PHYSICAL CHARACTERISTICS AND SOME OF THE ECONOMIC TRAITS OF OSMANABADI GOATS IN VIDARBHA REGION

THESIS

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MASTER OF VETERINARY SCIENCE
IN
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BY

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DECLARATION OF STUDENT

I hereby declare that the experimental research work and its interpretation of the thesis entitled **"PHYSICAL CHARACTERISTICS AND SOME OF THE ECONOMIC TRAITS OF OSMANABADI GOATS IN VIDARBHA REGION"** or part thereof has neither been submitted for any other degree or diploma of any University nor the data have been derived from any thesis/publication of any University or Scientific Organisation. The source of material used and all assistance received during the course of investigation have been duly acknowledged.

Abotshare

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CERTIFICATE – I

MR. ABHIJIT BHAGWANTRAO MOTGHARE has satisfactorily prosecuted his course of research for a period of not less than one semester and that the thesis entitled **"PHYSICAL CHARACTERISTICS AND SOME OF THE ECONOMIC TRAITS OF OSMANABADI GOATS IN VIDARBHA REGION"** submitted by him is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination in the subject of **Animal Genetics and Breeding** for the award of M.V.Sc. degree by the Maharashtra Animal and Fishery Sciences University, Nagpur.

I also certify that the thesis or part thereof has not been previously submitted by him for a degree of any other University.

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CERTIFICATE – II

This is to certify that the thesis entitled **"PHYSICAL CHARACTERISTICS AND SOME OF THE ECONOMIC TRAITS OF OSMANABADI GOATS IN VIDARBHA REGION"** submitted by **MR. ABHIJIT BHAGWANTRAO MOTGHARE** to the Maharashtra Animal and Fishery Sciences University in partial fulfillment of the requirement for the degree of M.V.Sc. has been approved by the Student's Advisory Committee after oral examination in collaboration with the External Examiner.

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"No work is done by a man alone,

the path is visible when a path is shown"

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(Abhijit B. Motghare)

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LIST OF ABBREVIATIONS

Abbreviation	Full form
%	- Per cent
χ^2	- Chi-square
BDS	- Body dimension score
BL	- Body length
CD	- Critical difference
cm	- Centimeter
et al.	- et alia (and others)
etc.	- etcetera
F.Cal	- F calculated
G.M.	- General mean
HAW	- Height at wither
HG	- Heart girth
i.e.	- that is
ISSGPU	- Indian Society for Sheep and Goat Production and Utilization
kg	- kilogram
PG	- Paunch girth
S.E.	- Standard Error
viz.,	- Namely

CHAPTER - I

INTRODUCTION

CHAPTER I

INTRODUCTION

When man began his farming operations in the dawn of history, the goat was the Kingpin of the pastoral life, making possible the conquest of desert and mountain and the occupation of the fertile land they beyond. According to many historian, goats were the first animals to be domesticated. Twelve thousands year old painting of goats have been found on the walls of caves in Europe (ANONYMS, 2004).

Goats have proved to be a great boon to the poor and landless labours or marginal farmers and due to their immense contribution to the poor peoples economy, goat has been described as a "poor man's cow". Goat is a one of the most friendly creations of nature. The goat is among the cleanest of animals and is a much more selective feeder than cows, sheep, pigs, chickens and even dogs. Goat do eat many different species of plants but do not want to eat food that has been contaminated or that has been on the floor or the ground. They have survived and interbred in genetic isolation and the potential productivity of many of the populations remain to be explored. In comparison with other domestic animals, goats are often victims of prejudice and neglect, but they have nevertheless fulfilled a most useful task in supplying a part of the human population with milk, meat, hair, leather and other byproducts like manure for agricultural use.

The ability to grow at a faster rate with low input and economical production of milk, meat, skin, fibre and manure production, makes it one of the most important species of livestock.

India is rich in livestock population. India ranks first in the world goat population. The goat population in the country is about 126 million or 23% of total animal population in the country. They produce about 0.48 million tonnes meat, 1.684 million tonnes of milk, 0.085 million tonnes pashmina and 0.109 million kg skin in addition to 390 thousand metric tonnes of manure. Annual growth rate of goats in India from 1950 is very high, in comparison to other species of livestock in spite of heavy rate of slaughter and its extensive use as meat animal.

