# COMPARATIVE STUDY OF ETHOGRAM AND LABOUR ECONOMICS OF OSMANABADI GOAT IN DIFFERENT HOUSING SYSTEM

**T H E S I S**

Submitted

In partial fulfillment of the requirements for the Degree of

**MASTER OF VETERINARY SCIENCE**

**IN**

**LIVESTOCK PRODUCTION AND MANAGEMENT**

**By**

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**(INDIA)**

## DECLARATION OF THE STUDENT

I hereby declare that the experimental research work and interpretation of the thesis entitled **"COMPARATIVE STUDY OF ETHOGRAM AND LABOUR ECONOMICS OF OSMANABADI GOAT IN DIFFERENT HOUSING SYSTEM"** or part thereof has not been submitted for any of the other degree or diploma of any university, nor the data has been derived from any thesis or publications of any university or scientific organization. The sources of material used and all assistance received during the course of investigation have been duly acknowledged.

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**Mr. OVHAL RAMESHKUMAR LAXMANRAO** has satisfactorily prosecuted his course of research work for a period of not less than one semester (for M. V. Sc.) / two semesters (for Ph. D.) and that the thesis entitled, **"COMPARATIVE STUDY OF ETHOGRAM AND LABOUR ECONOMICS OF OSMANABADI GOAT IN DIFFERENT HOUSING SYSTEM "** submitted by him is the result of research work is sufficient to warrant its presentation to the examination in subject of **Livestock Production and Management** for the award of **Master of Veterinary Science(M.V.Sc)** degree by the Maharashtra Animal and Fishery Sciences University, Nagpur .

We also certify that the **thesis is the result of the student's bonafide research work and** thesis or part thereof has not been previously submitted by him for a **diploma or** degree of any other university.

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## CERTIFICATE

This is to certify that the thesis entitled **"COMPARATIVE STUDY OF ETHOGRAM AND LABOUR ECONOMICS OF OSMANABADI GOAT IN DIFFERENT HOUSING SYSTEM"** submitted by Shri. / Miss. **OVHAL RAMESHKUMAR LAXMANRAO** to the Maharashtra Animal Sciences University, Nagpur, in partial fulfillment of the requirement for the degree of **Master of**

**Name & Signature of External Examiner** **Signature & Seal of HOD** **Signature of Guide/Advisor**

**Veterinary Science (M.V.Sc)** has been approved by the Student's Advisory Committee after examination in collaboration with the External Examiner.

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*Dedicated to*

*My Beloved Family*

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*Date: 18/01/2022*

*Dr. RameshkumarLaxmanraoOvhal*

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# *Introduction*

# 1. INTRODUCTION

Goat (*Caprahircus*) was the earliest ruminant domesticated around 9000to 7000 B.C. As “poor man’s cow” goats have multifaceted utility as a livestock species and play significant role in the rural economy and nutrition security of landless, small and marginal farmers in the country. The domestic goat *Capra hircus* is an important livestock species in India and other developing countries. As it provides a good source of meat, milk, fibre and skin, it is popularly known". It can profitably be raised with low investment under semi-intensive as well as the intensive systems of feeding management. They provide quick return on account of their short generation intervals, higher rate of prolificacy and ease with which the related products could be marketed. Their importance is indicated by various functional contributions (meat, milk, fibre and skin) socio-economic relevance (security, income generation and human nutrition) and stability tofarming system (Davendra and Lokeshwar, 1992).

According to 20$^{th}$ livestock census (2019) the total Livestock population was 536.76 million in the country. Total bovine population i.e. cattle, buffalo, mithun and yak was 303.76 million. Goat population in the country was 148.88 million. The total goat population increased by 10.14% over the previous livestock census (2012). About 27.8% of the total livestock is comprised of goat population in India. In India, Rajasthan state had the highest goat population of (20.84 million).The population of goat in the Maharashtra state was 10.60 Million. The goat population in Maharashtra state has increased by 25.72% over the previous livestock census (2012), the state stands 6$^{th}$ position in the country. The total milk production of the country was 187.7 million tons, in which the contribution of goat milk was about 3% (6098.73 thousand tons). In Maharashtra state milk production by goat during the year 2018 – 19 was 247.95 thousand tones. The average milk yield per goats in 2018 – 2019 was 0.45 kilogram / day in the country and 0.24 kilogram / day in the Maharashtra state. The total meat production in the country was 8.11 million tons. The goat meat contribute about 13.53% and sheep meat contribution is 8.36 %.The meat production in the Maharashtra state by goat is 1020.60 thousand tons (2018 -2019).

There are 34 defined breeds of goat in India mostly named after their habitat and communities rearing them. Goats have served the mankind earlier and longer than cattle and sheep. Goat is one of the earliest domesticated species and next oldest to dog. The goat is an important source of milk, meat and fibre for the people throughout the world. Goat milk is prescribed for children, old and sick as it is easily digestible and has medicinal value. Goat meat is preferred over other meats because it is leaner and therefore no religious taboos against its consumption. Goats are small livestock in high demand and can thrive on low inputs and local resources. Goat has widest ecological range and are found in many regions of the world ranging from the arctic cold, temperate, deserts and mountains to subtropical and tropical dry and humid zones. Originating in Asia, goats have spread over all continents and inhabit almost all climatic zones. They are recognized as one of the most successful domestic ruminants of the tropics and subtropics, which involve the arid, semi-arid, sub – humid, humid and the super humid climates.

Goat rearing is one of the important agricultural enterprises particularly in rural parts of this country and has proved very useful to man throughout the ages, largely because of their adaptability to varying environmental conditions under which the breeds and strain types have evolved and in which they are maintained. They have tremendous ability to survive, and often thrive on sparse vegetation unsuitable for feeding of other livestock. Goats can be profitably raised with low investment under intensive and most extensive forms of nomadic grazing. The vast majority of this poorer section of rural population depends on goat rearing for income and certain amount of meat and milk for home consumption. Goat rearing requires low cost and hence suited to landless labour marginal farmers and industrial workers.

An ideal housing enables in moderating the range of microclimate to which the animals are exposed and the degree of comfort depends upon the types of housing and type of floor which can be used. The principal functions of housing for livestock are health sustaining and comfortable environment to the animals, desirable working conditions for labour and supervisory staff and integration of housing with feeding, watering, and cleaning, handling and manure.

removal systems. Housing management, particular floor management is an important aspect of goat husbandry, which provides both comfort and cleanliness with minimal risk of injury. This gives better health cover to the animal and improves their growth rate and productivity. Therefore, ideal bed needs to be hygienic, dry, resilient and reasonably temperature resistant. Some sort of bedding is necessary in conventional and semi-conventional system of rearing for goats to achieve good health and high productivity. Good bedding management practice also reduces parasitic loads.

Alam *et al.*, (1986); and Nwe *et al.*, (1996) stated that plasma cortisol has been used as a reliable measurement of determining stress response. 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. This is due to the fact that submissive animals might be prohibited from retreating from an aggressive encounter, or to retreat in defeat. This can further lead to prolonged fights, because the distance the submissive animal has to retreat before its submissive behavior is recognized might not be effective in the area available. To be housed together with individuals that are on top in the hierarchy without the opportunity to retreat if there are aggressive encounters, is likely to be a highly stressful state over time. 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 feces or cortisol level in blood (physical response). When animals in a group are constrained to a certain area with high animal density and no possibility to escape, it has been demonstrated that they alter their behaviors to e.g. avoid feeding/drinking at the same time as higher ranking animals, or they will decrease their feeding/drinking intake (Loretz *et al.*, 2004; Ehrlenbruch *et al.*, 2010; and Jørgensen *et al.*, 2009).

No planned studies were conducted especially in Osmanabadi goat behavior and reproductive performance, feeding and economics management of Osmanabadi goat in different housing system aspects, the literature on behaviour indices especially in these Osmanabadi goats in different housing systems is very scanty.

Therefore experiment entitled “Comparative Study of Ethogram and Labour Economics of Osmanabadi Goat in Different Housing System.’’ was designed with following objectives:

**Objectives:**

1. Study of natural behavior of Osmanabadi goat for 24 hours in different housing system.

2. To study labour economics of Osmanabadi goat in different housing system.

# *Review of Literature*

## 2. REVIEWOF LITERATURE

Osmanabadi goats comprise states of Maharashtra, Andhra Pradesh, Karnataka, Tamilnadu and Kerala. In Maharashtra these goats are mainly distributed at Latur, Tuljapur, and Udgir area. Goat color is mostly black and rests are white, brown or spotted. Dressing percentage varies from 45-50, Market age is 8-12 months, Average adult body weight is 34-40kg, Banerjee (2018).

### 2.1 Feeding Behavior:

Gordan (1958) studied the effect of cage system and different diet combination of behavior in sheep kept in the cages by feeding different combination 100% hay and 100% concentrate and found that rumination period lasts from under 1 min up to 2 hrs. in sheep kept in cages.

Hooper and Welch (1983) studied the chewing efficiency and body size of goats. Thirty – two observations were made on 27 goats (18 mature, non – lactating females and 9 doe kids) to study the relationship among metabolic body size (body weight Ts), and chewing efficiency. A jaw motion recorder determined the minutes spent eating and ruminating during 24 h. In 2 – and 3 too old kids, incomplete development of rumen function and body size both appeared to affect chewing efficiency. The chewing of 9 month old kids resembled that of the mature goats after adjustments for body size. Because rumination time seldom exceeds 10 h per day, the efficiency with which the time available for rumination is used will affect intake.

Lu (1989) studies the effect of heat stress on feeding and production in goats. Found that upper critical temperature 25 to 30 $^{0}$ C affect feed and digestibility in goats and rate of passage of food material in goats. He also found that feeding fat, supplementing sodium bicarbonate and other minerals, and maximizing cold water intake may be beneficial for heat-stressed goats.

Solanki (2000) the study was conducted in semi-arid region, at Rajkot in Gujarat, India. The observations were recorded on free grazing indigenous goats of

Zalabadi breed. Time spent in various activities during day from 08 to 18 hours was recorded in different seasons. The entries for grazing, walking, standing and sitting activities were made at every five minutes interval. Out of the available time in the field, goats spent 62.4% time for grazing, 19.2% for sitting, 10.6% in standing and 7.8% in walking. Goats in their grazing activities as well as in forage selectivity pattern exhibited marked diurnal periodicity. There were two peaks for the grazing, one in morning and the other in the evening. The evening peak was more pronounced than morning one. More number of plant categories was grazed in morning than in evening hours. The plant species preferred in morning were different than the plant species in evening.

Njiru (2001) studied the behavior of Sannen and Togenberg in a modified sub-humid tropical environment of Kenya. The behavior of 6 Toggenburg and 6 Saanen female goats, grazing on natural vegetation in a modified sub-humid tropical environment of Kenya, was studied during the dry (January and February) and wet (April and May) seasons in 1997. The two exotic breeds grazed for 12 h daily. Observation on feeding, standing, lying and ruminating was done chronometrically at five-minute intervals between 0600 and 1800 h. These grazing times were based on the current practice of small holder farmers.

Aschwanden *et.al.* (2009) studied loose housing of small goat groups: Influence of visual cover and elevated levels on feeding, resting and agonistic behaviour. He observed frequent social conflicts among goats due to their strict rank relationships can pose problems in loose housing of goats by negatively influencing feeding and resting times of low-ranking group members. In his study, he tested whether enrichment of loose-housing pens with structural elements providing visual cover (partitions, lying niches) and elevated levels (platforms) is effective in reducing agonistic interactions and interruptions in feeding and resting behaviour in small groups of goats. The study involved 8 groups of goats consisting of 8–9 non-lactating females that differed in grouping age and the presence of horns in a two-by-two factorial design. We compared the feeding, resting and agonistic behaviour the goats showed in pens to which they were well habituated (original situation) with the behaviour they performed in these pens

after enriching them with additional structural elements providing visual cover and elevated levels (enriched situation). Finally, the arrangement of the pens was restored to the original situation (restored situation). In each group, the behaviour of two low-ranking, two medium-ranking and two high-ranking goats was continuously recorded by video. Using linear mixed-effects models, variables of goat behaviour were analysed with situation rank, grouping age and presence of horns as fixed explanatory variables. With most of the outcome variables, the effects of the housing situation interacted with those of the rank and/or the presence of horns. From the original to the enriched situation, the feeding bouts were generally longer. Furthermore, from the original to the enriched situation, fewer feeding bouts of low- and medium-ranking goats were interrupted by displacements, and fewer of these bouts were interrupted by medium- and high-ranking goats to initiate agonistic interactions. In addition, fewer resting bouts were interrupted by displacements received, and in medium- and high-ranking goats, the risk of an interruption whilst resting due to initiating an agonistic interaction decreased from the original to the enriched situation. The outcome variables' values in the restored situation hardly ever returned to the values of the original situation which is likely to indicate a carry-over effect of the enriched to the restored situation. In conclusion, our results show that enriching pens for small groups of goats with structural elements providing visual cover and elevated levels positively affects feeding, resting and agonistic behavior.

Desnoyers *et al*., (2009) observed chewing behaviour either measured with a portable automatic system (APEC) which records jaw movements or obtained by scan sampling video analysis in 12 individually housed dairy goats. One hour and daily time-intervals were used for the analysis. APEC and video showed better agreement for 1h than for daily time-intervals but a very high individual variability was observed for all the parameters measured. Daily duration of rumination seemed to be assessed better by the APEC than by the video because it is sometimes difficult to determine if the goats are resting or ruminating on the video. Daily duration of intake was however assessed better by the video because the automatic recorder interpreted all oral behaviors as intake. However, total chewing time is directly related to the amount of saliva produced which an

important factor in ruminant nutrition. Both systems were relevant to measure chewing behaviour of stall housed dairy goats, and to study the daily time-budget of feeding behaviour but results have to be interpreted carefully.

Guvara *et al.*,(2011) Studied the effect of solar radiation on female goat kids.In this study 40 dairy goat kids were used in 2 similar pens whose feeders were shaded (n = 20) or unshaded (n = 20) during 60 days. From May to July, behavioral data were collected through 10-minute scan samples during a 24-hour period for a total of 300 hours. Both pens were shaded on the opposite side to the feeder with 15 m2 each in a resting area. All goat kids were observed for their position inside the pen, and the number of times they were seen eating was recorded. When the concentrate was provided (between 13:00 and 13:30 hours, as usually in the farm), the time was recorded until >50% of the animals stopped feeding and went back to the resting area (concentrate test). Results suggest that shade on feeders helps to ameliorate some negative effects of solar radiation increasing feeding time and feed intake in female goat kids. This could be of great interest to prevent performance and welfare negative affectations.

Wadhwani et al., (2014) review the data regarding the housing system s and its impact on welfare in small ruminant .For the present study information form scientific journals was collected. It was found that reduction of well-being in extensive production systems, which can impair production efficiency of grazing animals and dramatically affect the welfare and health status of sheep and goats.

Weera singhe *et al.*,(2014) studied the Behavioral Study of SanenandJamnapari Cross Bred Goats kept in a Stilted House at Post Graduate Institute of Agriculture, University of Sri lanka, Objective of this study was to understand the behavior of goats kept in a stilted house. Behavior of 14 Sanan and Jamnapari goats (14Kg-37Kg) kept in stilted house was observed using an ethogram for six hour sessions in two days (rainy and hot). Each session lasted for five minutes. Frequency and times spent on seventeen mutually exhaustive behaviors were recorded. The time budget on behaviors such as saltate (0.5%), sniffing (0.59%), chattering (0.59%) and importantly on drinking (0.6%) were very low. Behaviors such as freezing, head movement, animal interaction, saltate, running, rumination,

Pathan *et.al*., (2017) studied the growth performance and behavior pattern of Sangamneri goat under different rearing systems was undertaken to find out the effect of different rearing systems on growth performance in Sangamneri goat.

The research was carried out at the Sangamneri Goat Unit College of Veterinary Science, Shirwal, and Maharashtra. India. For this study, twenty one (21) adult female Sangamneri goats around two years of age with uniform body weight were under taken. These goats were randomly distributed into three groups of equal number (07each). Group (T0) allowed browsing on jungle grasses and for (T1) group allowed to browse on jungle grasses with supplementation of commercial concentrate and (T2) group allowed to complete stall feeding with supplementation of commercial concentrate. The experiment was conducted during summer season for a period of three months (90 days).The parameters studied were growth performance, feed and water intake, under different rearing systems. Significantly ($P<0.05$) higher feed intake (gm/day) was observed in stall fed with Concentrate supplemented group (T2) as compared to other rearing systems. The overall average water intake (ml/day) of Sangamneri goat under grazing stall fed with concentrate supplementation feeding system was 2080.98 ± 27.01. The significant difference ($P<0.05$) was observed for daily water intake of Sangamneri goats between different rearing systems. T0 and T1 group have significantly ($P<0.05$) higher water intake than stall fed (T2) group.

Bagul (2017) studied the effect of different roofs on growth performance and Behavior of Osmanabadi Kids at Department of Livestock Production and Management and (ILFC), Bombay Veterinary College, Aarey Colony Goregaon, Mumbai. Eighteen Osmanabadi goat kids of 5 to 6 months of age of either sex were reared. These kids were randomly divided equally into three groups 'T0 (thatch roof), T1 (FRP sheet roof) and T2 (asbestos sheet roof). All the three groups were managed under similar system of management. The average daily fodder and water intake of Osmanabadi kids in different roof housing systems were 1.394 ± 0.03, 1.366 ± 0.03 and 1.377 ± 0.03 kg/day and 3.58 ± 0.14, 3.98 ± 0.11 and 3.77 ± 0.09 liter/day respectively. There was significant difference amongst each group for fodder intake, whereas the average daily water intake in kids of different roofs system showed non-significant difference between T0 and

**Karina et al., (2018)** study was conducted to evaluate the behavior of lactating Saanen dairy goats housed with or without the use of environmental enrichment technique. Twelve animals were split into two equal groups and assign to one of two treatments: stall with or without enrichment. Five objects were used to enrich the stalls: plastic PET bottles suspended and freely on the floor (both filled with corn as a visual and auditory stimuli), general cleaning brushes fixed to the wall of the stall, suspended tire, and a tree trunk for climbing. The behavior of the goats was observed during two hours for 10 consecutive days. The behaviors were recorded using focal-animal sampling method, observing each animal during 10-minute period. Descriptive statistics were calculated plotting the results in behavior frequency charts. Animals on both treatments showed similar behaviors frequencies for food intake and self-cleaning. However, a higher frequency of stereotyped behaviors was registered in the treatment without environmental enrichment. The highest frequency of interaction was observed for suspended tire, indicating animal's preference for this object. In conclusion, animals on enriched environment show more different behaviors than animals in non-enriched environment and showed greater preference for some object over others.

**2.3 Rumination Behavior:**

Bell *and* Lawn (1957) studied the pattern of rumination behavior in housed goats at Dept. Physiol., Royal Vet. Coll, London. Rumination was studied by recording jaw movements of 28 goats of ages from 6 weeks to 16 months. From 246 records, the average time spent ruminating was 7 hr. 44 min. in 24 hr.; of this time 75 per cent, was at night. The time spent chewing between regurgitations was from 30 to 70 sec. There was wide variation among goats, and in individuals on different days.

Hooper and Welch (1983) studied the chewing efficiency and body size of goats. Thirty two observations were made on 27 goats (18 mature, non – lactating females and 9 doe kids) to study the relationship among metabolic body size (body weight) , and chewing efficiency. A jaw motion recorder determined the minutes spent eating and ruminating during 24 h. In 2 and 3 too months old kids, incomplete development of rumen function and body size both appeared to affect.

Desnoyers *et al,* (2009) observed chewing behaviour either measured with a portable automatic system (APEC) which records jaw movements or obtained by scan sampling video analysis in 12 individually housed dairy goats. One hour and daily time-intervals were used for the analysis. APEC and video showed better agreement for 1h than for daily time-intervals but a very high individual variability was observed for all the parameters measured. Daily duration of rumination seemed to be assessed better by the APEC than by the video because it is sometimes difficult to determine if the goats are resting or ruminating on the video. Daily duration of intake was however assessed better by the video because the automatic recorder interpreted all oral behaviors as intake. However, total chewing time is directly related to the amount of saliva produced which an important factor in ruminant nutrition. Both systems were relevant to measure chewing behaviour of stall housed dairy goats, and to study the daily time-budget of feeding behaviour but results have to be interpreted carefully.

