

Influence of Feeder Design on Physiological and Haemato-Biochemical Parameters of Osmanabadi Goat Kids

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ABSTRACT

The effect of feeder design on the health and growth performance of the Osmanabadi goat kids was evaluated. A total of 18 Osmanabadi weaned kids of 5-6 month of age were randomly divided into 3 treatment groups (n=6), viz., T1, T2 and T3 for the study period of 60 days. T1 group kids were kept on conventional feeder and served as control, T2 on circular feeder and T3 on linear feeder. Rectal temperature, heart rate and respiration rate differed non-significantly across all the groups throughout the study. T3 group exhibited a significantly higher haemoglobin value (g/dL) than T2 and T1 group on 60th day of trial. The PCV value ranged from 19.0±0.73 to 25.0±0.4 %. A statistically significant elevation in TEC (x10⁶/μL) was registered on the 60th day in T3 (14.8±0.03) and T2 (14.7±0.04) as compared to T1 (14.4±0.08). The T1 and T2 showed a substantial but non-significant increase in N/L ratio as compared to T3. The maximum mean protein level differed non-significantly and was found highest on the 60th day of experiment in T3 (6.8±0.9 g/dL) group. The glucose data indicated no significant difference among all the groups with the lowest value observed on the 60th day in T3 group. Our findings indicated that modified linear feeder design was more suitable and exerted minimal stress resulting in better health and welfare of kids.

Key words: Haemato-biochemical profile, Feeder design, Osmanabadi goat kids, Physiological parameters, Welfare

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INTRODUCTION

Goats play a significant role in capital storage, employment/income generation and improving household nutrition (Rai and Singh, 2005). Goats can be reared with low cost input under both intensive and extensive systems. Goats are skilled browsers and prefer to eat wild plants as well as weedy plants found on the ranges. However, with the increasing urbanization, scarcity of grazing area is among one of the key challenges in the arena of goat rearing. Owing to which, the concept is slowly changing into zero grazing system. Thereby, goat management practices needs to be improved at commercial as well as farmers level (Kashyap *et al.*, 2020). The design of feeders has a direct impact on the performance of any farm in terms of reducing feed wastage, desirable feed intake, reduced aggression and meeting behavioral requirements (Kaur *et al.*, 2020). Good feeder design ensures a relatively even distribution of feed among goats with less aggression and wastage (Kaur *et al.*, 2021) paving the way for better health and welfare. Although, numerous organized goat farms in India use hexagonal feeders traditionally for feeding of goats as these have been designed and promoted by Central Institute for Research on Goats (CIRG), Makhdoom (Kaur *et al.*, 2021), however, there are very scanty reports on whether the feeders of different shapes have any influence on the growth and health of the growing goat kids or not. Therefore, the present study was undertaken to gain an insight into the effect of different feeder designs on physiological and haemato-biochemical parameters of Osmanabadi growing kids.

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MATERIALS AND METHODS

Experimental Animals and Design

The present study was conducted at the Osmanabadi Goat Seed Centre under Directorate Research Service, DSVCKV,

Durg (CG, India), for 60 days during winter season. A total of 18 Osmanabadi weaned kids of 5-6 month of age and weighing between 10-15 kg were selected for the experiment. All the kids were randomly divided into 3 treatment groups, viz., T1, T2 and T3 with 6 animals (3 males and 3 females) in each group. The area of pen in each group was 10 x 10 ft². All the animals selected were dewormed with fenbendazole @ 7.5 mg/kg body weight before starting the experiment. Free access of fresh and clean water was given *ad libitum* to the experimental animals.

Feeder Designs

All the animals of T1 group were kept on conventional feeder as control that consisted of 30 cm feeding space for each kid and total length 188 cm. In T2 group animals were kept on circular feeder and likewise in T3 group animals were kept on linear feeder (Fig. 1).

Recording of Physiological Parameters

The rectal temperature, respiration rate and heart rate were recorded every fortnightly from the start of the experiment in the early morning (between 7AM-8AM) posing minimal disturbance to the kids under study.

