

Abstracts of papers dealing with rabbits presented during the

**10<sup>TH</sup> SYMPOSIUM ON HOUSING AND DISEASES OF RABBITS,  
FURBEARING ANIMALS AND PET ANIMALS**

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First part of the abstracts (second part will be published in the next WRS issue)

**SECTION : ETHOLOGY, HOUSING, WELFARE**

**The use of operant conditioning as a method  
to determine the floor space requirement  
of fattening rabbits.**

W. BESSEI (Germany)

Operant conditioning has been applied recently to elucidate preferences and motivation in farm animals. In the present study rabbits have been conditioned to get access to feed and to increase or decrease the available floor space by pressing a bar. Also the number of bar pressing, e.g. the work which was needed to receive a response was increased gradually.

First experiments have shown that weaned rabbits learned easily to open a feeder by pressing a bar. The frequency of bar pressing declined only slightly when the number of bar pressing for one opening response was increased from 1 to 6 and 12. This means that the animals were prepared to work for their feed requirement even under aggravating conditions.

In a following experimental phase, the rabbits learnt to increase the floor space by the same operant mechanism while the feeder remained open. In contrast to the former situation, however, there was a sharp decline of work for increasing floor space as the requirement of bar pressing was raised from 1 to 6 and 12.

In a further experiment, the rabbits were offered the possibility to either increase or decrease their floor space in consecutive sessions. The initial floor space for the increasing or decreasing operation was 545 and 3150 cm<sup>2</sup> per rabbit respectively. Learning the bar pressing mechanism to open the feeder was more difficult under the large floor space conditions, but later on the rabbits worked actively to reduce the floor space. The response of the animals, as measured by the frequency of bar pressing and change of the floor space, for reducing the floor space was lower as compared to increasing the floor space. There was again a sharp decline of the bar pressing activity for the enlargement of floor space when the requirement for bar pressing for one response was increased. This decline was less pronounced when the rabbits worked for reducing the floor space because of the lower initial activity under this condition.

Since rabbits are prepared to increase and reduce their floor space it can be concluded that their preferred space may be in between of the extreme situations which have been tested in the present experiment.

**Use of infrared-videotechnique  
in behavioural investigations in rabbits.**

ST. HOY (Germany)

Up to now, artificial light with low intensity mostly was used to observe the behaviour of animals directly or by video recordings.

But light-dark-change is a main timer for daily periodicity so that use of light during the night can lead to possible impact on circadian rhythms in investigated animals up to occurrence of behavioural deviations. Presence of investigator in visual direct observations may also cause effects on species-specific behaviour of rabbits observed.

With the infrared (IR)-videotechnique in combination with a time lapse recorder (VCR) a method is available to investigate the behaviour of rabbits over 24 hours, on day and night (also at darkness). IR-videotechnique configuration contents of IR or residual light camera WV-CD 810/G or WV-BP 500 (Panasonic) with different objective lens, IR lamp WFL-I-LED 30 W, VCR AG 6024 HE (Panasonic), monitor WV-BM 80 and 180min video tapes. With these technique it is possible to record the behaviour over 24 hours with the 180min video tape. By time code generator (AEC box 18/28) time code can be added to tape either during recording or during copying tape. So, computer aided evaluation of video recordings is enabled by Video Tape Analysis System VTA with OBSERVER (Noldus). Specific video recorder with remote control connector is used (AG 5700- Panasonic) to put the data of behavioural events by typing keys of computer to time axis of VTA programme. The data analysis includes time-event table, time-event plot, elementary statistics, lag sequential analysis and other.

By IR-videotechnique the hitherto existing meaning was defeated that female rabbits would suck its kits only once a day and that mother-child relation in rabbits wouldn't exist.

In addition, 5 does siblings in a flat deck keeping system were observed over 24 hours during several days in suckling period to record the frequency of eating, drinking and solitary grooming. Does ate 44 to 80 times in 24 hr with an average duration of 169 to 302 seconds per stay at trough. Percentage of eating was 11.8 to 20.8% (on the base of 24 hr). Number of using nipple waterer ranged from 20 to 71 per 24 hr and the mean duration per stay at nipple was between 41 and 119 seconds (1.4 to 4.4% of total time). Female rabbits solitary groomed on average 118 times with a mean duration per grooming of 29 seconds (4% of total time). Differences in eating and drinking between light and dark period were not found.

