

Research Article

EFFECT OF FLOOR SPACE ON SERUM CORTISOL LEVEL OF OSMANABADI KIDS IN MUMBAI REGION OF INDIA

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ABSTRACT: This experiment was conducted to find out the effect of different floor space allowance on serum cortisol level of Osmanabadi kids. For this study, eighteen Osmanabadi kids between the age group of 3-4 months were randomly selected irrespective of sex. The selected kids were divided and kept into three different groups with different floor space comprising of 6 kids in each group. Group T0 (0.8m² floor space/kid), Group T1 (0.7m²/kid) and Group T2 (0.6m²/kid). The feeding and other management practices for all the three groups were similar. The blood sample was collected from each goat in fifteen days interval and the serum cortisol concentration (nM/l) was determined with the help of Radio Immuno Assay (RIA) kit. The average serum cortisol concentration were 12.66 ± 3.08, 10.85 ± 3.51 and 15.18 ± 3.88 nM/l in Group T0, T1 and T2 kids respectively. There was no significant effect (P<0.05) of floor space on cortisol concentration as a stress indicator in Osmanabadi kids.

Key words: Floor space, Stress behaviour, Osmanabadi kids, Serum cortisol concentration.

INTRODUCTION

Goat (*Capra hircus*) was the earliest ruminant domesticated around 9000 to 7000 B.C (Kumari *et al.* 2013). Ruminants are of

great economic importance in livestock industry and small ruminants play very important role in the socio-economic status of the society. In fact, goat plays a significant economic role for

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the farming communities living in lowland, midland and highland provinces. Amongst the goat breeds of India, Osmanabadi goat breed is a native of Marathwada region of Maharashtra, but it is reared, bred and well adapted throughout India.

The housing plays a key role in rearing of goats. An ideal housing enables in moderating the range of microclimate to which the animals are exposed. In housing management, particularly floor management is an important aspect of goat husbandry, which provides both comfort and cleanliness with minimal risk of injury. It is also well known fact that floor space plays limitations which have negative consequences on the welfare and production of animals, as well as on performance. Space is generally defined as the average area offered per animal and it is considered a defining feature of all animal production systems due to its economic implications (Petherick and Phillips 2009). The increase in space improves welfare and performance of farm animals (Boe *et al.* 2006). Stress is a normal physiological outcome of the individual when the animal is subjected to different situations. It may be due to environmental factors, feeding management, housing etc. According to Lindberg (2001) the lack of adequate space for an animal in a group can also affect the level of aggression and thereby the state of stress. Sufficient space is extremely important for animals to establish a hierarchy (Lindberg 2001). Confinement and high densities in combination can give rise to stress, which can be measured by e.g. elevated cortisol concentration in faeces or cortisol level in blood (physical response). Cortisol is the primary glucocorticoid (hormone) in the body of mammals (Sjaastad *et al.* 2003). Moberg (2000) stated that under carefully controlled

experimental conditions cortisol can be a reliable indicator of stress. Alam *et al.* (1986) and Nwe *et al.* (1996) stated that plasma cortisol has been used as a reliable measurement of determining stress response. As per the research is concerned, different floor space provision that categorically comes under housing system, may be a factor to discriminate the animal's stress response. So it is now challenging to undergo an experiment bearing this aim so as to make a solid reason for the farmers whether they would go for a manageable situation regarding floor space provision.

MATERIALS AND METHODS

This research work was conducted in Instructional Livestock Farm Complex (ILFC), Bombay Veterinary College, Mumbai.

Experimental Animals

Total 18 Osmanabadi kids apparently healthy (approximately 3-4 months of either sex) were used in the experiments to study the effect of space allowance on their behaviour for approximately ninety days. All 18 kids used in this experiment originated from the same experimental herd. The three groups were designed for the consideration and their distinguishing features were known by the different floor space allowances. The no. of animals remained same in all of the groups.

Gr.T0- 0.8m² floor space/kid (total 6 kids)

Gr.T1- 0.7m²/kid (total 6 kids)

Gr.T2- 0.6m²/kid (total 6 kids)

Accordingly pens of different sizes were built.

