

REPORT OF THE SCIENTIFIC COMMITTEE FOR ANIMAL NUTRITION
ON THE EFFECTS OF NITRATES IN FEEDINGSTUFFS

Opinion expressed 19 April 1978

TERMS OF REFERENCE

The Scientific Committee for Animal Nutrition was requested to give an opinion on the following questions :

1. What are the normal contents of nitrates in milk, milk powder and powdered whey ?
2. What are the maximum intakes of nitrates acceptable for animal species, in particular, cattle ?
3. What are the levels of nitrates, nitrites and nitrosamines which could result in products of animal origin from absorption by animals of feedingstuffs containing normal and increased levels of nitrates ?
4. In the light of the answers to the abovementioned questions, should maximum contents be fixed for nitrates in
 - straight feedingstuffs and, in particular, milk powder and powdered whey ?
 - complete feedingstuffs and, in particular, milk feeds ?

BACKGROUND

As the presence of nitrates at dose-levels normally found in feedingstuffs was considered harmless to animals and, indirectly, to man, these products were not made subject to limitations in Council Directive 74/63/EEC of 17 December 1973 concerning the fixing of maximum permitted levels for undesirable substances and products in feedingstuffs (1).

In July and August 1976, one Member State, since it considered that nitrates were not free of health risks, took successively various measures intended to limit the nitrate content in whole milk, skimmed milk powder and powdered whey.

Since the decision must be taken at Community level whether these measures are justified or must be rescinded, the Commission deemed it necessary to ask the Scientific Committee for Animal Nutrition a series of questions, the answers of which it felt were essential to clarify the situation.

OPINION OF THE COMMITTEE

The Committee has examined the available information on nitrate toxicity and the presence of nitrates in animal feedingstuffs. It has observed numerous gaps in this documentation and felt that, in the absence of additional data, it was difficult to assess the risks resulting from the presence of nitrates in feedingstuffs and to answer the Commission's questions.

(1) OJ N° L 38 of 11.2.1974, p. 31

In order to obviate these difficulties, it appeared necessary to have available results of analytical checks carried out on milk products in the Member States and to pursue experimental studies on the effects of nitrates on piglets and calves. To this end, trials were undertaken at the end of 1976 in the departments of two Members of the Committee and also in the Netherlands at the Instituut voor Landbouwkundig Onderzoek van Biochemische Produkten (ILOB at Wageningen) and at the Laboratory of Chemical Analysis of Foodstuffs of the National Institute of Public Health at Bilthoven.

The Committee considered it essential to wait until these experiments were completed and full reports available before voicing its conclusions. The answers to the Commission's questions are given below.

1. According to results of checks performed in 1976 and 1977 in the Member States, the nitrate contents of milk products were in the following ranges :

fresh milk : $< 0.1 - 3.1 \text{ mg NO}_3^-/\text{kg}$.

skimmed milk powder : - normally : $< 10 - 50 \text{ mg NO}_3^-/\text{kg}$;
- occasionally contents exceeding 50 mg/kg and reaching up to 440 mg/kg were noted.

powdered whey : $20 - 2700 \text{ mg NO}_3^-/\text{kg}$ with a maximum frequency occurring at 400 mg/kg .

It should be noted that high concentrations of nitrates in powdered whey result, in general, from cheese-making processes using added nitrates. The presence of nitrates in concentrations above $50 \text{ mg NO}_3^-/\text{kg}$ in skimmed milk powder can be considered indicative of poor quality resulting from faulty production or adulteration.

Furthermore, the possibility cannot be ruled out that variations in the results from different sources are, to some extent, due to the various analytical techniques used.

2. The sensitivity of the animals to nitrates varies according to species, age, composition of ration and rearing conditions. Although the available information is not complete enough to permit an assessment of toxicity thresholds, it has been observed that most livestock animals tolerate high levels of nitrates, which may reach $5,000 \text{ mg NO}_3^-/\text{kg}$ of dry matter in the case of green fodder.

