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THE ROLE OF IODINE IN NORMAL BREAST DEVELOPMENT IN YOUNG MAMMALS

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ABSTRACT. Iodine deficiency is an important health problem. Its role in breast pathology and treatment of breast disease has been well studied, but little is known about its role in the development of the breast in young mammals. We conducted a study on 3 weeks old female mice, having an iodine intake of 25% of the necessary, this privation of iodine was created using a special feeding formula and adding sodium perchlorate to the drinking water. After 4 weeks the breast tissues of this group was compared to the control group. The iodine privation prevented normal maturation of breast tissue in the studied lot. Iodine seems to play an important role in breast development in young female mammals.

KEYWORDS: iodine deficiency, breast development, perchlorate

INTRODUCTION

Lack of iodine still is an important health problem nowadays. Its main causes are lack of intake due to low environmental existence and the occurrence of substances that have an anti iodine effect. For the past years the role of iodine in the development of breast diseases has been studied, low levels of iodine contributing to the apparition of breast tumors, including cancer. Its potential in treating breast cancer has been proved.(O. Soriano et al., 2011) Although the contribution of iodine to breast health is certain, little data is known about its role in breast development. The effect of iodine depravation on the development of the brain and the general growth of infants and children has been wildly studied, but no reference has been found about its effects on breast maturation (Delange F. et al., 2000; Hynes K.L et al., 2013; DeLong GR et al., 1997). It is hypothesized that dietary iodine deficiency is associated with the development of mammary pathology and cancer. Mammary gland is embryo genetically derived from primitive iodide-concentrating ectoderm, and alveolar and ductal cells of breast specialize in uptake and secretion of iodine in milk in order to supply the offsprings with this trace-element. Breast and thyroid share an important iodide-concentrating ability and an efficient peroxidase activity, which transfers electrons from iodide to the oxygen of hydrogen peroxide, forming iodoproteins and iodolipids, and so protects the cells from peroxidative damage. (Venturi S et al., 2001) The mammary gland has only a temporary ability to concentrate iodides, almost exclusively during pregnancy and lactation, which are considered protective conditions against breast cancer. . (Venturi S et al., 2001)

MATERIALS AND METHODS

The aim of our study was to observe the effect of low iodine intake on the development of breast tissue in young mammals.

We conducted an experiment on 17 Swiss-NMRI female virgin mice, 3 weeks of age. For 4 weeks 15 mice were fed a very low iodine diet (study group) and 2 mice got normal diet (control group).

The very low iodine diet was made by combining the special feeding formula with a drinking solution of sodium perchlorate (400mg/100ml). The feeding formula (Table 1) was prepared using as a start point Dr Astwood's nr. 30 diet (Strum J et al., 1979). This diet provides 50% (100 µg iodine /kg) of necessary iodine for mice. The sodium perchlorate used additionally reduced

the iodine intake by 50%.By this method the mice received 25% of their recommended iodine intake.

The experiment was done respecting the European rights of laboratory animals. After 4 weeks the prelevation of the mammary glands was done in general anesthesia.

The mammary glands were analyzed in the Department Of Pathology, Faculty of Medicine, Timisoara.

Ingredient	**Quantity (for 1 kg)**
Wheat gluten flour	299,68g
Casein	100g
Corn oil	80g
Wheat flour	100g
Sucrose	370g
Mineral mix (1kg contains: 150g K_2HPO_4, 50g $MgSO_4$, 499,75g NaCl, 1g $FeSO_4$, 0,05g $CuSO_4$, 0,05g $MnSO_4$)	50g
Vitamin mix Vitfoss 8074	0,32g

Table 1 Low iodine feeding formula

RESULTS AND DISCUSSION

During the experiment we observed that all mice from the study lot presented skin lesions (eritematous, dry skin patches), the fur became gray and matte, with areas of alopecia. (Fig.1)The mice from the control group presented white, shiny, thick fur (Delange F. et al., 2000). These lesions can be compared to the skin lesions classically described in humans suffering from hypothyroidism.

Fig.1 Study group- areas of alopecia, eritematous skin

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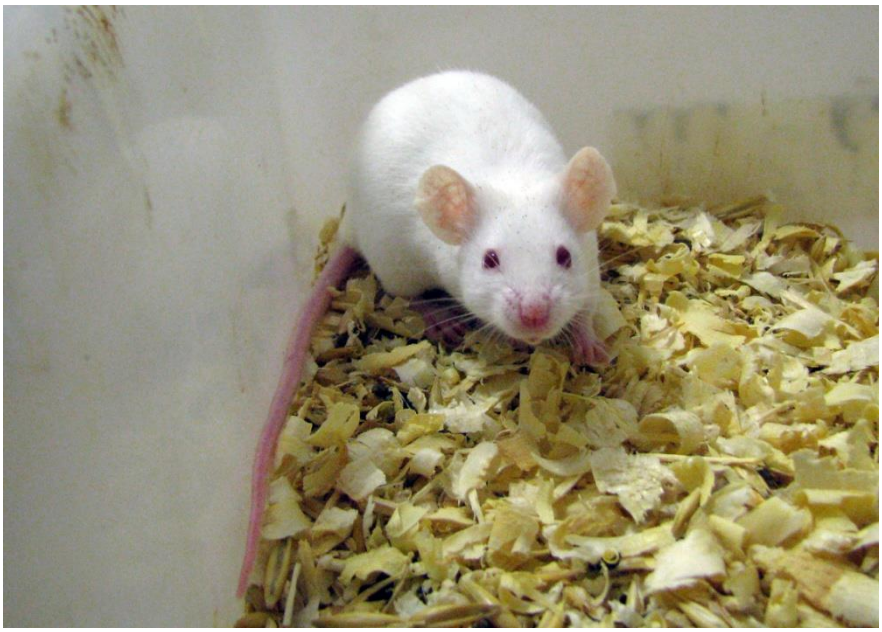

Fig.2 Control group – normal aspect of skin an fur

The young female mice, which received diet providing 25% of their iodine needs, had hypoplasia lesions in their mammary glands, all mice in the lot (rare glandular structures, rare ductal structures).(Fig.3,Fig.4) The mice in the control group presented normal developed breast tissues(Fig.5).

