

Cs¹³⁷ TRANSFER FROM MOTHER TO EMBRYOS, IN THE FIRST THREE YEARS AFTER THE CHERNOBYL ACCIDENT

Maria Toader¹, Radu A. Vasilache¹, Mirela L. Toader², Monica I. Vasilache³

¹Institute of Hygiene and Public Health, 1-3 Dr. Leonte St., R-76256 Bucharest, Romania

²Inspectorate of Sanitary Police and Preventive Medicine, Bucharest, Romania

³Technical Division, Rosu Water Mill, Bucharest - Rosu, Romania

INTRODUCTION

The kinetics of the transfer of radionuclides from mother to embryo is still a matter to be solved. After the Chernobyl accident, we had the possibility to study the transfer of Cs¹³⁷ from mother to embryo, in the case of a continuous and variable Cs¹³⁷ intake of the mother. The study was carried on for a period of three years after the accident. Our group performed also measurements of transfer from mother to embryo, in the case of a continuous, prolonged, but rather constant intake. The results of this study will be presented in future papers.

MATERIALS AND METHOD

During April 1986 - September 1989 we have determined Cs¹³⁷ content in 96 human embryos, aged between 5 and 11 weeks at the moment of prelevation, as well as Cs¹³⁷ dietary intake and urinary excretion of the mother, while they were in hospital for the abortion. All the subject mothers were living in Bucharest, and were aged between 17 and 44 years.

In order to do this, embryos of different ages were prelevated from the hospitals, as well as dietary intake and urine samples from their mothers, within the entire period of study.

The Cs¹³⁷ content of the embryos and of the dietary and biological samples was performed by radiochemical separation [1], followed by beta counting with a low-level, high-efficiency counter.

RESULTS AND DISCUSSION

Within the period of study, the average Cs¹³⁷ content in embryos increased from 97.3 mBq/g tissue in 1986, to 137.9 mBq/g tissue in 1987, then it decreased to 10.3 mBq/g tissue in 1988. In 1989, the content in embryos was very small; in many cases, it was below the minimum detectable activity (MDA). Those variations are presented in Fig. 1, where the peak Cs¹³⁷ content in embryos can be observed, in March 1987.

Since April 1986 until December 1986, 44 embryos of different ages were prelevated monthly, as well as dietary intake and urine samples from their mothers, and we measured the Cs¹³⁷ content. Among the 44 embryos studied, 16 were 7 weeks old, 11 were 6 weeks old, and the other covered the other ages from 5 to 11 weeks.

Table 1: Cs¹³⁷ content in embryos, with respect to the average value

Cs ¹³⁷ content in embryos (mBq/g tissue)	Age of the embryos (in weeks)					
	6	7	8	9	10	11
> 97.3	45.45%	56.25%	60%	-	66.66%	100%
< 97.3	54.55%	43.75%	40%	100%	33%	-

The average value of the Cs^{137} content in the embryos analysed in 1986 was 97.3 mBq/g tissue (for all the ages). Considering this value as reference value for that period, we have separated the Cs^{137} content in embryos in two groups: "high Cs^{137} content", when it exceeds the average value, and "low Cs^{137} content" when it is lower than the average. The percentage distribution of the Cs^{137} content in embryos, considering this reference value and the age of the embryos, is presented in Table 1.

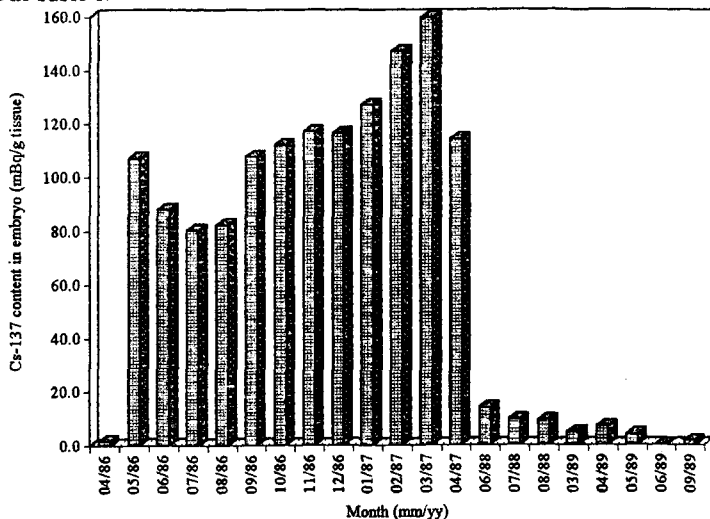


Fig. 1: Average Cs^{137} content in embryos

It appears that, the older are the embryos, the higher the number of cases with increased Cs^{137} content (with one exception: 9 weeks embryos). This indicates that Cs^{137} content tends to increase as the age of the embryo increases.

