# WELFARE AND HAEMATOLOGICAL INDICES OF WEANER RABBITS AS AFFECTED BY STOCKING DENSITY

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## ABSTRACT

Forty two weaner rabbits of mixed breeds and sexes with an average initial weight of 956.7±45.6 g were used to evaluate the effect of stocking density on welfare and haematological characteristics. The rabbits were allotted to four stocking densities of 10, 14.3, 20 and 25 rabbits/$m^2$. This corresponded to 2, 3, 4 and 5 rabbits per cage (50 x 40 x 30 cm) in a completely randomized design. Each condition was replicated three times. Animals were fed *Centrosema pubescens* supplemented with pelletized commercial growers' feed. Fresh and clean water was also freely available throughout the duration of the study which lasted six weeks. A significantly higher ($P<0.01$) body condition score was observed in rabbits stocked at 10 followed by those at 14.3, 20 and 25 rabbits/$m^2$. Rabbits reared at 14.3 had better fur condition ($P<0.01$) than those kept at 20 and 25 rabbits/$m^2$ respectively. During the open-field assessment, gait score was adversely affected ($P<0.01$) at the highest housing density. The proportion of rabbits with fight wounds increased ($P<0.01$) in densities of 20 and 25 rabbits/$m^2$. A higher incidence of hock and foot burns ($P<0.01$) was recorded among rabbits at the highest stocking density. Rabbits housed at 10 and 14.3 rabbits/$m^2$ were superior to those at higher densities in packed cell volume, haemoglobin concentration, red blood cell counts and mean corpuscular volume, although differences were not statistically significant. No definite trend was observed in mean corpuscular haemoglobin or mean corpuscular haemoglobin concentration. White blood cell counts; neutrophil, lymphocyte, monocyte and eosonophil values were also not significantly different among rabbits under the varying stocking densities. However, the neutrophil/lymphocyte ratio suggests that rabbits stocked at 20 and 25 rabbits/$m^2$ were more stressed. These results indicate that increasing the density beyond 14.3 rabbits/$m^2$ elicited some negative effects on live performance of weaner rabbits in the savanna zone of a tropical environment.

**Key words**: Stocking density, Welfare, Haematology, Weaner rabbits, Tropical environment.

## INTRODUCTION

Welfare of animals is largely regulated by various intrinsic and extrinsic factors, among which stocking density plays a pivotal role in causing stress and affecting animal behaviour. This has been a source of global concern, as the Standing Committee of the European Council for the Protection of Animals kept for intensive purposes has been working on specific recommendations for the welfare of domestic rabbits since 1996. Although a high cage density attenuates production costs, this might negatively influence growth rate and increase aggressive acts of animals (Maertens and De Groote, 1984, Bigler and Oester, 1996). The situation in which an animal cannot adjust to its environment can result in reduced welfare for that animal (Mench, 1992), and may equally lead to health-related problems. A knowledge of this can be obtained through haematological studies which, according to Ovuru and Ekweozor (2004), help in understanding the relationship between blood characteristics and habitat and the adaptability of the species to its rearing environment.

In the savanna zone of Northern Nigeria, backyard rabbit farming is becoming popular as a means of bridging the supply-demand protein gap. This could largely be attributed to the recent outbreak of the highly pathogenic avian influenza in poultry in the country which hit the zone and lead to a reduction in poultry-related activities (Maina, 2006). However, the determination of optimal stocking density or

spatial distribution is still a subjective evaluation done by the farmer, a situation that can undermine animal welfare and economic profitability. A review of available literature indicated that there exists paucity of information on welfare parameters and blood indices of rabbits in the sub-humid tropics.

Therefore, the present study was designed to evaluate the effect of stocking density on some welfare indicators and haematological parameters of weaner rabbits. The results derived from this will provide an objective data base on the appropriate space requirements for rabbits in the savanna area of a tropical environment.

