ABSTRACT

A large number of individuals living along the banks of the Techa River (Southern Urals, Russia) were exposed from discharges of liquid radioactive wastes that occurred in 1949-1956 from the first Russian nuclear facility “Mayak.” A unique database of measurements of 90Sr in humans, compiled at the Urals Research Center for Radiation Medicine (URCRM), provides the opportunity to develop biokinetic models for pregnant and lactating women. This paper presents the results of selecting ICRP bisalonic models for calcium (Ca) and strontium (Sr) in pregnant and lactating women from the Studied population. The structure of the ICRP foetal model was modified to include fetal compartments for the period of pregnancy and to allow for changes in mineral metabolism. Parameters of the foetal model specific to the Techa River population were estimated using ICRP approaches which account for Ca content in maternal diet and in the blood and skeletal compartments of mother and foetus. For the period of lactation, the ICRP methodology was extended to consider a longer breastfeeding period in the rural Techa villages that includes exclusive and partial breastfeeding but did not account for changes in mineral metabolism. Parameters defining Ca transfer to breast milk have been re-calculated (Fig.5). The biokinetic models described here for foetal and breast milk transfer will be used to reconstruct body burdens in the studied population and to estimate intakes of activity by the suckling infant from maternal ingestion of Sr isotopes. Reliable dose estimates can only be obtained if credible assessments of radiation risk are to be made on the basis of content in maternal diet and in the blood and skeletal compartments of mother and foetus. The major data set for evaluation of model parameters included measurements of 90Sr-body burdens conducted at the URCRM since 1974 with the use of a specifically designed whole-body counter SCHEL (URCRM) (Kholodnov 1994). More than 50,000 measurements were made between 1974 and 1997 on over 18,000 people who lived in the Techa riverine villages. Fig. 2 compares URCRM data for females from the Techa River population with corresponding predictions obtained with TBM and ICRP models. Of the two models only the TBM is gender-dependent and its predictions are in good agreement with URCRM data (Fig.2).

CONCLUSIONS

The biokinetic models described here for foetal and breast milk transfer will be used to provide intakes of activity of 90Sr of infants and of Ca and Sr of the suckling infant from maternal ingestion of Sr isotopes at the Techa River. Reliable dose estimation is essential if credible assessments of radiation risk are to be made on the basis of epidemiological studies of the Techa River cohorts.

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