INFLUENCE OF MANAGEMENT SYSTEMS ON GROWTH OF MALABARI GOATS

By

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THESIS

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requirements for the degree of

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DECLARATION

I hereby declare that the thesis entitled **"INFLUENCE OF MANAGEMENT SYSTEMS ON GROWTH OF MALABARI GOATS"** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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CERTIFICATE

Certified that the thesis, entitled "**INFLUENCE OF MANAGEMENT SYSTEMS ON GROWTH OF MALABARI GOATS**" is a record of research work done independently by **Shri. G. Ralston Sebastian Edward**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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G. RALSTON SEBASTIAN EDWARD

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Introduction

1. INTRODUCTION

Goats play an important role in almost all farming systems of the tropics and subtropics and are aptly known as "poor man's cow". India with 118 million heads stands first in the world with regard to goat population. The goat population increased over the years from 1972 to 1987, it is documented at an annual rate of 4.63 per cent (FAO, 1993).

Goats are the prime, herbivorous meat animal in India. Small body size, efficient adaptability and high reproductive performance make goats suitable for extreme and diverse environmental conditions. Every year about 55 million goats are slaughtered for meat and this accounts to 46 per cent of the total goat strength in the country (Patnayak *et al.*, 1995).

Goats have certain well known inherent qualities viz. high feed intake, especially higher quantity of forage; higher capacity for digestion of organic nutrients like crude fibre; higher fertility; short generation interval and docility.

In absolute figures goats make only a small contribution to the world milk scene but they guarantee human survival in adverse environmental conditions. Inadequate feed resources, less nutritive forage and unsuitable production systems are affecting goat production in India.

Intensive management system of rearing goats gained popularity among the farmers during the last few decades. Maintaining goats for their sustenance, slowly changed to commercial farming in developing countries. Since goats have excellent adaptability to different agro-climatic and ecological conditions, it is very easy to adapt this animal to different managemental systems.

The ultimate performance of goat depends on, how goats are fed. Diminishing pasture lands, poor yield of green grass and seasonal fluctuation in availability of forage are the major problems now. The improvement in the plane of nutrition by supplementation of concentrate mixture or grains mixed with roughage ration in suitable proportion, elevates the growth rate and enables them to attain acceptable market body weight at an early age. It helps effective utilization of roughage and reduces the practical difficulties and labour requirement in feeding.

In Kerala there are 1.581 million goats as per the latest Livestock Census of 1987. Nearly 35 per cent of the total meat production in India is from goats (Chopra, 1992). A sharp increase in goat meat price was observed during the last few decades (Pandey and Mange Ram, 1996). Indian chevon accounts to 16 per cent of total chevon production in the world (Tony, 1996).

The present study is aimed to assess the performance of growing Malabari goats under different managemental systems. These rearing systems are compared with goats reared on complete feed under confinement rearing. This study also aims to compare the bio-climatological influence on physiological norms and growth of goats under different managemental systems. Meat studies conducted at the end of the experiment evaluated meat production under different managemental systems.

Review of Literature

2. REVIEW OF LITERATURE

Goat production in India widely varies from place to place depending on climatic zones. Different management systems are in vogue according to the climate and the socio-economic status of the people. Limitations in goat production arise especially from scarcity of land and fodder. Possible approaches to future developments are education, extension, infrastructural development, better management, feeding and genetic improvement (Nitzsche, 1984).

The implementation of improved husbandry practices for small ruminants in a rural environment with little traditional use of pasture land is the new trend. The improved practices need to be carefully studied in relation to the local constraints like social awareness profile, nutritional standards and health status (Vlaenderen *et al.*, 1989).

2.1 Management systems

Chemineau and Groude (1985) reared goats for meat in semi-intensive outdoor management and found an average daily weight gain of 80 g in 30 days from birth and 67 g from 30 days to weaning. Barbari kids of 3 to 6 months reared under three different systems of management; intensive, semi-intensive and extensive grazing, showed better efficiency

under intensive management than other two systems (Saini *et al.*, 1987). According to their report daily weight gain was 61 g, 45 g and 30 g under intensive, semi-intensive and extensive grazing respectively.

Increasing feeding frequency, beyond twice daily, increased feed intake but did not influence body weight under intensive management system (Das and Joshi, 1987).

Saini (1987) reported slower growth rate in experimental animals under extensive management system. Growth rate was significantly lower under extensive system when compared to intensive system but cost of rearing was 70 per cent and 36 per cent lesser under extensive and semi-extensive systems respectively than in intensive system of management (Saini *et al.*, 1988).

In Greece, sheep reared in intensive production system gave better growth rate, reproduction and milk production (Gabrilidis, 1989).

Falagan (1989) observed that Murcia Granda goats maintained under intensive management system yielded higher quantity of milk. It was reported 550 kg milk yield in 210 days lactation with 4.9 per cent fat and 3.3 per cent protein.

Shrestha *et al.* (1992) noted a better birth weight, growth, kidding interval and incidence of twining in Chyangra goats (Mountain goats of Tibet) under five hours grazing and supplementation of 200 g concentrate per day. Beetal goat yielded highest quantity of milk when ad-libitum quantity of concentrates, greens and dry roughages were fed under intensive management system (Prasad *et al.*, 1994).

Prabaharan and Thirunavukarasu (1994) indicated that inadequate fodder and grazing lands, social ban on grazing of goats and problems in marketing of goats - mainly pricing and exploitation by middlemen - were major constraints in goat production.

The cost of production per unit body weight gain was minimum for kids weaned at two months of age under semi-intensive (Rs,6.09 to 7.25/kg) and maximum for kids weaned at three months of age fed intensively (Nagpal, 1995).

Yadav and Charan Singh (1995) revealed that individually fed female kids weaned at 90 days produce better results compared to group fed kids, weaned at 90 days and 60 days.

Khound *et al.* (1996) studied the growth performance of (Beetal x Assam local F_1) crossbred kids under zero grazing and browsing with concentrate supplement and browsing alone. They concluded that browsing or grazing supplemented with

concentrates may be of benefit in goat rearing. Semi-intensive and animal-tree crop integrated system are widely practiced by many goat farms in Malaysia (Rajion *et al.*, 1993).

2.2 Grazing management

Responses of Awassi sheep and Black goats to grazing in summer was studied by Yagil *et al.* (1988). They found that sheep sought shade and water after three hours of grazing when air temperature reached 32°C. The goats were content to remain grazing. The sheep were in a state of dehydration, showed increased body temperature and altered blood chemistry. The goats did not show signs of dehydration and did not drink but searched for shade. Similar findings were also reported by Johnson and Strack (1992) in Marino sheep.

Krysl and Hess's (1993) research indicated that grazing activities depend on environmental variables and vegetative characteristics. Fedele *et al.* (1993) found that goats have high preference to grasses. In summer goats prefer herbs and leguminous fodder than grasses. The intake level of grass was influenced by breed, amount of concentrate supplemented and its crude protein content.

Feeding duration of five hours per day is adequate for maintenance but insufficient for optimum production

(Nyamangara and Ndlova, 1995). The productivity of goats maintained on grazing alone and that of grazing with supplemented concentrate feed at the rate of 0.25 per cent of body weight did not show any significant difference whereas when fed a concentrate feed at the rate of 0.75 percentage of body weight showed significantly better growth. Khound *et al.* (1996) reported that kids under grazing or browsing were more vigorous in gathering their feeds in the afternoon till the time of sunset.

2.3 Adaptability

Goats can withstand both low and high environmental stress with equal efficacy (Jindal, 1980). Adaptability of Malabari goats in Tamil Nadu studied by Prakasam *et al.* (1987) showed a better growth rate and lesser mortality in kids. Mittal (1993) concluded that Barbari were well adapted to an arid environment and can be successfully reared on traditional type of management. Goats were adaptable to varying environmental conditions (Prabaharan and Thirunavukkarasu, 1995).

2.4 Body weight at weaning

The average body weight at weaning in three months old Malabari goats in Tamil Nadu were reported to be 8.26 ±

0.02 kg and 6.32 ± 0.05 for males and females respectively (Prakasam *et al.*, 1987). Mittal (1988) observed the body weight at weaning of Malabari goats 10.50 ± 0.82 and 9.55 ± 0.17 kg in males and females respectively. Weaning weight of Jamunapari kids were reported by Singh *et al.* (1984) as 7.45 ± 1.24 kg. Janardhana Reddy and Raghavan (1987) observed the mean weight of Desi kids as 11.5 kg at 3 months of age.

Nagpal *et al.* (1995) found an average weaning weight at 90 days (three months) as 16 kg under semi-intensive system and 15.4 kg under intensive system in kids of Sirohi, Marwari and Kitchi breeds during cooler months. Kim and Ko (1995) recorded 11.6 kg body weight in Korean native goats at 90 days of age.

2.5 Rate of growth

Mukundan and Bhat (1978) reported average daily weight gain of 34 g in Malabari goats from birth to one year. During this period they have also observed that Malabar x Saanen and Malabarix Alpine crossbred goats had gained 42 and 51 g respectively.

Barbari kids at 3 to 6 months age gained an average daily weight gain of 61 g, 45 g and 30 g under intensive, semi-intensive and extensive grazing respectively (Saini *et al.*, 1987). Daily body weight gain of 66.7 g is recorded

in Korean native goats between 4 to 7 months of age (Kim and Ko, 1995).

Kids of Sirohi, Marwari and Kutchi breed weaned at 3 months of age and reared under semi-intensive system of management showed an average growth rate of 89 g/day. The same experiment under intensively fed kids registered 88 g gain in body weight per day (Nagpal *et al.*, 1995).

As per Khound *et al.* (1996) the Beetal x Assam F_1 goats showed daily rate of gain of 43.57 ± 1.57 g, 45.43 ± 1.73 g and 35.00 ± 2.28 g for intensively fed, semi-intensive and extensive system of management respectively.

2.6 Body measurements

Body measurements of Black Bengal goats were studied by Singh *et al.* (1979) and recorded body weight, body length, height at withers and chest circumference as 10.8 kg, 43.7 cm, 49.1 cm and 53.3 cm respectively. And overall correlation of body weight with length, height, chest circumference were 0.64, 0.57 and 0.74 respectively.

Manik *et al.* (1984) reported the following body measurements in crossbred goats chest circumference 74.18 cm, body length 75.05 cm and height at withers 74.11 cm. They reported an average body weight of 34.85 kg. During the same

period they recorded body measurements of Beetal goats crosses with Alpine and Saanen and found no significant difference between its crosses.