Goat population of Maharashtra State was 9191 thousand (Belsare, 2002). In Maharashtra Osmanabadi is most important breed of goat. It is exclusively reared for meat purpose. The Latur, Tuljapur and Udgir talukas of Osmanabad district in Marathwada region are the home tracts of these goats. They have now spread into other parts of the Maharashtra State like Vidarbha region. The time has now to come employ goat rearing as a professional and scientific way for multiple returns tomorrow.

The present study is planned to collect the data about physical characteristics of Osmanabadi goats in Vidarbha region.

Keeping in view of these points the present research project is undertaken with the following objectives.

1. To study the physical characteristics of Osmanabadi goats in Vidarbha region.
2. To study the body measurements of Osmanabadi goats.
3. To study the economic traits of the Osmanabadi goats.

CHAPTER - II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

2.1 PHYSICAL CHARACTERS

The studies on physical characteristics of Osmanabadi goat are very scanty therefore the physical characters of other breeds of goat are here reviewed for comparison.

Mishra *et al.* (1980) reported that the average length of left and right horns of Sirohi goats were as 13.86±0.553 and 14.17±0.631 cm, respectively in adult does and 23.0625±1.6254 and 23.125±1.345 cm, respectively in adult buck.

Mazumder and Mazumder (1983) reported that males of pashmina goats are larger than the females. They are white, black or mixture of both and sometimes are grey and brown. Beared is present in both the sexes. The horns are mainly bent backwards and outwards and vary in size (10-50 cm). The ears are medium in size, erect or lateral in some auricular is atrophied.

Bhat (1988[a]) a study on the documentation of external traits in goats was conducted on 314 Barbari goats available at the Central Institute for Research on Goats Makhdoom. The coat colour variation showed 46.8 per cent animals to be of Barbari B type (brown spotting against white background); 2.9 per cent animals of solid brown SB type (solid brown coloration with white on forehead, belly and limbs); 18.1 per cent animals of type AB (brown colour on face and dark brown colour on neck, back, thighs

and limbs); 8.6 per cent animals of type A (dark brown face, body, neck, back, thighs and limbs); 12.7 per cent animals of type CC (Fawn colour), 0.32 per cent of completely white type D with a few brown spots and 0.32 per cent of black type E (black patches on head, back, thighs, belly and limbs); from the mating type data it was observed that these colours were inherited.

Bhat (1988[b]) a study on the documentation of external traits in goats was conducted on 304 Jamunapari goats at the Central Institute of Research on Goats Makhdoom. The coat colour variation showed that 4.3 per cent animals were completely white, 87.8 per cent white animals had brown, dark brown, fawn, brown and fawn patches on neck, ears, around eyes and 7.9 per cent white animals had black and black and fawn patches on neck, ears and around eyes.

Ghei and Bhushan (1989) conducted study on local goats of Sikkim and reported that, goats are medium in size. Coat colour is black and brown with 2 white stripes on the face extending from the base line of horns to upper lips. Head is elongated, forehead is long, narrow and well buldging with depression at the poll. The ears may be either leaf shaped, medium sized and drooping or small and erect. Horns are with pointed tips emerging from either side of the poll, extended laterally and turned backwards. They also reported that, the birth weight of male and female kids were 1.64±0.07 kg and 1.59±0.04 kg in single born and 1.42±0.07 kg and 1.33±0.3 kg in twins.

Reddy *et al* (1991) conducted survey to study the breeding practices in goats in rural areas of Andhra Pradesh. They reported that the majority of goats in this area were non-descript goats with black, white, grey

and combination of black and white colour. Red, brown, white and patches of red and white colour goats were also seen. They also found that the kidding percentage was on an average 142.81 per cent. The twinning and triplet births were 30 to 35 per cent and 5 to 10 per cent respectively.

Man Son (1998) conducted study on characterized Berari goat as unimproved native breed of Nagpur and Wardha districts of North Maharashtra and Nimar district of Madhya Pradesh with usually black colour. When colour pattern of Berari breed was compared with Osmanabadi it was observed that maximum Osmanabadi goats were having black (98.5%) coat colour with hardly 1.37 per cent goats with white markings which was not conspicuous in Berari goats.

Sexena *et al.* (1999) analysed the data of Barbari goats totalling 3247 from three districts of Uttar Pradesh and noted the average size of horns of this breed as 12.1, 12.3 and 12.7 cm in 1-2 years; 2-3 year and above age groups in males and 13.3, 11.5 and 12.6 cm in females respectively. The shape of horns was observed to be spiralled and curved and orientation was found to be mixed type. These workers observed small and erect ears varying from 8-13.5 cm in length in both the males and females over the age groups. In the above study variation in the length of tail from 9.35 cm at 3-6 months to 12.0 cm in males, 14.0 cm at adult animals were recorded. Males had slightly longer tails than females.