**Behavioural examinations  
on the mother-child relation in rabbits.**

U. WASSERZIER, K. SEITZ, K. LANGE, ST. HOY (Germany)

Up to now it is assumed, that there is no mother-child relation between rabbits and their kits. The examinations are showing the intensity of mother-child relation in different keeping systems. Behaviour of 24 rabbits kept in flatdeck cages and two-level-cages ("Swiss system" cages) were investigated with the help of Infrared-videotechnique over 35 days in four suckling periods. Number and manner of social contacts of does towards their litter were observed. The following parameters of behaviour were counted and evaluated: 1. Litter contact: the doe jumps into the litterbox without suckling her kits; with or without kits in the box. 2. Head contact:

the does head is in the litterbox. It is sniffing or turning the wool or litter.

It was found that the mean number of litter contacts on average of all hours was 0.5 per hour in the flat-deck system, whereas the "Swiss system" only 0.13 litter contacts/hour took place. Differences in head contacts were less obvious. On average 0.29 head contacts/hour were counted in the flatdeck system and 0.21 in the "Swiss system". Additionally it was observed, that more contacts (both litter and head contacts) took place right before and after suckling compared to other times of the day. On average 0.77 contacts were observed ten minutes before suckling and 2.08 contacts ten minutes after suckling in the flatdeck system. In the "Swiss system" less contacts were seen (on average 0.68 events ten minutes before and 0.51 contacts ten minutes after suckling). These results suggest, that keeping rabbits in smaller cages leads to more intensive mother-child relations, because the doe is fronted more often with her kits. In the "Swiss system" cages the second level offers a possibility for the doe to retire from her kits. The examinations also show, that suckling doesn't happen without any preparation. Separation of the doe from her kits is an interference of the mother-child-relation and is to be avoided.

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### **The effect of cage enlargement on the productivity and behaviour of rabbit does.**

J.M. ROMMERS, R. MEJERHOF (The Netherlands)

The influence of cage enlargement and height on the productivity and behaviour of does kept under commercial conditions was studied. Two cage surfaces (6000 cm<sup>2</sup> and 3000 cm<sup>2</sup>), two cage heights (50cm and 30cm), two cage floors (wire and alternative) and their combinations were tested. For the experiment 80 cages were used. Nulliparous New Zealand does were placed in the cages at 12 weeks of age. Natural mating was started at 14 weeks of age and does were maintained in production by 5-10 days post-partum mating.

A positive effect of the cage enlargement and height on productivity was found. The number of young born alive was increased in the heightened cages and the number of weaned rabbits was increased in both the enlarged and the heightened cages. In the heightened and enlarged cages with an alternative floor the young rabbits were heavier at weaning. No influence of the cage enlargement and height was found on the replacement rate of does.

In the enlarged cages, it was observed that does did not have a prevalence for a resting place further away from the nestboxes than in the standard cage. The frequency of nestbox visits was not influenced by cage size and varied strongly between does (from 4 till 100 times/24 hours).

In the heightened cages the does raised themselves, which was not seen in the standard cages, due to the limited vertical space.

In all cages, a limited amount of abnormal behaviour (gnawing and digging) was observed.

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### **The influence of light on fattening rabbits.**

L. BIGLER, H. OESTER (Switzerland)

At the beginning of sexual maturity, aggressive conflicts may occur in the group housing of male fattening rabbits and lead to serious injuries as has been shown by experience and literature.

The aim of the study is to determine if the injuries and the aggressive behaviour in fattening groups of male rabbits are influenced by the factor light. In a first trial the effect of different light intensities (5, 15, 30 and 45 Lux) on the social behaviour in 16 groups was investigated. In a second trial the fattening rabbits of 16 groups were held under two different lighting schedules (8L:16D and 16L:8D).

Behaviour observations occurred around the 64<sup>th</sup>, 74<sup>th</sup> and 84<sup>th</sup> day of life on 4 successive days.