Body measurements of Jamnapari and Barbari kids were studied during the first, second and third month of birth by Das *et al.* (1989). They opined that body length was not significantly affected by sex, except in Barbari kids of 3 months and Jamnapari kids of 2 months. Males were significantly taller than females in the first and third month, in Barbari and at birth, in Jamnapari kids.

Body conformation characters of indigenous goats of Nigeria was published by Ifut *et al.* (1991). They stated that at 2 to 8 months of age, body weight averaged 7.66 kg in males and 7.49 kg in females. Body length averaged 41.43 and 40.99 cm, heart girth 46.48 and 45.95 cm and height at withers 35.66 and 36.86 cm in males and females respectively.

The correlation of body weight with height at withers, chest circumference and the body length were 0.67, 0.88 and 0.86 for Criollo kids aged 30 to 180 days (Mejia and Castillo, 1991).

Seifert and Wuschko (1991) recorded the body weight, height at withers, body length and chest circumference of West African dwarf goat at 12 months of age. Body weight averages

for males and females were 59.2 kg and 62.1 kg. Height at withers were 92.7 cm and 92.6 cm, body length were 80.3 cm and 82.5 cm and chest circumference were 86.00 cm and 86.9 cm in males and females respectively. Sex of kids did influence body measurements in Assam local x Beetal kids (Sarma *et al.*, 1994).

2.7 Complete feed

The plane of nutrition significantly affected the chevon production and carcass characteristics of goats (Devendra and Owen, 1983). The primary need of goat production system is attainment of marketable body weight (Wadhwani and Patel, 1993). The improvement in plane of nutrition by supplementation of concentrate mixture of grain into roughage in suitable proportion elevates the growth rate.

Singh (1980) prepared a complete feed for goats based on cowpea fodder. He selected 90 days old Sirohi kid and fed the complete feed containing ground cowpea forage (50%), maize (27%) and groundnut oil meal (20%) supplemented 3 per cent with salt and mineral mixture. Average daily weight gain was 80 g. The feed required was 7.67 kg per kg live weight gain.

Utilization of complete feed by goats, was studied by Singhal and Mudgal (1983). They prepared a complete feed with 40 per cent wheat straw, 18 per cent berseem hay, 15 per cent

maize, 5 per cent groundnut cake, 5 per cent wheat bran, 12 per cent molasses, 2 per cent urea, 2 per cent mineral mixture and 1 per cent salt. Straw and hay were ground to 1 to 2 cm length. The feed was made into pellets of 8 mm diameter and 0.5 to 1.5 cm length under identical temperature and pressure. He observed better dry matter intake, DCP and TDN in groups fed with pelleted complete feed. However, digestibility of nutrients were slightly less with pellet feed. There was no significant difference between groups in performance.

Topsy *et al.* (1983) fed a diet composed entirely of greens and studied the growth of young male Anglo-Nubian goats. They found that the cost of feed per kg live weight gain for the goats fed greens and concentrate, was more than 3 times that for the goats given the green feed alone.

A semi-complete feed was prepared by Broqua (1990) with Lucerne hay, Lucerne silage, mixture of hay and fodder beet pulp, cereals and molasses. He fed 3.5 kg of semi-complete feed in the morning as one time feeding and 0.35 kg of additional Lucerne silage in the evening, for lactating goats yielded more than 2.5 kg of milk.

Ram *et al.* (1990) prepared a complete feed mix block (1 kg) made of wheat straw deoiled rice bran, mustard oil meal, fish meal and wheat straw. These rectangular 1 kg

blocks were prepared by compressing manually with the help of screw press.

Nageswararao *et al.* (1994) stated urea treated barley can be (by combining 3 per cent urea at 50 per cent moisture level held for 28 days) included upto 46.7 per cent along with 32.3 per cent barley grain, 20 per cent Arhar straw and 1 per cent mineral mixture and salt to maintain Jakhrana male goats successfully.

Eight iso-nitrogenous complete rations having concentrate to roughage ratio of 50:50 were formulated by Nageswararao *et al.* (1995). They incorporated test roughages such as Spear grass, Nendra grass (*Sahima nervosum*), hays, Sunflower, Sorghum straw, Maize stover, Groundnut hulls and Bagasse. They concluded that maize stover appeared to be a potential roughage source for inclusion in complete rations of goats under intensive system. Syama Dayal *et al.* (1995) found that maize husk, the outer covering of maize kernel obtained after separation of maize starch, can replace wheat bran upto 40 per cent in complete diets of goats. Animals treated with 40 per cent maize husk had significantly higher ($P<0.05$) CF digestibility and DCP and TDN intake were adequate.

2.8 Physiological responses

Heat stress significantly increased the rectal temperature and respiration rate. There was a significant decrease in roughage consumption (Joshi *et al.*, 1977). Goats in general have a higher rectal temperature and pulse rate than cattle and buffaloes (Jindal, 1980).

In goats the average morning and evening rectal temperature differed significantly and feed consumption and heart rate declined as hot season progressed (Monty, 1991). Nyamangara and Ndlova, 1995) recorded a diurnal variation of rectal temperature in three indigenous goat breeds of Zimbabwe as 0.43, 0.40 and 0.35 degree celsius. They recorded the respiration rate of the same breeds as 61.9, 52.7 and 40.3 per minute. He observed a rise in respiration rate with ambient temperature.

Ghosh *et al.* (1993) studied the physiological responses and feed intake of Bengal goats (2-3 years old and weighing 15 kg) under deep litter management. The average rectal temperature, respiration rate and pulse rate were 38.53°C ± 0.061, 29.09 ± 0.145 and 76.80 ± 0.319 per minute respectively. Over 12 months, rectal temperature, respiration rate and pulse rate differed significantly and were positively related to ambient temperature.

2.9 Carcass characteristics

Indigenous Malawi goats aged 4 to 8 months yielded a dressing percentage (empty gut basis) of 52.11 ± 3.00, lean percentage 64.55± 2.31 and fat percentage 6.43 ± 1.71 (Owen, 1975).

Bose and Basu (1984) studied the relation between body measurements and meat production in Beetal goats aged one to two and half years. They found a dressing percentage of 51.35 and 51.65 having an average body weight of 17.22 and 22.00 kg respectively. There were significant correlations of body length, height and chest circumference with slaughter weight (0.80-0.89).

The evaluation of carcass traits of indigenous breeds of goats is essential for developing appropriate breeding strategy (Anjanelyule and Joshi, 1995). Kulkarni *et al.* (1996) recorded the dressing percentage and skin percentage of Gaddi goats as 40.00 and 8.57 ± 0.20 per cent.

Mora *et al.* (1996) reported that the feeding levels had no effect on carcass weight or the chemical composition of soft tissues and liver weight. Weight was significantly different among goats fed at different feeding levels.

Barbari male goats above 15 months of age registered lower carcass yield (40.62%) than young animals (43.75%) (Agnlhotri and Pal, 1997).

Materials and Methods

3. MATERIALS AND METHODS

A four month study was conducted utilizing Malabari kids maintained in the Kerala Agricultural University Sheep and Goat Farm, attached to the College of Veterinary and Animal Sciences, Mannuthy. Mannuthy is situated geographically at longitude 76°, 16' E; at latitude 10° 32' N and an altitude of 22.25 metres above MSL. The study period was from March 1997 to June 1997 with an initial trial period of four weeks.

3.1 Selection of experimental animals

Thirty Malabari kids of similar body weight and age were randomly selected. At the time of selection they were between three to four months of age. Five males and five females were randomly assigned to three treatments.

3.2 Housing of animals

The experimental animals were stationed in separate enclosures of a conventional goat shed. This shed, located in East-West direction had cement concrete floor, 50 cm above the ground level with good drainage facility. It was roofed with asbestos sheet and was well lighted and ventilated. Raised wooden platform was provided in each shed. Hay racks were also fitted to the walls .

3.3 Management schedule

The experimental animals assigned to the first treatment were maintained under intensive management system and fed with complete feed alone (Plate 1). The second group of experimental kids were maintained under confinement rearing but fed with limited concentrates and cut green grass *ad libitum* (Plate 2). The third group was maintained on limited concentrates with five hours grazing from 9 a.m. to 2 p.m. and confined to the shed during the rest of the day (Plate 3).

3.4 Feeding and watering schedule

Kids of first treatment group, were fed on *ad libitum* complete feed alone. Feed was offered three times, at 0830 hrs, 1300 hrs and 1700 hrs respectively. Second and third treatment groups were fed measured quantity of concentrates at 0830 hrs and 1300 hrs, while group two had cut green grass, group three was allotted to browse. Clean fresh drinking water was provided.

3.5 Environmental variables

Maximum and minimum temperature and humidity was recorded daily in the experimental animal shed. Maximum, minimum thermometers and dry and wet bulb thermometers were installed

inside the animal shed for this and maximum and minimum temperature and humidity were recorded daily at 0800 hrs. Dry and wet bulb recordings were taken twice, morning 0800 hrs and again in the afternoon at 1415 hr. The daily rainfall in m.m, wind velocity km/hr (mean velocity in 24 hrs) and sunshine (number of hours of bright sunshine) in hrs from the records maintained in Kerala Agricultural University Meteorological Laboratory was used.

3.6 Physiological norms

3.6.1 Rectal temperature

The rectal temperature of all the experimental animals were recorded at 0745 hrs and 1345 hrs using a clinical thermometer before feeding and watering. The rectal temperature was recorded at biweekly intervals for four months.

3.6.2 Respiration rate

The respiration rate of the experimental animals were recorded by noting the raise and fall of the chest region for a minute during the early morning and evening hours before recording the rectal temperature and heart rate.

3.6.3 Heart rate

Using a stethescope fortnightly heart rate was recorded during the early morning and evening hours.

3.7 Morphometry

3.7.1 Body weight

Body weight of the experimental animals of the three treatment groups were recorded individually, using a platform balance while starting the experiment and then at every fortnight in the morning before offering feed and water.

3.7.2 Body measurements

3.7.2.1 Chest girth

The chest girth just behind elbow was measured using a standard measuring tape. The measurements were recorded fortnightly in all experimental animals.

3.7.2.2 Body length

The distance from the point of shoulder to the pin bones was taken as length and was recorded in cms using a standard measuring tape.

3.7.2.3 Height

The height upto the withers was measured at fortnightly intervals and recorded in cms.

3.8 Haematological study

Haemoglobin

Blood with EDTA as anticoagulant was collected at fortnightly intervals from all the experimental animals and the haemoglobin level was estimated. Sahl's acid haematin method was employed for this (Schalm, 1975).