Ambhore (2000) observed the average body measurement of Berari goats for 6 to 9 months of age and noted significant differences in the heart girth (56.88$\pm$0.35 and 63.33$\pm$0.046 cm) and height at withers

(54.00±0.43 and 60.77±0.55 cm). He observed non-significant differences between month with respect to body length (45.77±0.71 and 50.11±0.62 cm) and abdominal girth (58.88±0.75 and 62.55±0.97 cm). The averages for ear length, tail length and horn length were 14.5±0.22 and 14.06±0.17, 11.00±0.27 and 13.22±0.24 and 5.55±0.18 and 8.00±0.22 cm respectively for 6 and 9 months of age.

Jain *et al.* (2000) described Kodi-Adu breed of goat of South-eastern coastal region of Tamil Nadu having body length, height at wither and chest girth as 74.32±1.94, 87.07±1.13 and 82.63±1.144 cm respectively for adult males and corresponding figures of the above physical traits in the adult females were 72.57±0.06, 81.07±0.53 and 76.96±0.54 cm respectively. These workers observed horns in both sexes open apart with average horn length of 19.0±1.16 cm in males and 12.6±0.48 cm in females. The ears of this breed were observed to be medium in size, curved forward, slightly dropping [illegible] having average ear length of 15.27±0.10 cm. Tail length was reported to be average in size and then with average of 17.19±0.22 cm in length.

Data on physical traits were recorded by Thiruvenkadan *et al.* (2000) in Kanni Adu goats from farmers herds and observed the pooled means for height at withers, chest girth and body length as 78.35±0.31, 73.92±0.28 and 71.49±0.27 cm, respectively. The pooled averages for ear length and tail length were 16.25±0.09 and 18.38±0.16 cm, respectively.

Banerjee (2002) reported that Osmanabadi goats are large in size, coat colour varies, but mostly black (73.00%) and the rest are white,

brown or spotted. Ninty per cent males are horned, females may be horned or poled.

Shettar and Rudresh (2003) conducted study on Indigenous Bidri goats and reported that the black coat colour constituted 55% of the total sample and black skin was predominant with 45%. The significant percentage of black colour of coat and skin might be due to contribution of Osmanabadi genes towards Bidri goat gene pool. The ear orientation was mostly pendulous (95%). The mean ear length was 15.36±0.05 cms. The percentage of goats with straight forehead was 98%. The goats with wattles and beards were 5% and 2% respectively in the total sample, 84% of the goats were medium tailed and remaining were short tailed. The tail length is of not much significance in breed identity in goats.

2.2 BODY MEASUREMENT

According to height, goats can be classified into three categories: large (over 65 cm), small (51-65) and dwarf (under 50 cm) indicated the importance of height in classification of goats (Devendra and Burns 1970)

Bhadula (1979) conducted study on growth and size traits of Assam-Local and Saanen x Assam-Local kids and reported that the crossbreds had significantly higher body weight as well as larger body measurements than the purebred kids at all the ages from birth to 16th week. Male kids having significantly higher body weight and larger size measures than the female kids. No significant sex differences could be observed for any of the body measurements and body weight in pure breds.

Mukherjee *et al.* (1979) conducted study on grey and brown Bengal goats and reported that in group I (0 to 3 months) the body weight of Grey Bengal kids was higher than the Brown Bengal, although the difference between two was not statistically significant. The adult Brown Bengal goat weighed significantly more than the Grey Bengal. At adult stage, the Brown Bengal goats not only weighed heavier than Grey Bengal, but were also significantly longer and had larger chest girth. The difference observed for body weight and chest girth at adult stage did not exist when the animals became mature.

Singh *et al.* (1979[a]) body weight and 8 body measurements were recorded from 193 Black Bengal she goats of different ages groups. There was gradual increase in body weight in all the groups. The correlation of body weight with all the 4 body measurements were significant The overall correlation with different body measurements were also highly significant however correlation of body weight was highest with paunch girth and chest girth.