The animals were examined for injuries on three different moments. No effect of the different light intensities on the behaviour and on the injuries could be detected. The investigations on the duration of light showed effects on the sexual behaviour, the activity and locomotion. But there was no influence on the aggressive behaviour and on the frequency and severity of injuries.

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### **Genetic influences on the development of aggressive behaviour among male domestic rabbits kept together.**

G. HEIL (Germany)

After reaching sexual maturity at about 12 weeks of age male domestic rabbits might start biting at each other. This often causes injuries and in exceptional cases the attacked animal might die. So far nothing is known whether the age of the first occurrence of aggressive conflicts is influenced genetically. This aspect was investigated on the basis of rabbits from 5 different strains kept under the same conditions. For these investigations each experimental unit consisted of 2 male litter mates which, after reaching 9 weeks of age were placed in a usual fattening cage. A total of 194 of such pairs were available for this investigation and exposed to observation in order to find out at what age biting and injuries occurred for the first time. When this happened with a pair, the 2 sibs were separated and observation discontinued. The observations also finished when there had been no biting or injury until 31 weeks of age.

From all pairs under investigation 43% had to be separated during the observation period on account of aggressive encounters with the frequency between strains differing from 36 to 53%.

The age at which the pairs had to be separated averaged 19 weeks with a variation between strains from 15 to 21 weeks of age. In neither aspect were the differences between strains statistically significant.

The frequency of the occurrence of biting and the age at its first occurrence showed a large variation within each strain. Therefore no strain specific recommendations for the duration of the fattening period could be derived from these results. It should be pointed out, however that under the conditions the male rabbits were kept during these investigations there was very seldom biting in any of the strains before the age of 12 weeks which is also the usual end of the fattening period.

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## **SECTION . PRODUCTS, PRODUCT QUALITY**

### **Fattening rabbits in "grazing cages": performance and meat quality as compared to conventional in-door production.**

J. ZIMMERMANN, W. BESSEI (Germany)

There is a tendency for increasing demand for products from "ecological" production systems. The regulations for ecological animal production are based on less intensive management and feed of ecological origin. The aim of this study was a comparison of performance and meat quality of rabbits raised outdoors in "grazing cages" and fed a ration which has been formulated according to the regulations of ecological production, and rabbits of the same breed and age under a conventional indoor system. A total of sixty 28 days Old Grey hybrid rabbits (ZIKA) were housed in groups of 6 in 10 "grazing cages". The cage size was 130x80x40cm. The rabbits could graze through the wire over the whole fattening period. The cages had two wheels and a handle which allowed daily relocation so as to provide fresh green and to minimise the contact with the manure. The pelleted ration contained 10MJ ME and 16.25% crude

protein. The control indoor group was kept in conventional fattening cages of 3 rabbits each and was fed the same diet. One half of each group was slaughtered at 84 and 91 days, respectively. Slaughter weight as well as weight of thigh, back and organs were heavier in rabbits housed in-doors. No significant effect on any of the investigated meat quality traits could be observed with the exception of meat colour. Outdoors housed rabbits had darker coloured meat.

### Investigations of the bone mineral density of female zika-breeding rabbits with peripheral quantitative computerised tomography (pQCT™).

C. JULIUS, B. DRESCHER (Germany)

The bone mineral density was measured in 24 female ZIKA-breeding rabbits kept in group housing as well as in a single housing over a period of six months. The measurement point in both investigations was the calcaneus and the distal end of the tibia. The bone texture of spongy bone and compact bone are measured with peripheral quantitative computerised tomography.

The investigation have shown, that pregnancy and lactation have a considerable influence on the bone mineral density of female breeding rabbits.

The bone mineral density of spongy bone at the calcaneus of female animals is considerable reduced with pregnancy and lactation at the same time for the six month period. This shows high significant differences of the course of bone mineral density between test-rabbits and control-animals. The results are valid for group and single housing. The compact structure of the bone at the calcaneus responds with an increase of density to stand by the mechanical strain. There are also high significant differences between test-rabbits and the control animals. The phases of "only pregnancy" or "only lactation" have a clear influence on the change of bone mineral density of spongy and compact bone at the calcaneus. An important fact is the number of the born and simultaneously fostered rabbits.

