Radiation sterilised diets

A submission to an inquiry

An Australian Government inquiry into food irradiation held from 1987 to 1989 received the following submission from the Walter and Eliza Hall Institute of Medical Research:

'Laboratory mice at the Institute have been bred exclusively on food sterilised by gamma irradiation since 1969. No teratogenic or oncological effects have been observed which could be attributed to the gamma irradiation treatment. We cannot comment on possible effects on normal life span of these mice.'

Teratogenic concerns malformations and monstrosities of fetuses. "Oncological" refers to tumours.

The clear suggestion of this submission is that irradiated food is harmless. But closer scrutiny shows how this food has been supplemented with massive doses of nutrients.

Closer scrutiny

The aim was to work with germ free mice for scientific research. To this effect their diet was gamma irradiated with 50 kGy. Then the food was used at times ranging from one day to one month after irradiation. The breeding mice were kept for as long as they were reproducing rapidly and then killed. On average this was after 9 to 12 months as compared to a normal lifespan of 2 to 2½ years.

Vitamin E

The diet that was used was a commercial diet which was especially adapted to the circum-stances. Normally wheat is one of the major suppliers of vitamin E in the diet. On average, ground wheat contains 11 mg of vitamin E per kg (1). This adapted Barastoc mouse breeder ration on the other hand contained 130 mg per kg. This is more than 10 times the normal amount. Depending on the season it seems wheat could be replaced by rye, barley, oats or grain sorghum. In addition the diets contained also linseed meal, or peanut meal, or rapeseed meal, or safflower meal, or soybean meal. So, no shortage of vitamin E here.

Selenium

A very powerful antioxidant is selenium. Among the best natural sources are fish, muscle meat, and whole grains. We find this back in the Barastoc diet as meat and bone meal or bone and meat meal or fish meal. In addition the added salt contained 0.1 mg selenium per kg salt. Also, the synthetic antioxidant BHT was added to the diet.

Vitamin A

Vitamin A boosts the immune system and helps to prevent cancer (2). The Barastoc diet contained 18000 i.u. per kg.

General observations

In addition there was of course the interaction of all nutrients together.

Correspondence with the Walter and Eliza Hall Institute revealed that 'the original formulation (of the diet) was based on extensive testing in British laboratories in the 1960's.' Two staff members did the nutritional monitoring and kept tabs on signs for general ill-health or poor breeding performance. On at least one occasion the manufacturer had to vary the amounts of the natural ingredients.

In other words the diet was especially attuned to counter irradiation damage and to foster breeding performance. And as long as no suggestions are made that this mouse breeding program shows the harmlessness of irradiated food, things are above board.

Normal diets

On the other hand an Indian research from 1976 found that in mice fed for three months wheat irradiated with 0.75 kGy a significant reduction in the numbers of spermatogonia A and B and resting primary spermatocytes occurred (3).

Spermatogonia and spermatocytes are names for developmental stages of primitive male germ cells

This research had used a laboratory diet of which the mineral mixture was in accordance with the Association of Official Analytical Chemists and the vitamin mixture was in accordance with the National Academy of Sciences/ National Research Council (4).

Russian research from 1981 with rats fed for twenty months irradiated food found also a dramatic drop in spermatogonia and on many

occasions a complete absence of any formation of sperm cells. In addition they found that many
This Russian research used the ordinary animal house diet customary in the research institutes of the USSR. The total diet was irradiated either at the recommended dose, or at 1/10 of the recommended dose, or at 10 times this dose. In addition there was of course a control group of rats that received the same diet, but unirradiated. As a result of this experimental set up they found that there was direct dose dependence concerning the severity of the tissue damage and the irradiation dose of the consumed food (4)

In other words when normal animal house diets were used with normal supplementation, then irradiation of the total or part of it resulted in all kinds of adverse effects in the animals.

The art of supplementation

An additional observation is here of interest. Since the beneficial effects of vitamin E became wider known, farmers have started to give their farm animals vitamin E supplements. This has resulted in better quality products such as: reduced lipid peroxidation in meat and fat, milk fat and butter, improved tenderness of meat and improved sensory quality of meat (1).

Not surprisingly the manufacturers of diets for laboratory animals followed suit. This increased the fertility and litter size of the animals and resistance to infections and prevented nutritional diseases. But at the same time this novel approach defeated the purpose of laboratory animals. Laboratory animals are bred and raised for the purpose of being used in models of disease. To make them disease resistant defeats their purpose.

tissues in the testes were sclerotic (5).

Analyses of the National Institute of Health (Germany) found that on average the standard laboratory animal diet contained roughly 8 mg vitamin E per kg diet. This was routinely supplemented with 22 mg vitamin E to bring it to around 30 mg vitamin E per kg diet. However, nowadays commercial standard rodent diets contain often 60 mg/kg vitamin E.

Wrong baseline

Further research found that 60 mg vitamin E per kg standard animal diet gave maximal protection. It gave the same protection as diets containing 300 mg, 3000mg or 30000mg vitamin E per kg diet. So, if your control animals get already maximal protection, you could come to the conclusion that supplementation of vitamin E does not work, has no effect. This… while vitamin E supplementation has in reality a profound influence in raising resistance against diseases (1).

The increased content of vitamin E over the years and other antioxidants in standard laboratory diets, could be responsible for claims concerning the total absence of any protective effects from antioxidants or free radical scavengers in animal models for various diseases (1).

Conclusion

The Australian radiation sterilised diet, the partly or wholly irradiated normal animal house diets of the 1970s and 80s in India and Russia, and the excessively supplemented German animal house diet of the 1990s illustrate the power and importance of vitamin E and antioxidant supplementation in diets.

References

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