Gede et al., (2014) studied the effect individual and colony housing in Bligon goat. For the present stud five male Bligon goats were kept in individual housing, while five others were confined to colony housing for three months. The observations made included total time and frequency of feeding ad the time spent resting/laying, ruminating, urinating and defecating. Those parameters were observed for seven days over each month, with observations made for 24 hours a day, starting from 06.00h. The result indicated that Bligon goats kept on the individual housing fed significantly less frequently ($P<0.01$) and spent less time eating ($11.13 \pm 0.70$ vs $20.80 \pm 2.42$ times), laying ($18.47 \pm 0.40$ vs $30.67 \pm 1.18$ times), ruminating ($12.20 \pm 0.55$ vs $22.94 \pm 1.17$ times), and urinating ($10.37 \pm 0.58$ vs $14.47 \pm 0.72$ times) compared to Bligon goats kept under colony housing. , in contrast, the average time spent eating each meal ($25.27 \pm 1.35$ vs $15.70 \pm 1.93$ min), laying on each occasion ($42.84 \pm 3.16$ vs $28.68 \pm 1.66$ min) and ruminating on each occasion ($34.63 \pm 1.82$ vs $19.33 \pm 0.83$ min) was significantly higher ($P<0.01$) in Bligon goats kept on individual housing. The total time spent eating, laying, ruminating and frequency of defecation did not significantly differ with type of housing.

Weera singhe *et al*. (2014) studied the Behavioral Study of SanenandJamnapari Cross Bred Goats kept in a Stilted House at Post Graduate Institute of Agriculture, University of Sri lanka, Objective of this study was to understand the behavior of goats kept in a stilted house. Behavior of 14 Sanan and Jamnapari goats (14Kg-37Kg) kept in stilted house was observed using an ethogram for six hour sessions in two days (rainy and hot). Each session lasted for five minutes. Frequency and times spent on seventeen mutually exhaustive behaviors were recorded. The time budget on behaviors such as saltate (0.5%), sniffing (0.59%), chattering (0.59%) and importantly on drinking (0.6%) were very low. Behaviors such as freezing, head movement, animal interaction, saltate, running, rumination, chattering and chirping were affected by the climatic condition of the day. It was concluded that goats kept in stilted houses spend one third of their time budget on eating and but very little time in drinking.

Panda *et al*. (2016) studied the effect of different housing systems on the behavior in Osmanabadi kids. The aim of this study was to evaluate the effect of different floor space on rumination and resting behavior of Osmanabadi kids. Eighteen Osmanabadi castrated kids with an initial average body weight (BW) of 6.80 kg at 3-4 months old age (after weaning) were used in this experiment. There were three different floor space provision of 0.8, 0.7 and 0.6$m^2$ in three experimental groups (T0, T1 and T3 respectively) with the same managemental conditions. The behaviors were observed using continuous focal sampling method and measured as minutes/4hr/week. The results indicated that the lying period under the category of resting behavior and rumination duration were significantly ($P< 0.05$) higher with increasing floor space, In conclusion, floor space provision as managerial practice in goats has effects on resting and rumination behavior, where more floor space is favorable to the goats system than loose housing system.

Sjostorm et al (2019) studied the effect of housing systems on behavior in dairy cows.The objective of this study was to evaluate the effects of 2 winter (December to April) housing systems on dairy cow. Certified-organic cows (n = 268) were randomly assigned to 2 treatments (2 replicates per system): (1) outdoor straw pack (outdoor) or (2) 3-sided compost-bedded pack barn (indoor).

Cows calved during 2 seasons (spring or fall) at the University of Minnesota West Central Research and Outreach Center, Morris, Minnesota, organic dairy. Organic wheat straw was used as bedding for the 2 outdoor straw packs, and bedding was maintained. material was stirred twice per day with a small chisel plow.Daily rumination was 509 min/d for indoor cows and 530 min/d for the outdoor cows. In summary, lactating cows housed outdoors on straw-bedded packs had cleaner udders and improved udder health compared with cows housed in a compost-bedded pack barn.

**2.4 Drinking Behavior:**

Misra and singh (2002) effect of water deprivation on dry matter (DM) intake, nutrient digestibility, nitrogen retention and metabolic water production was studied in bucks of Sirohi, Marwari and Kutchi breeds during August–September. Eighteen adult bucks (4–4.5 years of age), six each of the above-mentioned breeds were divided into three treatment groups in such a way that each group had two bucks of each breed. Water was made available ad libitum to group I, once daily at 15 h to group II and once after 48 h (alternate day) at 15 h to group III. Animals were offered 400 g per buck per day of a pelleted concentrate mixture in the morning and it was consumed by them within 15–20 minutes. Animals were then offered ad libitum pigeon pea straw. The green grass (Cenchrusciliaris) 1 kg per buck per day was provided after watering at 15.30 h. Refusals were recorded next morning at 8.30 h daily. The experiment continued for a period of 60 days following an adjustment period of one month. Dry matter intake (g kg W−0.75 per day) was the lowest in group II (77.53) and the highest in group I (82.91). Total water intake (per kilogram DM intake) ranged from 2.33 l per buck per day in group III to 2.77 l per buck per day in group I. Water deprivation did not affect ($P>0.05$) DM intake, nutrient digestibility, nitrogen retention and metabolic water production. The study showed that water deprivation up to 48 h does not adversely affect feed intake and nutrient digestibility in non-producing adult goats of different rearing systems on growth performance in Sangamneri goat.

The Pathan *et al*.,(2017) studied the growth performance and behavior pattern of Sangamneri goat under different rearing systems was undertaken to find out the effect research was carried out at the Sangamneri Goat Unit College of Veterinary Science, Shirwal, Maharashtra (India).For this study, twenty one (21) adult female Sangamneri goats around two years of age with uniform body weight were under taken. These goats were randomly distributed into three groups of equal number (07each). Group (T0) allowed browsing on jungle grasses and for (T1) group allowed to browse on jungle grasses with supplementation of commercial concentrate and (T2) group allowed to complete stall feeding with supplementation of commercial concentrate. The experiment was conducted during summer season for a period of three months (90 days).The parameters studied were growth performance, feed and water intake, under different rearing systems. Significantly ($P<0.05$) higher feed intake (gm/day) was observed in stall fed with Concentrate supplemented group (T2) as compared to other rearing systems. The overall average water intake (ml/day) of Sangamneri goat under grazing stall fed with concentrate supplementation feeding system was 2080.98 ± 27.01. The significant difference ($P<0.05$) was observed for daily water intake of Sangamneri goats between different rearing systems. T0 and T1 group have significantly ($P<0.05$) higher water intake than stall fed (T2) group.

**2.5 Urinating Behavior:**

Mahairi *et al*.(2017) found significant effect of housing system on drinking ,rumination ,urination and defecation who reported higher urination percent on wooden slatted floor housing in dairy goats.

Shreen E (2017) This study was carried out on a flock of Baladi goat breed belonging to the farm of Faculty of Veterinary Medicine, Zagazig University and a private farm, at Hehia city, Sharkia governorate on a total number forty baladi goats, apparently healthy, aged from 9-18 months were used to and divided into 20 goat on each system of housing either in semi-intensive system and village system to investigate the effect of dominance hierarchy on ingestive (feeding, drinking and rumination), aggressive and eliminative behavior (frequency of urination and defecation) of goat in relation to housing system.

The animals were allocated randomly into two separate, equal groups (4 males, 16 females). The results revealed that there was a significance difference (P 0.66 were higher than goats with dominance index(0.33-0.66)and goat with dominance index.

Sutherland *et al.* (2017) dairy goats prefer to use different flooring types to perform different behaviors. Flooring is an important component of indoor housing systems for livestock as it can impact animal hygiene and welfare. Therefore, the aim of this study was to evaluate the lying and elimination preferences of goats, as well as their relative udder cleanliness, when presented with four different flooring types. At 8 months of age, 32 non-lactating female Saanen cross does (45.4 ± 6.10 kg) were restricted to one of four different flooring types for 10 days (2.9 $m^2$/goat), then restricted to the other three surfaces (10 days per surface) using a Latin square design (n = 8 replicates, 4 goats/replicate). The four flooring types included wood shavings (WS), metal mesh (MM), plastic slats (PS) and rubber matting (RM). After the restriction period, goats were given free access to all four flooring types simultaneously for 48 h. Lying behavior was recorded using accelerometers. In addition, lying location and elimination (urination and defecation) behavior were recorded from video for 24 h at the end of the free access period. To assess cleanliness, Escherichia coli (E. coli) counts were measured on the udder region of the goats and on each flooring type at the beginning of each restriction period. During the restriction period there was no difference in the time goats spent lying on any of the four flooring surfaces; however, goats on WS performed more lying bouts ($P \leq 0.005$) of shorter duration ($P \leq 0.005$) compared to goats on RM during day 2, 3, 4 and 5. During the free access period, goats spent more time on RM and PS and less time on MM and WS (% observations/24 h: RM: 46.3, PS: 30.4, MM: 11.6, WS: 11.5, SED: 6.19, $P < 0.001$). Moreover, goats preferred to urinate (% urination events/24 h: WS: 88.8, MM: 3.8, PS: 4.7, RM: 2.7, SED: 2.48, $P < 0.001$) and defecate (% defecation events/24 h: WS: 48.3, MM: 11.3, PS: 19.5, RM: 20.9, SED: 3.21, $P < 0.001$) on WS. The number of E. coli recovered from the udder was affected by flooring type ($P < 0.001$) with the highest numbers recovered while goats were restricted on WS. These results suggest that goats prefer to use different flooring types

depending on the behavior they are performing. Providing goats with multiple flooring options may better meet their needs in commercial systems, however further investigation into practical implementation of such designs are needed.

Alam *et al.* (2011)studied the effect of heat stress on behavior, physiological and blood parameters of goat. (Progressive Agriculture, 22(1), 37-45.) In his study he observed nine indigenous goats (three male and six female) were selected for the experiment which were almost similar in age and weight. Field trial was carried out in the Sheep, Goat and Horse farm of the Department of Animal Science. Laboratory analyses of the experimental samples were carried out in the laboratory of Animal Science and Department of Physiology, Bangladesh Agricultural University, Mymen Singh. All the goats were kept in three groups (one group consists one male and two female animals) in the room separated with fence. Roughage and concentrate feed were supplied everyday at adequate amount. A large water trough was provided for each group from where clean and cool water available ad libitum for the animals. The house was well ventilated and the space per animal was adequate. The floor, stall, water trough, and feeder were cleaned every day. The faeces were removed carefully from the house. Three treatment groups were made as follows: 0 hours heat exposure control group; 4 hours heat exposure (10 am to 2 pm heat exposure in grazing) and 8 hours heat exposure (9 am to 5 pm heat exposure in grazing). No. of urination per hours were recorded from 4 – 4.7 per hour and number of defecation recorded per hour was 0.75 – 1.5 per hour.

**2.6 Defecating Behavior:**

Destomo, *et al.,* (2020) Boerka Goat is a crossbred of Boer and Kacang goats and now becomes one type of goats that has been widely distributed and raised by the community. Goats are raised by farmers generally with grazing system. This study aimed to observe the effect of grazing time on goat productivity, physiology, and goat behavior. Eighteen male goats aged 1-1.5 years were divided into 3 groups. Goats are grazed for 6 hours, 4 hours and not grazed. The results showed that daily consumption of grazed feed was higher ($P<0.01$) than goats that were

## 2.7 Walking Behavior:

Solanki (2000) the study was conducted in semi arid region, at Rajkot in Gujarat, India. The observations were recorded on free grazing indigenous goats of Zalabadi breed. Time spent in various activities during day from 08 to 18 hours was recorded in different seasons. The entries for grazing, walking, standing and sitting activities were made at every five minutes interval. Out of the available time in the field, goats spent 62.4% time for grazing, 19.2% for sitting, 10.6% in standing and 7.8% in walking. Goats in their grazing activities as well as in forage selectivity pattern exhibited marked diurnal periodicity. There were two peaks for the grazing, one in morning and the other in the evening. The evening peak was more pronounced than morning one. More number of plant categories was grazed in morning than in evening hours. The plant species preferred in morning were different than the plant species in evening.

Casamassima *et al*., (2001) studied two groups of 20 early-lactating Comisana ewes were investigated the effect of two different housing systems on behavior, physiology and milk yield used and were allocated to either an indoor or outdoor daytime environment. The indoor environment was a 3mx12m straw bedded pen inside a pre-fabricated building. The outdoor environment was a 200m (2) paddock during daytime (09.00-19.00h) with ewes being moved to the shed, as described for the indoor treatment, at night. Behavior of ewes was recorded at 14 days interval from 09.00 to 19.00h. No differences were found between groups for endocrine and immune responses. Outdoor ewes had increased locomotors activities ($P< 0.01$) and decreased idling ($P<0.05$) compared to indoor animals. Results suggest that ewe welfare and productivity were not substantially affected by the housing system. The provision of feeding rations that meet the greater energy demand for maintenance is required to sustain productivity in outdoor reared sheep.

Bansode *et al*. (2018) studied the effect of housing systems on behavior in Osmanabadi kids. The research was carried out at the Red Kandhari Research and Instructional Farm, College of Veterinary and Animal Sciences, MAFSU, Parbhani. In this experiment twelve healthy of Osmanabadi goat kids of 3–4

months of age, body weight and body measurement were selected. The behavioral observations were recorded weekly for 24 hour where animal were under surveillance during which various activities pertaining to sitting or resting, feeding and rumination. The behavioral parameters viz Rumination, Feeding and Idling/Resting behavior exhibited non significant differences among the two housing system. However the rumination behavior increased with the advancement of age of animal and also it was more pronounced during night hours than the day hours. The feeding behavior was more pronounced when the feed was offered and it was reduced with lapse of time in both system of housing. The idling/resting behavior was more observed in conventional housing system than loose housing system.

**2.8 Sitting Behavior:**

Solanki (2000) the study was conducted in semi arid region, at Rajkot in Gujarat, India. The observations were recorded on free grazing indigenous goats of Zalabadi breed. Time spent in various activities during day from 08 to 18 hours was recorded in different seasons. The entries for grazing, walking, standing and sitting activities were made at every five minutes interval. Out of the available time in the field, goats spent 62.4% time for grazing, 19.2% for sitting, 10.6% in standing and 7.8% in walking. Goats in their grazing activities as well as in forage selectivity pattern exhibited marked diurnal periodicity. There were two peaks for the grazing, one in morning and the other in the evening. The evening peak was more pronounced than morning one. More number of plant categories were grazed in morning than in evening hours. The plant species preferred in morning were different than the plant species in evening.

Geng *et al*. (2009) studied the behavioral responses of pregnant ewes to high ambient temperature in loose housing system were investigated in this study. Pregnant ewes (87 Chinese little fat-tailed sheep, from the same loose house were chosen, and 9 ewes with similar body weight and age were marked for later individual behavioral observation. The ambient temperature and relative humidity were recorded, and the individual behaviors of the pregnant ewes were observed continuously from 04:50 to 20:00 once every other day, for 14 days.

The behavioral state of all the pregnant ewes were recorded once every hour from 5:00 to 20:00, the numbers of pregnant ewes selecting which kind of lying areas (area A and area B),were recorded at 15-minute intervals from 12:00 to 17:00 every day. The final results showed that the behavioral durations were significantly different in eating and drinking, rumination, resting, and locomotion for pregnant ewes ($P < 0.05$). The time spent in lying for rumination or resting was significantly longer than that for locomotion ($P < 0.05$). Temperature had a significant effect on the number of pregnant ewes lying on floor ($P < 0.05$). There were significant differences for pregnant ewes preference of area A and area B for lying at temperatures ranging from 27 to 31 C ($P < 0.05$). The results indicate that the lying behavior was affected more than the locomotion behavior for the pregnant ewes in the loose housing systems under the high ambient temperature.

Anuradha *et al*., (2013) studied on behavior and physiological response of Osmanabadi kids under different housing systems at Department of Livestock Production and Management, Bombay Veterinary College, Mumbai. They studied The effect of different types of housing system in hot humid climate of Mumbai on physiological and behavioral responses of Osmanabadi goat kids were studied in the present investigation. Significantly higher standing time and lower sitting time were recorded in kids of loose housed than conventional housed kids. The time spent on rumination was significantly higher in loose housed kids compared to conventional house kids. Thus present study indicates that loose house in hot months with kaccha floor and plastic shed net roof provide more comfort to kids than conventional house with slatted floor and asbestos roof.

Antil *et al*., (2019) studied experiment at Livestock Production Management division, Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India, on effect of bedding material on behavior of goat kids Animal welfare on slatted accommodation is influenced by stocking density and floor surface type. A study on effect of floor type and space allowance on welfare indicators of finishing steers was undertaken with determination of the effects of space allowance on slatted floors (1.5, 2.0, 3.0 or 4.0 $m^2$ / head) and floor type (slats v. straw) on the welfare of finishing steers as a main objective. Animal behavior lying, eating and social interactions were measured. A reduction in time

spent lying at was reported (P< 0.05) with space allowance < 2 $m^2$/head, whereas an increment was reported on straw beds when compared with animals housed on slats at 3 $m^2$/head (P< 0.001) at 1.5 m2 when compared with animals housed on straw at 4 $m^2$ /head. It was concluded that space allowance less than 3 $m^2$ / animal adversely affected animal welfare.

Atmoko et al (2020) studied different behavior of Etawah Grade does in early and late pregnancy period. Experiment was conducted on 14 Etawah Grade does in pregnant conditions with an age of fewer than 2 months as the early pregnancy group and gestational age of 4 to 5 months as late pregnancy group in Farm of Faculty Animal Science, university GadihMada. The method used was direct observation. The goats were observed for 24 hours. The data observed were consisted of activities including time and frequency of feeding, ruminating, standing, lying, urinating and defecating. Data behavior of goats was analyzed using T-test. The results showed that the temperature and humidity of the study ranged from 25 to 31 ºC and 65 to 90%, respectively. The heart rate frequency in late pregnancy higher (P < 0.05) than in early pregnancy conditions. There were significant differences (P < 0.05) on the behavior of early and late pregnancy of Etawah Grade does, in terms of frequency of feeding (17.11±1.33 and 13.61±2.85 times/day), and average in once feeding (10.24±1.64 and 12.88±2.36 minutes), standing duration (15.05±0.83 and 11.45±1.34 hours/day), laying duration (9.01±0.71 and 12.54±1.34 hours/day), average in once laying (31.32±3.6 and 47.89±5.68), and frequency of urination (6.56±0.34 and 9.55±2.01). The conclusion of the study is the Etawah Grade does during early pregnancy and late pregnancy has different behavior, especially on the frequency of feeding, average on once feeding, standing duration, time and average of once lying, and frequency of urination.

**2.9 Sleeping Behavior:**

Njiru (2001) studied the behavior of Sannen and Togenberg in a modified sub-humid tropical environment of Kenya. The behaviour of 6 Toggenburg and 6 Saanen female goats, grazing on natural vegetation in a modified sub-humid tropical environment of Kenya, was studied during the dry (January and February)

and wet (April and May) seasons in 1997. The two exotic breeds grazed for 12 h daily. Observation on feeding, standing, lying and ruminating was done chronometrically at five-minute intervals between 0600 and 1800 h. These grazing times were based on the current practice of small holder farmers.

Ramchandran et al., (2020) study the effect of flooring material on growth and behavior of male kids. male kids (36) at 6 months age, 12 each of Jamunapari, Jakhrana, Barbari breed were equally divided and allotted randomly in plastic and soil floor and reared up to 12 of age through April to September months, fed ad lib. roughage, green fodder and concentrate to meet nutrient requirements for optimum growth. Body weight was recorded fortnightly, physiological responses were recorded twice and blood sampling at 60th and 120th day of trial. The weight gain and ADG on plastic floor was similar as compared to soil floor. Kids were equally comfortable on both floors except RR; however, increased RR on plastic floor did not affect the weight gain in kids. Plasma AST and ALT enzymes, total protein, albumin, total cholesterol, triglycerides level differed non-significantly in kids reared on both plastic and soil floor indicating the suitability of plastic floor in goat shelters in semi-arid conditions.

Daniela et al.,(2020) Studied the behavior and BCS in dairy cows related to climate. The study reviewed the data of one year of environmental effect on the dairy cows. Among th e main result is emerges that the effect of weather parameters is quite restrained, except for THI> 70,which negatively affects the lying time .In addition the most productive cows are found to lie down more than the less productive cows ,and the parameters of milk production, lying time and BCS is linked by a similar trend.

**2.10 Agonistic Behavior:**

Grigoli *et al*. (2003) investigated the effects of housing system on different behavioral activities. Study was conducted on two groups of 20 Girgentana goats each. Both groups were maintained within the same shelter. Goats of one group (TS) were tethered in wooden stalls equipped with a trough and bucket, whereas the other group (FH) was free-housed in a straw-bedded pen. Increased standing

activity and both social and aggressive interaction seen in FH, whereas the goats in TS favored lying and ruminating activities, but excluded walking.

