Proceedings 4th World Rabbit Congress, 10-14 October 1988, Budapest Hungary, Vol. 2, 427-433

INCIDENCE OF NITRITES IN RABBITS

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INTRODUCTION

Poor quality of drinking water is commonly suspected as a cause of digestive troubles in rabbits. Among various abnormalities, chemical pollutants and especially nitrites (NO_2) are considered as being the most dangerous ones (Nouaille 1987).

Nitrites (NO_2) are the reduced form of nitrates (NO_3) which are very common in our environment and which take part in a transformation cycle ending at proteo-synthesis as follows (Bousset 1971)

$$NO_3 \longrightarrow \underline{NO_2} \longrightarrow N\ NH_n \longrightarrow N\ NH_2 \longrightarrow N \text{ proteic}$$

In fodder plants (except leguminous) and in polygastric animals, proteo synthesis is catalysed by various enzymes and chiefly by nitrate-reductase, when energetic sources are available (soluble carbo-hydrates).

In cattle, when conditions are unfavorable (excess of NO_2 or failure in protein transformation due to a lack of dietary energy) NO_2 accumulation and oxydation of hemoglobin (Hb) in methemoglobine (MetHb) are observed (Kemp Jainudeen and Ansel 1964).

As MetHb is a stable compound unable to transport oxygen, anoxia settles in gradually and when 80-90 p.cent of Hb are turned into Met Hb, animal dies of suffocation (Meissonnier 1978).

For human utilisation, drinking water characteristics are specified

by EEC Directive 80/778 of July 15th 1980 namely :

50 mg/l maximum for NO_3 and 0,1 mg/l maximum for NO_2

Consumption of a high NO_2 water is commonly considered as inducing severe digestive troubles in various animal species and particularly in rabbits but suspicious are much more frequent than definite pieces of evidence.

The aim of the present paper is to try to objectively assess the incidence of high NO_2 water on rabbits health and growth.

MATERIEL AND METHODS

Animals

252 30 days old rabbits are divided in 2 groups of 18 replications each : control "C" and treated "NO_2". Individual body weights and maternal origins are standardised in each group.

Food Animals are fed , during 42 days, the same commercial diet

Water Drinking water, suitable for human consumption is enriched for "NO_2" group with Sodium Nitrite so as to reach 10 mg/l (100 times the normal rate)

Checks : Investigations are performed on following points

- Chemical and bacteriological controls of water
- Mortality rate
- Growth rate : individual weighings at 0, 14, 28 and 42 days. Calculation of average daily gain (ADG)
- Measure of food conversion
- Dosage of hemoglobin and Methemoglobin by sprectrometry (controls being performed at 21 days on 10 additional animals in each group)
- Caecal pH measures and Coliform bacteria counts in previous animal

RESULTS

Results are summarized in tables 1-2-3

DISCUSSION

Chemical and bacteriological controls in water (table 1)

All characteristics are in quite conformity with official standards in "C" group.
In NO_2 group, the NO_2 level is as expected : 11 mg/l.
In more than 50 routine controls performed in rabbit units, highest NO_2 levels observed were 0,5-0,6 mg/l i.e 15 to 20 times less than experimental one.

Mortality (table 2)

During the second period (J14-J28), the mortality rate is rather high in two groups. The digestive origin of losses has been controled by post mortem examinations.
Such a rate of mortality due to an impaired balance of intestinal flora is commonly observed during the third week of the fattening period.
Whichever the period, no differences have been observed between the mortality rates in both groups.

Growth rate and food conversion (table 2)

By the 28 th day, a slight but significant growth reduction is recorded in NO_2 groups : 38,8 g/d versus 42,1 g/d (P 0,05) just as a rise in food conversion : 4,05 versus 3,65 (P 0,05).
Those differences could be considered as the beginning of a slight chronical NO_2 intoxication without any clinical consequence.
Nevertheless, on the whole period no difference has been observed between groups in average daily gain and food conversion.
Drinking water consumption is not different in both groups.

Hemoglobin (table 3)

After 21 days corresponding to an individual imput of 65 mg NO_2 (ie 3 mg/kg/day during 21 days) no rise in methemoglobin percentage has been observed.
That unexpected result could mean whether the NO_2 dose is too slight or conditions are suitable for a complete metabolization of NO_2 (energetic sources).

