

THESES OF DOCTORAL (PhD) DISSERTATION

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ETHOLOGICAL ANALYSES OF THE DOMESTICATED RABBIT FROM THE ANIMAL WELFARE ASPECT

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1. ANTECEDENTS OF THE RESEARCH, OBJECTIVES

During the last decades the rabbit breeding progressed towards intensification. The main objectives of this process were to improve productivity, efficiency and profitability. As a consequence of the continuous enlargement of the farms' size rabbit breeding changed towards "industrial production". Parallel to these changes due to the activity of animal rights/protection movements there is also an increased interest in EU countries for keeping and reproduction technologies that take the rabbit welfare viewpoint into account. The first natural type (happy, label) systems were improved one-two decades ago where the rabbits are kept in large areas and groups using lower stocking density. In several EU countries there are EU recommendations that satisfy animal welfare aspects however, these systems are not always justified with experimental results. The definition of the "ideal environment" for the rabbits is often based on personal feelings. A highly important demand is that the product should be free from any residues. At the 6th World Rabbit Congress CASTELLINI (1996) noted for the possible restrictions in the future use of the hormonal treatments. The major objective of the Rabbit Reproduction Group that was founded at that time was to develop alternative methods to induce the rabbits' oestrus without hormonal treatment. The above mentioned points show that there are certain areas with many unanswered questions but some details of the so called well-known areas can also be further analysed. The present thesis analyse the aspects of the does' reproduction, rearing and keeping technology of the growing rabbits.

In my studies the main objectives were the following:

- To determine the effect of the time of insemination, parity and litter size on the gestation length and on the kindling date.
- To analyse the does' nest building behaviour and the nest characteristics depending on the nest materials provided at different times prior to parturition.
- To study the effect of the various management methods on the nursing behaviour of the does.
- To analyse the influence of the nursing method's modification as a bio-stimulation method on the does' production.
- Supposing free choice of the growing rabbits and depending on their age:
 - to determine the chosen stocking density and its effect on their production.
 - to determine preference among different cage-floors.

2. MATERIALS AND METHODS

As both the objectives and the methods of my experiments were highly different, it was decided that the materials and methods of these trials are provided separately.

The analyses – except one - were conducted at the University of Kaposvár using Pannon White rabbits. The lighting period was 16 hours light and 8

hours dark. During summer without air conditioning the temperature occasionally reached levels as high as 28°C. In winter the rabbit house was heated to a minimum temperature of 15-16°C. The rabbits were fed *ad libitum* with a commercial pellet (does: energy = 11 MJ DE/kg, crude protein = 17%, crude fibre = 15,5%; growing rabbits: energy = 10.3 MJ DE/kg, crude protein = 16%, crude fibre = 15,5%) and drinking water was also available *ad libitum* from nipple drinkers. Detailed description of the experiments is given in the same order as provided in the results section.

2.1 Factors affecting the gestation length

The experiment was carried out using Pannon White rabbits. The population consisted of 5000 does providing the sufficient number of parturitions to be analysed. The rabbits were housed in closed buildings without air-conditioning and lightning programme, in flat-deck cages. The rabbit houses were provided with windows, the transition between the dark and light period occurred gradually between 22:00 pm and 4:00 am (the period termed night during the experiment was totally dark). The rabbits were fed *ad libitum* with a commercial pellet and drinking water was also available *ad libitum* from nipple drinkers.

The doe groups were randomly halved then one group (n=607) was inseminated in the morning (8:00-10:00 am), the other group (n=561) was inseminated in the evening (8:00-10:00 pm). Simultaneously with the inseminations the thigh muscle of the does was injected with 1.5 µg GnRH analogue to induce ovulation. From the expected date of parturition (i.e from the 29th day till the morning of the 35th day) the parturition and the litter size of the does was recorded in every two hours. Gestation length was determined by the period lasted between the actual insemination and

parturition. Kindling frequencies were depicted according to the gestation length and dark-light periods. Average gestation length was calculated the effect of parity and litter size on the gestation length was determined.

The statistical analysis of the experimental data was carried out by means of analysis of variance (SPSS 10).

