



Effect of nursing method and stocking density on the performance of early weaned rabbits

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ABSTRACT

The aim of the study was to compare the traditional rearing method with a two-phase method, with higher stocking density at early age, on productive traits of growing rabbits depending on their milk supply until weaning at 21 days of age. 252 rabbits were nursed by one or two does. Both groups were divided into two subgroups. In the first, 3 rabbits per cage were kept between 21 and 70 days of age (Group 3/3). In the other group 6 rabbits were kept between 21 and 42 days of age and later only 3/cages were reared till 70 days of age (Group 6/3). The effect of number of nursing does was significant on the feed intake (85 or 81 g/days; $P < 0.05$) and on the weight at 70 days of age (2093 or 2005 g; $P < 0.05$) for rabbits nursed by 2 or 1 does, respectively. It was an important observation that the kits nursed by two does and reared 6/cage are able to reach the nipple drinkers more easily than that of nursed by one doe and reared on a lower density (3 kits/cage) during the first week after weaning. This was the reason for the significant difference in weight gain after weaning. But the rearing method has no effect on the overall weight gain between the age of 21 and 70 days, on the body weight, feed intake and feed conversion. The effect of stocking density was significant on kit mortality between days 21 and 70; its value was 36 and 18% for the group 3/3 and group 6/3, respectively. Rearing the rabbits in two phases, 6 rabbits/cage between 21-42 days and 3 kits/cage between 42-70 days of age was found to be economically advantageous since more rabbits were housed in a cage or in a building matched with lower mortality and without any negative influence on the other traits. (Keywords: growing rabbits, nursing method, stocking density, performance)

ÖSSZEFOGLALÁS

A szoptatási mód és a telepítési sűrűség hatása a fiatalon választott nyulak termelésére

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2x2 tényezős kísérletben vizsgálták a felnevelési mód (egy vagy kétfázisú nevelés) és a tejellátottság (egy vagy két anyával történő nevelés) hatását. A 252 fiatalon (21 napos korban) választott nyulat előzőleg 1 vagy 2 anyával nevelték. Választás után mindkét csoport egyik felét 21 és 70 napos kor között hármával (3/3 csoport), másik felét 21 és 42 napos kor között hatosával, majd 70 napos korig hármával (6/3 csoport) nevelték. A két vagy egy anyával történő szoptatás szignifikánsan befolyásolta a fiókák takarmányfogyasztását (85 és 81 g/nap, $P < 0,05$) és a 70. napi testsúlyt (2093 és 2005 g, $P < 0,05$ sorrendben a két és az egy anyával

nevelt csoportban). A nagyobb telepítési sűrűség (6 nyúl/ketrec) előnye azzal magyarázható, hogy ezek a nyulak a választás után egymásra támaszkodva könnyebben elérték az itatószelepet. Hasonlóan előnyben voltak a korábban két anyával nevelt nyulak, mivel a nagyobb választási súlyuk miatt ők is könnyebben elérték az itatót. Ezt leszámítva a felnevelési mód (3/3 vagy 6/3 csoport) nem befolyásolta szignifikánsan 21 és 70 napos kor között a súlygyarapodást, a testsúlyt, a takarmányfogyasztást és a takarmányértékesítést. A telepítési sűrűség ugyanakkor szignifikánsan befolyásolta a nyulak 21 és 70 napos kor közötti elhullását (36 és 18%, sorrendben a 3/3 és a 6/3 csoportban). A kétfázisú nevelés, 21 és 42 napos kor között 6, majd 42 és 70 napos kor között 3 nyúl együtt nevelése gazdaságossági szempontból előnyös, mivel egy ketrecben átlagosan több nyúl nevelhető és ezzel javul az épületek kihasználtsága. Emellett a termelési eredmények nem romlanak, de az elhullás csökken.

(Kulcsszavak: növendéknyúl, szoptatási mód, telepítési sűrűség, termelés)

INTRODUCTION

The free choice of rabbits, weaned at the age of 21 days, among different-sized, neighbouring cages was studied by *Matics et al.* (2002). This study showed that rabbits are gathering in one of the smallest cages in the post-weaning period, leading to stocking density values of 50–70 rabbits/m². On the basis of this experience, a possibility – in connection with nursing by two does – was studied, where early weaned rabbits are reared in larger groups (6 rabbits/cage) at the beginning of the fattening period, while in the following period the conventional density (3 rabbits/cage) is applied. This, so-called „two-phase” method (6 rabbits in the post-weaning period in one cage, 3 rabbits afterwards) could lead to better utilization of the fattening cages and that of the rabbit stable, leading to a more economical rearing period.

