INVESTIGATION OF THE FACTORS DISGUISING RADIATION EFFECTS ON THE HUMAN BODY

Inna B. Korzeneva and Tatyana V. Styazhkina,
Russian Federal Nuclear Centre - All-Russian Scientific Research Institute of Experimental Physics, Russia

Yuri E. Dubrova, Tatyana V. Malinina, Valentina D. Prokhorovskaya, Olga N. Kholod,
Institute of General Genetics, Russian Academy of Science, Russia

ABSTRACT

Herein we have studied the effects of some hereditary and environmental factors on children's states of health. The factors under investigation, along with radiation, also impact the immunological status and human adaptivity, thus disguising hazardous radiation effects. The state-of-health criterion we have chosen are children's liability to a wide range of intrinsic diseases through the first three years of life. The analysis involved 626 children (326 male and 300 female) who's parents and grandparents lived in the vicinity of the Russian Federal Nuclear Centre (RFNC), a large-scale nuclear facility. Our results should preferably be taken into consideration when projecting radiation effects on the human body.

INTRODUCTION

Technical breakthroughs have resulted in increased environmental hazards to human health. The frequency and probability of ecological accidents have dramatically increased. Of greatest concern are those which are followed by an increase in genetically harmful factors, primarily radiation. Thus, investigating how these factors impact the descendants of people who have been exposed to radiation is of considerable interest.

The effects of radiation on children's organisms however, may be hidden by other hereditary and environmental factors which also depress the immunologic state and adaptivity. That is why the effects of these factors could also be considered to be from radiation. The above effects should be characterized so that the radiation-effect component can be outlined. This is essential in order to predict the state of health of residents near a nuclear site, or survivors of accidents involving radiation exposure.

This paper aims to study a number of hereditary and environmental factors affecting children's liability to a wide range of intrinsic diseases through the first three years of life.

FACTORS DISGUISING RADIATION EFFECTS

Previous investigations have revealed a substantial number of hereditary and environmental factors that effect the human state of health.

It is known that the probability of birth defects, malformations and genetically determined diseases (Down's Syndrome) increase with the maturity of the mother. In residential sites where radiation hazards exist, these effects could easily be taken to be terratogenous radiation effects.

Pediatric literature reads that suckling duration is proven to affect the morbidity of children in their first year of life (Mazurin, 1985). A suckling period of less than five months increases morbidity.

The next factor, the after-effects of which are similar to those of constant low-dose radiation, is previously recorded spontaneous abortions. If a mother in pre-pregnancy period suffered habitual miscarriages, it could be due to the presence of an unusual gene combination. There are presently 204 different gene

combinations, well known from biochemical gene markers (proteins) and by immunologicones (blood groups) (Dubrova et. al., 1986,1987; Ikramov et. al., 1986; Kucher et. al., 1987). Evidently, these gene combinations result in reproductive system malfunctions and, even in the case of a successful pregnancy, the baby that is born can possess depressed viability (Lerner, 1954). This could also be erroneously attributed to radiation.

Another disguising factor is low gestation age. The negative effect of prematurity on a child's state of health (first year morbidity) is a stated fact (Studenikin, 1988). Along with prematurity of major vital functions, such children possess, as a rule, poor height to weight indices and are the first to undergo sepsis, icterus of the new-born, anemia, and posthypoxic encephalopathy (Botwiniev et. al., 1980).

Chronic diseases of the mother and pregnancy pathologies also negatively effect a child's state of health. This is due to the fact that both the mother's organism, that is her state of health and feeding mode throughout the pregnancy period, and the "mother-child" interaction system substantially effect the changeability of anthropometric features of a child at the moment of birth (Penrose, 1954; Susanne, 1984; Mueller, 1984). At the same time, children having different anthropometric features at birth, possess different liabilities during the first year of life (Altukhov et. al., 1981; Altukhov, Kurbatova, 1990; Botviniev et. al., 1980). Consequently, a child's state of health is partially determined by residual effects of the mother's organisms, the so-called "maternity effect".

Several social aspects, such as the number of children per family and the age of entering a pre-school establishment, also impact morbidity to the following extent. The risk of infection of each baby increases with the number of children in the family. The earlier the baby enters kindergarten, the higher his morbidity compared with that of senior children. That is why, while answering the question whether the child's morbidity was radiation-induced, one needs to first determine the number of children per family, and the age entering kindergarten, for each case.