2.2 Monitoring the nest building behaviour

During the experiment the nest building behaviour of 85 multiparous does was monitored. The does were placed to wire cages having a basic area of 600×550 mm. The nest area was within the cage. The does could move to through a 140 mm diameter creep-hole into the 240×550 mm nest area. A perforated plastic nest tray (160×320 mm at the bottom) sunk into the nest area within the cage. The cages were equipped with hay-pockets that were provided with hay for nest building. Four experimental groups were made. In the first groups the hay-pockets were provided with hay on the 26th day of gestation and the door separating the cage and the nest area was open from the same time (n=23). The hay-pockets were provided with hay on the 27th, 28th and 29th day of gestation in the second, third and fourth groups, respectively. The hay-pockets were then provided with hay daily. The does carried the nest materials to the empty nest box in their mouth. During the observations the first touching of the hay the first occasion of moving hay to the nest box, the time of finishing the nest and the exact date of kindling were recorded. The nests were also evaluated according to the amount of hay used for building. If the nest became soiled they were removed from the nest box and replaced by wood shavings. Mortality of the kits was daily recorded until the age of three weeks. In order to compare the mortality of kits reared in built nests and conventionally equipped nest boxes the

mortality rate of a group (kindled at the same time as the other groups) kept in nest boxes bedded with wood shavings was also recorded.

2.3 The effect of the various management methods on the nursing behaviour of the does

The does were placed to spot-welded wire cages having a basic area of 275 × 600 mm (without the feeder and nest box). The nest tray sunk into the nest area within the cage, was bedded with wood shavings. The door on the wall separating the cage and the nest area could be closed. Nine kits of average body weight were placed in each litter. Any kits dying during the experiment were replaced with kits of the same age and similar body weight; thus litter size did not change during the experiment.

The following five experimental groups were formed:

- FF: the does had free access to the nest for a period of 16 days from the time of kindling (n=10 does).
- CC: the does had access to the nest from 8:00 to 8:30 a.m. for 16 days from kindling (n=10 does).
- FC: from kindling up to day 9 there was free nursing, then from day 10 to 16 the does were allowed to enter the nest box only once a day, from 8:00 to 8:30 a.m. (n=10 does).
- CF: from kindling up to day 9 the does were allowed to nurse their kits only from 8:00 to 8:30 a.m., then between days 10 and 16 they had free access to the kits (n=10 does).
- 16h: during the first 16 days of nursing the does had access to the nest from 16:00 p.m. to 8:00 a.m. while the door was closed between 8:00 a.m. and 16:00 p.m. (n=8 does).

During the experiment the nursing behaviour of the does was monitored from the time of kindling up to day 16 using video technique. During the evaluations of the videotapes the number of nursing events per day, the starting time of nursing and the end of nursing were recorded, the distribution of nursing events in 24 hours and the length of nursing were calculated.

Using the Observer/VTA software (HOY, 2000) between the 10-16th day subsequent to kindling (during the period of changing the nursing conditions) the behaviour of does in front of the nest box was studied in detail in groups FC and CC between 21:00 p.m. and one hour after nursing. In that study the incidence of three patterns of behaviour were recorded: head contact, scraping at the entrance to the nest, biting the wire mesh of the cage at the entrance to the nest. Statistical evaluation of the experimental data was performed by single-factor analysis of variance and by chi-squared test using the SPSS 10. software package.

2.4 Modification of the nursing system as a biostimulation method

The does were placed to spot-welded wire cages. The door on the wall separating the cage and the nest area could be closed. Uni and multiparous does were sorted randomly into three groups. In the control (C=58 does, 144 inseminations) group the door separating the cage and the nest area was continuously open thus the does could freely nurse their kits. In the experimental groups two (CN2=53 does, 126 inseminations) or three days (CN3=64 does, 148 inseminations) before insemination (11 days after kindling) the free nursing was modified and the does could only nurse their kits once a day (the door separating the cage and the nest area was opened

between 8:00 - 8:30 a.m.). At the 15th day after kindling the does inseminated 15 minutes after nursing then free nursing was again allowed. Simultaneously with the inseminations the thigh muscle of the does was injected with 1.5 µg GnRH analogue. The vulva's colour, turgescence and the receptivity of the does were observed at the insemination. Kindling rate and litter size was recorded. The weight of the kits and the litters were weakly measured till the age of 3 weeks, the average daily gain of the kits was also calculated. Mortality rates were daily recorded. Experimental data were evaluated by means of analysis of variance and by chi-squared test using the SPSS 10. software package. In the applied models parity was considered as a random factor.