For Gr.T0- Pen size (8 ft X 6ft)

For Gr.T1- Pen size (7ft X 6ft)

For Gr.T2- Pen size (6ft X 6ft)

*1²m ≈ 10² ft

Table 1. Average serum cortisol concentration (nM/l) in kids under different floor space (n=6).

| Fortnight | Group (T ₀) | Group (T ₁) | Group (T ₂) |
|-------------------------|-------------------------|-------------------------|-------------------------|
| 1 | 18.59 ±4.23 | 5.00 ±1.17 | 14.31±2.98 |
| 2 | 19.20 ± 3.98 | 16.67±4.10 | 15.02±3.11 |
| 3 | 2.60 ± 0.36 | 3.68 ±0.73 | 4.49±0.68 |
| 4 | 13.46 ± 4.22 | 12.47±3.34 | 28.74±5.83 |
| 5 | 9.48 ± 2.61 | 16.43 ±4.31 | 13.35±2.66 |
| Average (M±S.E.) | 12.66 ± 3.08 | 10.85 ± 3.51 | 15.18 ±3.88 |

Table 2. Analysis of Variance (RBD).

| Source of Variation | DF* | SS* | MSS* | F cal* | F prob* |
|---------------------|-----|--------|--------|--------|---------|
| Groups | 2 | 47.32 | 23.66 | 0.67 | 0.53 |
| Weeks | 12 | 457.87 | 114.46 | 3.24 | 0.07 |
| Error | 24 | 282.06 | 35.25 | - | - |
| Total | 38 | - | - | - | - |

*DF- Degree of Freedom; F.Prob - F.probable value ; SS- Sum of squares; MSS- Mean sum of squares; F Cal- F Calculated value.

Housing and Animal Management

The housing was of katcha housing type in which the flooring material is of natural soil and mud. This housing system is a very cost effective housing taking the economic status of the goat farmers in to account. The intention is to get maximum output by investing minimum costs. Ventillation aspect was also taken with high concern so as not to influence the experiment by any mismanagement with the said one. Every attempt was given to make the pens dry, clean and hygienic. Each goat was individually marked with ear tagging. The goats were all accustomed to human contact and handling, and were fed twice a day, usually between 09.00 and 10.00 A.M. in the morning and between 04.00 and 05.00 PM in the

afternoon. The kids were received chaffed green fodder @350gm/day/kid and concentrates @150gm/day/kid in the morning as well as in the evening. This amount then gradually increased in relation to the age and body weight. Fresh water was available for ad libitum consumption. Their pens were cleaned out once a day, usually in the morning, and a layer of sawdust was added in the solid resting area to ensure a dry surface.

Blood sampling

Basal cortisol levels in the blood were measured from 18 Osmanabadi kids once every 15 days as a indicator of stress. All the blood samples were labelled individually with the tag number of the goat. The blood samples were

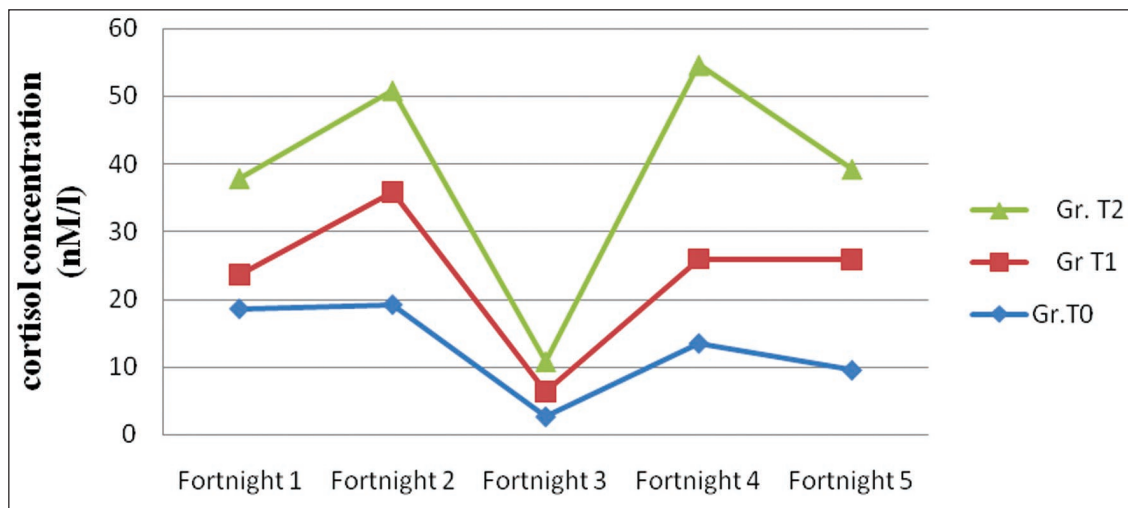


Fig. 1. Effect of floor space on serum cortisol concentration of kids.

collected in the morning, usually during one hour before the morning feeding, approximately between 8 to 9 a.m. Blood samples were drawn from all the goats via jugular venepuncture, and taken immediately after each other, starting with different animals/group each time. The samples were collected as gently as possible, trying our best not to arouse the goats. Sampling of one goat took approximately 30 sec. All of the blood samples were kept in a cold room at 4° C for 24 h after they were collected and the samples were centrifuged for approximately 15 minutes at room temperature at 3000 rotations/minute. Two samples from each blood sample were thereby put into Eppendorf tubes. All of the tubes were individually marked with tag number of the kid and date of sampling and then put in a freeze at -18°C.