## MATERIALS AND METHODS

### Experimental animals and design

The trial was conducted in the rabbitry of the Teaching and Research Farms, Faculty of Agriculture, Nasarawa State University, Keffi, Shabu-Lafia Campus, located in the guinea savanna agro-ecological zone of Northern Nigeria. The mean monthly maximum and minimum environmental temperature during the study which lasted six weeks were 34.55 and 25.65$^0$C, while the monthly relative humidity and rainfall were 72.50% and 126.55 mm, respectively.

Forty two weaner rabbits of mixed breeds and sexes with an average weight of 956.67±45.60 g obtained from a research institute were randomly allocated to four stocking density treatments: 10, 14.3, 20 and 25 rabbits/m$^2$. This corresponded to 2, 3, 4 and 5 rabbits per pen in a completely randomized design. Each condition was replicated three times. The allocation of rabbits was based on minimizing the variations in initial weights between replicate pens. The dimension of each pen made of wood and poultry wire mesh was 50 x 40 x 30 cm. The animals had about 13 hours natural light per day. They were fed *ad libitum Centrosema pubescens* supplemented with pelletized commercial growers feed with the following characteristics: crude protein 14.5%, fat 7.0%, crude fibre 7.2%, calcium 0.8%, available phosphorus 0.4% and metabolizable energy 2500 kcal/kg. Although rabbits can survive on all-forage diet alone, the addition of commercial feed supplementation was chosen because there are seasonal fluctuations in the quantity and quality of available forages and their potential negative effects as stronger in the hot-dry season of the year. Fresh water was also freely available throughout the duration of the study. The feeders and waterers were allotted proportionately, depending on the number of rabbits in the pens, and also strategically located to minimize extraneous variation.

The rabbits were inspected on a weekly basis for body condition, fur condition, gait score, hock and foot burn and fighty bites as described by Iyeghe-Erakpotobor and Olorunju (2005) and Ravindran *et al*. (2006). Body condition was scored on a five-point scale ranging from 1 (very poor) to 5 (very good) by stroking over the back bone of the rabbit with the palm of the hand to determine the level of muscle cover. Fur condition was scored by the presence or absence of coarse skin or hair falling off the skin, on a scale of 1 to 3, with 1 being poor with very rough skin incidence and 3 good, healthy skin condition (smooth fur). The gait score, or walking ability, was assessed for five randomly selected rabbits per treatment group. Two observers watched the animals spontaneously walking in the open-field (986 x 584 x 220 cm), and scored their walking ability on a two-point scale (0, normal gait, rabbit walks with ease, has regular and even strides and is well balanced; 1, rabbit walks with irregular and uneven strides and appears unbalanced; 2, rabbit is reluctant to move and is unable to walk many strides before sitting down). A score was ascribed only when there was consensus between the two observers. Hock and foot burn was scored using a three-point scale (1, no burns; 2, mild burns; 3, severe burns). Fighty bites were determined by the presence or absence of fight wounds on the skin on a scale of 1 to 3 with 1, being no bites and 3, many skin wounds.

**Haematological analysis**

At the end of the experimental period, blood samples were collected from three randomly selected rabbits per treatment group. About 5 ml of blood were collected from the external ear vein with a sterilized disposable syringe and needle. The blood was immediately transferred into well labeled tubes with ethylene diamine-tetra-acetic acid (EDTA) (0.05 ml/m1 of blood) as anticoagulant, while the tubes containing blood samples were kept in ice containers. Haematological analysis was carried out within 3 hours of blood collection. The parameters determined were packed cell volume (PCV), red blood cell (RBC) counts, white blood cell (WBC) counts and haemoglobin (Hb) concentration following standard procedures described by Davice and Lewis (1991). From the values of the PCV, Hb and RBC counts, the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and the mean corpuscular haemoglobin concentration (MCHC) were estimated. Leucocyte differential counts were also determined.

**Statistical analysis**

All data collected were subjected to one-way analysis of variance to assess treatment effect using the appropriate sub-routines of GENSTAT (2005) statistical package. Means among groups were compared by Fisher's Least Significant Difference (LSD) method.