Cs^{137} intake of the mothers took values between 61.5 and 127.2 Bq/day, in 1986, with an average value of 90.16 Bq/day. The percentage distribution of embryos with Cs^{137} content higher than 97.3 mBq/g tissue, with respect to Cs^{137} intake of the mother, is as presented in Table 2. The table below seems to point out that there is a step value for the mother intake (103.5 Bq/day) above which the percentage of embryos with "high Cs^{137} content" is directly dependent of the quantity of Cs^{137} ingested by the mother no matter how old is the embryo.

Table 2: Cs^{137} content in embryos with respect to Cs^{137} of the mother

Cs^{137} content in embryos (mBq/g tissue)	Cs^{137} intake of the mother (Bq/day)							
	40.3	61.5	70.4	93.8	103.5	105.6	119.0	127.2
> 97.3	20%	75%	-	-	80%	66.6%	80%	85.7%
< 97.3	80%	25%	100%	100%	20%	33.4%	20%	14.3%

Cs^{137} content in embryos prelevated during January 1987 - April 1987 was the highest among all the considered periods.

The 16 embryos studied in 1987 had ages between 6 and 10 weeks, the number of embryos of a certain age being variable (from one embryo aged 10 weeks, to 6 embryos aged 7 weeks) imposed an overall discussion of the values for all the embryos. In 1987, the percentage distribution of embryos with Cs^{137} content higher than the annual average was the following:

Table 3: Cs¹³⁷ content in embryos, in 1987

Cs ¹³⁷ content in embryos (mBq/g tissue)	Age of the embryo (weeks)				
	6	7	8	9	10
> 137.9	25%	83.3%	50%	100%	100%
< 137.9	75%	16.7%	50%	-	-

It can be seen that, while only 25% of the 6 weeks embryos have Cs¹³⁷ content higher than the average, all the 9 weeks and 10 weeks embryos have higher Cs¹³⁷ content than the average. Cs¹³⁷ intake of the mothers during January 1987 - April 1987 ranged between 92.6 and 134 Bq/day. From the results obtained it seems that the content in embryos increases as the intake of the mother increases.

Cs¹³⁷ content of the 17 embryos studied in 1988 was lower than in the precedent years, and ranged between 6.7 and 15.8 mBq/g tissue, with an annual average of 10.3 mBq/g tissue. Performing the same analysis as before, we have obtained the following data for the percentage distributions of "high Cs¹³⁷ content" with respect to the age of embryos:

Table 4: Cs¹³⁷ content in embryos, in 1988

Cs ¹³⁷ content in embryos (mBq/g tissue)	Age of the embryo (weeks)					
	5	6	7	8	9	10
> 10.3	50%	50%	66.66%	66.66%	33.3%	100%
< 10.3	50%	50%	33.3%	33.3%	66.6%	-

In this case too, the Cs¹³⁷ content seems to be higher in older embryos than in younger embryos.

Cs¹³⁷ intake of the mother during January 1988 - August 1988 took values between 6.5 Bq/day and 11.5 Bq/day. In this case, the data were not sufficient to allow us to make any correlation between the mother intake and the content in embryo.

In 1989 Cs¹³⁷ content in embryos was extremely low, 32% of the embryos having Cs¹³⁷ content below MDA, and the average Cs¹³⁷ content in embryos was 3.35 mBq/g tissue (for all the embryos analysed), and 6.31 mBq/g tissue (for the embryos with Cs¹³⁷ content above MDA). Because of the low Cs¹³⁷ content in embryos, any attempt of correlating the Cs¹³⁷ content with the age of the embryos or with the intake of the mother is very difficult.

CONCLUSIONS

The data discussed above seem to point to two conclusions:

- Cs¹³⁷ content in embryos increases as the age of the embryo increases
- there is a step value for the Cs¹³⁷ intake of the mother, above which the content of the embryo increases with the intake of the mother

The present data did not allowed us to correlate the Cs¹³⁷ content of the embryo with the age of the mother.

REFERENCES

1. EML Procedures Manual, HASL-300, Radiochemical determination of Caesium-137, pp. E-Cs-01-01 - E-Cs-01-09, New York, 1972