When all the 90 samples were collected, processed and labelled they were taken to Radiation Medicine Centre, Tata Memorial Hospital, Annex Building, Parel, Mumbai for estimation of serum cortisol levels. Cortisol

estimation was done by RIA using a commercial kit (Immunotech, France). This kit is used for human being and can be used in goats as studied by Sahlu *et al.* (1992) for serum cortisol estimation. RIA Kit for cortisol (IM 1841 cortisol C.T.RIA kit; Immunotech, France) The kit is comprised of (A) Anti-cortisol monoclonal antibody-coated tubes, (B) ¹²⁵I- labeled cortisol tracer and (C) Reference calibrators containing from 0-2000 Nm of cortisol Pipettes. Disposable tips and SR300 (Startec make) Auto RIA analyser were also taken up for the finishing part of serum cortisol estimation. Before processing the test, all samples and reagents were brought to room temperature. Disposable tips were used for pipetting and dispensing of reagents. The desired numbers of antibody-coated tubes from the kit were labelled and secured in a holder. 50 µl of calibrator or control or serum samples were dispensed into the antibody-coated tubes and labeled accordingly. 500 µl of tracer was then added into all the antibody-coated tubes. These tubes

were vortexed and incubated at 25^oc for 1 hour with shaking in an orbital shaker. After incubation the contents of the antibody-coated tubes (tracer) were carefully aspirated (except for 2 tubes meant for total count). Then the final step was data processing. The antibody-coated tubes were dried and data processed in SR300 Auto RIA analyser.

Statistical Analysis

The statistical analysis was done by RBD (Randomized Block Design) using the software developed by Jangam and Thali (2008).

RESULTS AND DISCUSSION

The serum cortisol concentration in blood serum of Osmanabadi kids of three groups recorded at fortnight interval is presented in Table 1 given below. At the start of the experiment, the basal values for serum cortisol concentration were 18.59, 5.00 and 14.31 nm/l in T0, T1 & T2 respectively. The average cortisol concentration in serum was found to be 12.66 ± 3.08 , 10.85 ± 3.51 , and 15.18 ± 3.88 nm/l at the end of the experiment in T0, T1 & T2 respectively. The highest level of cortisol was found in Kids of T2 in 4th reading which was 28.74nm/l and the lowest 2.60nm/l in Gr. T0 in 3rd reading.

The cortisol concentration of first month was the highest which might be due to the complete confinement of Osmanabadi kids with different floor space provision. However, in later weeks the kids were adopted with new floor space allotted in confinement showed lower cortisol levels. The cortisol level did not change significantly ($P < 0.05$) when kids reared in different group under different stocking density as evidenced by table no 2. Still, there was slight more concentration of serum cortisol levels

observed in kids of T2 (0.6m²/kid) than the kids of T0 (0.8m²) and T1 (0.7m²). It is an indication that the Osmanabadi kids can sustain stress even though the floor space allotted to them was lesser than the standard ones. The cortisol values varied from 4.0- 64.8 nm/l of the basal values, and between 0.6-75.8 nm/l for the experimental period in goats as stated by Kjoren (2012). Olsson and Hydbring- Sandberg (2011) measured cortisol level between 17 (± 1) and 49 (± 6) nm/l serum cortisol of goats exposed to fear-eliciting stimuli (as a stressor). Andersen *et al.* (2008) measured between 2-10 ng/ml of cortisol concentrations in adult goats exposed to social instability, while Nwe *et al.* (1996) measured between 42-166 ng/ml cortisol concentrations in goats exposed to transportation stress. There was no effect of space allowance on cortisol concentration of animals reported by Horten *et al.* (1991); Cockram *et al.* (1996); Early and Riordan (2006); Fuente *et al.* (2010); Uetake *et al.* (2011); Fuente *et al.* (2012); Kjoren (2012); Vas *et al.* (2013) which agrees with the present study. Basal cortisol concentrations were reported to be not elevated by space restriction in studies by Pearce and Paterson (1993) and Meunier-Salaun *et al.* (1987), which also concedes with the results of this study.

CONCLUSION

As far as the housing of goats for the goat farming is concerned, the importance of floor space provision cannot be ignored. No significant impact has been set up by the reducing trend of floor space allocation on the serum cortisol level in kids. Since cortisol is a indicator of stress, it can be implied that overcrowding of the animals resulted due to less floor space accommodation in a confined

housing system does not flash any significant impact on the stress level of the animals. So it can be concluded that the welfare status of the animals in terms of their stress level is not compromised by housing the animals with a comparative lower floor space recommendation.

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