## RESULTS AND DISCUSSION

The influence of stocking density on welfare parameters of weaner rabbits over the 42-day trial period is summarized in Table 1. Significantly higher ($P<0.01$) body condition score was observed in rabbits stocked at 10, followed by those at 14.3, 20 and 25 rabbits/$m^2$. The present result is consistent with the findings of Iyeghe-Erakpotobor and Olorunju (2005) where body condition score increased linearly from 6.7 to 13.3 rabbits/$m^2$. Rabbits stocked at 14.3 had significantly ($P<0.01$) better fur condition than those kept at 20 and 25 rabbits/$m^2$ (2.87, 2.57 and 2.44). This superiority may facilitate acceptability to rabbit consumers, retailers and wholesalers as rough furs may be perceived as associated with serious health problems especially where rabbits are marketed live. Gait score, as observed in the open-field test, was significantly ($P<0.01$) influenced, with rabbits reared at the highest density adversely affected. This corroborates the report of Ferrante *et al.* (1997) where a reduction in movements was observed in rabbits housed at 17 compared to those at 12 animals/$m^2$. It is also concurrent with the findings of Sorensen *et al.* (2000) who attributed poorer walking ability in birds reared at higher densities to constrained mobility and reduced opportunity for activity. Conversely, Trocino *et al.* (2004) reported that rabbits maintained at 16 rabbits/$m^2$ spent more time moving than those at 12 rabbits/$m^2$.

Fighty bites were significantly ($P<0.01$) affected by stocking density. Rabbits stocked at high densities (20 and 25 rabbits/$m^2$) displayed more unstable and aggressive behaviour. The present result is in agreement with the findings of Bigler and Oester (1996) in which the incidence of injuries in male rabbits 60 to 80 days of age increased significantly as the size of the group increased from 15 or less to 16-30 or over 40 animals. Similarly, Bandyopadhyay *et al.* (2006) proposed that, in highest stocking density, some birds would be dominant and others would be subordinates resulting in the establishment of social tension. In contrast to our findings, Iyeghe-Erakpotobor and Olorunju (2005) observed insignificant fight wounds in rabbits under varying stocking densities. They ascribed this to the high number of females and to the fact that the males had not reached sexual maturity. Morisse and Maurice (1996) also found that even at high densities, aggressive encounters were uncommon and mixed sex housing did not result in major problems. Significantly higher ($P<0.01$) incidence of hock and foot burns was recorded among rabbits reared at the highest density. This is attributable to the increased time that the rabbit spent sitting, in contact with the wire floors which, according to Drescher and Schlender-Bobbis (1996), are not a suitable substrate for rabbits and might predispose them to ulcerative pododermatitis (sore hocks). The present findings are also in consonance with a similar study in chickens where it was reported that foot pad lesion score increased linearly with

increasing placement density (Dozier III *et al.,* 2005). Ravindran *et al.* (2006) however, reported no treatment effects on hock and foot burns.

**Table 1**: Welfare parameters as affected by stocking density

| | Stocking density (rabbits/m$^2$) | | | | | |
|---|---|---|---|---|---|---|
| | 10 | 14.3 | 20 | 25 | Prob. | SEM[1] |
| Body condition | 4.39 | 4.00 | 3.67 | 2.98 | <0.01 | 0.08 |
| Fur condition | 2.72 | 2.87 | 2.57 | 2.44 | <0.01 | 0.05 |
| Gait score | 0.03 | 0.02 | 0.08 | 0.34 | <0.01 | 0.03 |
| Fighty bites | 1.00 | 1.00 | 1.20 | 1.33 | <0.01 | 0.06 |
| Hock and foot burns | 1.00 | 1.00 | 1.00 | 1.20 | <0.01 | 0.03 |