Singh *et al* (1979[b]) reported that the values of various measurements were higher in Jamnapari than in Barbari. The correlations of body weight with length, height, chest girth and paunch girth were positive in all the age groups. The correlation of body weight with length and chest girth was significant in all the age groups of both the breeds. Correlation between body weight and body height were also significant in all the groups except in the second (one-pair permanent incisor teeth) groups of Jamnapari goats. All correlations of body weight with paunch girth were significant except the one

in milch-teeth group of Jamnapari. Regression of body weight on length, height, chest girth and paunch girth was highest in the third groups (full mouth) consisting of only Barbari goats. In Jamnapari goats of group I: the predicted body weight was the highest (35.38) kg with body length, the lowest (3.25) kg, being with paunch girth. In Barbari goats also of this group showed lowest (362.60) kg with body weight and highest (1222.74) kg observed with the chest girth.

Misra (1980) reported the data on body weight and measurement were collected on 343 adult Sirohi does. The phenotypic correlations between body weight and various measurements showed that the coefficients of correlation were highly significant at all the ages. The coefficient of correlation between weight and length , heart girth, paunch girth and height were highest. The coefficient of determination increased with increase in age and was highest (85.35%) at 4 teeth stage.

Mukherjee *et al.* (1981) explained body weight and body measurement relationship in Grey Bengal goats. Phenotypic measurements were recorded in goats arranged in 5 age groups (0-3 months, 3-6 months, 6-12 months, 1 year-3 years and above 3 years). The body measurements included body weight, length, height and chest girth, phenotypic correlations of body weight with the three body measurements were found to be positive and significant in each age group. Highest correlation of body weight with chest girth followed by length and height. Regression of body weight on chest girth was highly significant in goats of 1-3 years and above 3 years of age.

Prasad *et al.* (1981) analyzed data on body weight measurement relationship in Black Bengal goats by estimation of phenotypic correlations of body weight with length, height and chest girth in 350 Black Bengal she goats of 5 age groups were calculated in 3 agro-climatic zones. The majority of weight measurement correlations were significant in different age groups. Correlations were higher at early age declining gradually with increase in age. Correlation of body weight with chest girth was highest in majority of cases followed by length and height, respectively. Partial regression of body weight on chest-girth was found highly significant whereas regression of body weight on length and height was non-significant.

Acharya (1982) summarized the body measurements of various important indigenous goat breeds as under.

Sr. No.	Breed	Sex	Chest girth (cm)	Body length (cm)	Height at wither (cm)
1	Sirohi	M	80.30±1.0	80.00±1.02	85.60±1.4
		F	62.40±0.2	61.30±0.20	68.40±0.2
2	Marwari	M	71.68±1.41	70.97±1.65	74.74±1.61
		F	68.60±0.26	63.51±0.44	69.29±0.22
3	Beetal	M	86.0±1.20	85.50±1.45	91.60±1.97
		F	73.7±0.70	70.42±0.88	77.13±0.46
4	Jhakrana	M	86.0±1.91	84.10±2.11	90.40±1.61
		F	79.13±0.31	77.74±0.36	79.12±0.29
5	Barbari	M	75.53±1.25	70.45±1.43	70.67±0.74
		F	63.31±0.40	58.68±0.38	56.18±0.37
6	Jamunapari	M	79.52±1.2	77.37±1.23	78.17±1.25
		F	76.11±0.38	75.15±0.46	75.20±0.38
7	Mehsana	M	76.90±1.2	71.20±1.00	80.40±1.20
		F	73.00±0.3	68.00±0.30	74.30±0.2

8	Gholiwadi	M	74.70±0.9	74.30±1.30	81.20±1.20
		F	75.20±0.2	72.40±0.30	79.50±0.3
9	Zalwadi	M	76.80±1.10	75.60±1.05	83.30±0.80
		F	74.20±2.30	71.80±0.30	78.50±0.20
10	Kutchi	M	78.40±0.7	77.10±1.30	86.40±0.7
		F	76.10±0.20	75.00±0.30	82.40±0.30
11	Surti	M	70.50±0.00	65.00±0.00	73.50±0.00
		F	71.80±1.02	66.60±0.85	66.60±0.85
12	Sangamneri	M	76.0±2.10	69.8±1.20	77.3±0.88
		F	71.0±0.30	62.5±0.06	68.0±0.12
13	Malbari	M	73.8±2.20	70.2±1.6	71.9±2.1
		F	67.4±0.5	63.5±0.5	63.2±0.3
14	Osmanabadi	M	72.06±2.04	69.5±1.93	77.87±1.68
		F	72.04±0.40	67.51±0.38	74.79±0.30
15	Kannaiadu	M	77.53±1.55	71.06±1.36	84.12±1.74
		F	70.83±0.44	67.30±0.38	76.15±0.45
16	Ganjam	M	83.1±0.9	76.2±1.2	84.5±0.7
		F	74.6±0.3	67.6±0.3	77.1±0.3
17	Bengal	M	72.0±1.35	63.2±2.14	58.3±3.16
		F	63.2±0.16	51.2±0.16	53.4±0.18
18	Gaddi	M	72.2±0.68	69.5±0.84	61.3±0.84
		F	69.3±0.48	65.2±1.18	58.1±1.02
19	Changthangi	M	63.0±0.44	49.5±0.36	49.0±0.29
		F	65.2±0.29	52.4±0.23	51.6±0.20
20	Chegu	M	80.70±1.15	75.8±1.07	68.6±0.98
		F	73.7±0.53	69.3±0.47	60.00±0.96