3.9 Feed analysis

Concentrate and complete feed were mixed in the farm at monthly interval, as four lots. The chemical composition and the fibre fractions were estimated as per the procedures presented in AOAC (1990) and Van Soest and Wine (1967) respectively.

3.10 Statistical analysis

The data generated were statistically analysed (Snedecor and Cochran, 1967).

Plate 1. Intensive management system with complete feed (Treatment I)

Plate 2. Intensive management system with conventional farm feed (Treatment II)

Plate 3. Semi-intensive management system (Treatment III)

Results

4. RESULTS

The observations and the results of the study are presented under different headings.

4.1 Body weight

The body weight of the kids at the beginning of the experiment and their fortnightly weights from first to eight fortnights are presented in Table 1 and the fortnightly weight gain is presented in Table 2. The mean body weight of male and female groups are given in Table 3. There were significant ($P<0.05$) difference in body weight between three treatment groups and significant ($P<0.01$) differences between fortnights (Table 4). The growth pattern is presented in Fig.1. Absolute growth recorded (Fig.2) shows that the complete feed group registered a better growth rate from second to fourth month of study period, though an initial weight loss was recorded in this group.

4.2 Body measurements

4.2.1 Height

The fortnightly mean height measurements under three treatments in different fortnights are given in Table 5. There were highly significant differences ($P<0.01$) between

sexes, treatments and fortnights (Table 6). Sexual dimorphism in body height is observed in the whole group. The average height at withers of the males were 40.74 cm and the females 50.53 cm. A better height was noted (53.25 cm) in Semi-intensive system of management compared to Intensively managed goats (52.25 cm) and Complete feed group (51.25 cm). The height showed gradual increase from first fortnight to eighth fortnight.

4.2.2 Girth

The mean girth measurements of animals in cm at different fortnights under three treatments are presented in Table 7. Significant difference ($P<0.01$) was found between sexes, treatments and periods (Table 8). The mean girth of animals during the study period under three treatments are 52.5, 54.39 and 53.9 cm respectively. The average girth measurement (third to seventh month) of 52.67 cm and 54.52 cm were recorded in males and females respectively.

4.2.3 Length

The mean length in cm of kids under three treatments at different fortnights are given in Table 9. There was significant difference ($P<0.01$) between sexes, treatments and fortnights (Table 10). The mean body length of males were 50.03 cm and that of females 51.78 cm. Between treatments the

mean values were 49.8, 51.2 and 51.68 cms respectively in first, second and third treatments.

4.3 Climatological variables

The weekly means of the climatological variables recorded at 0800 and 1400 hours for a recording period of 16 weeks from 1.3.1997 to 30.6.1997 are presented in Table 11 and plotted in Fig.3 to 7. There was an increase in humidity and rainfall and reduction in sunshine after fifth fortnight. Accordingly the first five fortnights were classified as hot-dry and sixth, seventh and eighth fortnights as rainy period.

4.4 Physiological norms

The mean values of rectal temperature (°C), respiration rate (number per minute), heart rate (number per minute) and haemoglobin level (g/dl) of the experimental kids under three treatments are presented in Table 12. The analysis of variance between morning and evening recordings, treatments and different fortnights are presented in Table 13, 14, 15 and 16 respectively. The average rectal temperature recorded in the morning (39.69°C) and evening (40.12°C) were significantly ($P<0.01$) different. A significantly ($P<0.05$) higher rectal temperature (40.02°C) was observed in treatment III compared to treatment I (39.87°C) and II (39.82°C). But no significant

difference was found between different fortnights. Average respiration rate in the evening was 33.68 (per min) and was significantly ($P<0.01$) higher than the morning recording (20.43 per min). Animals in the Semi-intensive system showed the highest mean of 28.69 per min. The heart rate recorded in the morning (79.5 per min) was significantly ($P<0.01$) lower than evening recordings (94.25 per min). Animals under Semi-intensive system showed a mean of 90.54 per min. The average haemoglobin level recorded in the hot-dry period was 8.96 g/dl and rainy period was 9.36 g/dl. There was no significant difference between treatments and periods.

4.5 Carcass characteristics

The mean values of various carcass characteristics are given in Table 17 and figure 7. No significant differences were noticed in carcass characteristics between treatments. Complete feed group registered a higher dressing percentage (49.15%) compared to Intensively managed kids (47.51%) and Semi-intensively managed kids (48.87%).

4.6 Feed analysis

Feed composition and results of feed analysis (complete feed and concentrate mixture) are presented in Table 18.

Table 1. Fortnightly body weights of kids

Treatment	Initial body weight (kg)	Fortnightly body weight (kg)							
		1	2	3	4	5	6	7	8
I	10.03± 0.41	10.32± 0.51	9.97± 0.65	10.92± 0.79	11.71± 0.87	12.47± 0.87	13.43± 0.82	14.40± 0.86	15.24± 0.95
II	10.29± 0.75	10.70± 0.84	11.40± 1.08	12.14± 1.18	13.05± 1.23	13.61± 1.25	13.95± 1.31	14.84± 1.44	15.68± 1.58
III	10.40± 0.83	10.90± 0.91	11.84± 1.02	13.10± 1.17	13.65± 1.27	14.40± 1.28	15.07± 1.89	15.84± 1.36	16.67± 1.34
F value	0.075	0.176	1.087	1.051	0.778	0.730	0.100	0.367	0.075
(P<0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Fortnightly body weight gain in kids (kg)

Treat-ment	Fortnightly body weight gain (kg)							
	1	2	3	4	5	6	7	8
I	0.29	-0.35	0.95	0.79	0.76	0.96	0.97	0.84
II	0.41	0.70	0.74	0.91	0.56	0.34	0.89	0.84
III	0.50	0.94	1.26	0.55	0.75	0.67	0.77	0.83

Table 3. Fortnightly body weight of male and female kids under three treatments

Treatment	Sex	Initial body weight (kg)	Fortnightly body weight (kg)							
			1	2	3	4	5	6	7	8
I	M	9.78± 0.64	10.12± 0.65	9.16± 0.48	10.00± 0.96	10.80± 1.15	11.67± 1.11	12.87± 0.94	13.92± 0.99	14.90± 1.20
	F	10.28± 0.56	10.52± 0.87	10.78± 1.17	11.84± 1.22	12.44± 1.29	13.12± 1.33	13.88± 1.33	14.78± 1.41	15.52± 1.53
II	M	9.94± 1.19	10.18± 1.22	10.54± 1.43	11.10± 1.56	12.45± 1.73	13.00± 1.79	13.42± 1.90	14.30± 2.38	15.17± 2.86
	F	10.64± 1.03	11.22± 1.24	12.26± 1.67	13.18± 1.82	13.54± 1.87	14.10± 1.89	14.38± 1.97	15.28± 2.00	16.10± 2.00
III	M	10.14± 1.34	10.44± 1.62	11.14± 1.82	11.70± 1.97	12.14± 2.02	12.88± 1.98	13.48± 2.03	14.18± 2.10	15.20± 2.09
	F	10.66± 1.14	11.55± 0.99	12.54± 1.05	14.50± 1.13	15.16± 1.16	15.92± 1.23	16.67± 3.21	17.50± 1.32	18.14± 1.35

Table 4. Analysis of variance of body weight

Source	df	Sum of squares	Mean square	F value
Replication	3	153.173	51.058	3.9157 *
Factor A (Sex)	1	8.465	8.465	0.6492 NS
Factor B (Treatment)	2	88.689	44.345	3.4009 *
AB	2	24.491	12.245	0.9391
Factor C (Fortnight)	7	581.972	83.139	6.3761 **
AC	7	93.779	13.397	1.0274
BC	14	51.211	3.658	0.2805
ABC	14	52.815	3.773	0.2893
Error	141	1838.516	13.039	

NS - Non-significant
* Significant at 5% level (P<0.05)
** Significant at 1% level (P<0.01)

Table 5. Fortnightly body height of kids under three treatments

Treatment	Mean height (cms) at different fortnights							
	1	2	3	4	5	6	7	8
I	45.62± 0.86	45.50± 0.77	47.00± 0.62	46.50± 0.37	47.62± 1.03	48.12± 0.51	51.62± 1.05	51.25± 0.90
II	46.87± 1.09	48.62± 0.84	49.87± 0.99	49.87± 1.06	50.75± 1.16	51.62± 1.03	53.12± 1.27	52.25± 1.16
III	47.50± 1.73	48.50± 1.23	49.62± 1.55	50.25± 1.64	51.00± 1.16	52.00± 1.11	52.87± 0.97	53.25± 1.23
F value	0.55	3.28	2.02	3.22	2.81	5.30 *	0.52	0.81

* Significant at 5% level (P<0.05)
NS Non-significant

Table 6. Analysis of variance of height of kids

Source	df	Sum of squares	Mean square	F value
Replication	3	359.188	119.729	16.3376 **
Factor A (Sex)	1	154.083	154.083	21.0253 **
Factor B (Treatment)	2	289.042	144.521	19.7202 **
AB	2	33.042	16.521	2.2543 NS
Factor C (Fortnight)	7	734.979	104.997	14.3273 **
AC	7	4.583	0.655	0.0893
BC	14	40.458	2.890	0.3943
ABC	14	53.792	3.842	0.5243
Error	141	1033.313	7.328	

NS - Non-significant
** - Significant at 1% level (P<0.01)

Table 7. Fortnightly body girth of kids under three treatments

Treatment	Mean girth (cms) at different fortnights							
	1	2	3	4	5	6	7	8
I	48.87± 0.85	49.87± 1.14	50.12± 1.55	51.37± 0.80	51.87± 0.89	54.25± 1.33	56.50± 1.05	57.12± 1.10
II	49.62± 1.14	50.12± 1.23	52.37± 1.36	54.00± 1.21	55.37± 1.55	57.12± 1.42	58.50± 1.85	58.00± 1.41
III	49.62± 1.45	50.37± 1.13	51.62± 1.10	54.75± 1.19	55.62± 1.08	55.50± 1.16	57.25± 0.84	57.50± 1.16
F value	0.13	0.04	0.76	2.67	2.99	1.17	0.58	0.12

