

INFLUENCE OF THE STOCKING DENSITY ON THE BEHAVIOUR IN FATTENING RABBITS KEPT IN INTENSIVE CONDITIONS

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Abstract - Ninety, 30 day old rabbits were housed in identical cages by groups of six, seven eight and nine animals corresponding to stocking densities of 15.3, 17.8, 20.4 and 23 rabbits/sq.m. Behaviours were recorded by video camera at six and 10 weeks of age, during nycthemeral observations consisting in 96 sequences of 1 mn every 15 mn. At six weeks of age, animals spent 60 % of their time at rest, 15 % in feeding activities and 25 % in others activities without marked influence of stocking densities. At 10 weeks of age, a significant reduction of feeding behaviour (10 vs 15 %) and an increase in other activities were observed in all groups. Comfort behaviour (self directed activities) was dominant (75-78 % of total observations); other consistent activities were: investigatory, social and locomotory behaviours. Sexual and stereotypic behaviour were not observed in animals slaughtered at 10 weeks of age. At six weeks of age the distribution of activities was independent of the stocking density. At 10 weeks of age, an increase of self directed activities (78 vs 68 %) and a reduction of social interactions and of locomotory activities was demonstrated above 6 rabbits per cage. From behavioural observations, results suggest that a loading of 40 kg/m² could be considered as an acceptable threshold in terms of animal welfare in rabbits kept in intensive conditions.

INTRODUCTION

In European countries of Latin tradition, rabbits are intensively reared for meat production. Animals are mainly kept in cages either individually or in groups of variable size. Young rabbits are generally weaned at 32 days (± 2 days) and they are fattened till about 10 weeks of age when their body weight reach 2.3 to 2.5 kg.

The use of wire mesh floor was generalised in seventies to control parasitism and to allow an easier and more profitable production but, as in other species kept in intensive conditions, biological and ethologicals needs have to be taken into consideration in rabbits (MORISSE and MAURICE, 1994).

For VERGA (1992) although domestication is recent, animals can show a good level of adaptation without major modifications of behaviours, except in the frequency of some of them depending on the characteristics of the husbandry system.

Different studies have been carried out on the behaviour in laboratory rabbits (Heath 1972) or in rabbits kept under semi natural conditions (MYKYTOWICZ, 1958, PODBERSCEK *et al.*, 1991) but very few have been performed in rabbits really kept in intensive conditions.

The incidence of stocking densities has been studied by different authors (COULMIN *et al.*, 1982, MAERTENS and DE GROOTE, 1984) but in most of experiments, only performance was taken into consideration. In 1992 FERRANTE *et al.* demonstrated that open field behaviour was not influenced by density in cages.

As various stocking densities ranging from 15 to 25 rabbits/sq.m (i.e : 37.5 to 62.5 kg/m²) have been observed in routine conditions, without any concern of the animal welfare, the present study was carried out to evaluate the influence of stocking density on behaviour of animals.

MATERIAL AND METHODS

Animals and housing systems

A total of 90 hybrid commercial type rabbits, 30 day old, was used to perform this study. Animals were housed till 10 weeks of age (2.5 kg of live weight) in wire mesh flat deck cages measuring 0.77x0.51x0.30 m. Each cage was equipped with a nipple drinker and with a 3 places feeder outside the cage. Animals were fed *ad libitum* a classical diet in pellets and lighting was available 8 hours daily (from 9 A.M. to 5 P.M.)

Rabbits were assigned to one of the four following stocking densities (St)

Group 1:	6	rabbits per cage	x	3 cages	=	15.3 rabbits/m ²	=	38.2 kg/m ²
Group 2:	7	"	"	"	=	17.8	"	44.5 kg/m ²
Group 3:	8	"	"	"	=	20.4	"	51.0 kg/m ²
Group 4:	9	"	"	"	=	23.0	"	57.5 kg/m ²

In each cage (or in each group for 7 and 9 rabbits/cage) numbers of males and females were equivalent.

Behavioural study

Behaviours were recorded by video cameras with infra red lighting, during 96 sequences of one min every 15 min throughout two 24 h periods at six and 10 weeks of age.

To accustom the animals to the camera system, the video apparatus were installed before the allotment and were not removed thereafter.

A first analysis of video tapes was performed to determine the primary activities such as resting, feeding and/or drinking and other activities.

For other activities, behaviours were placed in five different groups.

- Comfort behaviours: group of behaviours related to self body care (scraping, rubbing, licking, grooming, yawning and stretching).
- Social and marking behaviours: activities directed towards others (contact, rubbing, licking, sniffing) and including chin marking.
- Investigatory behaviours: these were related to cages or their equipment : rubbing, licking, gnawing or chin marking materials
- Agonistic behaviours: chasing and biting or scratching others.
- Locomotory behaviours: voluntary displacements of the body.

For each of the three repetitions of each stocking density, the number of rabbits displaying an activity and the type of activities were recorded from each of the 96 nycthemeral sequences. Average results were calculated and statistical analysis was performed using the Chi square test.

RESULTS

Primary activities

At 6 weeks of age (Table 1) rabbits housed at a density of 15.3/sq.m spent more time at rest and less time in activities (feeding and others), than did rabbits at higher stocking densities ($p < 0.01$).