2.5 Free choice of rabbit among the same or different sized cages

Rabbits weaned at the age of 3 weeks were placed in cage blocks made of wire mesh. The cage block consisted of 4 cages and the rabbits could move freely among the cages of the same block through swing doors sized 150 × 150 mm. In one experiment the cage block consisted of four cages of the same size (500 × 750 mm). Every cage was equipped with two nipple drinkers and with one feeder (of 300 mm length). 18, 24 and 30 rabbits were placed into the separate blocks with a stocking density of 12, 16 and 20 rabbits/m². Marking of the cages were made according to the rabbits' choice during the first week. The cage that was most frequently chosen by the rabbits was termed as 'cage A' while the other cages were termed as 'cage B, C and D' according to the decreasing preference of the rabbits. In the other experiment the cage blocks consisted of cages of different sizes. The smallest cage had a floor space of 300 × 500 mm, the size of other cages was twice, three times and four times that of the first (600 × 500 mm, 900 × 500 mm, 1200 × 500 mm). The cages were equipped with 1, 2, 3 and 4

nipple drinkers and with feeders (of 100 mm, 200 mm, 300 mm and 400 mm length) proportionally to their size. 8, 16 and 24 rabbits were placed into the separate blocks with a stocking density of 5,3, 10,7 and 16,0 rabbits/m². A 24-hour video recording was made once a week, then the number of rabbits in the various cages was counted by 30 minutes. Feed consumption was measured weekly and on the day of video recording. Number of rabbits per m² was compared by single-factor analysis of variance using the SPSS 10. software package. Hence the stocking densities of the various cages based on the rabbits' free choice could be compared.

2.6 Study of a two phase rearing method for growing rabbits

The rabbits were housed in a closed climatized rabbitry and were placed in spot-welded wire cages having a basic area of 250 × 400 mm (0,1 m²) using a two tier caging arrangement. The temperature was 16-17 °C, the lighting period was 16 hours light. Third of the rabbits (KK group, n=116) weaned at the age of 3 weeks were reared till 10 weeks of age two by two (20 rabbits per m²). Two-thirds of the rabbits were rearing in fours (40 rabbits per m²) between the age of 3-6 weeks, then at the age of 6 weeks they were halved into two groups (20 rabbits per m²). Half of the rabbits stayed in the same cages (NKH group, n=116) the other half was placed to cages two by two (NKÚ group, n=116). From the age of 6 weeks all rabbits were reared by twos. The weight of the growing rabbits and the feed consumption per cage were weakly measured, the average daily gain and the feed conversion ratio were also calculated. The mortality rate was continuously recorded. The data was evaluated using two-sample t-test and single-factor analysis of variance. The mortality rates of the groups were compared by chi-squared applying the SPSS 10. software package.

2.7 Examination of free choice of rabbits among different floors

Rabbits weaned at the age of 21 days were reared in two identical cage blocks till the age of 10 weeks. Each cage block had a basic area of 2 m² and consisted of 4 cages sized 500 × 1000 mm. The cages only differed in the floor. Within a cage block the following types of cage floors were randomly set: planked by OSB panel, plastic mesh, plastic slat and wire mesh. The animals could move freely among the cages through swing doors (150 × 150 mm). One or several rabbits were placed into a cage block. 24hours video recordings were made of the rabbits weekly. For the rabbits kept individually in a cage block the exact time spent in cages of different floors during the observed day was recorded. For the rabbits kept in groups the number of rabbits stayed in the cages of different floors was recorded by 30 minutes and the statistical analysis was carried out based on these results. On the days of the video recording feed consumption per cages was also recorded. Evaluating the different floor types the number of animals per m² was compared by means of single factor analysis of variance using the SPSS 10. software package.