Table 8. Analysis of variance of girth of kids

Source	df	Sum of squares	Mean square	F value
Replication	3	401.016	133.672	14.0788 **
Factor A (Sex)	1	163.172	163.172	17.1858 **
Factor B (Treatment)	2	123.448	61.724	6.5010 **
AB	2	36.031	18.016	1.8975
Factor C (Fortnight)	7	1708.911	244.130	25.7126 **
AC	7	39.286	5.612	0.5911
BC	14	76.135	5.438	0.5728
ABC	14	81.385	5.813	0.6123
Error	141	1338.734	9.495	

** Significant at 1% level (P<0.01)

Table 9. Fortnightly body length of kids under three treatments

Treatment	Mean length (cms) at different fortnights							
	1	2	3	4	5	6	7	8
I	44.62± 0.70	45.62± 0.56	48.00± 1.11	49.75± 0.55	49.50± 1.15	52.25± 0.75	54.12± 1.06	54.75± 0.81
II	46.50± 0.77	47.89± 1.09	48.87± 1.06	51.25± 1.26	52.37± 1.29	54.00± 1.59	54.75± 1.54	54.00± 1.70
III	47.50± 1.41	48.37± 1.03	50.12± 1.26	52.00± 1.53	52.37± 1.32	54.00± 1.08	54.62± 1.19	54.50± 1.25
F value	2.05	2.49	0.86	0.93	1.71	0.71	0.06	0.08

NS - Non-significant

Table 10. Analysis of variance of length of kids

Source	df	Sum of squares	Mean square	F value
Replication	3	314.729	104.910	11.9749 **
Factor A (Sex)	1	147.00	147.00	16.7793 **
Factor B (Treatment)	2	119.094	59.547	6.797 **
AB	2	76.594	38.297	4.3714
Factor C (Fortnight)	7	1693.896	241.985	27.6214 **
AC	7	36.583	5.226	0.5965
BC	14	53.073	3.791	0.4327
ABC	14	36.073	2.577	0.2941
Error	141	1235.271	8.761	

** Significant at 1% level (P<0.01)

Table 11. Climatological variables recorded outside the shed from March 1997 to June 1997

Parameters	Weeks															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Maximum T °C	35.87	36.17	34.71	35.25	36.43	35.37	34.42	35.42	35.73	34.83	34.63	33.77	34.75	34.06	33.76	31.17
Minimum T °C	22.53	22.91	24.32	24.93	24.79	24.14	24.33	24.23	25.31	24.37	24.84	23.82	23.82	24.93	23.22	23.20
Globe temp.°C 0800 hr	24.91	25.22	26.15	26.66	26.52	26.72	26.54	27.17	27.48	26.56	27.28	26.34	26.36	25.84	26.38	24.83
Globe temp.°C 1400 h	34.10	35.11	34.23	35.12	35.13	34.31	34.59	34.81	33.26	32.71	33.72	33.62	33.67	30.89	31.09	30.86
Rh% 0800 h	76.31	80.32	91.23	84.28	76.42	86.18	84.51	81.92	83.23	85.21	90.18	85.93	87.16	89.36	87.92	92.97
Rh% 1400 h	21.45	22.47	45.92	50.94	39.67	52.13	48.96	49.72	53.19	56.72	61.86	59.32	52.71	57.72	60.03	67.64
Wind km/h in 24 h	5.92	4.21	3.33	3.35	4.72	3.26	3.97	3.28	3.27	3.09	2.78	3.47	3.76	3.07	3.28	3.22
Sunshine hrs	10.29	10.11	9.18	8.76	9.21	9.82	9.32	9.30	8.92	7.36	6.15	3.68	8.16	8.94	8.57	6.87
Rainfall mm	-	-	-	-	-	8.20	-	-	-	15.40	19.60	-	28.00	24.00	109.40	50.00

Table 12. Physiological norms of the kids under three treatments

Physiological parameters	Rectal temperature (°C)				Respiration rate (number per minute)				Heart rate (number per minute)				Haemoglobin level (g/dl)	
Period	Hot-dry period		Rainy period		Hot-dry period		Rainy period		Hot-dry period		Rainy period		Hot-dry period	Rainy period
Time of recording	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening		
Treatment I	39.84	40.04	39.65	39.83	20.70	33.37	19.56	28.60	80.04	90.53	79.83	90.93	9.10	9.20
Treatment II	39.93	40.05	39.55	39.86	21.03	32.35	19.03	31.50	80.01	91.76	79.83	89.93	8.85	9.60
Treatment III	39.91	40.43	39.49	40.35	20.73	37.90	19.03	35.87	79.08	103.75	77.57	100.03	8.95	9.30
	Morning		Evening		Morning		Evening		Morning		Evening			
Mean	39.69±0.03		40.12±0.07		20.43±1.16		33.68±1.52		79.5±1.14		94.25±2.15		8.96	9.36

Table 13. Analysis of variance of diurnal variation in rectal temperature between treatments and between fortnights

Source	df	Sum of squares	Mean square	F value
Between morning and evening	1	2.440	2.440	72.0296 **
Factor A (Treatment)	2	0.397	0.199	5.8663 *
Factor B (Fortnight)	8	0.431	0.054	1.5923 NS
AB	16	0.068	0.004	0.1252
Error	26	1.881	0.034	

NS - Non-significant
* Significant at 5% level (P<0.05)
** Significant at 1% level (P<0.01)

Table 14. Analysis of variance of respiration rate between treatments and between fortnights

Source	df	Sum of squares	Mean square	F value
Between morning and evening	1	2370.756	2370.756	452.9206 **
Factor A (Treatment)	2	73.267	36.634	6.9986 **
Factor B (Fortnight)	8	52.206	6.526	1.2467 NS
AB	16	19.203	1.200	0.2293
Error	26	136.094	5.234	

NS - Non-significant
* Significant at 5% level (P<0.05)
** Significant at 1% level (P<0.01)

Table 15. Analysis of variance of heart rate between treatment and between fortnights

Source	df	Sum of squares	Mean square	F value	
Between morning and evening	1	2940.782	2940.782	94.1175	**
Factor A (Treatment)	2	375.714	187.857	6.0122	*
Factor B (Fortnight)	8	48.796	6.099	0.1952	NS
AB	16	108.623	6.789	0.2173	
Error	26	812.393	31.246		

NS - Non-significant
* Significant at 5% level (P<0.05)
** Significant at 1% level (P<0.01)

Table 16. Analysis of variance of haemoglobin level between treatments and between fortnights

Source	df	Sum of squares	Mean square	F value
Between treatments	2	0.028	0.014	0.0918 NS
Fortnights	8	2.287	0.286	1.9020 NS
Error	16	2.405	0.150	

NS - Non-significant

Table 17. Carcass traits of kids under three treatments

Particulars	Treatment I	Treatment II	Treatment III	F value
1. Slaughter weight (kg)	15.67	16.50	19.30	0.864 NS
2. Carcass weight (kg)	7.70	7.84	9.53	0.818 NS
3. Dressing percentage	49.15	47.51	48.87	0.634 NS
4. Boneless meat weight (kg)	5.28	5.12	7.00	1.832 NS
5. Boneless meat percentage	33.69	31.05	35.90	2.721 NS
6. Bone weight (kg)	1.77	2.39	2.16	1.445 NS
7. Weight of organs and offals (kg)	4.32	4.08	5.24	
8. Meat bone ratio	2.98:1	2.14:1	3.24:1	

NS - Non significant

Table 18. Feed composition and nutritive value

Ingredients	Complete feed (%)	Concentrate mixture (%)
Hay	25	-
Lucerne	10	-
Gingelly cake	10	10
Groundnut cake	5	15
Maize	20	30
Wheat bran	18	23
Rice polish	10	20
Mineral mixture	1.5	1.5
Salt	0.5	0.5
Dry matter	90.13	89.02
Crude protein	11.52	17.07
Crude fibre (DM basis)	15.51	6.33

