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10 October 1963

Iodine-131 Thyroid Dose from Milk in Italy during the Period September 1962 to February 1963

Abstract. *During the period September 1962 to February 1963, iodine-131 was measured in milk sampled in 14 Italian cities. At the end of the period the average intake was 9100 pc, corresponding to a thyroid dose of 0.31 rad; the maximum intake (at Bari) was 16,300 pc, corresponding to a thyroid dose of 0.56 rad.*

After the renewal of the nuclear tests in 1961 the Laboratory for Environmental Radioactivity carried on a program of monitoring the concentration of iodine-131 in milk. First results, referring to the period October to December 1961, have already been published (see *1*). In the following months no iodine-131 activity could be detected in milk up to the end of August 1962.

This report deals with the values measured from the end of August 1962 till the end of February 1963, when the concentration of iodine-131 in milk dropped again below the minimum detectable value (15 pc/lit.).

Cow's milk distributed to the population was sampled daily in Milan, Rome, Bari, and Catania, and weekly in Turin, Alessandria, Varese, Verona, Venice, Genoa, Florence, Ancona, Naples, and Palermo.

The samples were collected in the milk distribution centers of each city and are representative of the whole production of these centers. Each sample was measured in our laboratory. Such whole production has been called "measured" amount of milk. For each milkshed a surrounding area has been defined, taking into account orographical, meteorological, and agricultural features, so that the milk sample could be considered to be representative for the defined area. The production of milk in such an area has been called "surveyed" amount.

With reference to the Italian production of milk for direct consumption as liquid milk, the "measured" amount was nearly 15 percent and the "surveyed" amount ranged between 65 to 70 percent (*2*).

Measurements were carried on with gamma-ray spectrometers (*1*). In order to calculate the average intake of iodine-131 in Italy, we obtained an average of iodine-131 concentration in milk, weighted for the local consumption (Fig. 1).

In Fig. 1 the results for Milan and Bari are also recorded. The difference between the two patterns (representative of the situations in northern and southern Italy, respectively) is due both to the difference in cow's diet and meteorological conditions.

The integral intakes were calculated under the assumption of an ingestion of 1 liter/day (this figure is taken as an upper limit to the possible ingestion). In Fig. 2 the integral intakes for the weighted Italian average and Bari (where highest values were reached) are recorded.

Table 1. Iodine-131 intake from milk and delivered dose to the thyroid, in Italian cities.

City	Total intake (pc)	Thyroid dose (mrad)
Milan	6,800	230
Venice	9,500	320
Genoa	8,800	300
Florence	7,600	260
Ancona	8,700	300
Rome	9,900	340
Naples	11,300	390
Bari	16,300	560
Catania	7,900	270

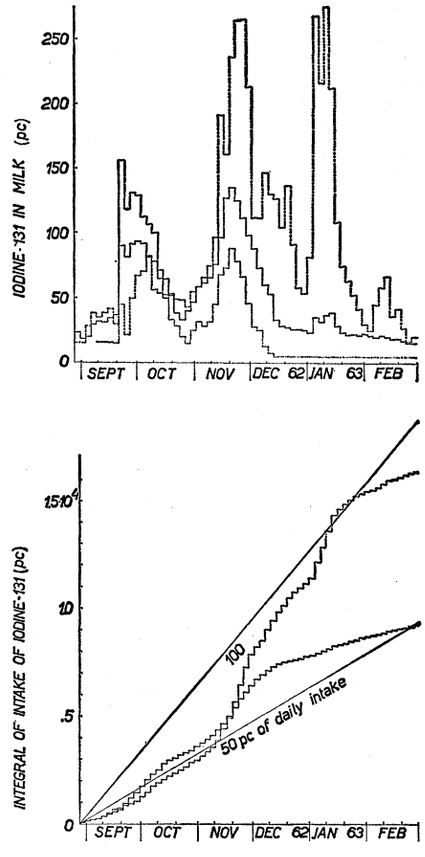

Fig. 1 (top). Concentration of iodine-131 in milk distributed by the milk distribution center of Milan (dotted line) and Bari (dashed line). The Italian weighted-average concentration is recorded by a solid line. The histograms concerning the period after 23 December for Milan and the Italian average must be regarded as representing an upper limit to the possible concentration. Fig. 2 (bottom). Graph of the integral of the intake of iodine-131 (by persons fed 1 liter of milk a day). Italian weighted average, solid line; Bari, dotted line.

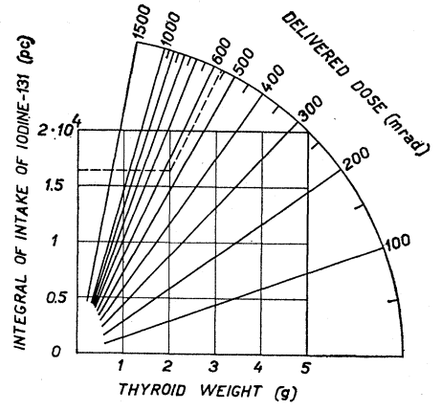

Fig. 3. Graph for calculating the dose delivered to the thyroid. The dashed line refers to the dose delivered to the babies of Bari, according to the assumptions previously reported.