Darokhan and Tomar (1983) conducted study on Changthang pashmina goats of Ladakh and recorded the body weight, body length, heart girth and height at withers, 2.03±0.03 kg, 21.18±0.14 cm, 29.53±0.12 cm and 26.64±0.13 cm in males and 1.82±0.02 kg, 20.53±0.13 cm, 28.45±0.14 cm

and 25.72±0.11 cm in female respectively at birth. They also observed that the male kid weighed and measured significantly more than the female kid. The year effects were significant. The body measurements were significantly and positively correlated phenotypically with the birth weight.

Khan and Sahni (1983) conducted study on 111 Jamnapari kids raised at the Central Institute for Research on Goats, Makhdoom, were analysed. Type of birth and regression of weights of dam had a significant effect on body weight and linear body measurements of kids at all ages. The effect of sex was significant on body weight, heart girth, paunch girth and chest width at birth; paunch girth at 1 month and body weight, paunch girth and chest width at weaning. Effect due to year of birth was significant on body weight, paunch girth and chest width at 1 month; body weight and all the measurements at 2 months and body length, body height, paunch girth and chest width at weaning. Season of birth affected significantly body weight, body length, body height, heart girth and paunch girth at 2 months and body weight, body length, body height and paunch girth at weaning. The adjusted mean of body weight at birth, 1,2 and 3 months of age were 2.840±0.041, 6.142±0.086, 8.651±0.091 and 10.680±0.103 kg respectively.

Mukherjee *et al.*(1983) reported body weight and 3 body measurements (length, height and chest girth) were recorded in 2/2 Grey Bengal goats of 5 age groups (0-3 months, 3-6 months, 6 months-1 year, 1 year-3 and above 3 years) in 3 different agroclimatic zones viz., (a) Gangetic plain, (b) Plateau, (c) Sub-plateaus. In sub-plateau all the correlations of body weight with 3 body measurements were statistically significant while in the

remaining 2 regions relatively lesser number of association of body weight with body measurements were found to be statistically significant. The correlation of body weight with chest girth was significant in all the cases.

Bhattacharya *et al.*(1984) reported estimation of body weight in Black Bengal goats from body measurements by selecting 135 female goats irrespective of their age and with body weight varying from 7.80 kg and above. The different body measures like, heart girth (55.24+0.72) (cm), height at withers (46.53+0.57) (cm), length (from pin bone to point of shoulders) (46.15+0.68) (cm) and the circumference of neck (30.06+0.51) (cm) at the base were taken from respective goats along with its body weight (13.14+0.52 kg). The measurements were taken with the help of tape graduated in cm and body weight was recorded with dial type weighing machine. A relationship between body weight, length, heart girth and length for body weight, heart-girth and circumference of neck as shown in the multiple regression model, was found to be best prediction equation for body weight estimation in Black Bengal goats.

Bose and Basu (1984) reported relationship between body measurements and meat production in Beetal goats, the study was based on 270 beetal male and female goats brought for slaughter. The males were below 1 year of age while females were about 2 ½ year old, only healthy goats of pure Beetal breeds were selected. The body measurement characters studied were; body length, withers height, heart girth, chest floor, height, chest depth, paunch girth, hipwidth, loin width and body weight. The meat characters studied were slaughter grade (1 to 5) judged before slaughter,

carcass weight, carcass grade (1 to 5), judged on dressed carcass and dressing percentage. Phenotypic correlations estimated within sexes revealed that the body measurements, particularly length, height chest and paunch girth were strongly correlated with slaughter weight and carcass weight while slaughter and carcass grade had medium correlations with body measurement.

Sarma *et al.* (1984) performed studies on body weight and body measurements of Assam Local x Beetal kids of pre-weaning age. Body weight and body measurements viz., body length, height at withers and heart girth were recorded at birth and at 15^{th},30^{th}, 45^{th} , 75^{th} and 90^{th} day of age. The birth weight was 1.55 ± 0.09 and 1.40 ± 0.14 kg in single born males and females, respectively, while it was 1.37 ± 0.06 and 1.21 ± 0.05 kg in twin born male and females.