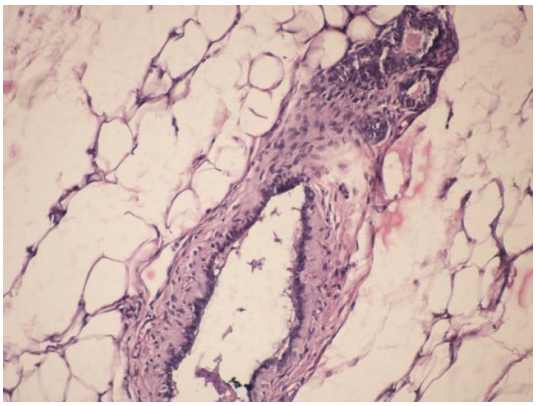

Fig.3 Rare glandular tissue, fatty stroma

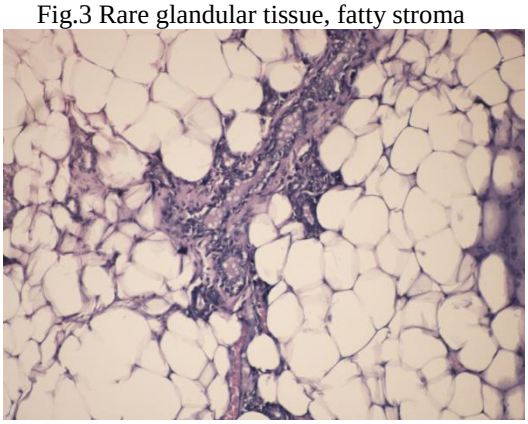

Fig. 4 Rare glandular structures, rare ductal structures, fatty stroma

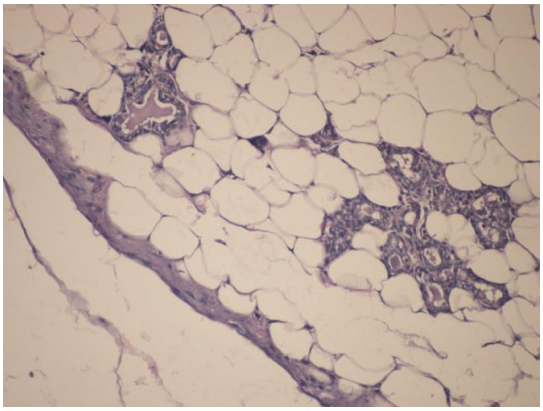

Fig.5 Normal breast tissue in control group

The lack of iodine produced a poor development of mammary tissues in young female mice. Because of lack of data in literature we cannot compare our results to other studies.

Iodine is compulsory for all living cells, both vegetal and animal, but only vertebrates possess a thyroid. In humans the total amount of iodine in the body is about 30–50 mg; less than 30% is present in the thyroid gland and its hormones. (Aceves C et al., 2005) About 60–80% of the total iodine is non-hormonal and is concentrated in extrathyroidal tissues, but its biological role is still unknown (Venturi S et al., 2001). Some groups have postulated that iodide may have an ancestral antioxidant function in all iodide-concentrating cells, from primitive algae to more recent vertebrates (Cann SA et al., 2000; Smyth PP et al., 2003; Cocchi M et al., 2000)

In one of our previous studies we observed a high incidence of thyroid pathology (32%) in

female patients with breast pathology suggesting the existence of a direct or indirect correlation between the two of them, probably iodine playing an important role. (Avram M et al., 2009)

Nowadays there are many regions in which the intake of iodine is not sufficient due to environmental lack of iodine. There also occur substances that impair the absorption of iodine. The sodium perchlorate, responsible for inhibiting gastric absorption of iodine, we used in this experiment might occur naturally in arid areas or in water, but its main source in the environment in artificial. (Wolff J. et al., 1998; Greer MA et al., 2002) It is used in airbags, pretensioned seatbelts, monitoring pressure systems in tires, batteries, etc. It is the key ingredient in rocket fuel. The biggest contamination with perchlorate determined until now is in California. This perchlorate comes from the battle rockets tested in the military units of this state. In that region the values of perchlorate in water are 7.5 times higher than normal (Baier-Anderson C et al., 2006).

Taking the above data into consideration we believe that the conditions artificially produced for the mice in the study group can occur for people living in certain environments too(low iodine dietary intake and environmental presence of substances blocking iodine absorption, so breast development in girls from certain regions might be negatively influenced.

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CONCLUSIONS

In our study lot we emphasized the fact that lack of iodine intake in young mammals prevents normal development of breast tissues. Further data on bigger study lots is needed, as well as studies on breast maturation in young girls from iodine deprived environments.

AUTHOR CONTRIBUTION

All authors have contributed equally to the present work.

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