### In vivo estimation of body composition of pregnant rabbits by X-ray computerised tomography.

G. MILISITS, R. ROMVARI, A. DALLE ZOTTE,  
ZS. SZENDRŐ, P. ROZSAHEGYI (Hungary)

X-ray computerised tomography (CT) and direct chemical analysis were used to determine the changes in body composition of 19 Pannon White does during their first pregnancy. The rabbits were scanned repeatedly by CT (at insemination, at the 14<sup>th</sup>, 21<sup>st</sup> and 28<sup>th</sup> day of pregnancy and 12 hours after kindling). As a control 27 nonpregnant does were also scanned at the same time. Altogether 25 scans were evaluated from each animal within the body interval of the scapular arch and the end of the femur on stretch position. Three dimensional histograms (3D) were constructed on the base of the density of picture forming pixels.

Within the first part of pregnancy (from the insemination to the 14<sup>th</sup> day) no important changes could be shown in the body composition of the does. In the second part of pregnancy (particularly from day 21) a significant growth in water and muscle content could be seen in the region of abdomen due to the intensive growth of foetuses. Regarding the whole interval of pregnancy a loss of fat in the pregnant rabbits and an increase of fat in the control rabbits were observed.

## SECTION : DISEASES, DISEASE PROPHYLAXIS

### Liver enzyme activities in rabbits after experimental infection with *Eimeria stiedai* or *pellerdyi*.

S. MATTHES, S. RAGNITZ (Germany)

In experimental investigations on rabbits, infected with coccidia oocysts (*E. stiedai* or *pellerdyi*) serum enzyme studies have been carried out in relation with the examination of parasitological and pathological parameters. The object was to find out whether the determination of clinical chemical parameters is useful for the diagnosis of the present infection.

During the infection with *E. stiedai* (liver coccidiosis) a statistical significant increase in the activity of the enzymes "lactic dehydrogenase" (LDH), "glutamate dehydrogenase" (GLDH), "aspartate aminotransferase" (AST), "alanine aminotransferase" (ALT), "γ-glutamyl transferase" (γ-GT) and a decrease in the activity of "alkaline phosphatase" (AP) in serum was detected. Changes in serum enzyme values during the endogenous cycle of the parasite were found out from the period of schizogonic stages and the beginning of sexual reproduction to the decrease of the number of oocysts in the faeces. They can be tracked back to a direct or indirect liver damage.

Rabbits infected with *E. pellerdyi* (intestinal coccidiosis) showed only slight clinical symptoms. There was a decrease of serum AP activity from day 6 to 9 post infection which can however be attributed more likely to a reduction of food intake than to cellular damage induced by the parasite.

The determination of clinical chemical parameters is useful for the diagnosis of rabbit liver coccidiosis, especially a combination of the enzymes GLDH, ALT and γ-GT should be preferred. During intestinal coccidiosis the changes in serum enzyme activities were not sufficient for the diagnosis.

### Reasons and pathogenetic mechanisms of vertebral column deformation in rabbits.

B. DRESCHER (Germany)

Female and male breeding rabbits caged singly in conventional cages or in a big box respectively, or in group housing system during a period of up to four years at all, have been investigated with a special regard to deformations of the vertebral column. A possible relationship of deformation and housing and locomotion conditions have been proved.

The findings show no deformations in male but distinct deformations in female rabbits. It could be shown that frequency and degree of alterations are related to the size of the cage and the possibility of locomotion.

The following factors support a deformation development of the vertebral column:

1. position failing as "flat sitting" in low cages,
2. general hypoplasia of the bony tissue caused by locomotion deficiency,
3. displacement of the body's centre of mass towards the caudal direction caused by the weight of the gravid uterus with the consequence of alteration of the static-dynamic forces of the trunk construction, too,
4. high calcium need caused by pregnancy and lactation at the same time.

The actual stand of investigations allows to conclude, that in a rabbit suitable housing system sufficient place and so sufficient possibility of locomotion, too, allows the rabbits to avoid position failings as well as a general hypoplasia of the bony tissue as main factors of deformations of the vertebral column.