Estimation of Haemato-biochemical Parameters

Blood samples from individual kids were collected aseptically on 0, 15th, 30th, 45th and 60th day of experiment. The various haematological and biochemical parameters such as haemoglobin, Packed cell volume and Total erythrocyte count were analyzed manually by using standard methods. Lymphocyte: Neutrophil ratio (L/N ratio) was also calculated to get an insight into the stress posed by the feeder types on goat kids. Serum total protein and blood glucose were estimated by biuret and GOD-POD (Oxidase-peroxidase) method, respectively. The data were analyzed by one way



Fig.1: Different feeder designs: a) T2 Circular feeder, b) T3 Linear feeder

Table 1: Effect of feeder design on mean \pm SE of fortnightly physiological parameters of Osmanabadi goat kids

Physiological parameter	Days of trial	T1 Conventional	T2 Circular	T3 Linear	P value
Rectal temperature (°F)	0 day	102.6 \pm 0.19	102.7 \pm 0.16	102.7 \pm 0.27	0.96
	15 day	102.5 \pm 0.25	102.5 \pm 0.29	101.6 \pm 0.24	0.53
	30 day	102.2 \pm 0.24	102 \pm 0.24	102.4 \pm 0.16	0.84
	45 day	102.1 \pm 0.16	102.7 \pm 0.80	102.5 \pm 0.09	0.37
	60 day	102.0 \pm 0.20	102.5 \pm 0.19	102.6 \pm 0.19	0.58
Respiration rate (Breaths/min)	0 day	25.0 \pm 1.6	24 \pm 1.5	27.6 \pm 0.6	0.17
	15 day	25.5 \pm 1.6	22.4 \pm 0.5	23.3 \pm 1.1	0.22
	30 day	26.3 \pm 0.9	25.5 \pm 1.2	23.3 \pm 0.6	0.11
	45 day	26.6 \pm 0.8	25 \pm 0.9	27.5 \pm 1.4	0.27
	60 day	27.1 \pm 1.01	25.8 \pm 0.9	26.6 \pm 1.3	0.70
Heart rate (Beats/min)	0 day	78.0 \pm 2.7	83.3 \pm 2.9	78.8 \pm 2.0	0.32
	15 day	79.0 \pm 2.1	80.6 \pm 2.5	81.0 \pm 2.9	0.84
	30 day	84.0 \pm 1.8	82.3 \pm 2.2	83.3 \pm 1.9	0.84
	45 day	85.0 \pm 2.7	78.8 \pm 2.9	80.0 \pm 1.8	0.23
	60 day	80.5 \pm 2.3	79.1 \pm 2.5	78.8 \pm 1.2	0.85

ANOVA and Chi-square test as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Effect of Feeder Design on Physiological Responses

Osmanabadi kids of all the three groups exhibited normal physiological responses, like rectal temperature, respiration rate and heart rate as presented in Table 1. The values of rectal temperature, respiration rate and heart rate ranged from 101.6 ± 0.24 to 102.7 ± 0.27 °F, 22.4 ± 0.5 to 27.6 ± 0.60 (instead of 0.55) breaths/min and 78.0 ± 2.7 to 85.0 ± 2.7 beats/min, respectively, during the experiment period. A statistically non-significant difference in average fortnightly values among control and treatment groups was observed in consecutive weeks till the end of the experiment period in all the parameters, indicating better welfare. Among the physiological parameters, rectal temperature and its fluctuations remain a good indicator of health and well-being of animal (Godyn *et al.*, 2019). The results of our study indicated that different feeder types didn't cause any adverse effect on health of growing kids.

Effect of Feeder Design on Haematological Parameters

The mean values of fortnightly haematological parameters of Osmanabadi goat kids studied have been shown in Table 2.

A non-significant difference was recorded among the three groups on all days for all the parameters, except for Hb, and TEC, which differed significantly ($p < 0.001$) between groups on day 60th of feeding trial.