Abdel-Hamid *et al*., (2017) studied impact of Dominance on Behavior of Goat reared under Different Housing Systems. In his study he made a two flock of baladi goats belonging to both the farm of faculty of veterinary medicine, Zagazig university and private one at Hehia city, Sharkeya in which a total number of forty baladi goats (9-18 m) were used and reared under two housing systems either semi-intensive or village system (20 goats per system) which randomly allocated into two sub-groups (4 male and 16 female). The following behaviors were assessed: ingestive, agonistic and eliminative for each housing system. The results revealed that there was significant effect of the dominance index on the behavior of goat with the highest for the dominance index & gt; 0.66 for goats reared under semi-intensive system followed by the village. Therefore, it can be concluded that rearing goats under the semi-intensive system could be better than the village one.

**2.11 Estrus Behavior:**

Bhattacharyya *et al*. (2000) studied Behavioral and physical signs of estrus in Assam local goat. 111 adult female healthy Assam [Assam Hill] local goats in estrus belonging to organized and private farms were used for studies of behavioral and physical signs of estrus. Estrus was detected using a vasectomised buck or by the clinical symptoms exhibited by estrous goats. Bleating, wagging of tail, swelling of vulva and dilatation of os - cervix were found to be the most common behavioral and physical signs of estrus in Assam local goat.

Lopes Júnior*et al*., (2001) Observed Estrus behavior and performance in vivo of Saanen goats raised in northeast of Brazil. In order to verify the estrus activity and to observe the body weight of Saanen goats, when reared in intensive condition of Northeast Brazil during four different seasons, ten adult Saanen goats were used. In this experiment four climatic seasons were considered; early rainy (ER), late rainy (LR), early dry (ED) and late dry (LD). Estrus behavior was monitored twice a day (8:00 a.m. and 4:00 p.m.) during all the experiment, using two vasectomied bucks. The estrus cycles were quantified within each season

and classified as short (< 17 days), normal (17-25 days) or long (> 25 days). The goats were weighed every seven days. During the late rainy season, a significant fall of the mean body weight of the animals was observed when compared to early rainy season. A larger percentage of goats in estrus were observed during the late rainy season.

Estrus duration was longer in the late rainy and early dry season than in early rainy and late dry season. During the experiment, there were 12.0% of short cycles, 50.3% of normal cycles and 37.7% of long cycles. The percentages of abnormal cycles (short and long cycles), in relation to total cycles monitored in each season were 52, 58, 38 and 50% for early rainy, late rainy, early dry and late dry, respectively. From the results of this study it can be concluded that pen-fed Saanen goats do not show seasonality for estrus behavior. Rainfall appeared to be an extero - receptive factor influencing the quality of sexual activity and performance in these goats.

Yahia *et al.* (2011) studied the seasonal variation in estrus behavior of goats in the local region of Kabylie (Algeria). A study on the changes in estrus behavior was conducted in 16 local goats from the Kabylie region of Algeria for a period of 13 months. The goats were kept non-pregnant during the experiment. The study was carried out on a rangeland, and the animals received clover hay and concentrate at 500 g per goat per day. The goats were exposed to natural photoperiod and maintained in the presence of a goat standing intact with a deck to prevent mating. Twice daily detection (morning and evening) of heat for 30 min was performed by direct observation. A female was seen in heat when she became receptive to the goat. During the 13 months of the study, 149 estrus episodes were detected when the number of significant heat behaviors was observed from late July until February. Majority were concentrated in the months of October, November and December. Thereafter, a period of low level of expression of heat from March to early July was observed. 71.5% of the goats showed at least one estrus during the month of October, up 85.7% in November and December and a minimum of 7.14% in June. It was concluded that the local goats in the region of Kabylie had a decreased sexual activity during spring and summer.

Sahidul *et al.* (2013) studied on Estrus behavior in Assam local goats. Physical and behavioral signs and intensity of estrus were studied in 34 Assam local goats. Estrus detection was carried out in does by exposing them to a teaser buck four times during the 24-hour period as well as by close visual observation. Observations on estrus were recorded from 1 day before estrus till 2 days post estrus. Swelling of vulva and pink vaginal mucosa were the most conspicuous physical signs of estrus and observed at night hours of the day of estrus in frequency percentage of 87.50 and 85.71 respectively. Wagging of tail and standing to be mounted by buck constituted predominant behavioral signs of estrus and recorded in 92.86-94.64 and 80.36-82.14 per cent observations respectively at evening to night hours of day of estrus. Other common behavioral signs of estrus were seeking and sniffing of male, the highest frequency percentage being 75.00 and 67.86 respectively recorded at evening hours of day of estrus. Bleating and loss of appetite were also prominent behavioral features observed at high frequency percentage during different periods on the day of estrus. Manifestation of estrus was 'intense', 'intermediate' and 'weak' in 47.06, 35.29 and 17.65 per cent observation, respectively.

Endo *et al.* (2015) in this experiment title Video tracking analysis of behavioral patterns during estrus in goats. They report a new method for measuring behavioral patterns during estrus in goats based on video tracking analysis. Data were collected from cycling goats, which were in estrus (n = 8) or not in estrus (n = 8). An observation pen (2.5 m × 2.5 m) was set up in the corner of the female paddock with one side adjacent to a male paddock. The positions and movements of goats were tracked every 0.5 sec for 10 min by using a video tracking software, and the trajectory data were used for the analysis. There were no significant differences in the durations of standing and walking or the total length of movement. However, the number of approaches to a male and the duration of staying near the male were higher in goats in estrus than in goats not in estrus. The proposed evaluation method may be suitable for detailed monitoring of behavioral changes during estrus in goats.

## 2.12 Body Condition Score:

Lowman *et al.* (1976) developed a method of assessing the body condition as a health indicator by assigning the points and termed as body condition score. The method consists of assigning each buffalo a score from 0 (severely emaciated) to 5 (very obese) with 0.5 increments. These parameter could give assessment of under nourishment (BCS<2.5) or very obese (BCS>4 to 4.5).

Cabiddu *et al*. (1999) mentioned that relationship between body condition score, metabolic profile, and milk yield and milk composition in goats. A study has been carried out in the centre-east area of Corsica in three goat herds (Corsican local breed) browsing a Mediterranean shrub land without any additional feed supply. The practical usefulness of BCS and metabolic profile in order to assess the nutritional conditions of goats during the milking period (80 to 120 days oflactation) was investigated on a sample of 18 goats selected in each herd. BCS metabolic profile and milk yield/quality were individually measured. A negative overall correlation was found between the mean BCS and milk yield ($r = -0.24$, $P<0.05$), due to the opposite trend of milk production and fat deposition. Results indicate that, under the specific conditions of this study, without a significant depletion of fat reserves or marked metabolic imbalances. Under extensive husbandry conditions, BCS and to a lesser extent blood parameter, can help in explaining the differences in milk yield between goat herds.

Nsoso *et al.* (2003) conducted research on relationships among body weight, body condition score and heart girth in indigenous Tswana goats raised under extensive and semi-intensive management during the dry and wet seasons. A total of 100 indigenous Tswana goats, owned by farmers and managed extensively, in wet and dry seasons, were used in Experiment 1; while 50 mature indigenous Tswana goats from the Botswana College of Agriculture were used in Experiment 2 in the dry season only under semi-intensive management. In both experiments, data were collected fortnightly on body weight, body condition score for 12-20 weeks. Season significantly affected BCS, with lower scores ($2.17 \pm 0.10$ to $2.65 \pm 0.10$) in the dry season than in the wet season ($3.17 \pm 0.10$ to $3.79 \pm 0.11$) Management did not significantly affect body condition score. It is

concluded that BCS is a more useful indicator of seasonal nutritional effects in goats than body weight or heart girth.

Grasso *et al*. (2004) reported the Influence of housing conditions and calving distance on blood metabolites in buffalo. Fourteen buffaloes were group-housed in a loose open-sided barn with a concrete floor and equipped with self-locking stanchions, where they received 10 m2/head of space allowance, as in standard intensive systems (Group IS). Fourteen others were group housed in a similar barn, but they also had the benefit of an outdoor yard with 500 m2/head as space allowance, including spontaneous vegetation and potholes for bathing and wallowing, as in traditional systems (Group TS). The buffalo were scored for body condition (BCS) at the beginning (5 days after calving) and at the end (175 days after calving) of the experimental period. They found that Initial score were 3.172.86 BCS units, for IS and TS, respectively and final 3.87 and 3.55; for IS and TS, respectively. BCS did not differ significantly between groups.

Cimen and Topcu (2013) conducted an experiment on 20 Turkish Saanen goats having 2 groups of 10 each. Group 1 was having BCS 1 and other group as BCS 2. The dams in BCS 1 group had showed lower milk fat content as compared to dams in BCS 2 group until third week. The total solids and protein levels of goats did not differ between BCS 1 and BCS 2 groups during all weeks of research. They found positive high correlations between total solids and protein ($r=0.997$; $p<0.01$) in BCS 1 group and BCS2 group ($r=0.9998$; $p<0.01$). Similar correlations were found for both BCS group in study. From the results, the lower BCS has negative significant influence on the milk fat synthesis for dams having low fat depots.

Darwesh *et al.* (2013) carried out experiment on nineteen black does to investigate the impact of lactation stage on body condition, blood metabolism and milk composition. Body condition was assessed together with blood and milk samples, which were collected at week 6 (early), 14 (mid) and 22 (late) of lactation. Body condition score of each doe was also assessed. The overall mean of body condition score was 2.35±0.08 and serum total protein, glucose, triglyceride averaged, respectively 5.80±0.10 g/dl, 120.87±5.34 mg/dl, 51.04±5.38 mg/dl, and milk fat, protein, lactose, solid non fat and total solid

percentages averaged 3.24±0.15, 4.49±0.10, 4.44±0.01, 9.71±0.11, and 12.95±0.20, respectively. Body condition at kidding decreased significantly at week 4 and then increased significantly (P<0.05) during mid and late part of lactation. Lactation stage also significantly affected (P<0.05) all milk constituents, and glucose.

Jalilian and Moeini (2013) conducted an experiment on 80 Sanjabi ewes (2–5 years old and 50–85 weight domain) were selected in animal unit of Mehregan farm. The ewes were divided to 4 treatment groups according to body condition score of (2, 2.5, 3, 3.5 ≤). The result of this experiment indicated that BCS = 3 had a signifcant effect (P< 0.05) on the kg lambs born per ewes. ewes with BCS = 3 had a better performance in the percentage of lambs born per ewes at mating while the lambing rate reduced in ewes with BCS of 3.5 or more. Birth weight of lambs was signifcantly affected by BCS of their ewes (P< 0.05). It is concluded that BCS had a signifcant effect on kg lambs born per ewes, birth weight of lambs, lambs weaning weight and colostrum productions (P< 0.05) and the score of 3 at mating time could optimize profitability of Sanjabi ewes.

Meshram.*et al.* (2014) studied "Correlation of body weight with body condition score and measurements in Osmanabadi goats" at Department of Livestock Production & Management, Nagpur Veterinary College, Nagpur - 440006. Data on 161 females and 30 males was collected from six different livestock farms to evaluate the performance of Osmanabadi goats. Data was distributed into two tracts, two sex group, four body weight groups, four age groups, four BCS groups. The body measurements viz. bodies lengths, height at wither were measured by the measurement scale and BCS scoring was performed by 1 to 5 scales at lumbar region, rib cage and sternal region.

Moeini *et al.* (2014) conducted an experiment on body condition score (BCS) on Merghoz goats' performance. In the first experiment, 80 goats (2-4 years old, 27-43 kg), and in the second experiment, 28 Merghoz goats (2-3 years old, 26-39 kg) were divided to 4 treatments groups according to their BCS (2.0, 2.5, 3.0, 3.5). The results of the first experiment indicated that BCS=3.0 had a significant effect on the kilogram kids born per kilogram goat. Similarly, the kids born per kilogram goat were affected by BCS. The results of the 2nd experiment also indicated that goats with BCS = 3.0 (32-36 kg) had better performance in

kids born per goat at mating and birth weight of kids was significantly affected by BCS of their dams.

Chichame.*et al.* (2017) studied Body condition score of Osmanabadi does partially fed on hydroponically grown maize fodder (Doctoral dissertation, MAFSU, Nagpur).The present study entitled Body condition score of Osmanabadi does partially fed on hydroponically grown maize fodder was carried out at Department of Livestock Production and Management, Nagpur Veterinary College, Nagpur 440006. A total 21 goats of Osmanabadi breed between ages 4 - 5 years were selected and randomly distributed in three experimental groups. T0 group was considered as control group and fed with Standard control diet. T1 group fed with the ration containing Dry + Concentrate + 50% Green+ 50% hydroponically grown maize fodder l where as T2 group fed with the ration containing Dry + Concentrate + 100% hydroponically grown maize fodder. The total duration of research work undertaken was 90 days.

Heins *et al.* (2019) studied the effect of winter housing systems on body condition score on organic dairy cows.In the study two winter December to April in two treatments in outdoor with straw pack and indoor with three sided compost bedded pack.Cows were evaluated during two seasons.All the production parameters including BCS was evaluated .In the result it was found that lactating cows housed outdoor on a straw bedded packs did not differ for production or SCS or for body weight ,BCS,or dry matter intake but had greater profitability than cows housed in an indoor compost bedded pack barn.

**2.13 Physiological Parameters:**

Rao and Mullick (1965) studied the effect of age, air temperature, and air humidity on the physiological reactions of kids. The physiological reactions were positively correlated with air temperature and air humidity. The correlations between air temperature and humidity with respiratory rate and body temperature were positive and highly significant. They found no effect of air temperature on pulse rate.

Prasetryo *et al.* (1984) conducted the study on the effect of heat and humidity on pregnant feral goat. The experiment compared three groups of does: Group I feed ad libitum and housed at "thermo neutral" temperatures; Group II , fed ad libitum , housed at temperature and humidity as found in some humid tropical conditions; Group III housed at thermo neutrality, "pair fed" with Group II assuming that Group II would reduce feed intake. From 27 feral does, aged 2 to 4 years, with known conception dates, 18 does expected to kid over a short period were allocated, on a stratified random live weight basis, to three groups. Dry matter intake in their study in three groups is 922g, 864g and 749g/day respectively. Rectal temperature in the study for 15 and 21 days was 38.9 $^0$C, 39.2$^0$C, 39.4$^0$C, and 39.6$^0$C, 38.7$^0$C and 38.9 $^0$C for each parameter. Differences between groups and weeks were highly significant.

# *Materials & Methods*

## 3. MATERIALS AND METHODS

The detail of the research, materials used and methodology adopted in this study are given below.

### 3.1 Place of Experiment

The present study entitled "Comparative Study of Ethogram and Labour Economics of Osmanabadi Goat in Different Housing System'' was carried out at Punyashlok Ahilyadevi Sheep and Goat Development, Farm, at Dhiwadi Tq. Man Dist. Satara. The site is geographically situated at the latitude of 17° 40' north, 74° 30' east.

### 3.2 Environmental conditions

The climatic condition in and around Dahiwadi, is generally hot and dry with average temperature during the year was between 26 to 41$^{o}$C and the corresponding relative humidity in morning 85.56% and in evening 80.17%. The average rainfall during these experimental periods was 586.51 mm in 32.88 rainy days.

### 3.3 Experimental animals, housing and management

The experiment was conducted on twelve adult female goat for three months Punyashlok Ahilyadevi Sheep and Goat Development , Farm, at Dhiwadi Tq. Man Dist. Satara. Twelve adult female goat in 4 – 5 years old were randomly selected and divided into two groups.viz,

Group '$T_1$': Six goats were maintained under conventional housing system.

Group '$T_2$': Six goats were maintained in loose housing system.

**Housing system for Group** '$T_1$' **goats**

a) Conventional housing system was having availability feed and water for 24 hours. Goats were allowed for free natural movement.
b) Roof was of asbestos sheet, slope type with height at center 12 feet and towards side wall 6 feet. Side wall were of 4 feet height. With provision of Cross ventilation.

c) Floor was of cement and concrete with feeding alloy, manger with slope at standing space of 6 inch. Chaffed green and dry fodder was available in feeding manger throughout 24 hours. Concentrate was given separately as per the requirement.

**Housing system for group $T_2$ goats**

Group **$T_2$** goats were provided loose housing system. The system comprises of two separate areas (i) shaded area under roof (ii) Open area (no roof).

a) The roof of shaded area was similar as that of group '$T_1$'; The floor was different type. The floor in both the areas (shaded area and open area) was of *Murum* type made up of broken bricks and murram and compacted with heavy roller. The floor was having the capacity of absorption of water.
b) **Provision of feed and water**: The feeding manger and water tank were provided in both the open to sky areas and roofed area. Green and dry fodder was available throughout 24 hours and goats were free to move in open as well as shaded areas. Concentrate was provided as per requirement.

The experimental groups of goat were allotted in two groups. The details of housing system are as follows.

| **Groups** | **Housing System** | **Number of Animals** |
|---|---|---|
| Group '$T_1$' | Intensive Rearing System | 6 Adult Goats |
| Group '$T_2$' | Extensive Rearing System (Loose Housing System) | 6 Adult Goats |

**3.4 Recording of the data**

The instrument for recording the various activity performed by goat in the present study was eight CCTV camera with DVR and with inverter for continuous

Plate No.3.1 :Farm entrance of sheep and goat farm Dahiwadi.

Plate No.3.2 :Intensive housing system shed with cctv camera (Group $T_1$).

Plate No.3.3 : Extensive housing system shed (Group $T_2$).

Plate No.3.4 : DVR machine fitted with CCTV camera cable

Plate No.3.5 : Feeding behavior of goats under cctv camera recording

Plate No.3.6 : Drinking water arrangements of goat

Plate No.:7 Open space for installed with CCTV

Plate No.8 Recording of goat behaviour

electric supply for the camera setup. The data was collected for 24 hours a day fortnightly over a 90 days period of experiment from the footage recorded in the DVR.(Each camera was with 2MP(Mega Pixel) capacity with night mode vision.

### 3.4. Feeding Behavior

3.4.1Time Spent for Feeding:

The time spent for feeding by individual goat and pattern of feeding in 24 hours will be recorded. Intake of feed in 24 hours by individual goat in both groups will be calculated and expressed as duration of feeding in minutes and intake of feed will be expressed as kilograms of feed per day/ animal. Feeding behavior will be observed in intensive system (Group '$T_1$') and in extensive system (Group '$T_2$') for 24 hours a day fortnightly over a 90 days period of experiment.

### 3.4.2 Drinking behavior:

3.4.2.1. Time spent for drinking water :

Total time taken for drinking in 24 hours by individual goat in both the groups (Group '$T_1$' and Group '$T_2$') will be recorded by CCTV camera and will be expressed as duration of drinking in minutes per day per animal. It was recorded for 24 hours a day fortnightly over a 90 days period of experiment. The data obtained from the recording from four closed circuit television (CCTV) cameras for 24 hours a day fortnightly over a 90 days period of experiment, drinking behavioral activity was observed standing as well as in sitting position or in any other position of the goat. The time spent by individual goat for drinking of water in a day and in the night time will be observed and expressed in minutes/animal.

### 3.4.3 Rumination Behavior:

3.4.3.1. Time spent for rumination:

Total time taken for rumination in 24 hours by individual goat in both the groups (Group '$T_1$'and Group '$T_2$') will be recorded by CCTV camera and will be expressed as duration of rumination in minutes per day per animal. It will be recorded for 24 hours a day fortnightly over a 90 days period of experiment. The data obtained from the CCTV recording from four closed circuit televisions (CCTV) cameras for 24 hours a day fortnightly over a 90 days period of experiment, ruminating behavioral activity was measured in standing as well as in sitting position. The time spent by individual goat for rumination in a day and in the night time will be calculated and will be expressed in minutes / animal / day.

### 3.4.4 Urination Behavior:

3.4.4.1 Time spent for urination:

The time taken by goat for urination was measured as well as urinating frequency of individual goat in 24 hours was measured in Group '$T_1$' and Group '$T_2$' for 24 hours a day fortnightly over a 90 days period of experiment. The observations of urinating time were expressed in minutes / goat and frequency of urination will be expressed as number of urination / goat /day. The same behavior was measured in day time as well as in night hours also and will be expressed in minutes / goat and frequency of urination will be expressed as number of urination per goat for a period of 24 hours.