3. RESULTS

3.1 Factors affecting the gestation length

The time of insemination during the day (morning or 12 hours later) did not influence the average length of gestation. Although the does inseminated earlier also showed earlier parturitions but the time of kindling was affected by the photoperiod and the kindling peaks were observed during the dark periods. Parity and litter size significantly influenced the length of gestation. The gestation length increased with the increasing parity (till the 10th parturition) and decreased with the larger litters. On the contrary the nursing

or non-nursing status of the does and the number of kits that were nursed by the does at insemination did not influence the gestation length.

3.2 Monitoring the nest building behaviour

The later the hay was available for the does the more intensively it was carried to the nest boxes. The quality of the built nests was generally (70-80%) good or excellent but at least two or three days was necessary for nest building. If the available time was shorter then difficulties on kindling could be observed (kindling on the empty nest box or on the mesh). There was no significant difference in mortality rate between nests built of hay and the conventional nests made of wood shavings. In nests with soiled bedding material the mortality rate was increased. These nests however showed lower quality also at their building.

3.3 The effect of the various management methods on the nursing behaviour of the does

Part of the does (25%) nursed their kits more than once a day. The number of does nursing their kits more times a day increased when once-a-day nursing was changed to the free nursing system. The number of daily nursing events showed substantial individual (genetic) differences. Does most often nurse their kits in the hours after dark but the second nursing occurred at dawn or in the morning. Closing the nest box for several hours then opening the creep hole stimulated the does to visit the nest. The does nursed their kits twice a day spent more time in the nest at both nursing events than those does nursing the kits only once a day. In the case of once-a-day nursing, behavioural patterns indicating nervousness of the doe (head contact, scraping, wire biting) that could be observed with high frequency only in the hour before the nest box was opened. When changed over from

free to controlled nursing, these behavioural forms appeared with higher frequency and several hours earlier. After some days however the does adapted to this nursing form and the behaviour forms of nervousness appeared with decreasing frequency.

3.4 Modification of the nursing system as a biostimulation method

Modification of the free nursing to controlled nursing 2 days before the insemination did not significantly affect the conception rate and litter size. If the modification occurred 3 days prior to the insemination then the average litter size and the litter size/AI increased by 14-15% and 18-19%, respectively with unaltered weaning weight and mortality rate.

3.5 Free choice of rabbit among the same or different sized cages

The experiments justified that the early (3 weeks old) weaned rabbits like to huddle in one cage (preferably in a smaller one) and the freely chosen stocking density reached 60-70 rabbits/m². Equalisation of stocking density started after the age of 6.5 weeks when the number of rabbits stayed in the larger cages also increased. Feed consumption in the certain cages changed proportionately with the number of rabbits stayed in the cages.

3.6 Study of a two phase rearing method for growing rabbits

The two-phase rearing of rabbits weaned at a young (3 weeks old) age, increasing the stocking density to 40 rabbits/m² till the age of 6 weeks, then halving the groups and placing one half to other cages, while rearing remaining rabbits in the original cages did not exert any unfavourable effects on the feed consumption, weight gain, feed conversion ratio and mortality rate of the growing rabbits.

3.7 Examination of free choice of rabbits among different floors

The rabbits reared individually preferred the planked-floor, after reaching the age of 6 weeks they increasingly stayed also at plastic mesh. The rabbits reared in groups (after weaning at the age of 3 weeks) huddled in cages having a planked-floor or plastic mesh floor. After the first week despite the continuous cleaning the soiled and wet planked-floor was chosen by fewer and fewer rabbits. In spite of the definite preference of plastic mesh during the first period, with the advancing age the rabbits choose more frequently the two other floor-types and at the same time the difference among the various groups was levelled.

4. CONCLUSIONS AND RECOMMENDATIONS

At the end of the gestation the time, kindling time was mainly determined by the changing photoperiods. The parturitions occurred most frequently and least frequently at night and at (around) noon, respectively. The length of gestation was therefore partly independent of the time of insemination.