**The state of health of raised rabbits in small farm.**

A. FRINDT, M. BRZOZOWSKI, R. GLOGOWSKI,  
M. KATKIEWICZ; R. CZUMINSKA (Poland)

113 rabbits from small farms in south regions of central Poland were examined for their health status. The rabbits were between 123 and 175 days old and had a body weight between 2,2 and 2,7 kg. Most of them were New Zealand White. The examination of rabbit health has been lead in two ways: the observation of living stock and the results of diagnostic dissections.

The outcome suggest, that the main health problem war liver coccidiosis (25% of examined population). There were also detected the cysts of tapeworm *Cysticercum pisiformis* and ear mange in whole population.

**Study of the dental development in young rabbits.**

B. DRESCHER, A. FALTER (Germany)

The heads of ZIKA-rabbits, dead between 0 and 28 days of age have been prepared anatomically and afterwards they have been divided into two halves in the sagittal plane. Each time the left halves of the heads were roentgenized in a latero-medial path of rays using a fine marking film. To demonstrate the dental development for each living day from 0 up to 28 days one sample had been chosen to present the process of dental development:

- at birth (day 0): there are 2 incisors and 3 premolars in the upper jaw and 1 incisor and 2 premolars in the lower jaw,
- first week: development of the first molar in the upper and lower jaw,
- second week: development of the second molar in the upper and lower jaw, development of 3 permanent premolars in the upper jaw and 2 in the lower jaw,
- third week: growth of the permanent premolars,
- fourth week: lost of the deciduous premolars as well as final development of the third molars in both jaws.

Summarising the results we see that at the usual weaning age, namely 28 days, the dentition has developed completely as well as that the teething has finished. The permanent dentition is:

2I 3PM 3M  
II 2PM 3M

**Results of continuous measurements of ammonia and carbon dioxide in keeping rabbits.**

ST. HOY, K. LANGE (Germany)

Large information exist considering the concentration of relevant gases from view point of animal hygiene in keeping farm animals but less is known about the dynamics of these gases in rabbit housing. It seems reasonable to assume that especially in rabbit stables with a high stocking density and a poor quality of ventilation system the concentration of ammonia and carbon dioxide can be increased.

The aim of our own investigations was to determine continuously the concentration of ammonia and carbon dioxide under air ventilated conditions. The measurements took place in a small chamber with flatdeck for 10 New Zealand rabbits (average body weight: 3,7kg; 0,29 m<sup>3</sup>/rabbit) and in a farm house with 105 females, 20 males and approximately 400 young rabbits after weaning. Both stables had a ventilation system with inlet and outlet fans. Faeces were removed once a week in small chamber. In the farm, manure was stored below flatdecks and removed once a measuring period. Concentration of ammonia (NH<sub>3</sub>) and carbon dioxide (CO<sub>2</sub>) were determined by multigas monitoring on the basis of photo acoustic spectral analysis, added by short time measurements of NH<sub>3</sub> with ammonia tubes. Air temperature was on average 20°C. Weekly means, average of 3 days respectively and dynamics over 24 hr were calculated.

Low concentrations of ammonia (3.4 to 5.6 ppm) and carbon dioxide (575 to 685 ppm) were measured in the small air conditioned chamber. Maximum of NH<sub>3</sub> reached for a short moment 12.3 ppm. Highest peak in CO<sub>2</sub> concentration was 939 ppm. Results of NH<sub>3</sub> measurements with ammonia test tubes agreed with values measured by multigas monitoring. Mean on average of 27 measurements was 5.4 ppm.

In the farm means (of 3 days) were found of 10.5 to 14.7 ppm (NH<sub>3</sub>) and 959 to 1040 ppm (CO<sub>2</sub>). Ammonia had a maximum of 24.9 ppm. Threshold value of ammonia valid for other farm animals (calves, pigs) with a concentration of 20 ppm was overstepped only for a short period by approximately. 5 ppm. Low CO<sub>2</sub> concentration indicates a good function of ventilation systems in both stables. Increase in CO<sub>2</sub> and NH<sub>3</sub> concentration seem to be connected with begin of light period