### 3.4.5. Defecation behavior:

3.4.5.1 Time spent for defecation:

The time taken by goat for defecation and frequency of defecation of individual goat in 24 hours will be measured in Group '$T_1$' and Group '$T_2$'for 24 hours a day fortnightly over a 90 days period of experiment. The observations of defecation time expressed in minutes / goat / day and frequency of defecation will be expressed as number of defecation /goat. The same behavior will be measured in night hours also and were expressed minutes / goat and frequency of defecation were expressed as number of defecation per goat for a period of 24 hours.

**3.4.6. Walking Behavior:**

3.4.6.1.Time spent for walking:

Goats are walking from one place to another in the house for feeding, drinking and for various social reactions. The time taken by goat in the housed area for walking for various purposes will be measured for 24 hours a day fortnightly over a 90 days period of experiment in Group '$T_1$' and Group '$T_2$'. The observations of walking time will be expressed in minutes / goat / day the same behavior will be measured in day time as well as in night hours also and will be expressed in minutes /goat for a period of 24 hours.

**3.4.7. Resting Behavior:**

3.4.7.1 Time spent for lying down

Total sitting time taken by goat in 24 hours a day fortnightly over a 90 days period of experiment will be observed for Group '$T_1$' and Group '$T_2$' and time will be calculated and it will be expressed in terms of minutes /goat . Same behavior will be observed in night time also and total time will be calculated and it will be expressed in minutes per goat for a period of 24 hours.

**3.4.8 Sleeping Behavior:**

3.4.8.1Time spent for sitting:

The time taken by goat in the house for sleeping will be measured for 24 hours a day fortnightly over a 90 days period of experiment in Group '$T_1$' and Group '$T_2$'. The observations will be expressed in minutes /goat. The same behavior will be measured in night hours also and will be expressed in minutes per goat for a period of 24 hours.

**3.4.9. Agonistic Behavior:**

3.4.9.1 Time spent on attacking :

Agonistic (combative) behaviors like attacking,. The reason for these behaviors in goats is the instinct to protect both themselves and their food sources .Agonistic behaivior was recorded in 24 hours a day fortnightly over a 90 days period of experiment in an intensive rearing system and an extensive rearing

system of goat in both the experimental groups via Group '$T_1$' and Group '$T_2$' by using CCTV camera recording.

### 3.4.10 Estrus Behavior.

3.4.10.1 Time spent on estrus and intensity of estrus:

Detection of estrus is one of the most critical components for successful breeding. The estrus is the physiological process and it occur continuously unless pregnancy ,diseases or unfavorable season interrupt it. So in the present research work no goat was found in oestrus.

### 3.4.11 Body Condition Score:

For considering the body condition score of the goat following points were taken in to account as per Graff (2011).

1. Flesh covering as spinous processes of the spine,loin and rump region .
2. Prominence of spinous processes.
3. Sharpness of spinous processes.
4. Prominance of depression in tail region i.e between back bone and pins and between pins and hook bones.

The BCS of each goat was recorded by visual observations and by palpation of the different regions like prominences and sharpness of spinous processes loin and rump and prominences and depression in tail by three evaluators and the average of three were consider for the result.

| BCS | Condition of goat |
|---|---|
| 1 | Emaciated |
| 2 | Thin |
| 3 | Average |
| 4 | Fatty |
| 5 | Obese |

### 3.4.12 Physiological Indicators:

#### 3.4.12.1 Rectal Temperature:

Rectal temperature was recorded in all the groups by clinical veterinary thermometer and expressed in degree Celsius.

#### 3.4.12.2 Respiration rate (breaths / minute)

The movements of the flank region and the movements of the nares for one minute were counted separately for one minute. One inward and one outward movement was considered as one complete breath.

#### 3.4.12.3 Heart Rate (beats / minute):

Heart rate was recorded with the help of stethoscope placing on left side of chest and beats were recorded for one minute and was expressed as beats per minutes.

**Statistical Analysis:**

All the data obtained were subjected to analysis as per Snedecor and Cochran (1994) by using Two Sample T – Test and simple arithmetic calculations of the data obtained. The results of the statistical analysis so obtained were spread over result and discussion.

# Results & Discussions

# 4. RESULTS AND DISCUSSION

The results of present study entitled, “Comparative Study of Ethogram and Labour Economics of Osmanabadi Goat in Different Housing System.’’It was carried out at Punyashlok Ahilyadevi Sheep and Goat Development , Farm, at DahiwadiTq. Man Dist. Satara. The present work was intended to study the behaviour and economics of Osmanabdi goats.

The observations of the parameters were recorded by CCTV Camera and statistically analysed by two sample T test of significance. On the basis of analysed data, the recorded facts presented and discussed in scientific manner in the foregoing pages as the result of the present study.

## 4.1 Feeding watering and rumination time under different housing system

### 4.1.1. Time Spent for feeding (minutes per twenty four hours):

Average fortnight wise data for twenty four hours of time spent on feeding in Osmanabadi goats during the course of study has been presented in table 4.1 and the same is presented graphically in figure 4.1. It was observed from the table that the average fortnightly time spent on feeding for twenty four hours in Osmanabadi goat from groupT1’ (Conventional housing system) and group ‘$T_2$’ (Extensive housing system) was 187.63±8.90 and 237.93±16.33 in minutes respectively.

The average fortnight wise data for twenty four hours was subjected to statistical analysis and presented in table 4.1. The time spent for feeding in intensive and extensive housing system ranged between 156.7±15.73 and 214±22.61. 202±3.92 and 289.5±1.47minutes per twenty four hours respectively. The average time spent in group T2 i.e. extensive housing system was higher than group T1 may be due to goats remain stress free and free movement of the body due to open space available for them which was not available in other housing system.

Table No. 4.1 Effect of different housing system on feeding time in Osmanabadi goat (minutes per twenty four hours) (N=6)

| Fortnight | Time Spent on Feeding | | T stat |
|---|---|---|---|
| | Group T1 | Group T2 | |
| 1 | 214±22.61 | 289.5±1.47 | 2.703 |
| 2 | 211.7±17.28 | 280±2.43 | |
| 3 | 183.6±11.60 | 205.9±9.94 | |
| 4 | 156.7±15.73 | 202±3.92 | |
| 5 | 182.6±2.07 | 246.7±6.77 | |
| 6 | 177.33±6.55 | 203.5±10.10 | |
| Mean ±SE | **187.63±8.90** | **237.93±16.33** | |
| t critical (0.05): 2.22 **: Non significant *: Significant at 5% | | | |

### 4.1.2 Time Spent for drinking (minutes per twenty four hours):

Average fortnight wise data for twenty four hours of time spent on drinking of water in Osmanabadi goats during the course of study has been presented in table 4.2 and the same has been shown graphically in figure 4.2. It was observed from the table that the average fortnightly time spent on drinking of water for twenty four hours in Osmanabadi for 'groupT1' (conventional housing system) and 'group$T_2$' (extensive housing system) was 0.16±0.05 and 0.35±0.06 minutes respectively.

The time spent for drinking of water in intensive and extensive housing system ranged between 0.08±0.01 and 0.4±0.11.,0.1±0.05 and 0.5±0.04minutes per twenty four hours respectively. The average time spent in group T2 i.e. extensive housing system was higher than group T1 may be due to goats remain stress free and free movement due to open space available for them which is not available in other housing system (table 4.2).

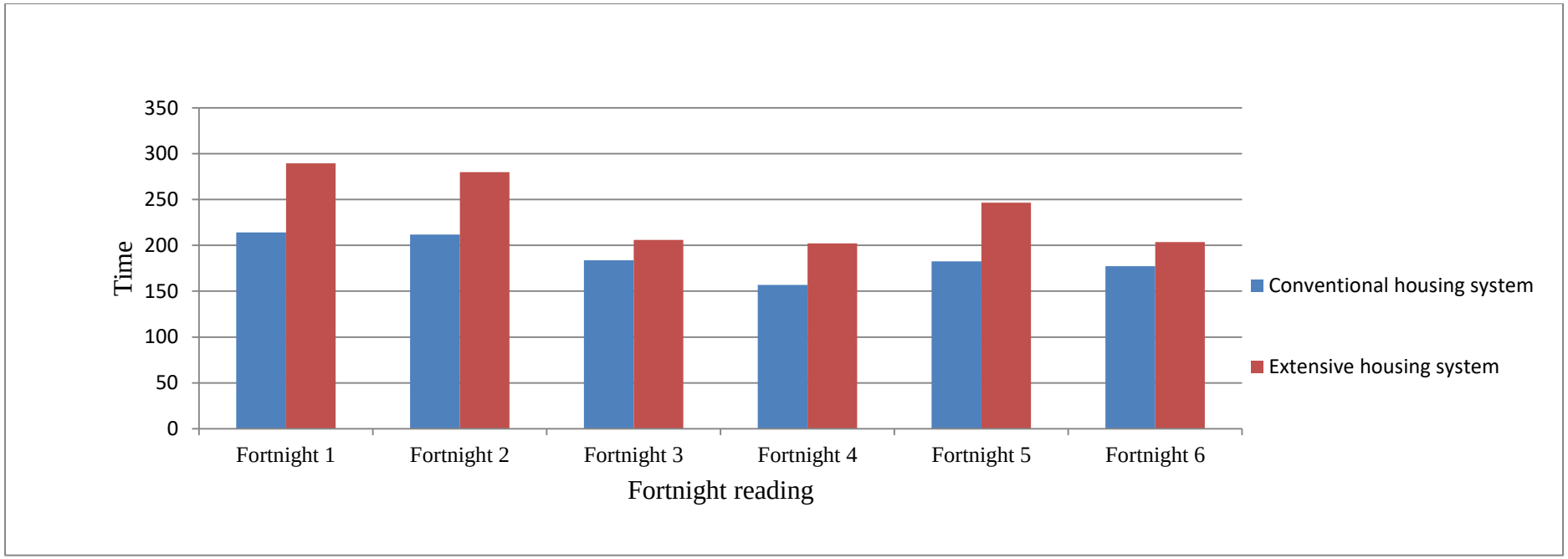


Fig.4.1Effect of different housing system on feeding time in Osmanabadi goat

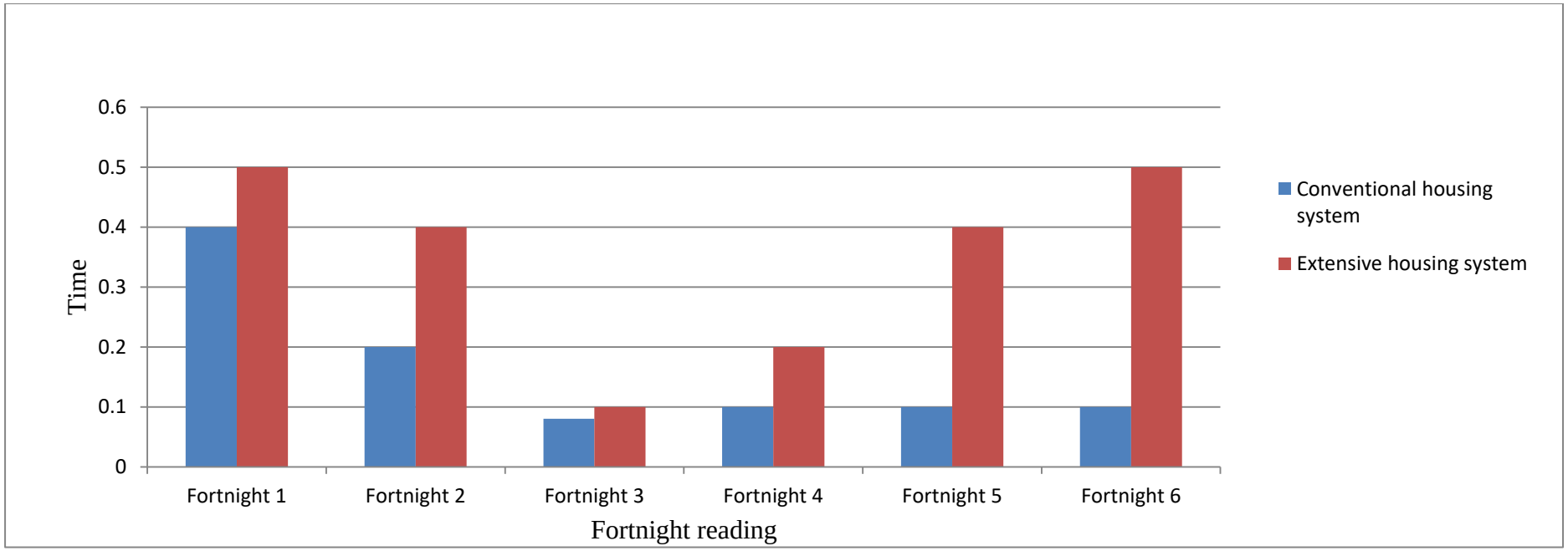


Fig.4.2 Effect of different housing system on drinking of water in Osmanabadi goat

Table No. 4.2 Effect of different housing system on drinking time in Osmanabadi Goat (minutes per twenty four hours) (N=6)

| Fortnight | Time Spent on Drinking | | T stat |
|---|---|---|---|
| | Group T1 | Group T2 | |
| 1 | 0.4±0.11 | 0.5±0.04 | 2.22 |
| 2 | 0.2±0.11 | 0.4±0.07 | |
| 3 | 0.08±0.01 | 0.1±0.05 | |
| 4 | 0.1±0.07 | 0.2±0.02 | |
| 5 | 0.1±0.07 | 0.4±0.07 | |
| 6 | 0.1±0.08 | 0.5±0.03 | |
| **Mean ±SE** | **0.16±0.05** | **0.35±0.06** | |
| t critical (0.05): 2.22 | **: Non significant | | *: Significant at 5% |

### 4.1.3 Time Spent for Rumination (minutes per twenty four hours):

Average fortnight wise data for twenty four hours of time spent on rumination in Osmanabadi goats during the course of study has been presented in table 4.3 and shown graphically in figure 4.3. It was observed that average fortnightly time spent on rumination for twenty four hours in Osmanabadi goat from from'groupT1' (conventional housing system) and 'group$T_2$' (extensive housing system) was 384.66±12.51 and 510.66±20.71 minutes respectively.

The time spent for rumination in intensive and extensive housing system ranged between 341.5±31.21 and 412.4±54.42.439±67.50 and 563.6±17.45 minutes per twenty four hours respectively. The average time spent in group T2 i.e. extensive housing system was higher than group T1 may be due to goats remain stress free and goats could move freely due to open space available for them which is not available in other housing system.

Table No. 4.3 Effect of different housing system on rumination time in Osmanabadi goat (minutes per twenty four hours) (N=6)

| Fortnight | Time Spent on Ruminating | | T stat |
|---|---|---|---|
| | Group T1 | Group T2 | |
| 1 | 341.5±31.21 | 468±52.72 | -5.20 |
| 2 | 412.4±54.42 | 439±67.50 | |
| 3 | 351.7±40.36 | 547±48.89 | |
| 4 | 402.2±60.87 | 496±12.56 | |
| 5 | 410±57.01 | 563.6±17.45 | |
| 6 | 390.2±54.43 | 550.4±6.58 | |
| **Mean ±SE** | **384.66±12.51** | **510.66±20.71** | |
| t critical (0.05): 2.22 NS :Non significant *: Significant at 5% | | | |

Fortnight wise time spent on rumination for 24 hours (in minutes) data was found statistically significant ($P \leq 0.05$) within the experimental groups. In the present study rumination was higher in extensive housing systems. These findings are similar with the findings of Aschwanden *et al.* (2009), Bagul (2017), Desnoyers et al (2009),Guvara et al (2011),Weera singhe et al (2014) and Pathan et (2017).However the result found by Gorban, (1958),Hooper and Welch (1983)Lu,.(1989),Njiru, (2001) and Gede et al. (2014) which was not similar with the present research.

In present study time spent on feeding for a period of twenty four hours was higher 237.93 ± minutes in goats under extensive housing system than other housing system. This may be due to goats get natural environment so there is no stress on goats so consume more feed that to improve feeding activity and also free access of water of the goats under loose housing system.

Fortnight wise time spent on rumination for 24 hours in minutes data was found statistically significant ($P \leq 0.01$) within the experimental groups. In the present study rumination time was higher extensive housing 510.66 minutes/24hrs and lowest was 384.66 minutes/24hrs these results are associated with the results found by Bell et al (1957),Weera singhe et al (2014) and

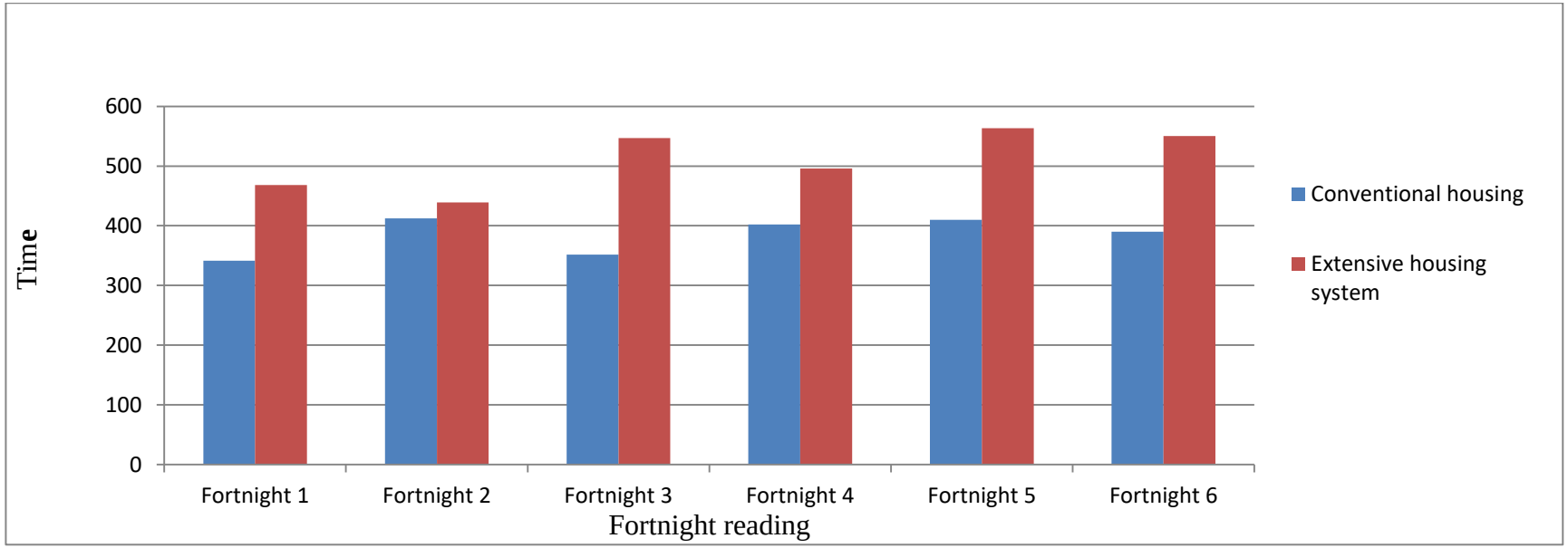


Fig.4.3 Effect of different housing system on rumination time in Osmanabadi goat

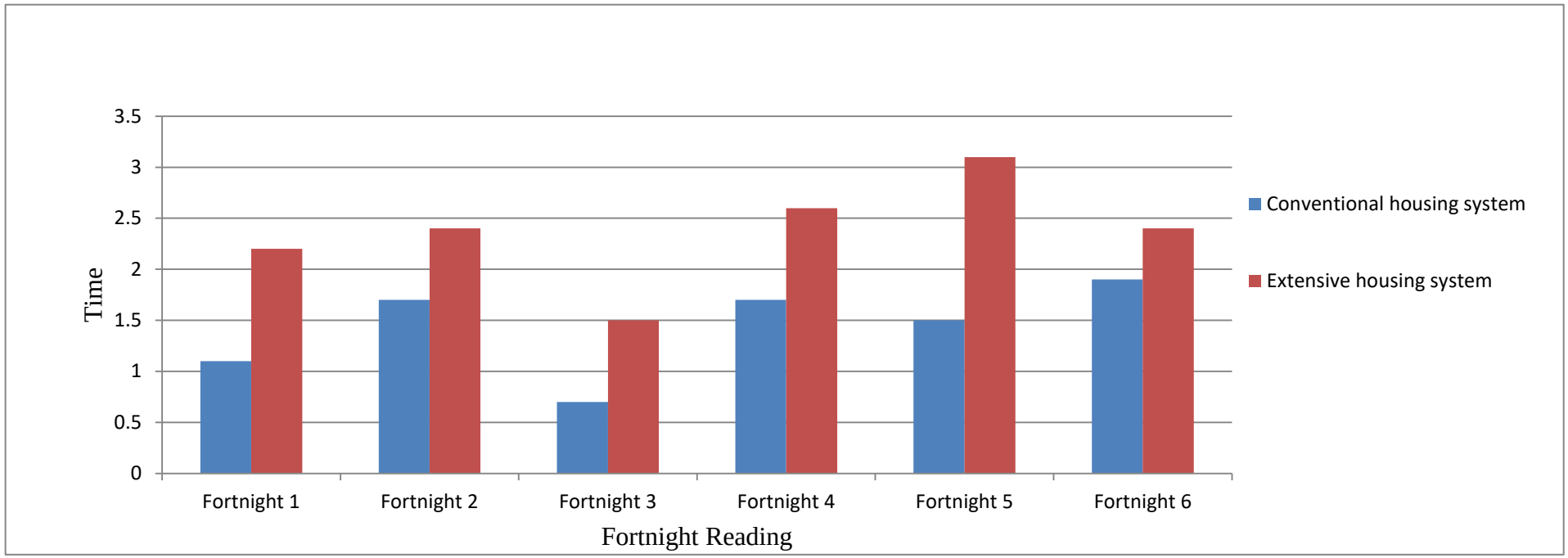


Fig 4.4 Effect of different housing system on urination time in Osmanabadi goat

Pathan et (2017), where as the result found by Mishra et al (2002) and Pathanet (2017) which is opposite with the present research.Patra*et al.* (2008) found tethering on grazing on rumination was 331 and 360minutes/day in goats.