Among purely genetic factors we should underline heterozygosity (the degree of gene variability) of children and the level of outbreeding (the matrimonial distance in couples). Several papers have revealed that the majority of inborn malformations and greater morbidity were recorded for those babies with a decreased level of heterozygosity (gene variation) (Botviniev, 1980; Altukhov et. al., 1981). The viability of infants is also negatively impacted by outbreeding —couples of different nationalities, or residents of distant places. Bresler, for instance, (Bresler, 1982) points to an increase in reproduction losses (miscarriages, still-births) together with the growth in matrimonial distance between the parents. Growth of morbidity among descendants of distant marriages have been convincingly demonstrated in several reports (Kobyliansky, Livscits, 1989; Dubrova, Korzeneva,1997). It is especially important to distinguish between the consequences of outbreeding and low dose effects of radiation while studying the state of health of residents inhabiting nuclear industry sites. As soon as the population is formed, there is a spontaneous neglect of religious or national aspects, so the outbreeding level is rather high.

?As soon as all of the enlisted factors, similarly with radiation, depress immunologic state and human adaptivity, which results in morbidity growth, studies aiming at revealing radiation effects on human sanity should evaluate how the above genetic and environmental factors count on it.?

OVERVIEWED FACTORS

We have overviewed the effects of the following factors:

- 18 characteristics of the mothers (age, suckling period, number of previous pregnancies, number of spontaneous abortions, sex of the child, prematurity of the child, present pregnancy pathologies, chronic diseases of the mother by seven organ systems).
- genetic factors (heterozygosis of the children – the number of heterozygous loci in each child – in 8 polymorphic gene loci, coding erytrocyte enzymes and blood serum proteins synthesis, such as 6-

phosphogluconate dehidrogenase (6-PGD), glyoxalasa (GLO), esterase D (ESD), asid phosphotase (ACP), phosphoglucomutase (PGM), group specific component (GC), haptoglobine (HP) and transferrine (TF).
- outcrossing degree of the parents.
- social factors (number of children per family, educational level of parents, age of entrance to kindergarten).

MATERIALS AND METHODS.

We have analyzed the cases of 626 children (326 male, 300 female) who's parents and grandparents permanently lived at the vicinity of a RFNC a large-scale nuclear site.

We took venous blood samples for genetic typing which was done by the standard method of blood protein electrophoresis in polyacrilamide and starch gels (Harris, Hopkinson, 1976).

RESULTS

Resulting from our studies we have discovered:

- Mother's characteristics: the presence of nephro-urologic diseases substantially increases the probability of influenza during the first year of life and allergic reactions during the second and third years. This could be due to a number of reasons, which are to be determined by special investigations that account for genesis of specified diseases.
- Social factors: children from families having two or more children are consistently more liable to infections.
- Genetic factors: heterozygosis of the considered gene loci combination doesn't generally influence the morbidity of children during the first three years of life. However feeble, statistically-significant effects are revealed for two loci: ACP (correlation with acute respiratory diseases and intestinal infections) and ESD (correlation with otitis and infectious diseases) during two time intervals (the first year and the second-third years); and for one locus PGM1 (correlation with anaemia and mouth infections) during the first year. As a whole, during the second-third years of life, heterozygous children are more seldom ill, while the situation is opposite during the first year of life. The reason for the absence of marked effects can lie in the fact that, in the considered group of children, associations between individual genotype and diseases can exist, but corresponding conditions for their whole realization haven't yet formed due to the absence of serious unfavourable environments.
- Genetic factors: child morbidity increases linearly with the level of outbreeding. It is important that the liability of a child to diseases does not depend on the level of genetic differences between the parents, but on the combination of several nationalities in a child's genotype.
- Genetic factors: outbreeding effects a child's morbidity without the impact of social characteristics of the families under investigation such as level of education and the age of child's entry into kindergarten.

POSSIBLE APPLICATION

The acquired results should be accounted for when planning investigations aimed at studying radiation effects on human health. Above all they could be of significant social importance as they could dispel exaggerated rumours about environmental hazards from nuclear industry sites, as well as assist in forming conscious attitudes of the population toward radiation hazards and establish a smooth psychological climate amidst those employed by the nuclear industry and research branch.

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