At 10 weeks of age, an increase in resting and a corresponding reduction in feeding and other activities were observed at the highest density ($p < 0.05$).

For each stocking density, nycthemeral activities were different between six and 10 weeks of age; at 10 weeks, rabbits displayed less feeding behaviours and more other activities than they did at six weeks of age.

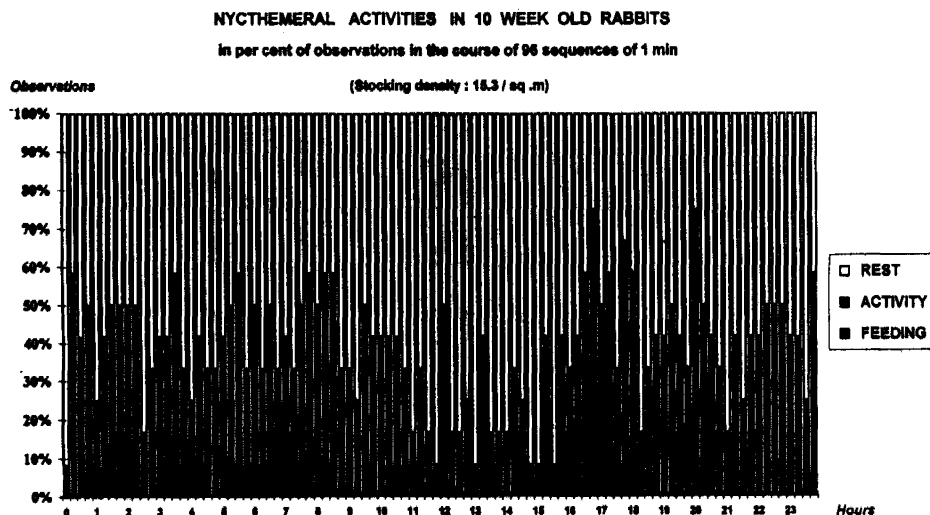
Table 1 : Distribution of nycthemeral activities at 6 and 10 weeks of age at various stocking densities (in % of total observations).

Number of rabbits	Age (w)	Rest	Activities		Statistical difference	
			feeding	others	density*	ageP<
6	6	60.6	14.9	24.4	a	0,01
	10	57.3	10,6	32,1	x	
7	6	57.1	17.4	25.5	b	0.01
	10	58.1	10.1	31.7	x	
8	6	58.3	15.4	26,3	b	0.01
	10	57.9	11.1	30.9	x	
9	6	59.4	14.8	25.8	b	0.01
	10	61.6	8.7	29.7	y	

*Distribution with the same letter do not differ significantly χ^2 test.
 $a \neq b$ for $P < 0.01$ $x \neq y$ for $P < 0.05$

At 10 weeks of age, and at a density of 15.3 rabbits/sq.m the repartition of basic activities throughout 24h, given by Figure 1, showed that feeding and activities were observed at any time, by day as well as by night with just a slight reduction of activity between 11 A.M. and 4 P.M.

Figure 1 : Nycthemeral activities in 10 week old rabbits (in percent of observations in the course of 96 sequences of 1 min.)



Behavioural pattern

Analysis of behavioural pattern (Table 2) gave evidence that comfort behaviour was dominant (75 to 78 % of all activities) whatever ages and stocking densities.

Time spent by animals to display investigatory, agonistic and locomotory behaviours were equivalent and ranged from 5 to 10 % of observations.

At six weeks of age, distribution of different activities was not influenced by stocking densities.

At 10 weeks of age, mainly in the lowest density, a reduction of comfort and investigatory behaviour was observed whereas social and agonistic encounters respectively increased or appeared.

Table 2 : Behavioural pattern at 6 and 10 weeks of age at various stocking densities (in % of total observations)

Number of rabbits	Age (w)	Comfort	Investigatory	Social	Agonistic	Locomotory	Statistical difference	
							Density*	Age
6	6	75.3	8.0	7.7	0	8.8	a	0.01
	10	67.8	3.7	15.7	2.4	9.5	x	
7	6	79.5	7.9	7.9	0.2	4.2	a	NS
	10	77.3	5.9	10.8	0.2	5.8	y	
8	6	76.3	5.7	9.8	0	7.8	a	NS
	10	75.2	5.4	11.6	1.4	6.4	y	
9	6	78.9	6.9	8.7	0	4.8	a	NS
	10	78.9	4.7	8.6	0.6	7.2	y	

*Distributions with the same letter do not differ significantly χ^2 test $P < 0.01$.

DISCUSSION

On average, fattening rabbits between six and 10 weeks of age spent 60 % of their time lying, 10-15 % feeding and 25-30 % displaying others activities.

At 6 weeks of age, although differences were statistically demonstrated in primary activities between the lowest density and other ones, nevertheless differences were of poor amplitude.

At 10 weeks of age, animal housed nine per cage showed more conclusive differences i.e : a strong reduction of feeding behaviour and a higher frequency of other activities. That observation is concordant with results by MAERTENS and DE GROOTE (1984) who demonstrated that feed intake and subsequently daily gain were significantly lower above 15 rabbits/sq.m although the number of feed places did not seem to be a limiting factor.