### 4.2.1 Urination time minutes/24hrs in different housing systems in Osamanabadi goat

Average fortnight wise data for twenty four hours of time spent on urination in Osmanabadi goats during the course of study has been depicted in table 4.4 and the same is presented graphically in figure 4.4a. It was notices that the average fortnightly time spent on urination for twenty four hours in Osmanabadi goat from from'groupT1' (conventional housing system) and 'group$T_2$' (extensive housing system) was 1.44±0.18 and 2.36±0.21 in minutes respectively.

The time spent for urinating in intensive and extensive housing system ranged between 0.7±0.09 and 1.9±0.30. 1.5±0.38 and 3.1±0.47minutes per twenty four hours respectively. The average time spent in group T2 i.e. extensive housing system was higher than group T1. As goat spent more time in drinking so drink more water and consequently spent more time in urination.(table 4.4)

Table No. 4.4 Effect of Different Housing System on Urinating Time in Osmanabadi Goat (minutes per twenty four hours) (N=6)

| Fortnight | Time Spent on Urinating | | T stat |
|---|---|---|---|
| | Group T1 | Group T2 | |
| 1 | 1.1±0.13 | 2.2±0.11 | -3.30 |
| 2 | 1.7±0.33 | 2.4±0.14 | |
| 3 | 0.7±0.09 | 1.5±0.38 | |
| 4 | 1.7±0.35 | 2.6±0.32 | |
| 5 | 1.5±0.32 | 3.1±0.47 | |
| 6 | 1.9±0.30 | 2.4±0.17 | |
| **Mean ±SE** | **1.44±0.18** | **2.36±0.21** | |
| t critical (0.05): 2.22 | **: Non significant | | *: Significant at 5% |

### 4.2.2 Defecation time minutes/24hrs in different housing systems in Osamanabadi goat.

Average fortnight wise data for twenty four hours of time spent on defecating in Osmanabadi goats during the course of study has been presented in table 4.5 and the same has been presented graphically in figure 4.5. It is seen from the table that the average fortnightly time spent on defecating for twenty four hours in Osmanabadi goat from from'groupT1' (Conventional housing system) and 'group$T_2$' (Extensive housing system) was 2.7±0.05 and 3.11±0.08 in minutes respectively.

The average fortnight wise data for twenty four hours was subjected to statistical analysis and presented in table 4.5. The time spent for defecation in intensive and extensive housing system ranged between 2.7±0.03 and 2.9±0.50. 2.9±0.11 and 3.1±0.20 minutes per twenty four hours respectively. The average time spent in group T2 i.e. extensive housing system was higher than group T1.The T2 i.e. extensive housing system was higher than group T1. As goat spent more time in eating so eat\ more feed and fodder and consequently spent more time in urination.(table 4.5).

Table No. 4.5 Effect of different housing system on defecation time in Osmanabadi goat (minutes per twenty four hours) (N=6).

| Fortnight | Time Spent on Defecating | | T stat |
|---|---|---|---|
| | Group T1 | Group T2 | |
| 1 | 27±0.03 | 3.1±0.20 | -4.11 |
| 2 | 2.8±0.54 | 3.5±0.30 | |
| 3 | 2.9±0.22 | 2.9±0.11 | |
| 4 | 2.7±0.43 | 3.1±0.19 | |
| 5 | 2.8±0.41 | 3.0±0.46 | |
| 6 | 2.9±0.50 | 3.1±0.09 | |
| **Mean ±SE** | **2.7±0.05** | **3.11±0.08** | |
| t critical (0.05): 2.22 | **: Non significant | *: Significant at 5% | |

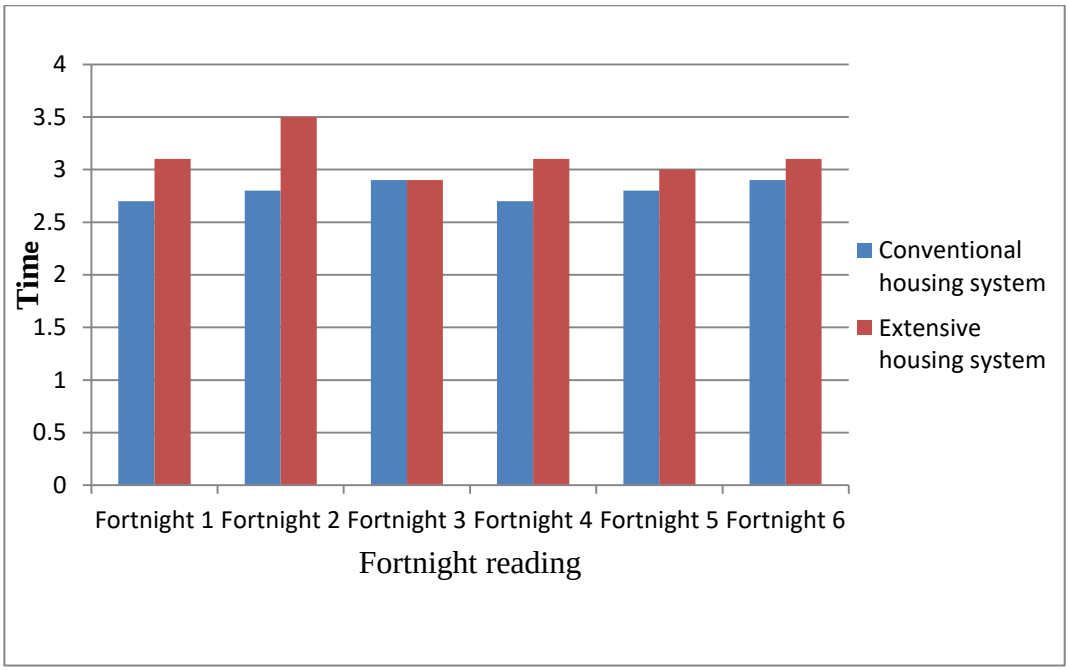


Fig 4.5 Effect of different housing system on defecation time in Osmanabadi goat.

In present study time spent on urinating for a period of twenty four hours was higher 2.36±0.21 minutes in goats under extensive housing system than other housing system. This may be due to goats get natural environment so there is no stress on goats.

4.3 Walking, lying and sleeping time minutes/24hrs in different housing systems in Osamanabadi goat.

### 4.3.1 Walking time minutes/24hrs in different housing systems in Osamanabadi goat.

Average fortnight wise data for twenty four hours of time spent on walking in Osmanabadi goats during the course of study has been presented in table 4.6 and the same has been presented graphically in figure 4.6. It was observed from the table that the average fortnightly time spent on walking for twenty four hours in Osmanabadi goat from from'group T1' (conventional housing system) and 'group$T_2$' (extensive housing system) was 26.41±1.33 and 28.93±1.14 in minutes respectively.

The time spent for walking in intensive and extensive housing system ranged between 21.6±0.73 and 30.5±3.10.,25.0±1.39 and 31.4±0.99minutes per twenty four hours respectively. The average time spent in group T2 i.e. extensive housing system was higher than group T1. T2 i.e. extensive housing system was higher than group T1. As the extensive housing more space provided consequently animals spent more time in walking (table 4.6).

Table No. 4.6 Effect of different housing system on walking time in Osmanabadi goat (minutes per twenty four hours) (N=6)

| Fortnight | Time Spent on Walking | | T stat |
|---|---|---|---|
| | Group T1 | Group T2 | |
| 1 | 21.6±0.73 | 26.3±0.36 | -1.43 |
| 2 | 27.6±1.53 | 31.4±0.99 | |
| 3 | 25.5±0.58 | 28.3±0.29 | |
| 4 | 24.3±2.19 | 25.0±1.39 | |
| 5 | 29.0±1.24 | 31.2±0.87 | |
| 6 | 30.5±3.10 | 31.3±1.25 | |
| **Mean ±SE** | **26.41±1.33$^{NS}$** | **28.93±1.14$^{NS}$** | |
| t critical (0.05): 2.22 NS : Non significant *: Significant at 5% | | | |

Fortnight wise time spent for urination for 24hrs in minutes date was found statistically significant within the experimental group's .These findings are in similar with the findings of of Shereen E.Abdel-Hamid (2017) found significant difference in urination and defection behavior in baladi goats. Whereas Gede et al (2014) who found no significant effect of housing on defecation in Bligon goats .Mhairi *et al*. (2017) found significant effect of housing on urination and defecation also found higher urinatinon percent on wooden slatted floor housing in dairy goats.

In present study time spent on urination for a period of twenty four hours was higher 2.36 ± 0.21 minutes in goat under extensive housing system than other housing system. This may be due to gats get natural environment so there was no stress on goat.

### 4.3.2 Lying time minutes/24hrs in different housing systems in Osamanabadi goat.

Average fortnight wise data for twenty four hours of time spent on sitting in Osmanabadi goats during the course of study has been presented in table 4.7 and the same is presented graphically in figure 4.7. It was observed from the table that the average fortnightly time spent on sitting for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$'

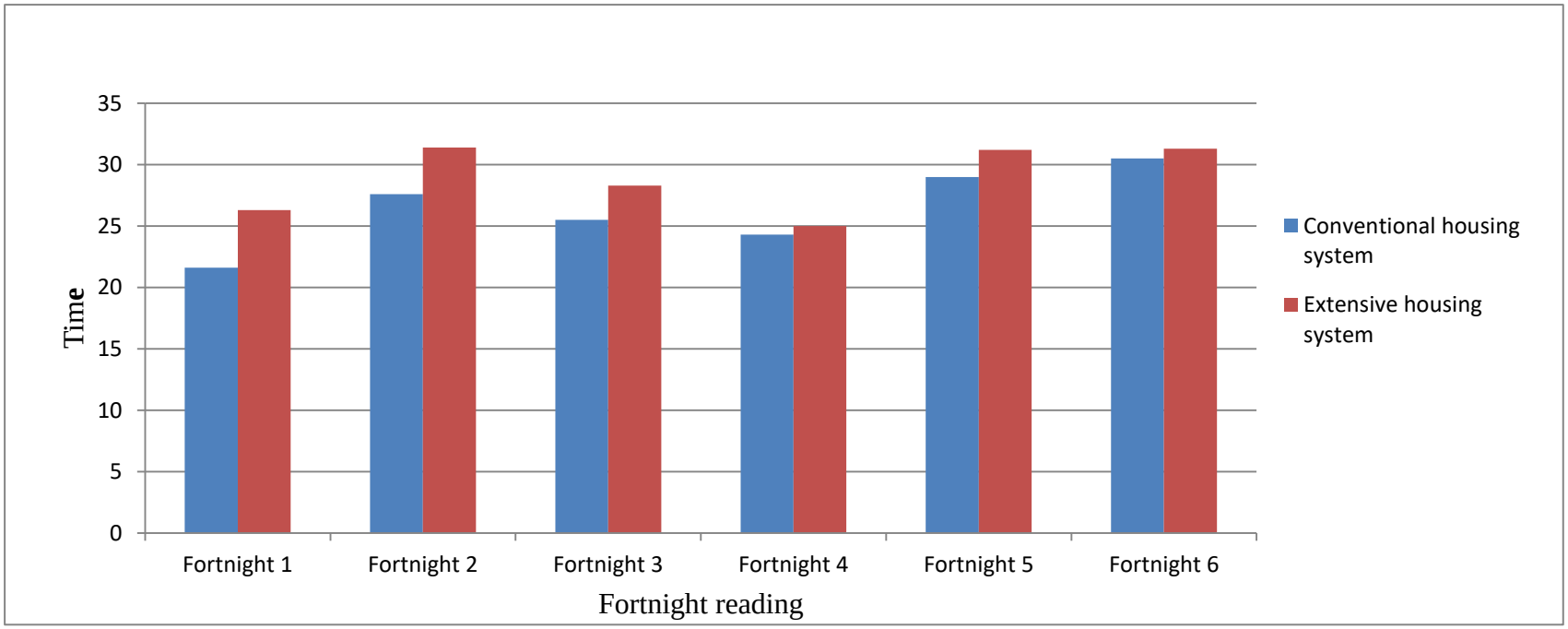


Fig 4.6 Effect of different housing system on walking time in Osmanabadi goat

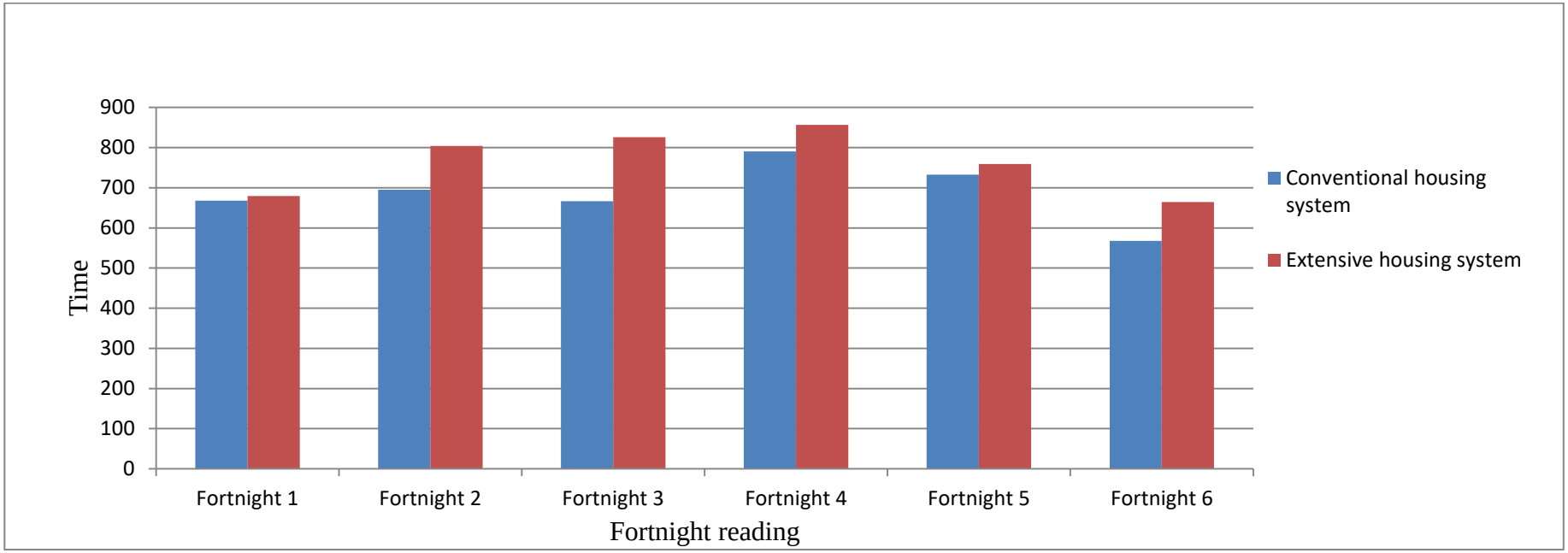


Fig 4.7 Effect of different housing system on lying time in Osmanabadi goat

(extensive housing system) was 686.75±30.49 and 764.76±32.22 in minutes respectively.

The time spent for sitting in intensive and extensive housing system ranged between 567.6±12.20 and 790.7±102.21. 664.3±34.40 and 856.7±26.55 minute per twenty four hours respectively. The average time spent in group T2 i.e. extensive housing system was higher than group T1. T2 i.e. extensive housing system was higher than group T1. As goat spent more time in drinking so drink more water and consequently spent more time in urination. (Table 4.7)

Table No. 4.7 Effect of different housing system on lying time in Osmanabadi goat (minutes per twenty four hours) (N=6)

| Fortnight | Time Spent on Lying | | T stat |
|---|---|---|---|
| | Group T1 | Group T2 | |
| 1 | 668±31.60 | 679.2±37.10 | -1.75 |
| 2 | 695±14.14 | 803.8±26.47 | |
| 3 | 666.8±26.75 | 825.7±15.31 | |
| 4 | 790.7±102.21 | 856.7±26.55 | |
| 5 | 732.4±83.76 | 759±63.45 | |
| 6 | 567.6±12.20 | 664.3±34.40 | |
| **Mean ±SE** | **686.75±30.49$^{NS}$** | **764.76±32.22$^{NS}$** | |
| t critical (0.05): 2.22 NS: Non significant *: Significant at 5% | | | |

### 4.3.3 Sleeping time minutes/24hrs in different housing systems in Osamanabadigoat .

Average fortnight wise data for twenty four hours of time spent on sleeping in Osmanabadi goats during the course of study has been presented in table 4.8 and the same is presented graphically in figure 4.8. It was observed from the table that the average fortnightly time spent on sleeping for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 105.68±7.56 and 127.48±6.75 in minutes respectively.

The time spent for sleeping in intensive and extensive housing system ranged between 77.3 ±4.48 and 120.6±8.40. 104.0±9.03 and 144.6±13.14 minute per twenty four hours respectively. The average time spent in group T2 i.e. extensive housing system was higher than group T1. As the goat has more space available then walk and tired and so they more time in sleeping (table 4.8)

Table No. 4.8 Effect of Different Housing System on sleeping time in Osmanabadi Goat (minutes per twenty four hours) (n=6)

| Fortnight | Time Spent on Sleeping | | T stat |
|---|---|---|---|
| | Group T1 | Group T2 | |
| 1 | 77.3±4.48 | 144.3±13.33 | -2.14 |
| 2 | 103.6±3.93 | 144.6±13.14 | |
| 3 | 99.1±11.30 | 135.1±10.30 | |
| 4 | 105.7±7.99 | 115.5±8.02 | |
| 5 | 120.6±8.40 | 121.3±4.21 | |
| 6 | 100.8±7.87 | 104.0±9.03 | |
| **Mean ±SE** | **105.68±7.56$^{NS}$** | **127.48±6.75$^{NS}$** | |
| t critical (0.05): 2.22 NS : Non significant :NS *: Significant at 5% | | | |

Fortnight wise time spent on walking for 24 hours in minutes data was found statistically non-significant within the experimental groups. These findings are in similar with the findings of Casamassima *et al.* (2001) and Endo *et al*. (2015) who found that housing not affect the walking time in ewes and goat.

These findings are in contrast to the findings of Solanki, (2000) found Zalabadi goat breed , Bansode et al. (2018), Jadhav and Killedar (2020) and Ramchandran et al (2020).

Fortnight wise time spent on sitting for 24 hours in minutes data was found statistically non-significant within the experimental groups.These findings are in similar with the findings of Anuradha*et al*. (2013) and Grigoli,A et al(2011) who found no significant effect of housing on sitting behavior in Osmanabadi and Girgentana goat.