The „two-phase” method was investigated in combination with the double-nursing method. In the rearing methodology described by *Szendrő et al.* (2000), to the doe an other is placed that is subjected to weaning at the third week of nursing. The early weaning is an obligatory element of the double-nursing, therefore, the development of a new rearing method is reasonable.

MATERIALS AND METHODS

The experiment was carried out at the University of Kaposvár, on Pannon White rabbits (n=252). Rabbits were reared in a closed building, in flat-deck fattening cages (400×300 mm). The building was not climatized, the summer temperature therefore reached 28–30 °C occasionally. The aeration was provided by blowers on the back-wall of the stable. The daily lighting was 16 hours. Rabbits were fed a commercial rabbit feed (DE: 10.3 MJ/kg, crude protein: 16.5%, crude fibre: 15.5%). Water was provided from nipple drinkers *ad libitum*.

One half of the rabbits were reared with one (n=126), the other by two does (n=126), as described by *Szendrő et al.* (2000). Rabbits were weaned at 21 days of age. Both groups were divided into two subgroups. In the first two, 3 kits per cage were kept between 21 and 70 days of age (Group 3/3, n=42 and 42, formerly nursed by 1 or 2 does). In the other two groups 6 rabbits were kept between 21 and 42 days of age (n=84+84) and later only 3/cages were reared until 70 days of age (group 6/3).

Individual body weight and feed intake per cage was measured every week. Mortality was recorded continuously. Production data and mortality were evaluated by analysis of variance and the chi² method, by means of the software SPSS 10. The significance of between-group differences was analysed by the Duncan test.

RESULTS AND DISCUSSION

Nursing with one or two does

As shown in *Table 1*, the body weight at the 21st day (485 g) in the group nursed by two does significantly ($P<0.01$) exceeded that of the other group nursed with one doe (432 g); former was identical with the body weight at the 28th day of the latter group (432 g). Differences between the two groups persisted until the age of 70 days (2093 and 2005 g). The advantage of nursing by two does was confirmed by *Szendrő et al.* (2002, 2006).

The effect of stocking density on body weight was significant only at the age of 28 and 35 days, Group 6/3 achieved a 6% higher weight (*Table 1*). Later, till 70 days of age, the differences between the two groups were not significant.

Table 1

**Effect of nursing method and stocking density on body weight
and weight gain of kits**

Age, days (1)	Number of nursing does (2)				Effect (3)	
	1		2		Does (6)	Density (7)
	Stocking density (4)					
	3/3 (n=42)	6/3 (n=84)	3/3 (n=42)	6/3 (n=84)		
Mean \pm SE (5)	Mean \pm SE (5)	Mean \pm SE (5)	Mean \pm SE (5)			
Body weight, g (8)						
21	434 ^A \pm 12.1	429 ^A \pm 5.9	486 ^B \pm 10.3	483 ^B \pm 8.1	**	NS
28	460 ^A \pm 21.5	499 ^A \pm 9.9	549 ^B \pm 19.7	570 ^B \pm 11.4	**	**
35	654 ^A \pm 30.1	717 ^B \pm 15.3	777 ^{BC} \pm 28.4	802 ^C \pm 16.0	**	*
42	936 ^A \pm 31.8	961 ^{AB} \pm 16.4	993 ^{AB} \pm 31.2	995 ^B \pm 16.7	*	NS
49	1213 ^A \pm 36.5	1233 ^{AB} \pm 18.4	1302 ^B \pm 31.2	1259 ^{AB} \pm 20.1	**	NS
56	1500 ^A \pm 37.0	1535 ^{AB} \pm 20.3	1611 ^B \pm 35.5	1579 ^{AB} \pm 21.5	**	NS
63	1736 ^A \pm 34.2	1786 ^{AB} \pm 20.6	1863 ^{BC} \pm 36.9	1873 ^C \pm 21.5	**	NS
70	1975 ^A \pm 35.3	2035 ^{AB} \pm 20.7	2079 ^B \pm 41.5	2107 ^B \pm 21.9	**	NS
Weight gain, g/day (9)						
21-28	3.7 ^A \pm 3.4	10.1 ^{AB} \pm 1.9	9.0 ^{AB} \pm 3.4	12.3 ^B \pm 1.6	NS	*
28-35	29.9 \pm 2.3	31.1 \pm 2.1	32.5 \pm 4.0	32.0 \pm 2.5	NS	NS
35-42	33.5 ^B \pm 0.8	34.0 ^B \pm 1.5	27.2 ^A \pm 1.8	26.6 ^A \pm 1.0	**	NS
42-49	39.3 \pm 1.1	38.7 \pm 1.2	40.1 \pm 3.0	37.6 \pm 1.1	NS	NS
49-56	39.8 ^A \pm 0.8	43.2 ^B \pm 0.9	44.7 ^B \pm 1.9	45.8 ^B \pm 0.6	**	*
56-63	33.6 ^A \pm 1.0	36.0 ^A \pm 0.9	36.4 ^A \pm 1.7	41.4 ^B \pm 1.1	**	**
63-70	34.9 \pm 1.6	35.6 \pm 1.3	31.6 \pm 3.2	33.6 \pm 1.6	NS	NS
21-70	31.0 \pm 0.6	32.8 \pm 0.6	32.7 \pm 1.4	32.9 \pm 0.4	NS	NS