Fig.1 FORTNIGHTLY BODY WEIGHT OF KIDS FROM WEANING TO EIGHTH FORTNIGHT

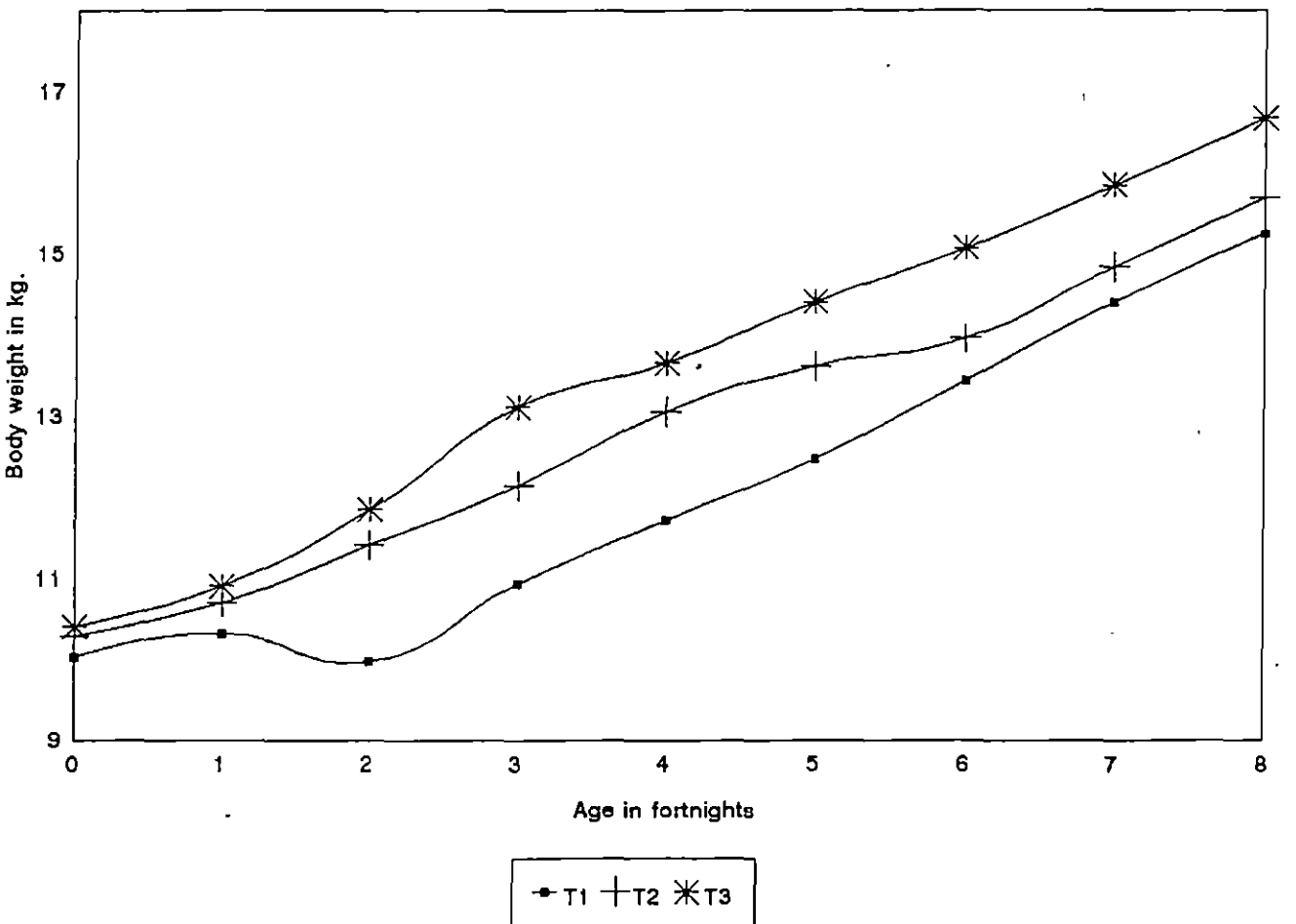


Fig.2 ABSOLUTE GROWTH

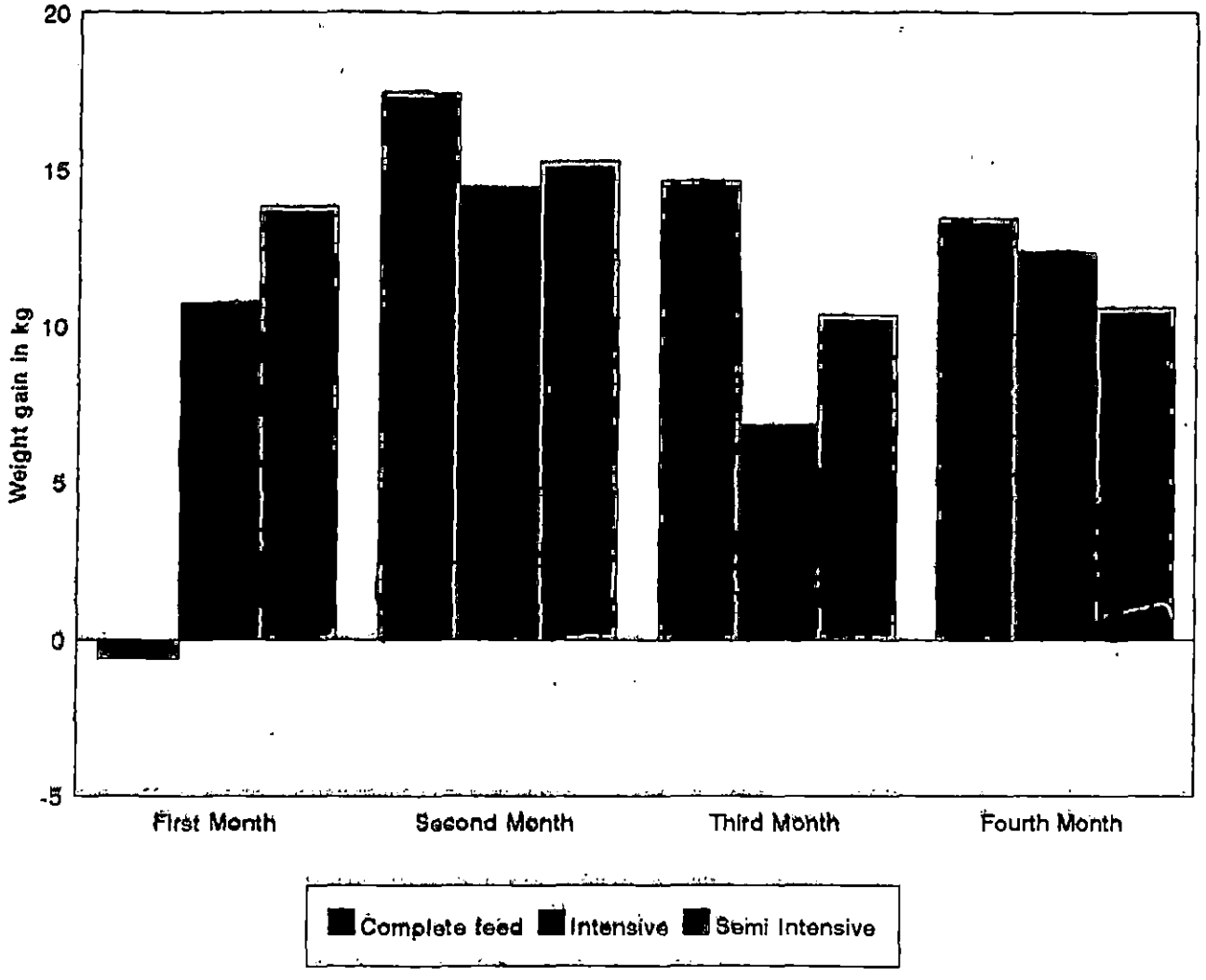


Fig.3 MAXIMUM , MINIMUM TEMPERATURE AND TEMPERATURE RECORDED AT 0800 AND 1400 HOURS

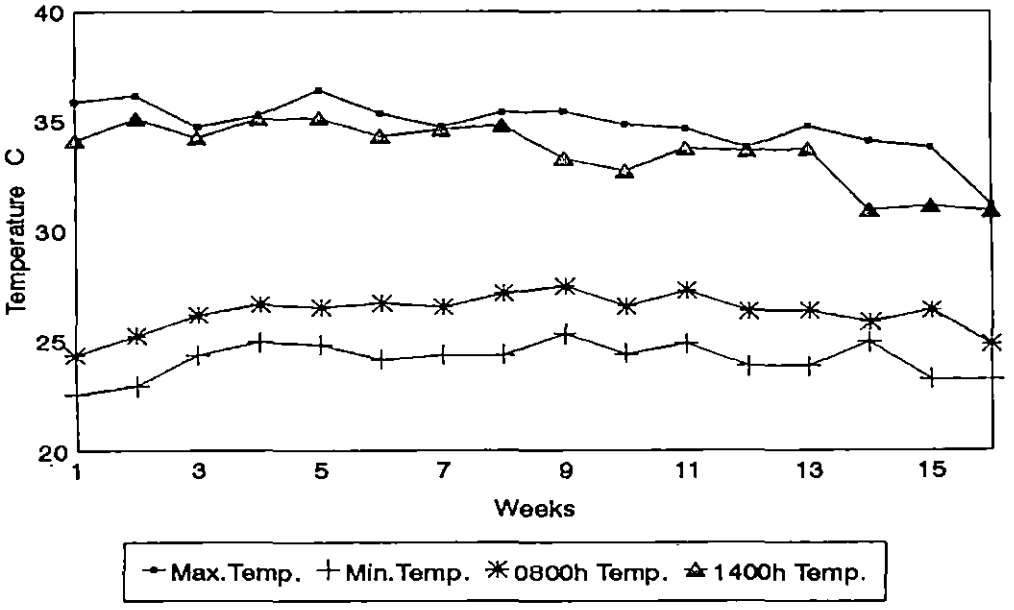


Fig.4 RELATIVE HUMIDITY RECORDED OUTSIDE THE SHED

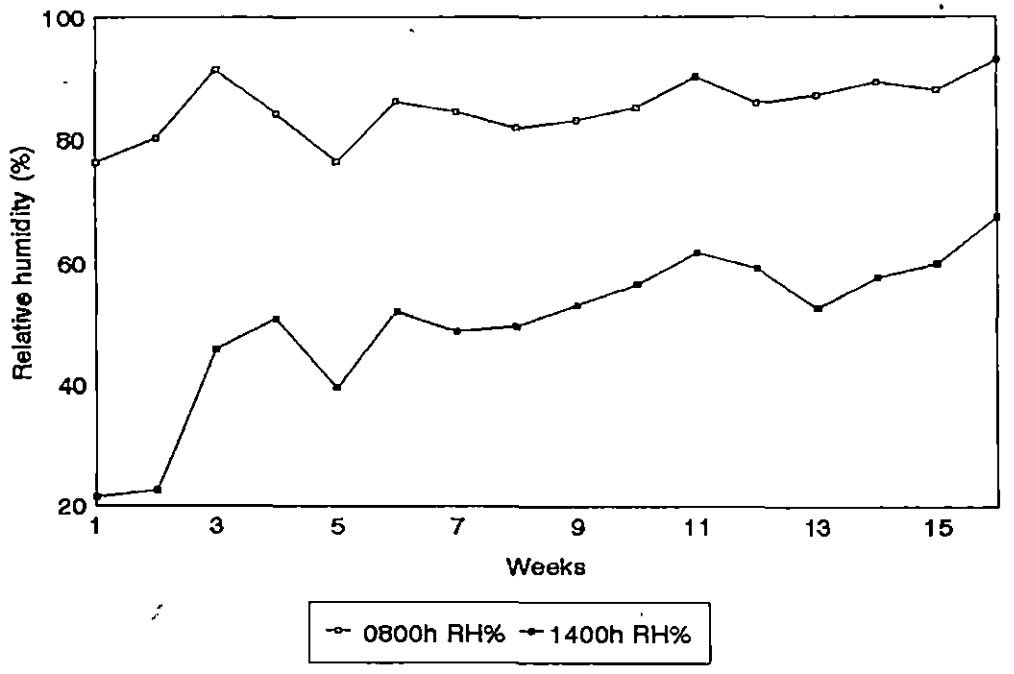


Fig.5 WIND VELOCITY RECORDED OUTSIDE THE SHED

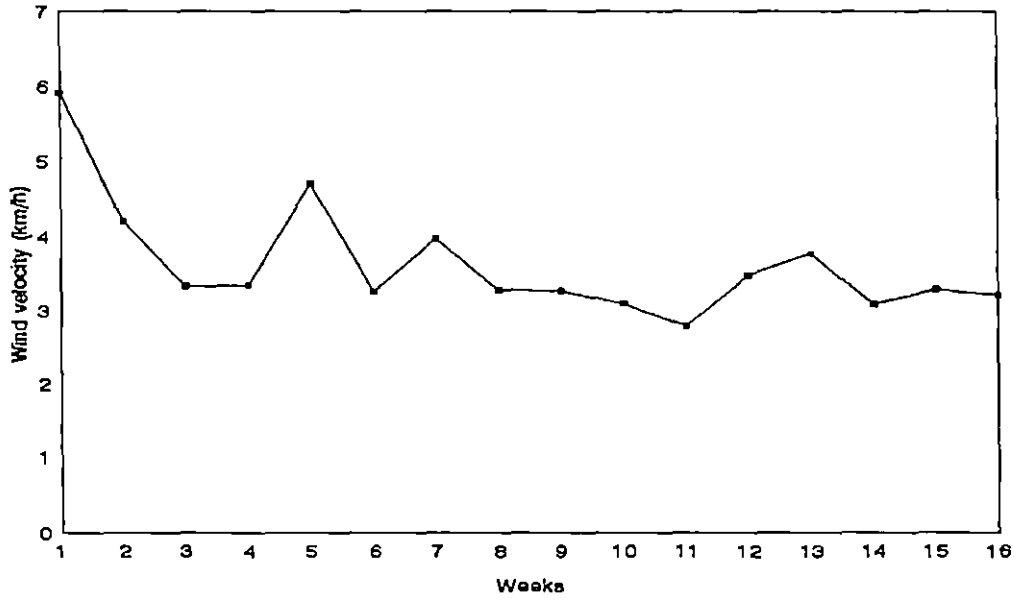


Fig.6 SUNSHINE RECORDED OUTSIDE THE SHED

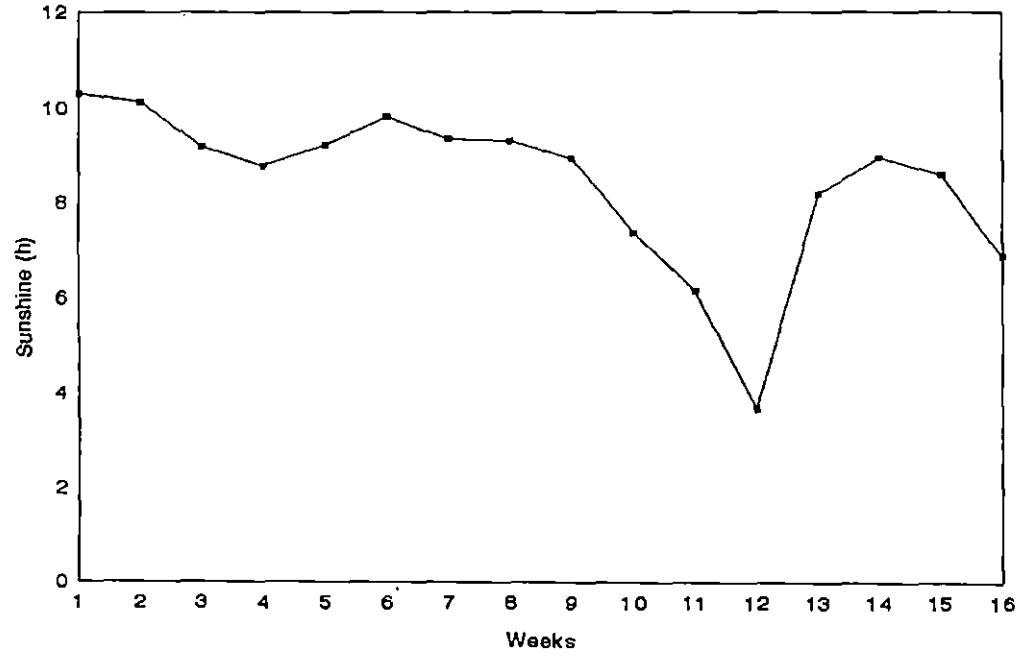


Fig.7 RAINFALL RECORDED DURING THE STUDY PERIOD

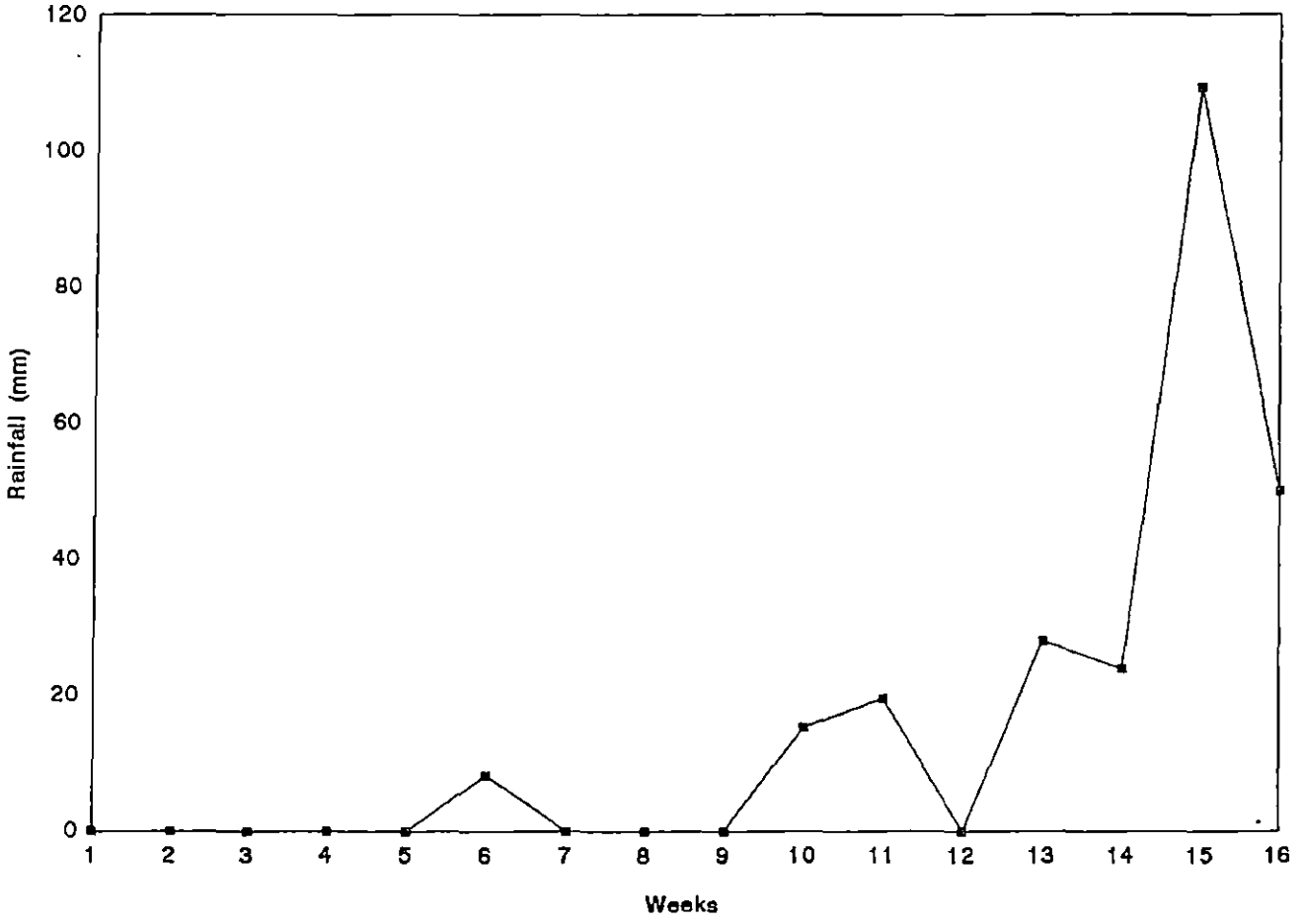
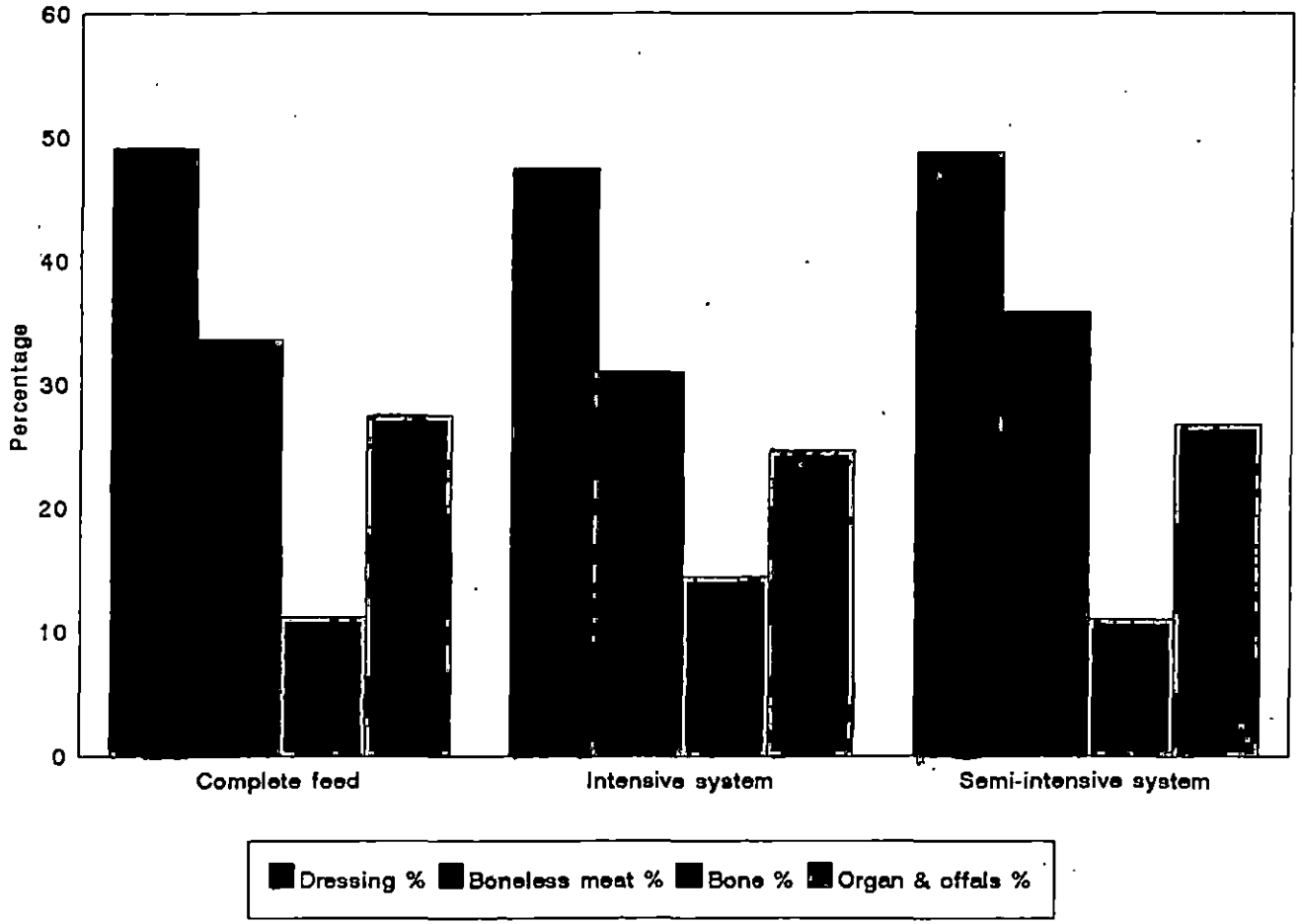


Fig.8 CARCASS CHARACTERISTICS OF KIDS UNDER THREE TREATMENTS



Discussion

5. DISCUSSION

5.1 Body weight

The system of management showed a significant influence on growth rate of kids. The animals under semi-intensive system showed a better body weight gain when compared to other systems. Saini *et al.* (1987) observed a better growth rate in Intensive system with a body weight gain of 5.57 kg with a daily growth rate of 61 g per day. Nagpal *et al.* (1995) recorded a better growth rate (67 g) in intensively managed kids. This difference in the growth rate may be due to the difference in the age group of experimental animals used under these systems of management and the breeds used. Khound *et al.* (1996) reported significant difference in body weight gain between three management systems in crossbred goats of Assam. The weight gain observed by these workers is similar to the present observation.