The nest building instinct of the rabbit does kept in industrial-scale conditions kindling in artificial nest boxes for several generations is still remained Using the provided hay the majority of the does built a good or excellent quality but a surprisingly small sized nest. The hay has to be placed in the cages at least two or three days prior to the expected parturition to provide the necessary time for nest building. If the available time was shorter then kindling on the empty nest box or on the mesh could occur. Part of the nests could be soiled (similar to nests made from wood shavings), but if these nests were replaced in time with dry bedding material then mortality rate was not higher than on conventional nests made of wood

shavings. Oppositely, placing wood shavings to the nest boxes is also appropriate to efficiently rear the kits.

Domestic rabbit does generally nurse their kits during the active dark period. Contrary to the findings some authors our results justified that part of the does nursed their kits twice or three times a day. Changing the once-a-day nursing to the free nursing system the number of does nursing their kits more times a day could be further increased. The increased nursing frequency however did not result better milk supply (according to the results obtained thus far). Closing the nest box for several hours and then opening the creep hole stimulated the does to visit the nest and immediately nurse their kits. When modified from free to controlled (once-a-day nursing in the morning) nursing, behavioural forms of the does were changed. Behavioural patterns indicating nervousness of the doe (head contact, scraping, wire biting) could be observed with increasing frequency from the dark hours till the morning nursing. After some days however, the does adapted to this nursing system. The stress caused by this nursing form might be against animal welfare aspects but it may be suitable to induce oestrus in the nursing does. Modification of the free nursing to controlled nursing 3 days prior to the insemination can be considered as a biostimulation method that can replace oestrus synchronising PMSG treatment. Hormonal treatments are considered with increasing disapproval in the EU, consequently alternative methods are required. Changing free nursing to controlled nursing 3 days prior to the insemination increased the proportion of does showing oestrus, conception rate and litter size. Summing the beneficial results the litter size/AI increased by 14-19% compared to free nursing (without PMSG treatment). It also has to be noted that the modification of the nursing system did not change weaning weight and mortality rate.

The early weaned rabbits like to huddle in one cage (preferably in a smaller one). Then the freely chosen stocking density can be manifold of the suggested value of 16 rabbits/m². From the age of 5-6 weeks the number of rabbits staying in the larger cages starts to increase. Thus applying a two phase rearing method is not against animal welfare aspects. Following the weaning at the age of 3 weeks the rabbits can be reared in fours (instead of twos) increasing the building and cage utilisation without exerting any unfavourable effects on the production.

From the available floor types (planked by OSB panel, plastic mesh, plastic slat and wire mesh) the individually reared rabbits preferred the planked-floor and plastic mesh floor. If the rabbits were reared in groups then despite the continuous cleaning the soiled and wet planked-floor was chosen by fewer and fewer rabbits. The rabbits showed definite preference towards plastic mesh floors as it satisfied their requirements, but they also accepted plastic slat and wire mesh floors with the advancing age.

5. NEW EXPERIMENTAL RESULTS

1./ Kindling time was influenced by the changing photoperiods, therefore the length of gestation was partly independent of the time (morning or 12 hours later) of insemination.

2./ Changing the once-a-day nursing to the free nursing system increased the number of does nursing their kits more times a day. When modified from free to controlled nursing, behavioural patterns indicating excitement of the doe could be observed with increasing frequency.

3./ Changing free nursing to controlled nursing 3 days prior to the insemination increased the litter size by 14-15%. This modification of the nursing system can be considered as a biostimulation method that can replace PMSG treatments.

4./ In case of their free choice, the early weaned (at 3 weeks of age) rabbits like to huddle in one cage (preferably in a smaller one). Applying a two phase rearing method doubling the stocking density (to 40 rabbits/m²) between the age of 3-6 weeks, then halving the groups and placing one half to other cages, while rearing remaining rabbits in the original cages did not exert any unfavourable effects on the rabbits' production.

5./ If the rabbits were reared in groups they showed preference towards plastic mesh floors and rejected planked floors. Plastic slat and wire mesh floors were also accepted with the advancing age of the rabbits.

6. Publications on the subject of the dissertation

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