Caecal parameters (table 3)

pH and Coliform counts are inchanged in both groups. Those results can be considered as the expression of a quite normal intestinal physiology (Morisse 1985).

CONCLUSION

In experimental conditions, NO_2 dose ingested by rabbits is 20 times higher than highest levels recorded in fields conditions.
Obviously NO_2 high treatment has neither altered health of animals nor their intestinal physiology or hemoglobin status.
Although average daily gain and food conversion are not globally different after 42 days, a slight decrease in growth rate as a slight rise in food conversion are observed by 21th day.
Obviously NO_2 in drinking water does not seen to be, when alone, a significant cause of digestive problems but the slight growth reduction observed during the fifth week incites to be careful with females because of higher NO_2 doses they are able to ingest and of a possible susceptibility of embryos.

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TABLE 1 : Chemical and bacteriological characteristics of water in C and NO_2 groups.

	NO_3 mg/l	NO_2 mg/l	NH_4 mg/l	pH	Bacteria
C	31	0,04	0,11	8,7	0
NO_2	45	11	0,15	7,4	0

TABLE 2 : Comparison of mortality and growth rates in both groups.

	0-14 days		14-28 days		28-42 days		0-42 days	
	T	NO_2	T	NO_2	T	NO_2	T	NO_2
Mortality p.cent	0,8	1,6	8,8	4,8	0,9	0	10,3	6,3
Average daily Gain (g/day)	40,2	41,0	39,7	38,9	42,1	38,8 *	40,7	39,5
Food conversion	2,68	2,56	4,10	3,80	3,65	4,05 *	3,58	3,47
Average water consumption ml/day	193	183	312	281	368	330	280	258

* $P < 0,05$
(Average daily gain and food conversion for alive rabbits at the end of each period)

TABLE 3 : Hemoglobin and caecal characteristics at 21 days (10 animals in each group)

	Hb g/100 ml	MetHb p.cent Hb	Coliform Nb/g	pH
T	11,8±0,45	0,51±0,23	$< 10^3$	6,04±0,18
NO_2	11,6±0,82	0,44±0,14	$< 10^3$	6,09±0,11

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SUMMARY

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Drinking water added with sodium nitrite so as to contain 10 mg/l of NO2 is provided to 126 rabbits during 6 weeks.
Health conditions, zootechnical performances (growth and food conversion) hemoglobin characteristics and caecal parameters (pH and coliform) are compared with results of 126 control rabbits receiving NO2 free water.

Globally none of those parameters has been influenced by high NO2 levels (not even the methemoglobin rate).
After 4 weeks of treatment a slight but significant ($P < 005$) decrease of growth rate and a slight rise of food conversion are observed.

As experimental dosage is about 20 times the highest levels recorded in fields conditions, NO2 is not considered as playing a significant role in digestive pathology. Nevertheless cautiousness is advised for females for reasons of toxic accumulation for long times and of possible susceptibility of embryos.

RESUMEN

INCIDENCIA DE LOS NITRITOS SOBRE EL CONEJO

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Un agua enriquecida en nitritos por el nitrato de sodio a fin de lograr una concentracion de 10 mg/litro es consumida por 126 conejos durante 6 semanas. Su estado sanitario, su desarrollo zootecnico, sus caracteristicas sanguineas (hemoglobina) y intestinales (pH, Coliformes), han sido comparados a las de 126 conejos testigos, que han recivido un agua libre de nitritos ; globalmente ninguno de esos parametros ha sido influenciado por el tenor elevado de nitritos (ni siquiera el porcentage de metahemoglobina). Se nota sin embargo, despues de 4 semanas de tratamiento, una disminucion ligera, pero significativa, del crecimiento y un aumento del indice de conversion.

Dado que la dosis experimental es aproximadamente 20 veces mas elevada que el tenor maximo encontrado en los criaderos, es dificil atribuir a los nitritos un papel importante en los desarreglos digestivos. Sin embargo, se recomienda prudencia con las reproductoras, en razon de los riesqos de acumulacion de los nitritos durante largos periodos y de la posible sensibilidad de los embriones.