A, B, C in the same row mark significant differences, at $P<0.05$ level. (A, B, C: sorokon belül $P<0,05$ szinten szignifikáns különbséget jelöl.); * $P<0.05$, ** $P<0.01$, NS=not significant (Nem szignifikáns)

1. táblázat: A szoptatási mód és a telepítési sűrűség hatása a növendéknyulak testsúlyára és súlygyarapodására

Életkor, nap(1), Nevelő anyák száma(2), Hatások(3), Telepítési sűrűség(4), Átlag(5), Anyák száma(6), Telepítési sűrűség(7), Testsúly (g)(8), Súlygyarapodás (g/nap)(9)

In the daily weight gain differences ($P<0.01$) were only proven in the periods between 35–42 and 49–63 days. Between days 35 and 42 the group with one doe, while in the

period between 49 and 63 days the other group reached higher gain. In the total fattening period (21–70 days) rabbits reared with two does showed better results (32.8 g/day), though the difference was not significant. Although the results supported the advantage of the double-nursing method, the difference between the two groups was lower, than before (Szendrő et al., 2000, 2002, 2004).

The rabbits nursed with two does took up significantly more feed in the period between the 42nd and 49th days (97 vs 89 g/day; P<0.01), between the 63rd and 70th days (121 vs 112 g/day; P<0,01) as well as in the total fattening period (85 vs 81 g/day; P<0.01) than those nursed with one doe. In earlier studies similar differences were found (Gyarmati, 2001; Szendrő et al., 2002, 2004). One reason of the difference is the higher maintenance requirement arising from the higher body weight, while, on the other hand, rabbits consuming more milk before weaning may take up more feed also after it (Table 2).

Table 2

Effect of nursing method and stocking density on feed intake and feed conversion of kits

Age, days (1)	Number of nursing does (2)				Effect (3)	
	1		2			
	Stocking density (4)				Does (6)	Density (7)
	3/3 (n=42)	6/3 (n=84)	3/3 (n=42)	6/3 (n=84)		
	Mean ± SE (5)	Mean ± SE (5)	Mean ± SE (5)	Mean ± SE (5)		
Feed intake, g/day (8)						
21-28	24.4 ± 1.9	25.2 ± 1.6	23.7 ± 2.8	24.0 ± 1.6	NS	NS
28-35	49.5 ± 4.0	52.4 ± 1.9	53.0 ± 4.8	55.4 ± 2.9	NS	NS
35-42	63.0 ± 3.3	69.5 ± 2.0	67.8 ± 3.0	68.1 ± 2.5	NS	NS
42-49	87.4 ± 3.4	90.8 ± 3.1	98.0 ± 4.5	95.7 ± 2.4	**	NS
49-56	109.1 ± 5.4	114.4 ± 1.9	120.9 ± 12.0	118.6 ± 2.2	NS	NS
56-63	109.7 ± 3.9	109.7 ± 1.9	108.2 ± 3.1	110.6 ± 1.7	NS	NS
63-70	109.3 ^A ± 2.4	114.9 ^{AB} ± 1.9	117.9 ^{AB} ± 8.0	124.5 ^{BC} ± 2.7	**	NS
21-70	78.9 ^A ± 2.1	82.4 ^{AB} ± 1.4	84.2 ^{AB} ± 3.5	85.3 ^{BC} ± 1.3	*	NS
Feed conversion (g/g) (9)						
21-28	6.52 ^B ± 2.03	2.43 ^A ± 0.90	2.73 ^A ± 1.03	1.95 ^A ± 0.33	**	**
28-35	1.67 ± 0.13	1.77 ± 0.13	1.63 ± 0.30	1.73 ± 0.11	NS	NS
35-42	1.88 ^A ± 0.09	2.07 ^A ± 0.06	2.54 ^B ± 0.16	2.63 ^B ± 0.16	**	NS
42-49	2.22 ^A ± 0.01	2.36 ^{AB} ± 0.02	2.50 ^{AB} ± 0.15	2.57 ^B ± 0.02	**	NS
49-56	2.75 ± 0.17	2.66 ± 0.05	2.69 ± 0.19	2.59 ± 0.05	NS	NS
56-63	3.28 ^B ± 0.16	3.07 ^B ± 0.09	3.00 ^B ± 0.12	2.69 ^A ± 0.05	**	**
63-70	3.15 ^B ± 0.11	3.25 ^B ± 0.14	3.92 ^A ± 0.33	3.93 ^A ± 0.40	*	NS
21-70	2.55 ± 0.04	2.52 ± 0.02	2.59 ± 0.07	2.60 ± 0.03	NS	NS

