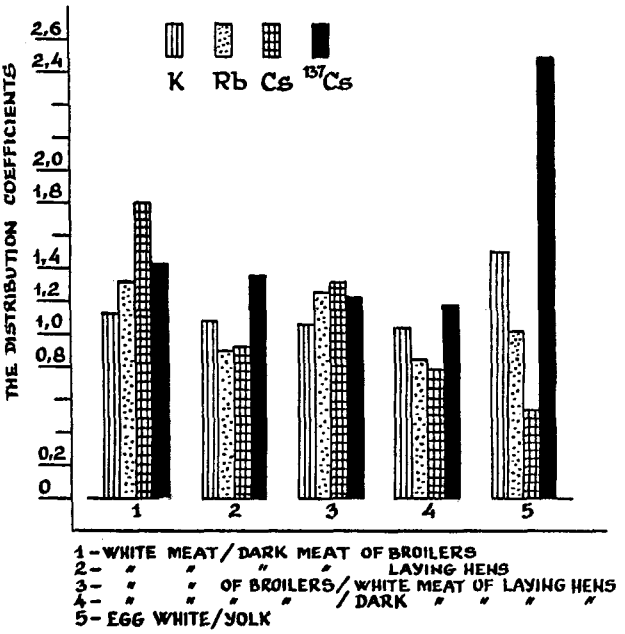


FIG.1 THE DISTRIBUTION COEFFICIENTS OF K,Rb,Cs AND $^{137}Cs$ SAMPLES FOR POULTRY MEAT AND EGGS

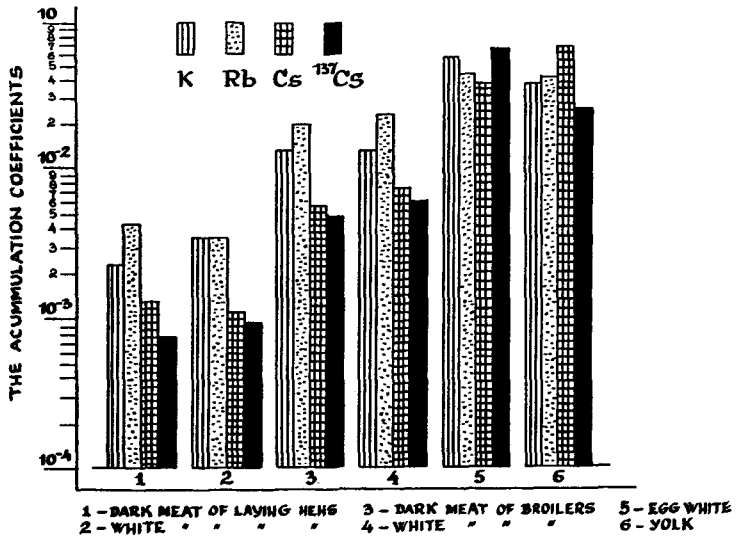


FIG.2 THE ACCUMULATION COEFFICIENTS OF K,Rb,Cs AND $^{137}Cs$ FOR POULTRY MEAT AND EGGS