It is a well-known fact that haematological parameters can be used to assess the health as well as the physiological status of farm animals under consideration (Etim *et al.*, 2014). Our findings corroborated with Imasuen (2012), who reported that Hb values were found significantly higher in intensively reared goats compared to extensively reared goats. Significantly elevated value of Hb in T3 on 60th day of experiment designates a better response of these kids to stressful conditions. Results on PCV are in agreement with Patil *et al.* (2014), who reported that PCV% was higher in the goats under stall feeding group compared to grazing group. Similarly, Debbarma *et al.* (2022) and Mane *et al.* (2022) documented significantly higher PCV% in intensive rearing group compared to semi-intensive and extensive systems. However, Imasuen (2012) did not find difference in levels of PCV% in semi-intensive and intensive systems. These differences may be attributed to the variation in breed, different experimental settings, seasonal influences etc.

In the present study, we recorded significantly higher values of TEC on the 60th day in T3 and T2 compared to T1 group kids. These results were in general agreement with

Table 2: Effect of feeder design on mean \pm SE of fortnightly haemto logical parameters of Osmanabadi goat kids

Haematological parameter	Days of trial	T1 Conventional	T2 Circular	T3 Linear	P value
Hb (g/dL)	0 day	7.76 \pm 0.14	7.83 \pm 0.14	7.73 \pm 0.09	0.85
	15 day	7.83 \pm 0.16	8.05 \pm 0.17	8.11 \pm 0.11	0.42
	30 day	8.11 \pm 0.25	8.18 \pm 0.18	8.26 \pm 0.10	0.15
	45 day	8.18 \pm 0.11	8.20 \pm 0.14	8.50 \pm 0.07	0.13
	60 day**	8.2 \pm 0.88 ^a	8.31 \pm 0.10 ^a	8.88 \pm 0.12 ^b	0.001
PCV (%)	0 day	19.1 \pm 0.7	19.6 \pm 0.76	19.0 \pm 0.73	0.80
	15 day	20.6 \pm 0.61	21.6 \pm 0.42	21.5 \pm 0.56	0.39
	30 day	22.0 \pm 0.5	22.8 \pm 0.6	23.3 \pm 0.71	0.34
	45 day	23.0 \pm 0.8	23.0 \pm 0.51	23.5 \pm 0.42	0.81
	60 day	23.6 \pm 0.49	24.1 \pm 0.6	25.0 \pm 0.4	0.21
TEC ($\times 10^6/\mu$ L)	0 day	12.3 \pm 0.17	12.3 \pm 0.09	12.3 \pm 0.11	0.96
	15 day	13.1 \pm 0.03	13.4 \pm 0.1	13.2 \pm 0.1	0.24
	30 day	13.3 \pm 0.1	13.5 \pm 0.11	13.5 \pm 0.07	0.19
	45 day	13.6 \pm 0.06	13.7 \pm 0.04	13.7 \pm 0.04	0.52
	60 day**	14.4 \pm 0.08 ^a	14.7 \pm 0.04 ^b	14.8 \pm 0.03 ^b	0.001
Neutrophil: Lymphocyte (N/L) Ratio	0 day	0.49 \pm 0.08	0.64 \pm 0.06	0.65 \pm 0.05	0.21
	15 day	0.68 \pm 0.08	0.66 \pm 0.09	0.59 \pm 0.05	0.70
	30 day	0.55 \pm 0.05	0.57 \pm 0.04	0.57 \pm 0.04	0.90
	45 day	0.72 \pm 0.07	0.73 \pm 0.08	0.54 \pm 0.08	0.21
	60 day	0.60 \pm 0.08	0.66 \pm 0.05	0.47 \pm 0.04	0.14

Mean bearing different superscripts within a row differed significantly ** $p < 0.01$.