Malabari goats registered a daily weight gain of 43.41 g, 44.91 g and 52.25 g under Complete feed Intensive management, Intensive management with concentrates and cut grass and Semi-intensive management systems. The Semi-intensive management system was found to be better for Malabari kids. Saini *et al.* (1987) recorded an average growth rate of 45 g per day in kids under Semi-intensive system. Whereas animals in Intensive management system registered a growth rate of

61 g per day. This may be due to the use of younger animals for their experiment. Moreover they have given 400 g of concentrates per kid per day with good quality greens. The fluctuation in the growth rate, during the second fortnight in Complete feed group of the present experiment may be due to the sudden shift to a new feed. This lag in the growth pattern might have been due to the changes in the rumen. Ensminger (1990) stated that a sudden shift to a new feed leads to serious digestive upsets. The pH of the rumen falls and lactic acid production increases dramatically leading to distruction of microorganisms and this inturn affects the rumen motility resulting in abdominal discomfort and weakness.

Studies with very young Barbari kids (Saini *et al.*, 1987) resulted in a better growth rate (61 g per day) under Intensive management system. A better growth rate of 80 g per day with complete feed was reported in Sirohi kids (Singh, 1980). Mukundan and Bhat (1978) noted an average daily gain of 34 g from birth to one year in Malabari goats. In the present study also the daily weight gain under different systems of management was less when compared to the above studies in Barbari and Sirohi kids. The lower growth pattern of the present study can be assumed as the peculiarity of Malabari breed. Mudgal (1980) observed an average daily gain of 49 g, 72 g, 55.8 g and 52 g in different crosses of Alpine, Beetal and Sannan crosses maintained under different diet

schedules. There was a decline in the growth rate between the second and the fourth fortnights in all the three treatment groups. This may be due to slight managemental alterations made to combat respiratory ailments in some animals of each group and also due to seasonal changes.

Sex difference on growth rate during the third month to the seventh month of age was not significant in the present observation. This is in agreement with Shrestha *et al.* (1992). They found no significant difference between male and female Tibetian goats from birth to 32 weeks. Nagpal and Chawla (1985) although observed a higher body weight in males at birth there were no reports of sexual difference in body weight from three to six month old group of Alpine, Beetal, Sannen and Beetal crosses. Arjun Singh *et al.* (1984) did not find any sex difference in body weight in Jamnapari and Barbari goats at six months. Bhoite *et al.* (1993) reported that sex had significant effect on body weight upto three months of age.

A highly significant effect of growth periods on body weight in the present experimental groups is similar to the reports of Arjun Singh *et al.* (1984), who reported a significant seasonal growth difference in Jamnapari and Barbari kids. A similar report (Saini *et al.*, 1988) stating the effect of season on the same breeds showed that there was

slump in growth rate during the summer irrespective of the managemental systems. Nagpal and Chawla (1985) reported that the influence of season was more pronounced at early age in various crossbred goats. Bhoite *et al.* (1993) found significant effect of season on body weight in Angora and crossbred goats. All these reports are in agreement with the present observations.

5.2 Body measurements

5.2.1 Height

In the present finding a sexual dimorphism in body height was observed. Female kids (50.53 cm) had significantly higher body height compared to male kids. It is not in agreement with the reports of Singh *et al.* (1987). In their reports Black Bengal goat males, measured 49.69 cm and females 48.58 cm. Das *et al.* (1989) reported similar findings in Jamnapari and Barbari goats. Koul *et al.* (1990) reported an average wither height of 50.6 cm for male Pashmina goats and 48.5 cm for females. Similar sexual dimorphism in body height was reported by Seifert and Wuschko (1991) and Taneja *et al.* (1992). A significant difference between body height and treatments as well as periods may be associated with the increase in the body size as the animals are in their peak period. Many reports are there to substantiate this (Park *et al.*, 1977; Das *et al.*, 1989). Influence of period on body

height was found highly significant (P<0.01). A gradual increase in body height was observed as age advances.

5.2.2 Girth

The mean girth measurements of animals at the end of study period under three treatments are 57.12, 58.00 and 57.5 cm respectively. The animals of the second treatment group had a better girth measurement. The heart girth measurements of animals were connected to many production traits. Worman *et al.* (1990) stated that heart girth had higher relation with body weight. Heart girth was used to predict the body weight for Tswana goats. The female goats had better gain in girth compared to males. In Black Bengal goats Singh *et al.* (1987) noticed that sexual dimorphism was not evident as the body girth was 56.92 cm in males and 56.66 cm in females. The present observation is on growing animals and the above report on Black Bengal goats was from adult animals connected with a slaughter study. Varade *et al.* (1997) reported a higher girth measurement of77.37 cm in local non-discript goats. This may probably be due to the use of old animals (1.5 years) and other breed factors. Others also reported that sex had a significant effect on chest girth at three months (Khan and Sahni, 1983; Das *et al.*, 1989; Taneja *et al.*, 1992).

5.2.3 Length

The present finding in Malabari goats showed that there was significant difference in body length between treatments and between fortnights. Sexual dimorphism was also noted. Biswas *et al.* (1990) reported that in Chegu pashmina goats sex differences were not significant for conformational traits. The present study is not in support of this. Manik *et al.* (1984) recorded a higher body length of 75.05 cm, 70.55 cm and 73.70 cm in Beetal, Alpine x Beetal and Saanen x Beetal goats respectively. The lower values registered in Malabari goats when compared to the above breeds, may be due to the larger body conformation of exotic breeds used for cross breeding. This breed difference in body conformation is also supported by the studies on Beetal goats by Pander *et al.* (1989) where Beetal breed showed greater body measurements than all other breeds at different ages.

Ifut *et al.* (1991) noted a body length of 40.99 cm and 41.43 cm in Nigerian male and female goats respectively. Das *et al.* (1989) stated that the linear body measurements was not affected by sex, except in Barbari kids of three months and Jamnapari kids of two months. Hence it can be assumed that sexual dimorphism exists in certain indigenous breeds and Malabari is one breed. The body length of animals at

different stages of growth can be used as an effective managemental tool in predicting their body weight.

5.3 Climatological variables

The climatological factors especially high and low values are systemic stressors which evoke a gamute of changes in the biological processes of goats. The ambient temperature along with the relative humidity makes different biological alternations in different breeds. Goat is especially privileged to be able to withstand both high and low environmental stressors with equal efficacy (Jindal, 1980). The climate of Mannuthy was divided into rainy season (May-November) and dry season (December to April). Rainy season was characterised by a monthly rainfall above 200 mm. The relative humidity was highest and ambient temperature, sunshine and wind velocity were the lowest. In dry season ambient temperature, hours of sunshine and wind velocity were highest with low humidity and rainfall (rainfall during this season will be negligible except during the month of April) (Somanathan, 1980). He further classified the rainy season as cold and wet (maximum temperature below 30°C and rainfall above 500 mm (June-August) and warm and wet (maximum temperature above 30°C and rainfall below 500 mm May to September excluding June, July and August). Dry season was classified as warm and dry (December and January) and hot and

dry (February to April). In warm and dry maximum temperature did not exceed 32°C. Maximum temperature was above 32°C in hot and dry period.

During the study period the mean maximum temperature (weekly) of 36.17°C was observed in March and minimum of 31.17°C was recorded in June, and the maximum temperature was above 32°C in all four months except the last week of June. The mean weekly minimum temperature ranged from 22.53°C (first week of March) to 25.31°C (first week of May). The mean weekly globe temperature at 0800 hour and 1400 hours respectively were a minimum of 22.53 and 24.83°C during first week of March and last week of June and a maximum of 27.48 and 35.13°C during ninth and fifth week of experiment respectively. The relative humidity recorded at 0800 hours ranged from 76.31 to 92.97 per cent and at 1400 hours 21.45 to 67.64 per cent.

The air movement ranged from 2.78 to 5.92 km/h (in 24 hours) during the study period. It was higher in March and April and more or less static between May and June. Hours of sunshine hours ranged from 3.68 to 10.29 hours in 24 hours. First 10 weeks it was higher and after that it reduced. The total weekly rainfall in first three months were poor. There was no rainfall in March and a negligible amount of 8.20 mm in April and 35 mm in May and 211.4 mm recorded in June.

Out of the 16 weeks of experimental period the first ten weeks, the maximum temperature, hours of sunshine and wind velocity were higher and the relative humidity was comparatively lesser and the rainfall was scanty. After ten weeks the sunshine hours and wind velocity reduced and a hike in relative humidity and rainfall was observed. Hence the first ten weeks were classified as hot-dry period and remaining as rainy period (Somanathan, 1980; Thiagarajan, 1989).

Johnson (1977) stated that body temperature liability was higher in goats than sheep during short exposure of heat or cold. Magdub *et al.* (1987) observed a depression in growth rate at 34°C ambient temperature in Saanen kids. Below 24°C air temperature, humidity had no effect on heat stress (Berman *et al.*, 1985; Wolfenson *et al.*, 1988). A positive correlation of rectal temperature and respiration rates with ambient air temperature and humidity was reported by Razdan *et al.* (1968); Teneja (1969). In Jamnapari goats; Joshi *et al.* (1977) observed that heat stress significantly increased the rectal temperature and respiration rate.