A, B, C in the same row mark significant differences, at P<0.05 level. (A, B, C: sorokon belül P<0,05 szinten szignifikáns különbséget jelöl.) *P<0.05, **P<0.01, NS=not significant (Nem szignifikáns)

2. táblázat: A szoptatási mód és a telepítési sűrűség hatása a növendéknyulak takarmányfogyasztására és takarmányértékesítésére

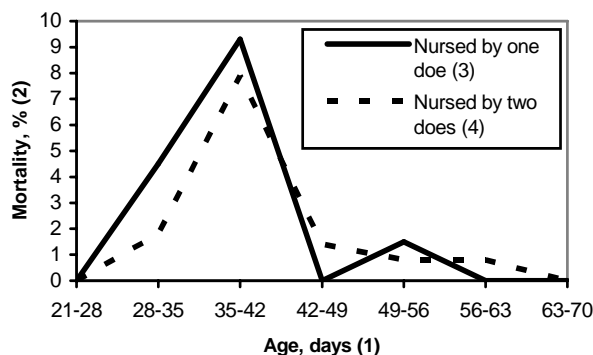
Életkor, nap(1), Nevelő anyák száma(2), Hatások(3), Telepítési sűrűség(4), Átlag(5), Anyák száma(6), Telepítési sűrűség(7), Takarmányfogyasztás (g/nap)(8), Takarmányértékesítés(9)

With regard of feed conversion, in the period between 21 and 28 days the double-nursed, while in the period between 35 and 49 days the other group showed significantly better results. In the total fattening period these differences were nullified, rabbits reared with one or two does consumed 2.53 and 2.59 kg feed (NS) for one kg body weight gain, respectively. Similar results were published by Szendrő *et al.* (2006).

Mortality peaked at the 3rd week after weaning (Figure 1), though neither in this, nor in the total fattening period the two groups showed statistical difference. As experienced in former studies, the mortality by the double-nursing is more advantageous (Gyarmati, 2001).

Figure 1

Effect of number of nursing does on the mortality of growing rabbits weaned at the age of 21 days



1. ábra: A nevelő anyák számának hatása a 21 napos korban választott nyulak elhullására

Életkor, nap(1), Elhullás(%) (2), Egy anyával nevelt(3), Két anyával nevelt(4)

Number of rabbits per cage

From the viewpoint of the body weight at 28 (535 and 505 g, $P < 0.01$) and 35 days (760 and 716 g, $P < 0.05$), the density of 6 rabbits/cage was advantageous (Table 1). Although in the „6/3” group slightly higher results were found in the total experiment, this was not statistically provable. Matics *et al.* (2004) reported similar results.

As shown in Table 1, the body weight gain was interesting between the days 21 and 28. The lower values were reached by the threesome stocked rabbits with one doe; this was followed by the group of two does stocked threesome and the one doe and six rabbits in one cage; the best results were reached in the group nursed by two does and stocked by six. The differences might have been caused by the location of the nipple drinkers. Though the drinkers were not too high in the fattening cage (250 mm), but those were slightly far from the vertical wall of the cage which led to more difficult/problematic drinking. Rabbits nursed by one doe and stocked threesome were in the most disadvantageous situation. In this case rabbits of relatively low body weight could not help each other in the drinking, or at least not so effective as those stocked by six in the one doe-nursed group. In latter case the six rabbits had better opportunities to help each other in reaching the drinkers and drinking. Rabbits were in the most

advantageous situation from this viewpoint when they were nursed by two does and stocked by six; this ensured more help in the drinking process.