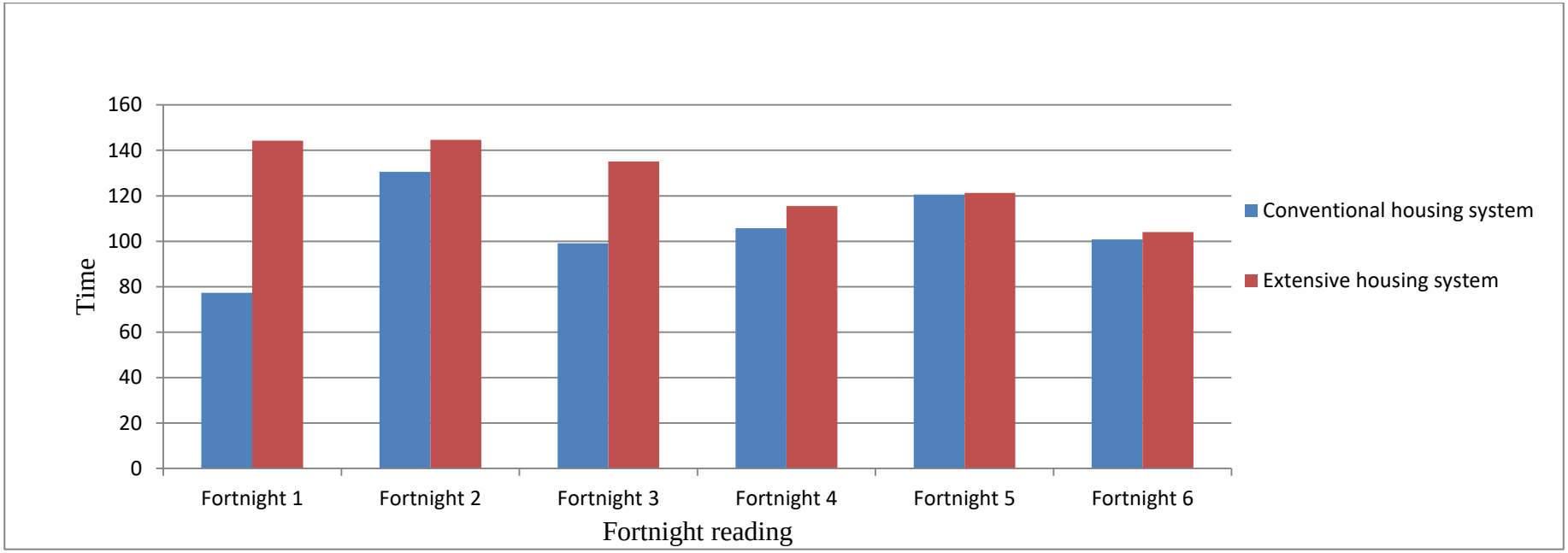


Fig 4.8 Effect of different housing system on sleeping time in Osmanabadi goat

These findings are in contrast to the findings of Geng et al.(2009), Antil et al. (2019) ,Atmoko et al. ,Whereas different result were found by Solanki (2000).

In present study time spent on sitting for a period of twenty four hours was higher 764.76±32.22 minutes in goats under extensive housing system than other housing system. This may be due to goats get natural environment so there is no stress on goats so consume more feed that to improve sitting activity and also free access of water of the goats under loose housing system.

Fortnight wise time spent on sleeping for 24 hours in minutes data was found statistically non-significant within the experimental groups. Fortnight wise time spent on sitting for 24 hours in minutes data was found statistically non-significant within the experimental groups.Thesefindings are in similar with the findings of Anuradha *et al*.(2013) and Gede et al .(2014) found that housing systems not affects the sleeping behavior of Bligon goat.

These findings are in contrast to the findings of SandeepBansode et al (2018), Jadhav and AnkitaKilledar (2020) Ramchandran et al (2019) and Wadhwani et al (2014) and Aschwanden et al (2009) found that housing had a significant effect on sleeping behavior in goat.Patra*et al.* (2008) found the effect of tethering and grazing on idling was763 and 733minutes/day in goats.

In present study time spent on sleeping for a period of twenty four hours was higher 127.48±6.75 minutes in goats under extensive housing system than other housing system. This may be due to goats get natural environment so there is no stress on goats so consume more time that to improve sleeping activity and also free access of water of the goats under loose housing system.

## 4.4 Agonistic behaviour

### 4.4.1 Time Spent for attacking (minutes per twenty four hours):

Average fortnight wise data for twenty four hours of time spent on agonistic behaviour in Osmanabadi goats during the course of study has been presented in table 4.9 and the same is presented graphically in figure 4.9. Perusal to data revelled the average fortnightly time spent on attacking for twenty

four hours in Osmanabadi goat from from‘groupT1’ (conventional housing system) and ‘group$T_2$’ (extensive housing system) was 1.14±0.57 and 3.05±0.58 in minutes respectively.

The average fortnight wise data for twenty four hours was subjected to statistical analysis and presented in table 4.9. The time spent for attacking in intensive and extensive housing system ranged between 0.08±0.04 and 3.8±0.42.,1.7±0.20 and 5.2±0.60minutes per twenty four hours respectively. The average time spent in group T2 i.e. extensive housing system was higher than group T1 T2 i.e. extensive housing system was higher than group T1. As the goat have more movable space available then they use this place for forceful attacking so they more time in sleeping table 4.9).

Table No. 4.9 Effect of Different Housing System on Attacking Time in Osmanabadi Goat (minutes per twenty four hours) (n=6)

| Fortnight | Time Spent on Attacking | | T stat |
|---|---|---|---|
| | Group T1 | Group T2 | -2.31 |
| 1 | 0.5±0.06 | 5.2±0.60 | |
| 2 | 0.1±0.02 | 2.8±0.34 | |
| 3 | 3.8±0.42 | 4.4±1.06 | |
| 4 | 0.8±0.43 | 2.4±0.67 | |
| 5 | 1.6±0.13 | 1.7±0.20 | |
| 6 | 0.08±0.04 | 1.8±0.25 | |
| **Mean ±SE** | **1.14±0.57*** | **3.05±0.58*** | |
| t critical (0.05): 2.22 NS: Non significant *: Significant at 5% | | | |

Fortnight wise time spent on attacking for 24 hours in minutes data was found statistically significant ($P \leq 0.05$)within the experimental groups.These findings are in similar with the findings of Abdel-Hamid *et al* (2017) Jadhav and Killedar (2020),Ramchandran et al (2019) , Wadhwani et al ( 2014 ) , Aschwanden et al (2009) and Shereen E. Abdel-Hamid (2017) found significant difference in aggressive behavior in baladi goats. Whereas Karina et al (2018) found that enriched environment show more behavior in Sannen dairy goats.

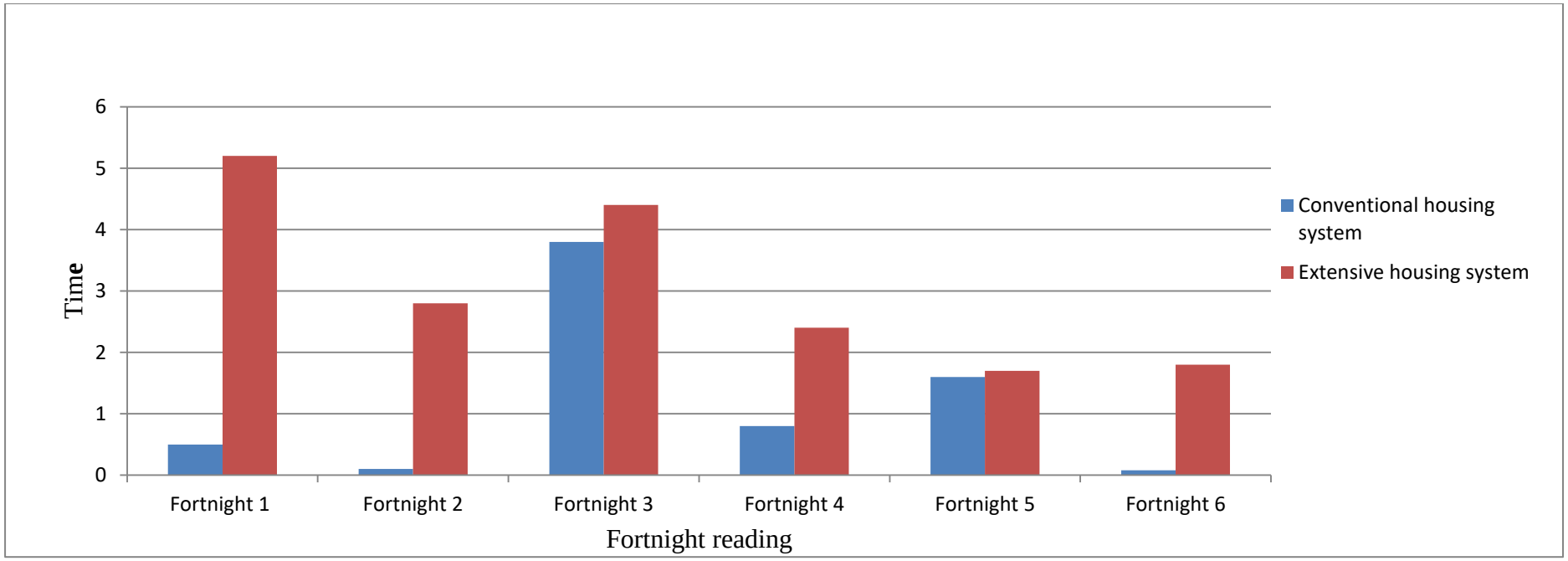


Fig 4.9 Effect of different housing system on attacking time in Osmanabadi goat

These findings are in contrast to the findings of Grigoli, et al. (2011) who found no significant effect of housing on aggressive behavior in Girgentana goat.

In present study time spent on attacking for a period of twenty four hours was higher 3.05±0.58 minutes in goats under extensive housing system than other housing system. This may be due to goats get natural environment so there is no stress on goats so consume more time that to improve sleeping activity and also free access of water of the goats under loose housing system.

### 4.5 Body Condition Score:

According to Graff (2011) the standards for evaluating of BCS in Osmanabadi goat was conducted in experimental both group, Group $T_1$ and Group $T_2$. For each grouptotal 6 female goats were assessed separately. During assessment of BCS of each goat, the goat was allowed to stand on flat surface. By using palpation method and visual observations BCS had been assessed keeping normal image of a healthy female Osmanabadi goat at their respective age in mind. Total prescribed surfaces by Graff were assessed critically and evaluated. Each of the observations by giving the appropriate score from 1 – 5 points .Thus overall 12 goats were assessed fortnightly 6 times during the study. The data generated was statically analyses by using two samples T – test of significance.

The details of the total number of goats distributed in two groups, Group $T_1$ and Group $T_2$ with their evaluated BCS has been presented in Table No.4.10 and graphically presented in figure no.10. Average fortnight wise data for body condition score (BCS) in Osmanabadi goats during the course of study is presented in table 4.6 and the same is presented graphically in figure 4.6a. It is seen from the table that the average fortnightly body condition score (BCS)in Osmanabadi goat from group '$T_1$' (Conventional housing system) and group'$T_2$' (Extensive housing system) was 3.14±0.01 and 3.22±0.01 respectively.

The average fortnight wise data for body condition score (BCS) was subjected to statistical analysis and presented in table 4.10 Body condition score (BCS) in intensive and extensive housing system ranged between 3.11±0.06, 3.18±0.04 and 3.2±0.05, 3.25±0.03. Body condition score (BCS) in group 'T'$_2$

i.e. extensive housing system was higher than group $T_1$, it may be due to goats remain stress free and free movement of the body due to open space available for them which is not available in other housing system.

Table No.4.10 Body condition score (BCS) of Osmanabadi goat

| Fortnight | Body condition score | | T stat |
|---|---|---|---|
| | Group 'T'$_1$ | Group' T'$_2$ | |
| 1 | 3.11±0.06 | 3.21±0.03 | |
| 2 | 3.16±0.04 | 3.25±0.02 | |
| 3 | 3.18±0.04 | 3.2±0.05 | -5.356 |
| 4 | 3.15±0.04 | 3.25±0.02 | |
| 5 | 3.13±0.05 | 3.2±0.05 | |
| 6 | 3.16±0.07 | 3.25±0.03 | |
| **Mean ±SE** | **3.14±0.01** | **3.22±0.01** | |
| t critical (0.05): 2.22 NS: Non significant *: Significant at 5% | | | |

The BCS in the present study is in agreement with the Drenam and Bery (2006) who reported that season and housing significantly affects the BCS in goat.WhereasSjostrom et al (2019) who reported that BCS of cows had not significantly affected by indoor and outdoor housing systems..B.j.Heins et al (2019) and Daniela et al. (2020) foundthat no significant effect of indoor and outdoor housing and temperature humidity index in dairy cows.

## 4.6 Physiological Parameters:

4.7.1Rectal Temperature ($^0$ F)

4.7.2Respiration rate (breaths / minute)

4.7. 3Heart Rate (beats / minute)

### 4.6.1Rectal Temperature ($^0$F)

Physiological parameters viz body temperature, heart rate, respiration rate was recorded fortnightly during the course of experimental period.

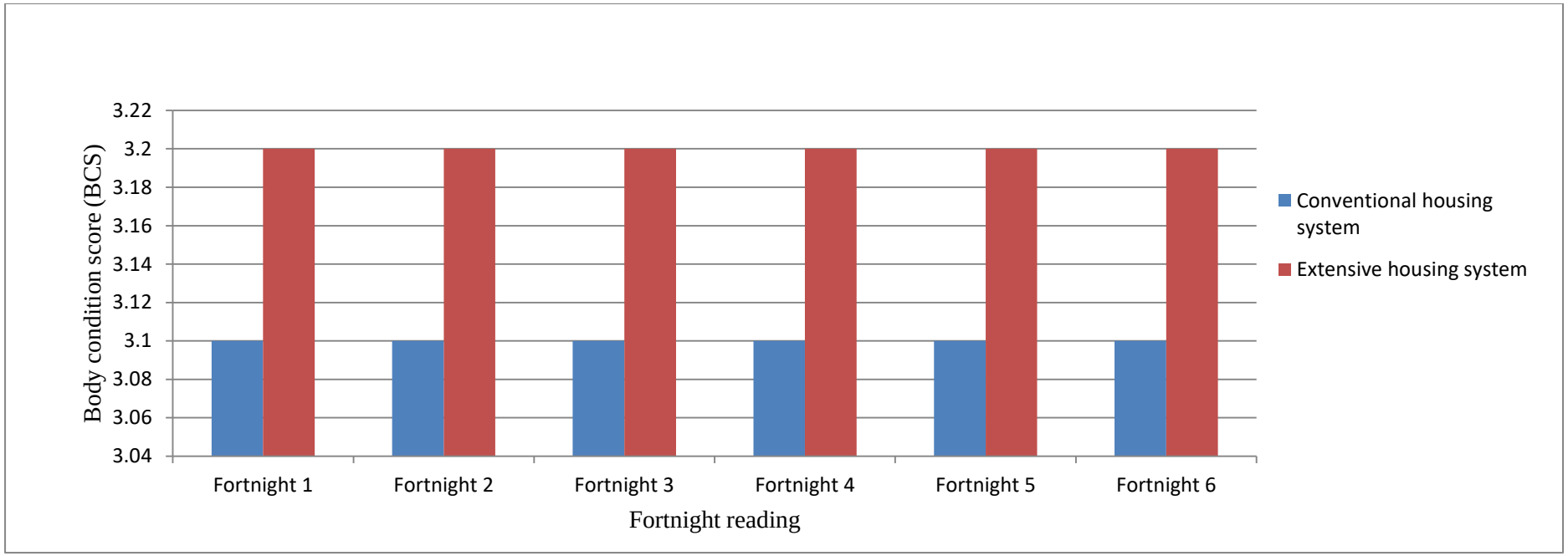


Fig 4.10 Effect of different housing system on body condition score (BCS) in Osamanabadi goat

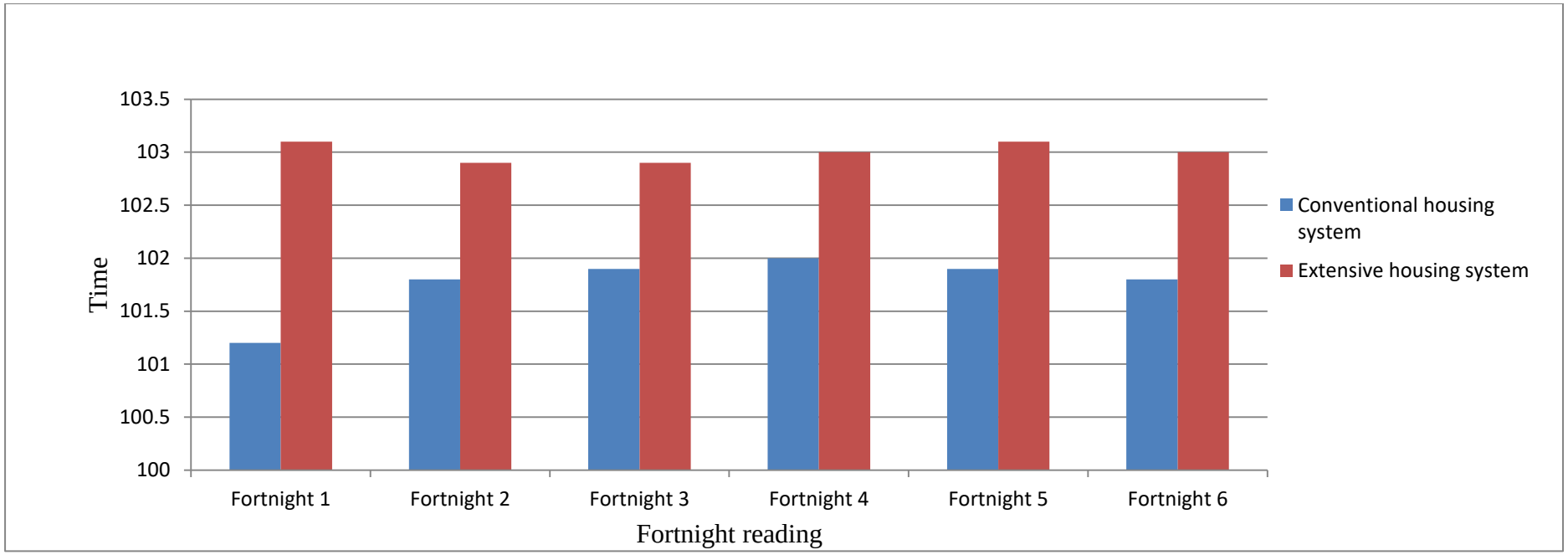


Fig 4.11 Effect of different housing system on rectal temperature in Osamanabadi goat

Average fortnight wise data for body temperatures in Osmanabadi goats during the course of study has been presented in table 4.11 and the same is presented graphically in figure 4.11. It was observed from the table that the average fortnightly body temperature in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$ (extensive housing system) was 102.88.±0.04 and 102.51±0.18 $^0$F respectively.

The body temperature in intensive and extensive housing system ranged between 102.8±0.07 and 103±0.04, 101.9±0.10 and 103±0.08 $^0$F respectively. The average body temperatures in group '$T_1$' and '$T_2$' i.e. extensive housing system was within normal range for the entire experimental group during the course of study.

In present study body temperature in the present study for three month was measured at fortnightly interval was within the normal range in goats under extensive and intensive housing system.

Table No. 4.11 Effect of different housing system on rectal temperatures in Osmanabadi Goat (F) (N=6)

| Fortnight | Rectal Temperatures ($^0$F) | | T stat |
|---|---|---|---|
| | Group '$T_1$' | Group '$T_2$' | |
| 1 | 101.2 ±0.16 | 103.1±0.15 | -9.945 |
| 2 | 101.8±0.12 | 102.9±0.10 | |
| 3 | 101.9±0.14 | 102.9±0.19 | |
| 4 | 102.0±0.19 | 103.0±0.08 | |
| 5 | 101.9±0.14 | 103.1±0.13 | |
| 6 | 101.8±0.30 | 103.2±0.16 | |
| **Mean ±SE** | **101.2 ±0.16** | **103.1±0.15** | |
| t critical (0.05): 2.22 NS: Non significant *: Significant at 5% | | | |

### 4.7.2 Respiration rate (breaths / minute)

Average fortnight wise data for respiration rate in Osmanabadi goats during the course of study has been presented in table 4.12 and the same has been

presented graphically in figure 4.12. It was observed from the table that the average fortnightly respiration rate in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 27.55 ±0.24 and 25.15±0.69 breaths/ minute respectively.

The average fortnight wise data for twenty four hours was subjected to statistical analysis and presented in table 4.12. The respiration rate in intensive and extensive housing system ranged between 26.6±0.42 and 28.3±0.33. 22.3±0.71 and 27.5±0.76breaths/ minute respectively. The average respiration rate in group '$T_1$' and group '$T_2$' i.e. extensive housing system was within normal range for the entire experimental group during the course of study.