5.4 Physiological norms

5.4.1 Rectal temperature

The average diurnal rectal temperature of kids were 39.69 and 40.12°C. A highly significant ($P<0.01$) difference was observed between morning and afternoon recordings. Gosh and Pan (1994) observed an increase in rectal temperature during afternoon recording over respective morning observations. The average morning rectal temperature in Black Bengal goats was 38.2°C and afternoon temperature was 41.1°C in hot humid season. It was further reported that a significant ($P<0.01$) effect of species, season and time of recording, was evident on rectal temperature. Degen (1977) found a similar result. The morning and evening rectal temperature of Awassi sheep and Black Bengal goats showed diurnal variations. This also supports the present findings in Malabari goats.

Elevation in the rectal temperature was noted in the mid morning and afternoon which declined during early morning and late evening (Wrenn *et al.*, 1961; Hafez, 1968). Rectal temperature at 0600 and 1700 hours showed an increase with seasonal rise in environmental temperature (Ghosh *et al.*, 1993).

Kids under Semi-intensive management had a higher rectal temperature of 40.02°C compared to other treatments (39.87 and

39.82°C in treatment I and II respectively). This may be due to the increased activity and exposure to solar radiation during 5 hours of grazing. Animals exposed directly to the environment have the added stress of solar radiation (Ingram and Mount, 1975). Heat stress due to standing in the sun, and an increase in metabolic rate due to activity can induce an increased body temperature (Ingram and Mount, 1975; Yagil *et al.*, 1988). These may be the reasons for the increased rectal temperature exhibited by the animals under Semi-intensive system of management.

5.4.2 Respiration rate

There was significant difference ($P<0.01$) between morning (20.43 per min.) and evening (33.68 per min) respiration rate in Malabari kids. Increased respiration rate is an important means of heat dissipation in domestic livestock at high temperatures (McDowell, 1972). Ghosh and Pan (1994) stated that respiration rate varied significantly in different seasons and in different times of recordings. They recorded an average respiration rate of 20.5 per min in the morning and 31.5 per min in the afternoon in Black Bengal goat during cold humid season. Das *et al.* (1996) recorded a diurnal variation in respiration rate in Pashmina Cheghu goats and its crosses in subtropical plain.

There was no significant difference in morning respiration rate between treatments. But a highly significant difference in evening respiration rate was observed between treatments. Kids given five hours grazing under Semi-intensive system had significantly higher respiration rate. Solar radiation has a considerable impact on respiration rate of animals (Johnston *et al.*, 1960). Joshi *et al.* (1977) found that exposing Jamnapari goats to heat, increased the respiration rate from 18.1 to 111.6 per minute after 6 hours of exposure and to 162.3 per minute after 24 hours of exposure. The respiratory frequency of Barbari and Jamnapari bucks, housed in a shed with north-south orientation were significantly higher than those in east-west orientation, due to higher temperature caused by direct solar radiation (Puneetkumar *et al.*, 1993). All these studies support the present findings in Malabari goats.

5.4.3 Heart rate

Heart rate recorded in the morning hours are significantly lower (79.5 per min.) than evening (94.25 per min). Puneetkumar *et al.* (1993) observed an increase in cardiac frequency with increase in maximum temperature.

Kids sent out for grazing had a higher heart rate than the other two groups maintained under Intensive management. Exposure to higher ambient temperature and solar radiation in

the open and increased activity had been reported to increase the heart rate (Thomas and Razdan, 1973; Thiagarajan, 1989).

5.4.4 Haemoglobin level

Average haemoglobin level of 8.96 g/dl in hot dry period and 9.36 g/dl in rainy period were observed in Malabari goats. Duncan and Prasse (1986) reported a normal haemoglobin level of 8-12 g/dl in goats. The present observation is akin to this level. McDougall *et al.* (1991) observed an average haemoglobin level of 9.3 g/dl in Saanen goats. There was no significant difference in haemoglobin level between treatments and season in the present study. Kataria *et al.* (1992) observed an average haemoglobin level of 11.76 ± 0.13 (gm%) in winter and 12.35 ± 0.13 (gm%) in summer in Marwari goats. They found that haemoglobin level between seasons was not significant. Barghout *et al.* (1995) stated that haemoglobin level was negatively correlated with atmospheric temperature in Baladi kids. Santra *et al.* (1996) found no significant difference in haemoglobin level between seasons in Jamnapari goats. This is similar to the present study.

5.5 Slaughter study

Kids under complete feed group showed a better dressing percentage of 49.15, compared to 47.51 and 48.87 per cent in treatment II and III. Misra and Prasad (1996) observed a

similar dressing percentage in Sirohi and Beetal x Sirohi crossbred kids of six to nine months of age. But Agnlhotri and Pal (1997) in Barbari goats and Kulkarni *et al.* (1996) in Gaddi goats; reported a lesser dressing percentage. This may be due to the breed difference in carcass yield.

Sahu and Prasad (1987) compared the slaughter traits of six months old sheep and goats. They recorded a dressing percentage of 46.2 in goats weighing 15-20 kg body weight and 41.5 in goats weighing 20-25 kg body weight. They have also noted a better dressing percentage of 50.91 and 51.3 per cent in sheep under the two weight categories, respectively. Physiological age has an effect on dressing percentage. The dressing percentage of young kids had been reported to be as high as 62 per cent (Bergman, 1940; Schwarzendahl, 1940). However, in the present study the better dressing percentage could be obtained.

There was no significant difference in dressing percentage between treatments in the present experiment. Bhuyan *et al.* (1996) used a different combination of concentrates and roughages in Beetal x Assam local male kids of three to four months of age. Effect of nutritional treatment on carcass traits was not significant. Misra and Prasad (1996) also supports this findings. They found no difference in dressing percentage between two feeding systems

in Sirohi and Beetal x Sirohi crossbred male kids. Devendra and Owen (1982) stated that plane of nutrition significantly affected the chevon production.

Summary

6. SUMMARY

The experiment was conducted to assess the performance of Malabari goats under different management systems and to evaluate the bio-climatological influence on their physiological norms. The animals under different managemental systems were slaughtered and meat studies were also done.

Randomly selected Malabari kids of three to four months of age were allotted to three treatments. Ten animals in the first treatment group were maintained under intensive management fed on a complete feed. The ten animals of treatment two; maintained under intensive system; were under the conventional farm concentrate and *ad libitum* cut fodder. The third treatment group was maintained under semi-intensive system, with five hours of grazing supplemented with concentrate feeding.

Morphometric observations were made at fortnightly intervals. Physiological norms and climatological variable were recorded at specific intervals. Three goats from each group (seven to eight months of age) were utilised for slaughter studies at the end of the study period.

Significant difference was noticed ($P<0.05$) in the body weight of animals between different management systems adopted. Body weight was significantly influenced by the

periods. Animals maintained on complete feed registered better growth rate from second to fourth month though animals under Semi-intensive system registered higher final weight at the end of the experiment which was 16.67 + 1.34 kg.

The morphometric observations viz. the height, girth and length were recorded. The animals under the semi-intensive system showed a better height and length whereas animals under the intensive system showed a better girth. Highly significant difference was noticed between males and females in all the three morphometric observations. The average height, girth and length were 40.74 cm, 52.67 cm, 50.03 cm respectively in male kids and 50.53 cm, 54.52 cm and 51.78 cm in female kids respectively. Females showed a higher value when compared to the males. The morphometric indices showed significant difference between fortnights and these values lead to the conclusion that the growth rate is different under different management systems.

The experimental period was divided into hot dry and rainy periods based on the climatological observations. The mean maximum temperature during the experimental period ranged from 31.17°C in June to 36.17°C in March and the minimum, ranged from 22.53°C in March to 25.31°C in June. The relative humidity percentage showed an increased range of 76.31 to

92.97 per cent, during the dawn and lower value of 21.45 to 67.64 per cent during the dusk.

Among the physiological norms recorded rectal temperature, heart rate and respiration rate showed significant difference between the management systems adopted. In the semi-intensive system the mean rectal temperature recorded was 40.02°C. The mean heart rate was 90.54 per min and the mean respiration rate was 28.69 per min. It was concluded that animals let out for grazing showed an increase in their physiological norms. There was no sexual dimorphism in the physiological norms but highly significant difference in the diurnal observations existed. The morning mean body temperature was 39.69°C and the evening mean body temperature was 40.12°C. Similarly the morning mean heart rate was 79.5 per min and evening mean 94.25 per min. The respiration rate showed a diurnal variation. It was 20.43 per min in the morning and 33.68 per min in the evening.

An average haemoglobin level of 8.96 g/dl in the hot dry period and 9.36 g/dl in the rainy period was recorded in Malabari goats. There was no significant difference in haemoglobin level between treatments and between seasons.

The experimental animals under intensive system of management with complete feed showed a better dressing percentage in meat studies, when compared to other

managemental systems. There was no significant difference in other carcass traits between three different management systems. The mean slaughter weight of Malabari kids of seven to eight months of age was 17.15 kg and the mean carcass weight was 8.35 kg.

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INFLUENCE OF MANAGEMENT SYSTEMS ON GROWTH OF MALABARI GOATS

By

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ABSTRACT OF A THESIS

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ABSTRACT

An experiment was conducted to assess the effect of management systems on growth of Malabari goats. Thirty Malabari kids aged three to four months of age were selected randomly and allotted to three treatments. Kids under treatment I were fed complete feed and managed intensively. Animals under treatment II and III, were maintained under Intensive and Semi-intensive systems. Animals maintained on complete feed registered a better growth rate from second to fourth month. Whereas animals in Semi-intensive system showed a better final growth. Body weight was significantly influenced by the period in all the treatments. Kids under Semi-intensive system showed a better height and length, whereas kid, under Intensive system showed a better girth measurement. In morphometric observations females had a significantly higher value compared to males. The body measurements also showed a significant difference between fortnights and it increased with age, in all three treatments. The experimental period was divided into hot-dry and rainy periods based on climatological observations. Physiological norms like rectal temperature, heart rate and respiration rate showed significantly higher rates in animals kept under Semi-intensive system of management. A highly significant difference in the diurnal observations in the physiological

norms were noted. But there was no sexual dimorphism in physiological norms. There was no significant difference in haemoglobin level between treatments and between seasons. The goats fed on feed under Intensive management system showed a better dressing percentage but there was no significant difference in other carcass traits between treatments.