Table 3: Effect of feeder design on mean \pm SE of fortnightly biochemical parameters of Osmanabadi goat kids

Biochemical parameters	Days of trial	T1 Conventional	T2 Circular	T3 Linear	P value
Serum total protein (g/dL)	0 day	6.66 \pm 0.2	7.2 \pm 0.1	6.8 \pm 0.21	0.08
	15 day	6.11 \pm 0.13	5.8 \pm 0.19	6.6 \pm 0.47	0.18
	30 day	6.9 \pm 0.25	6.2 \pm 0.16	6.2 \pm 0.3	0.66
	45 day	6.1 \pm 0.27	5.8 \pm 0.18	5.3 \pm 0.3	0.13
	60 day	6.5 \pm 0.5	6.2 \pm 0.51	6.8 \pm 0.9	0.27
Blood glucose (mg/dL)	0 day	92.5 \pm 2.7	94.8 \pm 4.8	93.8 \pm 7.5	0.55
	15 day	92.5 \pm 5.0	90.1 \pm 4.1	92.0 \pm 3.5	0.61
	30 day	96.1 \pm 3.4	92.0 \pm 3.8	93.5 \pm 3.8	0.53
	45 day	95.6 \pm 2.9	93.1 \pm 3.4	92.1 \pm 3.4	0.49
	60 day	98.8 \pm 4.4	94.0 \pm 2.0	93.3 \pm 1.4	0.55

Patil *et al.* (2014) and Raju *et al.* (2015), who reported that animals reared under intensive system were having higher level in RBC counts.

A non-significant difference was registered in N/L ratio among all the groups. However, from 45th to 60th day of experiment, T3 exhibited a lower value as compared to T1 and T2. The N/L ratio is an indicator of stress (Stanger *et al.*, 2005). Stress induced decline in lymphocytes numbers can be associated to glucocorticoids induced changes in redistribution of lymphocytes from blood to other compartments of body (Dhabhar, 2002; Parmar *et al.*, 2013). Our results indicated that group T3 kids could better respond to the stress as indicated by their lower N/L ratio in comparison to the other groups. Since the physiological adaptation and the systemic relationship are broadly determined using haematological values (Shah *et al.*, 2007), our data on Hb, PCV, TEC and N/L ratio suggested that both linear and circular feeder were well accepted by growing kids and it further promoted growth and welfare of goat kids with kids in T3 group exhibiting better response.

Effect of Feeder Design on Biochemical Parameters

The results of effect of feeder on serum total protein and blood glucose are presented in Table 3. Throughout the study, there were non-significant fluctuations in protein and glucose levels across groups. The maximum mean protein and minimum blood glucose level was observed on the 60th day of experiment in T3 compared to T1 and T2. Our results on protein corresponds to Yadav *et al.* (2023), who reported that the system of rearing, *i.e.*, grazing and stall feeding didn't affect the total protein values in Sirohi goats. Feeder types did not affect the nutritional intake among all groups. In agreement with our findings, Kaur *et al.* (2020) also observed that no significant difference was found in the total protein among different feeder types.

Exposure to stress leads to behavioral and physiological alterations and activation of adrenomedullary response by the release of catecholamines such as epinephrine and norepinephrine (Soin and Sunthamala, 2023). Epinephrine

increases hepatic glucose production and inhibits insulin secretion and the glucose uptake by tissues (Nonogaki, 2000) resulting in increased glucose levels. Additionally, a hormonal cascade also triggers the release of glucocorticoids which further leads to elevated glucose levels in stressed animals. In our study T1 exhibited the highest glucose levels consistently from 15th day onwards, which may indicate a certain level of stress in kids compared to T2 and T3 groups. Moreover, T3 group animals had lowest blood glucose levels on 60th day of the study, further signifying that kids kept on linear feeder were more comfortable and least stressed as compared to other groups. Interestingly, in our study no significant variation in blood glucose level was registered which further indicates that none of the feeder systems under study exerted a major stress to the growing kids. Additionally, all the kids were in growing stage and were provided ideal nutritional and management system that ensured their proper growth and welfare so the kids were not in a negative energy balance.

CONCLUSIONS

In conclusion, our study revealed that different feeder designs have a significant influence on the health of the goat kids. Moreover, modified linear feeder design was more appropriate and can be a better option as it posed minimal stress resulting in better health and welfare of kids.

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