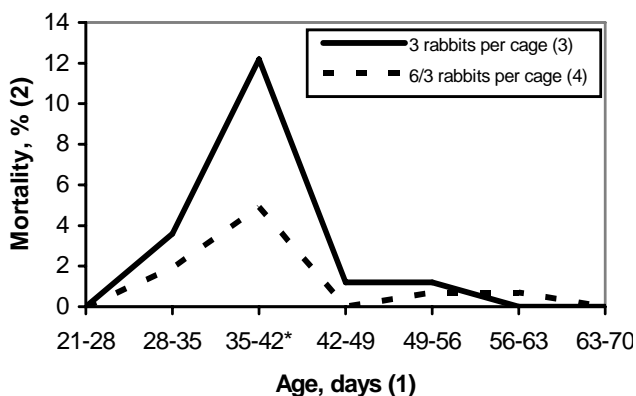
In the latter period stocking density had only significant effect at the age of 42–63 days. The „6/3” group showed better body weight gain, independently from the condition whether they were nursed by one or two does. Differences are hard to explain, since in this period rabbits were stocked threesome everywhere. Stocking had practically no effect on the body weight gain between days 21 and 70.

No differences were found in the feed intake in none of the above cases. This is rather remarkable, as from the differences in the body weight gain in the period between 21 and 28 days differences were expected; rabbits of lower gain may have consume less. The „6/3” group showed higher feed conversion ratio values in the periods between days 21 and 28 and in period between days 56 and 63 (4.63 and 2.19 g/g; $P < 0.01$). As in these periods the feed intake was not, while the body weight gain was different, the better feed conversion may arise from the better body weight gain.

Mortality had a peak at the 3rd week after the weaning, though the „6/3” group showed significantly lower values than found in the groups stocked threesome (Figure 2). Though later no differences were shown, arising from the relatively strong post-weaning differences in the mortality, between 21 and 70 days significant difference was found.

Figure 2

Effect of stocking density on the mortality of growing rabbits weaned at the age of 21 days (*the difference was significant at $p < 0.05$ level)



1. ábra: A telepítési sűrűség hatása a 21 napos korban választott nyulak elhullására (*a különbség $P < 0,05$ szinten szignifikáns)

Életkor, nap(1), Elhullás(%) (2), 3 nyúl/ketrec(3), 6/3 nyúl/ketrec(4)

In an other experiment, where rabbits weaned at the age of 21 days were reared in cages of 250×400 mm – either in the total period twosome, or before the 42nd day foursome and after it twosome – no differences were found in the above traits (Matics et al., 2004). According to the results of Samoggia et al. (1988), the optimal stocking density was 6 weaned rabbits per cage in the first phase and 3 or 4 kits in the finishing period.

This supports again that the location of the drinkers modified the results obtained in the one-phase and two-phase rearing.

According to *Maertens and De Groote* (1984) and *Aubret and Duperray* (1992) the effect of stocking density depends on the weight of rabbits/m². If the rabbits are slaughtered at a younger age (lower body weight), the stocking density (animals/m²) could be higher. In case of a two-phase rearing system, at younger age (till 6 weeks) the body weight of kits is low, therefore the stocking density in body weight/m² is lower as compared to the figures (40–46 kg/m²) suggested by *Maertens and De Groote* (1984) and *Aubret and Duperray* (1992).

CONCLUSIONS

The nursing with two does, just like shown in earlier studies, shortened the fattening period with some days. Under the present experimental conditions this method had a further advantage. Rabbits with higher body weight were able to reach the drinkers better, therefore, the badly located drinker is less disadvantageous from the viewpoint of post-weaning body weight gain, when compared to the group nursed with one doe. Rearing six rabbits in a cage was pronouncedly advantageous from the viewpoint of drinking. It seems that the rabbits could reach the drinkers this way more effectively, possibly by learning on each other. Of course, the aim in the future is not to help rabbits in drinking from badly located drinkers, but to pay more attention on the location of the drinkers in case of early weaning.

The two-phase rearing, i.e. rearing six rabbits in one group after the weaning and halving them later, was markedly advantageous from the viewpoint of mortality. Accordingly, if the possibility to keep each other warm is given, it may have influence on the survival chances.

In further traits only minor differences were found for the „3/3” and the „6/3” groups. Since two-phase rearing is highly advantageous from the viewpoint of mortality, it did not influence all other traits inversely (maybe it was a little advantageous). Therefore, it can be concluded that this rearing method does not influence the production badly. It is thus evident that the two-phase rearing, in joint with the double nursing is economically beneficial, since it improves the utilization of cages and stables.

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