Table No. 4.12 Effect of different housing system on respiration rate in Osmanabadi goat (breaths / minute) (N=6)

| Fortnight | Respiration Rate | | T stat |
|---|---|---|---|
| | Group '$T_1$' | Group '$T_2$' | 3.27 |
| 1 | 27.3 ±0.71 | 24.6±0.76 | |
| 2 | 27.5±0.80 | 22.3±0.71 | |
| 3 | 26.6±0.42 | 25.6±0.61 | |
| 4 | 28.0±0.73 | 25.6±0.88 | |
| 5 | 28.3±0.33 | 25.3±0.49 | |
| 6 | 27.6±1.02 | 27.5±0.76 | |
| **Mean ±SE** | **27.55±0.24** | **25.15±0.69** | |
| t critical (0.05): 2.22 NS : Non significant *: Significant at 5% | | | |

### 4.7.3 Heart Rate (beats / minute)

Average fortnight wise data for heart rate in Osmanabadi goats during the course of study is presented in table 4.13 and the same is presented graphically in figure 4.13. It is seen from the table that the average fortnightly heart rate in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$'

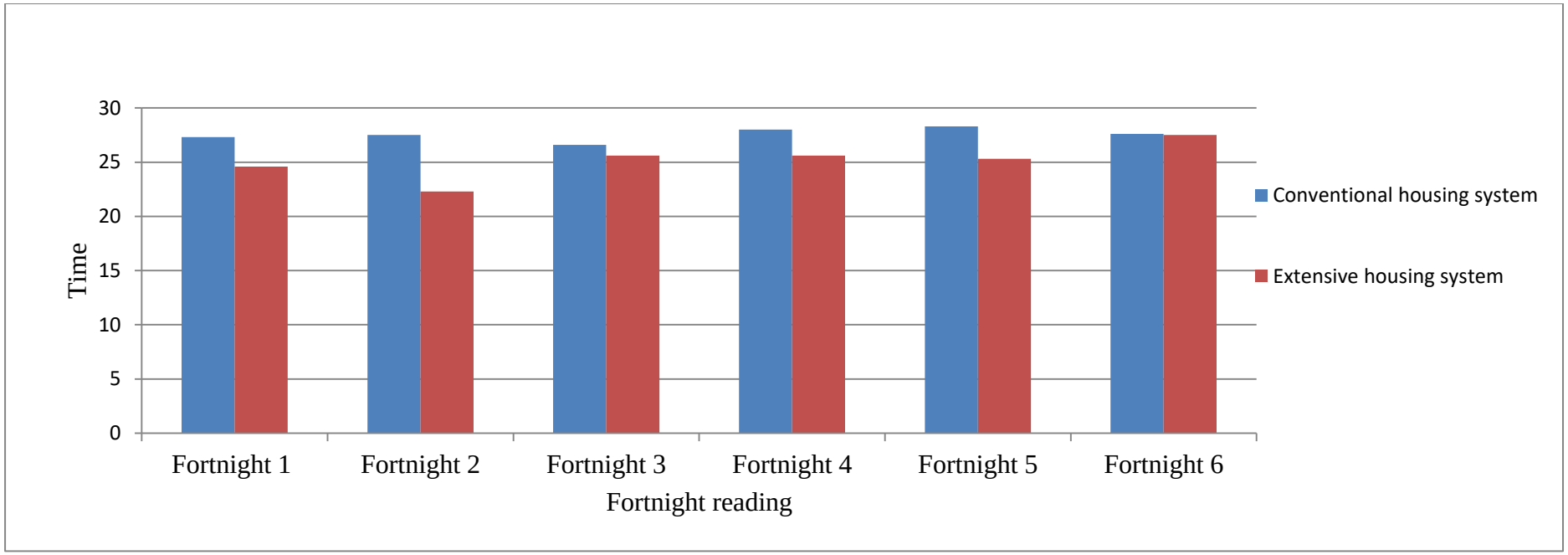


Fig 4.12 Effect of different housing system on respiration rate in Osamanabadi goat

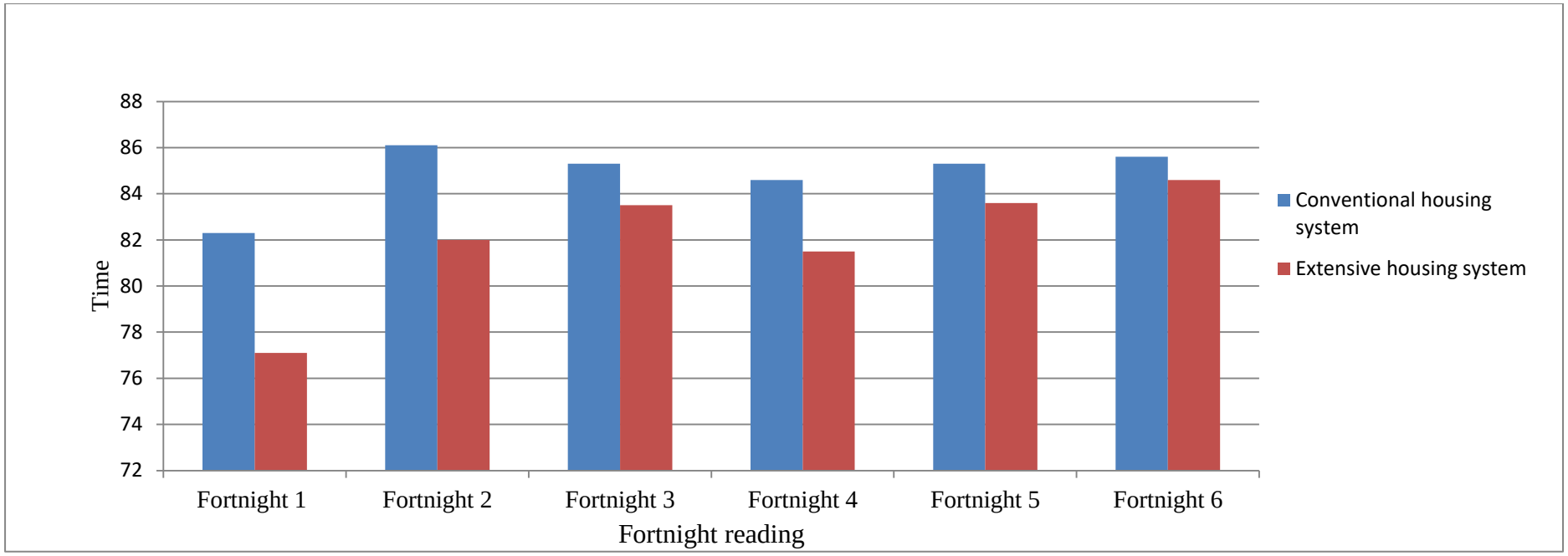


Fig 4.13 Effect of different housing system on heart rate in Osamanabadi goat

(extensive housing system) was 84.86±0.55 and 82.05±1.09 beats/ minute respectively.

The average fortnight wise data for twenty four hours was subjected to statistical analysis and presented in table 4.14. The heart rate in intensive and extensive housing system ranged between 82.3±2.56 and 86.1±0.74.,77.1±1.04 and 84.6±1.14beats/ minute respectively. The average heart rate in group T1 and group T2 i.e. extensive housing system was within normal range for all the experimental group during the course of study.

Table No. 4.13 Effect of Different Housing System on Heart Rate in Osmanabadi Goat ( beats / minute) (N=6)

| Fortnight | Heart Rate | | T stat |
|---|---|---|---|
| | Group T1 | Group T2 | |
| 1 | 82.3 ±2.56 | 77.1±1.04 | |
| 2 | 86.1±0.74 | 82.0±1.29 | |
| 3 | 85.3±0.88 | 83.5±0.84 | 2.30 |
| 4 | 84.6±1.17 | 81.5±1.25 | |
| 5 | 85.3±1.38 | 83.6±1.54 | |
| 6 | 85.6±0.71 | 84.6±1.14 | |
| **Mean ±SE** | **84.86±0.55** | **82.05±1.09** | |
| t critical (0.05): 2.22 NS: Non significant *: Significant at 5% | | | |

Fortnight wise rectal temperatures for 24 hours in $^{0}$F data was found statistically significant ($P \leq 0.05$)within the experimental groups. These findings are in similar with the findings of Prasetryo*et al* (1984)found significant effect of housing on rectal temperature. Also report found by Rao and Mullick (1965),Solanki et al (1989) found rectal temperature 39.2,38.7 and 38.1 $^{0}$ C which is closely similar with the present study.

The results were found by Bhata et al. (2005), Patel et al. (2007) significant difference in rectal under different housing systems in goat.

These findings are in contrast to the findings of Patil et al. (2008) who reported non-significant difference under different housing systems in Osmanabadi kids.

Fortnight wise respiration rate for 24 hours in breaths/minute data was found statistically significant ($P \leq 0.05$)within the experimental groups.The results were found by Bhata et al (2005), Patel et al (2007) and Rahman and Nagpaul (2013) and Obebiyi et al (2007) found significant difference in rectal under different housing systems in goat.

These findings are in contrast to the findings of Patil et al (2008) and Rao and Mullick (1965) who reported non-significant difference in respiration rate in goat under different housing systems.

In present study respiration rate in the present study for three month was measured at fortnightly interval was within the normal range in goats under extensive and intensive housing system.

Fortnight wise heart rate for 24 hours in beats / minute data was found statistically significant ($P \leq 0.05$) within the experimental groups. These findings are in similar with the findings of Prasetryo *et al* (1984) found significant effect of housing on heart rate. Solanki et al (1989) found heart rate 78, 73 and 67 which is similar with the present study.

The results were found by Patel et al. (2007) and Also report found by Rao and Mullick (1965) significant difference in heart rate under different housing systems in goat.

These different results found by Patil et al (2008) who reported non-significant difference under different housing systems in Osmanabadi kids.

In present study heart rate in the present study for three month was measured at fortnightly interval was within the normal range in goats under extensive and intensive housing system.

### 4.8 Labour economics

In the present study following labour economics in different housing system under conventional and extensive housing system (loose housing) were studied.

Table No.14 Average daily time (hrs) utilized to complete day to day activity on the livestock farm under different housing systems.

| Sr.No. | Day to activity with time required | Group '$T_1$' | Group '$T_2$' |
|---|---|---|---|
| 1 | Time required to offer concentrate | Nil | Nil |
| 2 | Time required to offer fodder | 90 | 90 |
| 3 | Time required to offer water | 10 | 10 |
| 4 | Time required to clean the shed | 30 | 15 |
| 5 | Time required to clean the shed premises | 45 | 45 |
| 6 | Total time required to complete day to activity | 4.35hrs | 4.20hrs |
| 7 | Labour required per day | 1 | 1 |
| 8 | Labour charges per day (Rs.) | 300 | 300 |

In the present study labour economics was calculated in both experimental groups for twelve hours of day for 90 days period of experiment .Average daily time required to offer feed and fodder, water and cleaning activity in the shed and around the premises area was calculated.

The average daily time required to offer green and dry fodder in group '$T_1$' housing system was 90 minutes per day and also the average daily time required to offer green and dry fodder in group '$T_2$' housing system was 90 minutes per day.

On the basis of labour hour requirement in different housing system to perform different activity like to offer feed and fodder, drinking water, cleaning of shed and premises of the shed, the extensive housing system required less labour hours per day as compared to conventional housing systems.

According to Singh *et al*. (1995) studied the economics of goat rearing under field conditions in rural Mathura ; UP observed that the share of labour expenditure is about 37.19% of the total expenditure.

# *Summary & Conclusion*

## 5. SUMMARY AND CONCLUSION

The present study entitled "Comparative Study of Ethogram and Labour Economics of Osmanabadi Goat in Different Housing System'' was carried out at Punyashlok Ahilyadevi Sheep and Goat Development, Farm, at Dhiwadi Tq. Man Dist. Satara. The experiment was conducted on twelve adult female Osmanabadi goats. Twelve adult female goat in 4–5 years old were randomly selected and divided into two groups.viz,Group '$T_1$' Six goats were maintained under conventional housing system. Group '$T_2$' Six goats were maintained in loose housing system. The feeding manger and water tank were provided in both the open to sky areas and roofed area. Green and dry fodder was available throughout 24 hours and goats were free to move in open as well as shaded areas. Concentrate was provided as per requirement.

The average fortnightly time spent on feeding for twenty four hours in Osmanabadi goat from group '$T_1$' (Conventional housing system) and group '$T_2$' (Extensive housing system) was 187.63±8.90 and237.93±16.33 in minutes respectively.The time spent for feeding in intensive and extensive housing system ranged between 156.7±15.73 and 214±22.61., 202±3.92 and 289.5±1.47minutes per twenty four hours respectively. Fortnight wise time spent on feeding for 24 hours in minutes data was found statistically significant ($P \leq 0.05$)within the experimental groups.

The average fortnightly time spent on drinking of water for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 0.16±0.05 and 0.35±0.06 in minutes respectively.The time spent for drinking of water in intensive and extensive housing system ranged between 0.08±0.01 and 0.4±0.11, 0.1±0.05 and 0.5±0.04minutes per twenty four hours respectively. Fortnight wise time spent on drinking of water for 24 hours in minutes data was found statistically highly significant within the experimental groups.

The average fortnightly time spent on ruminating for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 384.66±12.51 and 510.66±20.71 in minutes

respectively. The time spent for ruminating in intensive and extensive housing system ranged between341.5±31.21 and 412.4±54.42.439±67.50 and 563.6±17.45minutes per twenty four hours respectively. Fortnight wise time spent on feeding for 24 hours in minutes data was found statistically highly significant within the experimental groups.

The average fortnightly time spent on urinating for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 1.44±0.18 and 2.36±0.21 in minutes respectively.The time spent for urinating in intensive and extensive housing system ranged between 0.7±0.09 and 1.9±0.30., 1.5±0.38 and 3.1±0.47minutes per twenty four hours respectively. Fortnight wise time spent on feeding for 24 hours in minutes data was found statistically highly significant within the experimental groups.

The average fortnightly time spent on defecating for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 2.7±0.05 and 3.11±0.08 in minutes respectively.The time spent for defecating in intensive and extensive housing system ranged between 2.7±0.03 and 2.9±0.50, 2.9±0.11 and 3.1±0.20minutes per twenty four hours respectively. Fortnight wise time spent on feeding for 24 hours in minutes data was found statistically highly significant within the experimental groups.

The average fortnightly time spent on walking for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 26.41±1.33 and 28.93±1.14 in minutes respectively. The time spent for walking in intensive and extensive housing system ranged between 21.6±0.73 and 30.5±3.10.25.0±1.39 and 31.4±0.99minutes per twenty four hours respectively. Fortnight wise time spent on walking for 24 hours in minutes data was found statistically non-significant within the experimental groups.

The average fortnightly time spent on lying down for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$'

(extensive housing system) was 686.75±30.49 and 764.76±32.22 in minutes respectively. The time spent for sitting in intensive and extensive housing system ranged between 567.6±12.20 and 790.7±102.21, 664.3±34.40 and 856.7±26.55minutes per twenty four hours respectively. Fortnight wise time spent on walking for 24 hours in minutes data was found statistically non-significant within the experimental groups.

The average fortnightly time spent on sleeping for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 105.68±7.56 and 127.48±6.75 in minutes respectively. The time spent for sleeping in intensive and extensive housing system ranged between 77.3±4.48 and 120.6±8.40,104.0±9.03 and 144.6±13.14minutes per twenty four hours respectively. Fortnight wise time spent on sleeping for 24 hours in minutes data was found statistically non-significant within the experimental groups.

The average fortnightly time spent on attacking for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 1.14±0.57 and 3.05±0.58 in minutes respectively. The time spent for attacking in intensive and extensive housing system ranged between 0.08±0.04 and 3.8±0.42, 1.7±0.20 and 5.2±0.60minutes per twenty four hours respectively. Fortnight wise time spent on attacking for 24 hours in minutes data was found statistically significant ($P \leq 0.05$)within the experimental groups.

The average fortnightly time spent on estrus for twenty four hours in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 0.0±0.0.0 and 0.0±0.0 in minutes respectively.So no goat was found in oestrus in any type of housing systems.The average fortnightly body condition score (BCS) in Osmanabadi goat from group '$T_1$' (conventional housing system) and group'$T_2$' (extensive housing system) was 3.14±0.01 and 3.22±0.01 respectively.Body condition score (BCS) in intensive and extensive housing system ranged between 3.11±0.06 ,3.18±0.04 and3.2±0.05,3.25±0.03.Fortnight wise body condition score (BCS) data was found statistically highly significant ($P \leq 0.01$)within the experimental groups.

The average fortnightly rectal temperature in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 101.77.±0.11 and 103.03±0.04 in $^0$F respectively. The body temperature in intensive and extensive housing system ranged between 101.2±0.16 and 102±0.19.,102.9±0.10 and 103.2±0.16 $^0$ F respectively. Fortnight wise rectal temperature in Osmanabadi goat data was found statistically highly significant within the experimental groups.

The average fortnightly respiration rate in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 27.55 ±0.24 and 25.15±0.69 breaths/ minute respectively.The respiration rate in intensive and extensive housing system ranged between 26.6±0.42 and 28.3±0.33, 22.3±0.71 and 27.5±0.76breaths/ minute respectively. Fortnight wise respiration rate data was minutes was found statistically significant ($P \leq 0.05$) within the experimental groups.

The average fortnightly heart rate in Osmanabadi goat from group '$T_1$' (conventional housing system) and group '$T_2$' (extensive housing system) was 84.86±0.55 and 82.05±1.09 beats/ minute respectively. The heart rate in intensive and extensive housing system ranged between 82.3±2.56 and 86.1± 0.74., 77.1±1.04 and 84.6±1.14beats/ minute respectively. Fortnight wise respiration rate data was found statistically significant ($P \leq 0.05$) within the experimental groups.

From the result obtained and statistical analysis of the data, the conclusion could be drawn that the effect of different housing system on behavior of Osmanabadi goat is significant in feeding, ruminating, drinking, urinating, defecating, attacking behavior of the goat.

The physiological parameters such as rectal temperature, respiration rate, heart rate and body condition score of the Osmanabadi goat is significantly affected in the different housing system.

The average daily percentage of man hours required to perform different activity like to offer feed and fodder, drinking of water, cleaning of the shed and

premises of the shed, in group '$T_1$' housing management was 36% per twelve hours of the day and the average daily percentage of man hours in group '$T_2$' housing management was 33% minutes per twelve hours of the day.

The overall conclusion of the present study is that the extensive system of housing is good for welfare of the Osmanabadi goats.