Figure 1 gives evidence that in each sequence of nycthemeral observations, at least one rabbit in each cage took a short meal. Our observations are consistent with findings of PRUD'HON *et al.* (1972) who demonstrated that rabbits do not eat at fixed hours all together but have 20 to 30 meals per day on average.

The major differences observed in each groups when rabbits became older were a reduction of feeding activities corresponding to a physiological slackening in growth rate and an increase in others activities, likely due to a higher frequency of social interactions.

Some activities classically described such as sexual behaviours have not been listed as they were exceptionally observed in 10 week old animals and sniffing others without mounting was considered as social behaviour. That lack of real sexual activities is concordant with observations by LEHMAN (1991) who demonstrated that in semi natural conditions, males did not display sexual behaviour before 70 days.

Stereotypic behaviour described as "activity performed repeatedly in a fixed manner and in response to no discernible stimulus and with no discernible goal" (MURPHY, 1978) were not observed.

In fact, some repeated scraping of the floor and some short nibbling of cage walls were observed, but we consider that they did not fit with the classical definition of stereotypes. Digging holes in ground or in straw bedding is a normal behaviour in rabbits; when they scrape a grid floor, they display a normal behaviour on an abnormal substrate.

In the same way, some nibbling of material (edge of feeders or walls of cages) only performed during a few seconds cannot be considered as an "activity performed repeatedly in a fixed manner....." from an animal in which gnawing and nibbling are basic behaviours.

At 6 weeks of age, comfort behaviours, mainly self grooming were dominant (75-80 % of activities other than feeding); investigatory, social and locomotory behaviours were observed with an equivalent frequency ranging from 5 to 10 %.

Repartition of those different activities throughout 24 hours was poorly dependent of the stocking density, likely due to the fact that, at 6 weeks of age, body weight of animals does not exceed 1.3 kg and that total loading per sq.m does not exceed 30 kg/m² even in the highest stocking density group.

At 10 weeks of age, although they were not frequent, some aggressive encounters were observed ; it is likely that a rank order appeared in animals which, although sexually immature, began to behave like adults. Results gave evidence that agonistic behaviour was not dependant of the stocking densities.

At 10 weeks of age, the significant reduction of social and locomotory behaviour with a corresponding increase in self directed activities (comfort) beyond 6 rabbits per cage, suggest that 15 rabbits/sq.m could be the threshold compatible with an acceptable expression of behaviour. In fact loading per sq.m would be a more valid expression of stocking density and in our study, the total weight of animals corresponding to 15.3 rabbits per sq.m was 38 kg/m².

That figure is concordant with observations of MAERTENS and DE GROOTE (1984) who concluded that a very clear negative influence on performance was observed from 40 kg/m², due to a problem of overcrowding, leading to a lack of comfort.

CONCLUSION

Results of this study confirm that, in fattening rabbits slaughtered before sexual maturity, dominance and sexual behaviour leading to aggressive encounters are uncommon and allow the rearing of mixed sexes without major problems.

In young animals, behavioural patterns are only slightly affected by stocking densities but at 10 weeks of age, social interactions and locomotory activities are reduced beyond 15 rabbits per sq.m (i.e 38 kg/m²). Our results

on behaviour are concordant with zootechnical observations showing that performance is strongly impaired by excessive density.

Taking into consideration the behavioural pattern of rabbits kept in intensive conditions, it is suggested, subject to further investigations, that welfare of animals could be improved if their stocking density did not exceed 40 kg/sq.m.

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Influence de la densité sur le comportement du lapin de chair en élevage intensif - 90 lapins de 30 jours ont été mis en cage à raison de 6, 7, 8 ou 9 sujets par cage, soit à des densités de 15,3 - 17,8 - 20,4 et 23 sujets par m². Les comportements ont été étudiés à l'aide de caméras vidéo filmant les animaux à 6 et 10 semaines à raison de 96 séquences d'une minute tous les quarts d'heure. A 6 semaines, les lapins passent 60 p.cent de leur temps au repos, 15 p.cent à se nourrir et 25 p.cent en activités diverses sans influence marquée du niveau de densité.

A 10 semaines, on observe dans tous les groupes une réduction significative du temps passé à s'alimenter et une augmentation du temps réservé aux autres activités.

Les différents comportements étudiés ont été classés en cinq rubriques :

Confort (Comportements auto-dirigés, 70 à 78 p.cent du total des observations), exploration, social, agonistique et locomoteur ; aucun comportement sexuel et aucune stéréotypie n'ont été observés chez des sujets abattus à 10 semaines.

A 6 semaines, la répartition des différentes activités n'est pas influencée par la densité.

A 10 semaines, au-dessus de 6 sujets par cage, on observe une augmentation des activités autodirigées et une réduction des interactions sociales ainsi que des déplacements.

Sous réserve de travaux complémentaires, les résultats suggèrent qu'un chargement de 40 kg/m² pourrait être considéré comme une limite acceptable en terme de comportement chez le lapin en élevage intensif.