[1]Standard error of means

The mean values of the red cell components of rabbits are presented in Table 2. There were no significant differences in packed cell volume (PCV), haemoglobin concentration (Hb) red blood cell counts (RBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and the mean corpuscular haemoglobin concentration (MCHC), although rabbits raised at 10 and 14.3 rabbits/m$^2$ had better numerical means (with the exception of MCH and MCHC). The results concur with the findings of de la Fuente *et al.* (2004) in which packed cell volume was similar in rabbits stocked at 8 and 12 rabbits per cage. The differences between the two stocking densities, according to the authors were insufficient to improve rabbit welfare. However, the mean PCV values obtained in rabbits stocked at 20 and 25 rabbits/m$^2$ in the present study are only slightly above the normal range of 25.0–45.0% reported in the literature (Mitruka and Rawnsley, 1977).

**Table 2**: Mean erythrocytic values

| | Stocking density (rabbits/m$^2$) | | | | | |
|---|---|---|---|---|---|---|
| | 10 | 14.3 | 20 | 25 | Prob. | SEM[1] |
| Packed cell volume (%) | 34.5 | 32.9 | 28.4 | 28.2 | 0.34 | 2.72 |
| Haemoglobin (g/dl) | 10.2 | 9.47 | 8.93 | 8.80 | 0.68 | 0.88 |
| Red blood cell counts (x10$^6$/µl) | 6.23 | 6.17 | 5.37 | 5.30 | 0.51 | 0.54 |
| Mean corpuscular volume (µ$^3$m) | 56.1 | 53.2 | 52.8 | 52.9 | 0.72 | 2.31 |
| Mean corpuscular haemoglobin (µ/g) | 16.2 | 15.4 | 16.6 | 16.6 | 0.75 | 0.88 |
| Mean corpuscular haemoglobin concentration (%) | 29.2 | 29.0 | 31.5 | 31.4 | 0.76 | 2.17 |

[1]Standard error of means

Rabbit leucocytic values are reported in Table 3. No significant differences were observed in white blood cell counts, neutrophils, lymphocytes, monocytes or eosonopils of rabbits under the four stocking densities investigated. However, the high average neutrophil values of rabbits kept at 20 and 25 rabbits/m$^2$ could be indicative of stress which elicits a defense response.

**Table 3**: Mean leucocytic values

| | Stocking density (rabbits/m$^2$) | | | | | |
|---|---|---|---|---|---|---|
| | 10 | 14.3 | 20 | 25 | Prob. | SEM[1] |
| White blood cell counts (x10$^9$/1) | 5.50 | 5.60 | 5.27 | 5.13 | 0.94 | 0.61 |
| Neutrophils (%) | 45.6 | 45.9 | 48.33 | 49.7 | 0.32 | 1.27 |
| Lymphocytes (%) | 52.8 | 50.8 | 47.5 | 47.6 | 0.13 | 1.36 |
| Monocytes (%) | 1.13 | 2.20 | 2.03 | 1.67 | 0.26 | 0.36 |
| Eosinophils (%) | 0.33 | 0.83 | 1.10 | 1.00 | 0.75 | 0.53 |
| Neutrophil/Lymphocyte (N:L) ratio | 0.86 | 0.90 | 1.02 | 1.04 | 0.11 | 0.02 |

[1]Standard error of means

## CONCLUSIONS

Rabbit welfare was affected by stocking density. Apart from a higher body condition score, rabbits stocked at 10 were similar to those housed at 14.3 rabbits/m$^2$ in fur condition, gait score, fighty bites and hock and foot burns. Although no significant effects were observed in the erythrocytic variables, higher average packed cell volume, haemoglobin concentration, red blood cell counts and mean corpuscular volume were recorded for rabbits stocked at 10 and 14.3 compared to their counterparts

raised at 20 and 25 rabbits/$m^2$. Stocking density did not influence leucocytic values. However, rabbits stocked at 20 and 25 rabbits/$m^2$ appeared to be more stressed as indicated by the high neutrophil/lymphocyte ratio. It is concluded that group-housing of rabbits at a density of 14.3 rabbits/$m^2$ could guarantee and promote an improved welfare in a tropical environment.

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