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# *Appendix*

APPENDIX – I

Feeding time of goats for 24 hours (Minutes)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 110 | 128.8 | 220 | 144 | 184.7 | 154 | 295.2 | 291 | 204.9 | 205.2 | 247 | 192.9 |
| 2 | 250.2 | 226.7 | 140 | 83.6 | 179.8 | 196 | 287.1 | 282 | 181.8 | 207 | 243 | 182.8 |
| 3 | 196.2 | 212.9 | 190 | 172.5 | 173.6 | 175 | 292.6 | 277 | 247.9 | 212.6 | 264 | 247.9 |
| 4 | 227 | 221.3 | 168 | 184.7 | 186.9 | 164 | 286.1 | 278 | 206.6 | 207.1 | 227.6 | 203.6 |
| 5 | 257.3 | 248.2 | 206 | 180.1 | 186.2 | 186 | 289.2 | 274 | 212.4 | 189 | 231 | 212.4 |
| 6 | 243.3 | 232.6 | 178 | 175.3 | 184.8 | 189 | 287.1 | 278 | 181.8 | 191.1 | 268 | 181.8 |

APPENDIX – II

Drinking time of goats for 24 hours (Minutes)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 0.5 | 0.8 | 0.1 | 0 | 0 | 0 | 0.5 | 0.2 | 0 | 0.1 | 0.2 | 0.4 |
| 2 | 0.9 | 0.2 | 0.03 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.3 | 0.2 | 0.4 | 0.4 |
| 3 | 0.3 | 0.1 | 0.1 | 0.06 | 0.1 | 0.05 | 0.5 | 0.3 | 0.2 | 0.2 | 0.3 | 0.5 |
| 4 | 0.3 | 0.2 | 0.06 | 0.1 | 0.1 | 0.3 | 0.4 | 0.3 | 0.06 | 0.3 | 0.3 | 0.6 |
| 5 | 0.2 | 0.1 | 0.1 | 0.06 | 0.06 | 0.06 | 0.6 | 0.5 | 0.03 | 0.2 | 0.5 | 0.6 |
| 6 | 0.7 | 0.06 | 0.1 | 0.06 | 0.08 | 0.05 | 0.7 | 0.7 | 0.3 | 0.2 | 0.7 | 0.5 |

APPENDIX – III

Ruminating time of goats for 24 hours (Minutes)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 270 | 283 | 216 | 222 | 218 | 204 | 434.2 | 345.2 | 486.8 | 505 | 523 | 566 |
| 2 | 246.5 | 208 | 273.5 | 235 | 247.7 | 261.1 | 563.5 | 669.2 | 642.5 | 532 | 518 | 538 |
| 3 | 315.4 | 505.3 | 337.2 | 378 | 521.1 | 404.4 | 222.8 | 239.4 | 373.7 | 503 | 622 | 534 |
| 4 | 373.3 | 455 | 368.2 | 532.2 | 453.4 | 550 | 503.2 | 312.6 | 542.4 | 483 | 588 | 552 |
| 5 | 436.1 | 520.8 | 431.1 | 567.7 | 504.4 | 431.5 | 552.6 | 517.8 | 525.6 | 442 | 539 | 540 |
| 6 | 408.2 | 502.6 | 484.2 | 478.7 | 515.8 | 490.7 | 533.3 | 552.7 | 716.2 | 511 | 592 | 573 |

APPENDIX – IV

Urinating time of goats for 24 hours (Minutes)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 1 | 0.7 | 0.36 | 0.8 | 0.4 | 0.7 | 2.5 | 3 | 2.6 | 4.2 | 4 | 2.3 |
| 2 | 1.8 | 0.7 | 0.9 | 0.6 | 1 | 1.8 | 2 | 2.1 | 1.4 | 2.4 | 3.1 | 2 |
| 3 | 1 | 2 | 0.9 | 2.6 | 2 | 2 | 2 | 2.4 | 0.8 | 2.8 | 3.8 | 3 |
| 4 | 1 | 2.2 | 0.8 | 2.5 | 1.1 | 3 | 2.6 | 2.3 | 2.2 | 2.3 | 3.9 | 2.1 |
| 5 | 1.2 | 2.4 | 1 | 2.2 | 2.1 | 1.9 | 2.1 | 2.2 | 2 | 2.1 | 3.2 | 3 |
| 6 | 1 | 2.4 | 0.7 | 2 | 2.5 | 2.2 | 2 | 2.8 | 0.06 | 2.2 | 0.9 | 2.4 |

APPENDIX – V

Defecating time of goats for 24 hours (Minutes)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 2.18 | 1.1 | 2.4 | 2.4 | 1.2 | 2 | 3.7 | 2.5 | 3.1 | 3 | 1.4 | 1.4 |
| 2 | 2.6 | 1.2 | 2.83 | 0.7 | 2.5 | 0.8 | 3.1 | 4.8 | 2.7 | 2.8 | 2.7 | 2.7 |
| 3 | 3.4 | 3.3 | 3.6 | 3.4 | 2.5 | 3.8 | 3.1 | 3.2 | 2.5 | 3.9 | 4.1 | 4.1 |
| 4 | 2.2 | 3.8 | 3.5 | 3.6 | 3.8 | 3.7 | 2.2 | 3.4 | 3.2 | 3.4 | 3.6 | 3.6 |
| 5 | 2.5 | 3.8 | 2.8 | 3 | 3.6 | 3.2 | 3.3 | 3.8 | 3.1 | 2.6 | 4.3 | 4.3 |
| 6 | 3.4 | 3.9 | 2.3 | 3.1 | 3.7 | 3.9 | 3.2 | 3.6 | 3.1 | 2.9 | 2.2 | 2.2 |

APPENDIX – VI

Walking time of goats for 24 hours (Minutes)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 22 | 35 | 27 | 21.5 | 27 | 45.4 | 25.9 | 32.4 | 29.2 | 18.6 | 34.2 | 35.4 |
| 2 | 25 | 27 | 24 | 15.3 | 34.7 | 30 | 27.2 | 33.7 | 29.2 | 24.3 | 29.7 | 28.5 |
| 3 | 21.5 | 24.2 | 26.3 | 26.6 | 29.8 | 29.7 | 26.5 | 29.8 | 27.6 | 26.5 | 32.3 | 34.3 |
| 4 | 20.2 | 26.2 | 27.1 | 31.1 | 28.1 | 27.8 | 26.6 | 28.6 | 28.2 | 28.1 | 28.7 | 29.8 |
| 5 | 20.1 | 26.5 | 24.3 | 25.8 | 26.1 | 25.8 | 26.9 | 29.8 | 27.7 | 26 | 32.7 | 28 |
| 6 | 21.3 | 26.8 | 24.5 | 25.8 | 28.8 | 24.5 | 24.7 | 34.6 | 27.9 | 27 | 29.8 | 31.9 |

APPENDIX – VII

Sitting time of goats for 24 hours (Minutes)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 692 | 701 | 777 | 404 | 830 | 591 | 509.2 | 849 | 842.5 | 963 | 760.2 | 556 |
| 2 | 750 | 718 | 587.3 | 1181.3 | 353.1 | 549 | 746.8 | 747 | 855.7 | 848.1 | 457.8 | 596 |
| 3 | 609 | 718 | 627 | 832.5 | 890.5 | 559 | 731 | 807 | 843.7 | 852.8 | 789.3 | 672 |
| 4 | 649 | 705 | 669 | 725.3 | 804.5 | 555 | 749.4 | 904 | 832.5 | 883.4 | 836.5 | 711 |
| 5 | 750 | 626 | 644 | 851.1 | 645.2 | 536 | 665 | 729 | 751.7 | 827.1 | 903.5 | 794 |
| 6 | 558 | 702 | 696.8 | 750.1 | 871.3 | 616 | 674 | 793 | 828.3 | 766.3 | 806.7 | 657 |

APPENDIX –VIII

Sleeping time of goats for 24 hours (Minutes)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 61 | 148 | 150 | 100 | 152 | 103 | 184.6 | 159 | 147 | 108 | 107.6 | 64.6 |
| 2 | 87.6 | 123 | 88.1 | 114 | 94.4 | 88.5 | 156.1 | 132 | 114 | 80 | 118 | 98.2 |
| 3 | 75.2 | 127.2 | 95.2 | 117 | 124.3 | 99 | 150.8 | 204 | 176.7 | 134 | 131.5 | 112 |
| 4 | 71 | 122 | 108.1 | 68.3 | 130.8 | 103.1 | 162.2 | 130 | 128.2 | 125 | 132.4 | 127.1 |
| 5 | 91 | 129.1 | 79.2 | 120.1 | 102.5 | 89.8 | 118.2 | 124 | 106.6 | 117 | 112.3 | 120.1 |
| 6 | 78.3 | 134.7 | 74 | 114.8 | 120 | 121.5 | 94 | 119 | 138.5 | 129 | 126.5 | 102.1 |

APPENDIX –IX

Attacking time of goats for 24 hours (Minutes)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 0.4 | 0.2 | 3.5 | 2.1 | 2 | 0.01 | 4.3 | 2.8 | 2.1 | 0.7 | 1.6 | 1.7 |
| 2 | 0.6 | 0.1 | 3.5 | 2.4 | 2.1 | 0.01 | 7.7 | 1.7 | 9.3 | 4.3 | 1.6 | 1.6 |
| 3 | 0.8 | 0.1 | 4.4 | 0.1 | 1.6 | 0.02 | 5.2 | 2.1 | 3.1 | 0.06 | 1.2 | 2.5 |
| 4 | 0.4 | 0.1 | 5.2 | 0.3 | 1.6 | 0.05 | 6.3 | 3.1 | 4.2 | 3.2 | 2 | 0.9 |
| 5 | 0.4 | 0.2 | 2.1 | 0.2 | 1.3 | 0.1 | 4.2 | 3.8 | 2.8 | 3.4 | 1.4 | 2.6 |
| 6 | 0.6 | 0.2 | 4.1 | 0.2 | 1.3 | 0.3 | 3.9 | 3.7 | 4.9 | 2.8 | 2.6 | 1.9 |

APPENDIX –X

Estrus time of goats for 24 hours (Minutes)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

APPENDIX –XI

Fortnightly rectal temperature of goats ($^0$F)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 103.2 | 102.9 | 102.6 | 103 | 102.8 | 103.4 | 101.8 | 102.9 | 102.3 | 102.8 | 103.3 | 101.8 |
| 2 | 102.4 | 103 | 102.8 | 102.9 | 102.6 | 103.1 | 102 | 103 | 103.1 | 103.2 | 103.2 | 102 |
| 3 | 102.8 | 103 | 103.1 | 102.9 | 102.7 | 103.2 | 101.6 | 102.5 | 102.8 | 103.1 | 102.9 | 101.7 |
| 4 | 103.1 | 102.8 | 102.9 | 103 | 103 | 102.7 | 101.7 | 102.8 | 101.7 | 102.7 | 102.8 | 101.8 |
| 5 | 102.6 | 103 | 102.8 | 103.2 | 103 | 103 | 102 | 102.7 | 103.2 | 103.1 | 103.2 | 101.9 |
| 6 | 103 | 102.8 | 103 | 103.1 | 102.9 | 102.7 | 102.3 | 102.6 | 102.8 | 102.9 | 102.9 | 102 |

APPENDIX –XII

Fortnightly respiration rate of goats (breath / minute)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 24 | 27 | 28 | 26 | 29 | 30 | 22 | 20 | 27 | 26 | 24 | 27 |
| 2 | 27 | 24 | 26 | 28 | 29 | 23 | 25 | 21 | 26 | 23 | 26 | 25 |
| 3 | 28 | 27 | 25 | 28 | 29 | 28 | 27 | 23 | 25 | 24 | 27 | 28 |
| 4 | 28 | 29 | 27 | 30 | 28 | 29 | 23 | 25 | 23 | 25 | 26 | 29 |
| 5 | 28 | 29 | 27 | 26 | 27 | 29 | 25 | 22 | 27 | 27 | 25 | 26 |
| 6 | 29 | 29 | 27 | 30 | 28 | 27 | 26 | 23 | 26 | 29 | 24 | 30 |

APPENDIX – XIII

Fortnightly heart rate of goats (beats / minute)

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 76 | 88 | 87 | 83 | 88 | 84 | 75 | 80 | 80 | 77 | 85 | 88 |
| 2 | 78 | 83 | 84 | 80 | 87 | 83 | 80 | 78 | 84 | 81 | 87 | 86 |
| 3 | 76 | 88 | 84 | 85 | 83 | 87 | 74 | 82 | 83 | 83 | 88 | 87 |
| 4 | 89 | 86 | 84 | 85 | 80 | 87 | 78 | 81 | 86 | 79 | 78 | 81 |
| 5 | 87 | 86 | 89 | 88 | 89 | 87 | 76 | 84 | 83 | 84 | 81 | 84 |
| 6 | 88 | 86 | 84 | 87 | 85 | 86 | 80 | 87 | 85 | 85 | 83 | 82 |

APPENDIX – XIV

Fortnightly body condition score (BCS) of goats

| Fortnight | Group $T_1$ | | | | | | Group $T_2$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 2.9 | 3.0 | 3.2 | 3 | 2.9 | 2.9 | 3.1 | 3.2 | 3 | 3.2 | 3.2 | 3.2 |
| 2 | 3.0 | 3.1 | 3.1 | 3.2 | 3.1 | 3.3 | 3.2 | 3.2 | 3.3 | 3.3 | 3.1 | 3.3 |
| 3 | 3.2 | 3.2 | 3.2 | 3.1 | 3.2 | 3.3 | 3.3 | 3.3 | 3.3 | 3.2 | 3.4 | 3.3 |
| 4 | 3.2 | 3.3 | 3.0 | 3.1 | 3.2 | 3.2 | 3.2 | 3.3 | 3.1 | 3.3 | 3 | 3.3 |
| 5 | 3.3 | 3.2 | 3.3 | 3.2 | 3.3 | 3.3 | 3.3 | 3.2 | 3.2 | 3.3 | 3.2 | 3.3 |
| 6 | 3.1 | 3.2 | 3.3 | 3.3 | 3.1 | 3 | 3.2 | 3.3 | 3.3 | 3.2 | 3.3 | 3.1 |

# *Abstract*

## THESIS ABSTRACT

| | | | |
|---|---|---|---|
| 1. | Title of the thesis (in Capital letters) | : | COMPARATIVE STUDY OF ETHOGRAM AND LABOUR ECONOMICS OF OSMANABADI GOAT IN DIFFERENT HOUSING SYSTEM |
| 2. | Full name of student | : | Ovhal Rameshkumar Laxmanrao |
| 3. | Name and address of Major Advisor | : | Dr. A. H. Kodape<br>Associate Professor,<br>Department of Livestock Production and Management<br>Mumbai Veterinary College |
| 4. | Degree to be awarded | : | M.V.Sc |
| 5. | Year of award of degree | : | 2021 |
| 6. | Major subject | : | Livestock Production and Management |
| 7. | Total number of pages in the thesis | : | |
| 8. | Number of words in the abstract | : | 297 |
| 9. | Signature of Student | : | |
| 10. | Signature, Name and address of forwarding authority (HOD / SH)<br><br>Date: | : | Dr. A. H. Kodape<br>Associate Professor,<br>Department of Livestock Production and Management<br>Mumbai Veterinary College |
| 11. | Signature of the Associate Dean | : | |

## ABSTRACT

The present study entitled “Comparative Study of Ethogram and Labour Economics of Osmanabadi Goat in Different Housing System’’ was carried out at Punyashlok Ahilyadevi Mendhi v SheliVikas Mahamandal Farm, at Dhiwadi, Dist. Satara. Twelve adult female goats were selected and divided into two groups under conventional and extensive housing system. The study was conducted for three months. Average fortnightly time spent on feeding in Osmanabadi goats during the course of study was 187.63±8.90 and 237.93±16.33 minutes, respectively and it was significant. The average rumination time under different housing was 384.66±12.51 and 510.66±20.71 minutes and it differed significantly between groups. The average drinking time of water in different housing was 0.16±0.05 and 0.35±0.06 in minutes and highly significantly different.The average urination time under different housing was 1.44±0.18 and 2.36±0.21 minutes and highly significantly different.The average defecating time under different housing was 2.7±0.05 and 3.11±0.08 in minutes and highly significantly different between groups. The average walking time, lying time and sleeping time under different housing was 26.41±1.33 and 28.93±1.14, 686.75±30.49 and 764.76±32.22 and 105.68±7.56 and 127.48±6.75 minutes and was not significantly different, respectively. The average attacking time under different housing was 1.14±0.57 and 3.05±0.58 minutes and highly significantly different.The average estrus time under different housing was 0.0±0.0.0 and 0.0±0.0 in minutes and was not significantly different. The average body condition score (BCS) in different housing was 3.14±0.01 and 3.22±0.01 and highly significantly different. The average rectal temperature, respiration rate, heart rate under different housing was 102.88.±0.04 and 102.51±0.18, $^{0}$F, 27.55±0.24 and 25.15±0.69 breaths/ minute, 84.86±0.55 and 82.05±1.09 beats/ minute respectively and was significantly different. The labour economics was higher in intensive than extensive system. Thus from the overall results it can be concluded that intensive and extensive housing had a significant effect on the natural behavior of Osmanabadi goats.

**प्रबंध सारांश**

| | | | |
|---|---|---|---|
| १. | प्रबंधाचे नाव | : | विविध निवारा पद्धतीमधील उस्मानाबादी शेळींच्या नैसर्गिक वर्तणुकीचा आणि अर्थशास्त्राचा तुलनात्मक अभ्यास |
| २. | विद्यार्थ्याचे नाव | : | ओव्हाळ रमेशकुमार लक्ष्मणराव |
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| 6. | मुख्य विषय | : | पशु उत्पादन व व्यवस्थापन |
| 7. | प्रबंधाची एकूण पाने | : | |
| 8. | सारांशाचे एकूण शब्द | : | २५७ |
| 9. | विद्यार्थ्याची सही | : | |
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| 11. | सहयोगी अधिष्ठाता,<br>मुंबई पशुवैद्यक<br>महाविद्यालय, परेल,<br>मुंबई-४०००१२ | : | |

## गोषवारा

"विविध निवारा पद्धतीमधील उस्मानाबादी शेळीचा नैसर्गिक वर्तणुकीचा आणि श्रमिक अर्थशाशास्त्राचा तुलनात्मक अभ्यास" या शीर्षकाचा सध्याचा अभ्यास पुण्यश्लोक अहिल्यादेवी मेंढी व शेळी विकास महामंडळ प्रक्षेत्र , दहिवडी , जि. सातारा येथे पार पडला. बारा प्रौढ मादी शेळ्या निवडल्या आणि बंदिस्त आणि मुक्त संचार गोठा प्रणाली अंतर्गत दोन गटांमध्ये विभागल्या गेल्या. तीन महिने हा अभ्यास करण्यात आला. अभ्यासादरम्यान उस्मानाबादी शेळयांनी चारा खाण्यात घालवलेला पाक्षिक सरासरी वेळ अनुक्रमे १८७.६३±८.९० आणि २३७.९३±१६.३३ मिनिटांत होता आणि तो लक्षणीय होता. विविध संगोपन पद्धती अंतर्गत सरासरी रवंथ वेळ ३८४.६६±१२.५१ आणि ५१०.६६±२०.७१ मिनिटांत आणि अत्यंत लक्षणीय भिन्न होता. वेगवेगळ्या घरांमध्ये पाणी पिण्याची सरासरी वेळ ०.१६±०.०५ आणि ०.३५±०.०६ मिनिटांत होती आणि अत्यंत लक्षणीयरीत्या वेगळी होती. वेगवेगळ्या घरांतर्गत सरासरी लघवीची वेळ १.४४±०.१८ आणि २.३६±०.२१ मिनिटांत आणि अत्यंत लक्षणीयरीत्या वेगळी होती. सरासरी लेंडी टाकण्याची वेळ वेगवेगळ्या घरांतर्गत २.७±०.०५ आणि ३.११±०.०८ मिनिटांत आणि अत्यंत लक्षणीय भिन्न. विविध संगोपन पद्धती अंतर्गत सरासरी चालण्याची वेळ, बसण्याची वेळ आणि झोपण्याची वेळ २६.४१±१.३३ आणि २८.९३±१.१४, ६८६.७५±३०.४९ आणि ७६४.७६±३२.२२ आणि १०५.६८±७.५६ आणि १२७.४८±६.७५ मिनिटांमध्ये अनुक्रमे लक्षणीय नव्हती. विविध संगोपन पद्धती सरासरी आक्रमणाची वेळ १.१४±०.५७ आणि ३.०५±०.५८ मिनिटांत होती आणि अत्यंत लक्षणीयरीत्या वेगळी होती. वेगवेगळ्या घरांतर्गत सरासरी माजाचा कालावधी वेळ ०.०±०.० आणि ०.०±०.० मिनिटांत होती आणि ती लक्षणीयरीत्या वेगळी नव्हती. वेगवेगळ्या घरांमध्ये सरासरी शरीर स्थिती स्कोअर (BCS) ३.१४±०.०१ आणि ३.२२±०.०१ आणि अत्यंत लक्षणीय भिन्न होता. गुदाशयाचे सरासरी तापमान, श्वासोच्छवासाचा दर व हृदय गती वेगवेगळ्या घरांतर्गत १०२.८८±०.०४ आणि १०२.५१±०.१८, $^{0}$F, २७.५५±०.२४ आणि २५.१५±०.६९ श्वास/मिनिट ८४.८६±०.५५ आणि ८२.०५±१.०९, मिनिटांत लक्षणीय होती. वेगळे श्रमिक अर्थशास्त्र व्यापक प्रणालीपेक्षा अधिक गहन होते. अशाप्रकारे एकूण परिणामांवरून असा निष्कर्ष काढला जाऊ शकतो की उस्मानाबादी शेळयांच्या नैसर्गिक वर्तनावर वेगवेगळ्या घरांचा महत्त्वपूर्ण परिणाम झाला.

# *Vita*

## VITA

Mr. Ovhal Rameshkumar Laxmanrao was born on 1st june 1978 in Sarul of Beed District, Maharashtra State. He has completed his S.S.C from Bhagwan Vidayalaya, Beed, with Distinction in the year 1994. He completed his H.S.C. from Dayanand Science College, Latur, under The Pune Board of Secondary & Higher Secondary Education in 1996. He actively participated in various extra-curricular activities like poem reading and sports in school and college.

He successfully completed his graduation as Bachelor of Veterinary Science & Animal Husbandry (B.V.Sc. and A.H.) from College of Veterinary and Animal Sciences, Parbhani during 1996 to 2001.

He completed his M.V.Sc. with first class in the Department of Livestock Production and Management from the Mumbai veterinary college, Mumbai, a historic and oldest college in India. He was enthusiastically involved in various farm activities and training programmes carried out there.

He is working in Maharashtra State Department of Animal Husbandry as Livestock Development Officer Gr ‘A’ from 2007.