The dose delivered to the thyroids of babies under 1 year old was evaluated according to the following equation derived from Eq. 17, p. 867 of reference *3*, where $\bar{E}_\beta$ has been substituted by $\bar{E}_{eff}$; this takes into account the contribution of both beta and gamma radiations:

$$D_{(\infty)} = (73.8 \cdot \bar{E}_{eff} \cdot A \cdot U \cdot T_{eff})/M$$

where $D_{(\infty)}$ = total absorbed dose to the thyroid for complete removal of I^{131}; $\bar{E}_{eff}$ = effective energy per disintegration, 0.230 Mev (*4–6*); A = total intake in microcuries; U = uptake in gland as a fraction of A, 50 percent (*5*); T_{eff} = effective half life of I^{131} in the gland, assumed to be equal to physical half life, 8.05 days (*5*); and M = mass of the gland in grams.

Because of the uncertainty about the mass of babies' thyroids (*5, 7–9*) a graph for calculating the delivered dose as a function of both the amount of iodine-131 ingested and the thyroid's weight, is included (Fig. 3). However, according to Italian literature (*8*) a value of a thyroid mass of 2 g seems to be acceptable.

In Table 1 the doses calculated under this assumption are recorded for some cities where the data collected were sufficient to ensure statistical reliability (*10*).

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Mice Reared with Rats: Modification of Behavior by Early Experience with Another Species

Abstract. *Mice in group 1 (controls) spent all their lives with other mice. Mice in group 2 had experience only with male and female rats after weaning; group 3 mice had no experience with peers—each litter was reduced to one pup, which was reared in isolation after weaning; group 4 mice were fostered to a lactating rat mother at approximately 3 days of age and thereafter lived only with rats. In adulthood group 4 mice were the least active and group 3 the most; mice in groups 2 and 4 preferred to spend time in a chamber adjacent to a rat, those from groups 1 and 3 in a chamber containing another mouse; when mice were paired off within experimental groups and given the opportunity to fight each other, the percentage of pairs in which fights occurred for groups 1, 2, 3, and 4 were, respectively, 44, 27, 100, and 0.*

Prior research has shown that the behavior of the mother rat toward her young between birth and weaning significantly modifies the offspring's subsequent emotional behavior and body weight (*1*). Other experiments have shown that postweaning social interactions with other organisms of the same species affect subsequent behavior (*2*). These are instances of intraspecies social interactions. One logical extension of these studies is to investigate interspecies social interactions in which the species involved are similar enough to be able to live together and interact with each other, yet are different enough in their behavioral patterns ("culture") so that one species can be influenced by the other. Such an experiment would help determine the degree of generality of the findings concerning the effects of early social interactions. This report presents the results of such an interspecies experiment with the rat and mouse, in which it is shown that the behavior pattern of mice reared with rats is markedly different from the behavior of mice reared with siblings or in isolation (*3*).

For group 1 (controls), approximately a week before expected parturition, female mice of the C57BL/10 strain were placed singly in metal maternity cages (22.5 by 22.5 by 37.5 cm) that had solid floors covered with shavings. The second day after a litter was born, it was reduced to four males and two females. The litter was weaned at 21 days and placed in stainless-steel cages (19 by 20.5 by 27.5 cm), two males and one female to a cage.

For group 2, the procedure before weaning was identical to that of group 1. When weaned at 21 days, the male mice were placed, singly, in steel cages each of which contained a male and a female Purdue-Wistar rat that had just been weaned. In this group, therefore, experiences before weaning were with the mouse mother and peers and after weaning were solely with rat peers.

For group 3, approximately 3 days after the birth of a mouse litter (range, 3 to 4 days) the litter was reduced to one male pup. These pups were weaned at 21 days and placed singly in steel cages. The social experiences of each animal in this group were thus limited to interactions with its mother between birth and weaning.

For group 4, when mice were approximately 3 days of age (range, 2 to 5 days), two males from the same litter were fostered to a Purdue-Wistar rat that had given birth to her own litter at the same time or after the mouse litter was born. The rat litter was reduced to two male and two female pups. The same metal maternity cages were used as for the mouse litters. In the event that both fostered pups in any one litter died, and if there were still available male mice from the same litter 5 days of age or younger, one or two more male mice were fostered to that rat mother.

In five litters both mice lived through weaning; (one of the ten died before testing); in 25 other litters one mouse lived. (In the subsequent tests these two subgroups did not differ in any of the behavioral variables and were combined in the analysis.) In most cases litters were weaned when they were 21 days old. In a few instances, where the mice were older than the rats, it was necessary to postpone weaning a litter until the rat pups were 20 days of age. At weaning a male mouse and a male and female rat were placed together in a steel cage. The social experiences of most of these mice, then, were with rat mothers and rat peers until weaning and entirely with rat peers after weaning.

The mice remained in their respective