With regard to veal, trials conducted in France with two lots of 16 animals showed that a daily intake of nitrates of 50 to $60 \text{ mg NO}_3^-/\text{kg}$ of ration for six weeks followed by 18 to 25 mg/kg of ration for ten weeks (the water for preparation of the ration having a content of $50 \text{ mg NO}_3^-/\text{kg}$) had no influence on growth pattern, biochemical parameters of the blood or hepatic reserve in vitamin A. Experiments in the Netherlands on 60 calves aged between 10 and 18 weeks confirmed the high tolerance of cattle to nitrates.

Daily administration of nitrates for eight weeks at dose-levels of 400 , $2,000$, $5,000$ and $10,000 \text{ mg NO}_3^-/\text{kg}$ of milk replacer respectively had no effect on growth pattern, weight increase, food conversion rate, quality of carcass and biochemical parameters of the blood. Histopathological examination of the liver and the kidneys was negative. It was also established that the presence or absence of antibiotics in the ration had no influence on the results.

Piglets alone appear to be sensitive under certain conditions. In experiments performed in Germany, it has been observed on new-born animals removed from the mother that daily intake of nitrates caused a slight increase in the methaemoglobin content of the blood where dose-levels exceeded $400 \text{ mg NO}_3^-/\text{kg}$ of milk replacer ; the other biochemical or physiological parameters were unaffected. The phenomenon was however revealed to be reversible (the methaemoglobin content returning to normal after three to four weeks despite continuous administration of the nitrates) and had no effect on growth.

3. The normal contents of nitrates in milk were given under item 1. The nitrite contents appear generally less than 0.3 mg NO₂⁻/kg of fresh milk and the N-nitrosamine contents below the detection limit (0.1 µg/kg of fresh milk).

A significant increase in the nitrate content of milk appears only when high doses of nitrates are absorbed by the cow. Concentrations of 13 to 20 mg NO₃⁻/kg have been recorded in fresh milk in cases where the quantity of nitrates absorbed had caused intoxication (dose-levels of the order to 600 mg NO₃⁻/kg of live weight).

At the end of the experiments conducted on calves in the Netherlands (see under item 2), the nitrate, nitrite and N-nitrosamine contents were determined in various tissues of the trial animals. The average nitrate contents were as follows :

NO ₃ ⁻ content in the ration (mg/kg) \ NO ₃ ⁻ content in wet tissues (mg/kg)	18 (control)	400	2.000	5.000	10.000
Muscle	2	5	25	30	65
Liver	8	16	22	34	65
Kidney	4	13	44	92	182
Blood	2	11	53	115	245

The nitrite contents (of the order of 1 mg NO₂⁻/kg of wet tissue) appeared constant in all tissues and for all groups of animals and unconnected with the amounts of nitrates ingested.

Determination of N-nitrosamines by highly specific methods showed the presence of traces of these products (always below 1 µg/kg of wet tissue) in the tissues of both the control and treated animals. As with nitrites there was no correlation with the amount of nitrates ingested.

4. According to present scientific knowledge, normal levels of nitrates found in feedingstuffs do not involve risks for animals.

High levels of nitrates, which may reach 5,000 mg NO₃⁻/kg of feedingstuff are generally well tolerated by livestock. Only piglets appear, under certain conditions, to be sensitive. In this regard, it has been observed that, in new-born piglets separated from their mothers, the administration of nitrates at dose-levels higher than 400 mg NO₃⁻/kg of milk replacer resulted in a slight modification of the methaemoglobin content of the blood. This modification appeared, however, to be temporary (the methaemoglobin content reaching the normal level after three or four weeks, despite the continuous administration of nitrates in the ration) and without effect on the health of the animal.

Moreover, on the basis of data available on calves, continuous administration of nitrates, even at high levels, does not result in the presence of nitrites or nitrosamines in animal products.