Mukherjee *et al* (1986) conducted study on body weight and 3 body measurements (length, height and chest girth) were taken and recorded in 421 Brown Bengal does at 5 age groups (0-3 months, 3-6 months,6-12 months, 1-3 years and above 3 years) in three different agro-climatic regions viz., (a) Gangetic plain, (b) plateau, (c) sub-plateau. The correlations of body weight with the three body measurements were positive and significant in each region.

Biswas *et al.* (1990) conducted study on body weight and conformational traits in Chegu Pashmina goats at birth were analysed by Least Square method (LSQ). The LSQ mean of birth weight, body length, height and heart girth were 2.13 ± 0.02 kg, 29.24 ± 0.18 cm, 28.43 ± 0.18 cm and 32.28 ± 0.20 cm respectively while the male kid (2.15 ± 0.02 kg) was

significantly heavier than the female kid (2.11±0.02 kg), sex difference was non-significant with respect to conformational traits. All these traits were influenced significantly by period of birth but season effect was not evident. Age of dam had no effect on any of the traits except heart girth. Three successive generations did not evince any difference in the various traits studied. Period x sex and season x sex interaction effects were non-significant. Regression on dams weight was highly significant for birth weight, body length and heart girth.

Das *et al.* (1990) predicted body weight from body measurements in Jamnapari and Barbari goats reared under intensive management system. The study included 50 Jamnapari and 115 Barbari kids born at sheep and goat farm of IVRI, Izatnagar. Body weights and linear body measurements such as length (from point of shoulder to point of tuber ischii), height (from base of hoof to heighest point of wither), heart girth (around the thoracic cavity just behind the elbow joint) and hip (from the tuberosity of ilium of one side to the other across the rump.) were taken within 12 hours after the kid was born and in the morning at 3 and 6 month of age. Stepwise multiple regression procedure was employed to determine the combination of body measurements, which can explain the maximum variation in the dependent variable, the body weight. Results revealed that hip measurement was not a good predictor for body weight of growing kids and linear body measurements were poor predictor for birth weight in both the breeds. Heart girth alone could be used effectively for prediction of body weight ($R^2 < 80\%$) of kids at 3 and 6 months. The combination of heart girth and height was a

better predictor for body weight at 3 and 6 months in kids of both the breeds than the combinations between heart girth and length and between length and height.

Kumar and Bhat (1990) the records on body weight and measurements from birth to 12 months of age, at 3 months interval, on 524 Jamnapari kids sired by 12 bucks, maintained at Central Institute for Research on Goats, Makhdoom, Mathura (U.P.) during 1982-84. Phenotypic correlation coefficient between body weight and body measurements and among measurements were found to be positive and highly significant. They were higher in early life. Correlation between weight and chest girth (0.72) was highest in majority of the cases followed by length (0.71) and height (0.78) , respectively. Mostly, genetic correlation were significant, all being positive. Prediction of weight from body measurements had higher accuracy at 3,6,9 and 12 months of age and a very low accuracy at birth. It was seen that chest girth alone or in combination with length and / or height had high accuracy of prediction at all ages except at birth.

Bhoite *et al.* (1994) conducted the biometrical studies on Sangamneri goats and reported the average body weight of 59.090±2.184 and 35.722±1.047 kg in male and female respectively. The body length, height at withers and chest girth were 76.400±2.117 and 65.290±0.0664, 80.200±2.225 and 69.630±0.664 and 85.500±1.811 and 74.015±0.753 cm in the males and females, respectively. The males were significantly heavier ($P < 0.01$) than the females. So also three body measurements recorded for the males were significantly ($P < 0.01$) higher than females.

Varade *et al.* (1997) studied body measurements of local goats under field condition by collecting data on body measurements and body weights of 50 non-descript local adult females and found that body weight of does was 26.34±1.27 kg. Body measurements were 77.37±1.53, 81.63±1.08 and 92.96±1.32 cm for heart girth, abdominal girth and body length respectively. It was observed that the body weight was significantly and positively correlated with heart girth and body length. Body weight could be predicted from heart girth with at least 73% reliability but this prediction from body length and abdominal girth was comparatively low, thus heart girth can be used to predict body weight in the absence of weighing apparatus in rural areas.

Deb *et al.* (1998) conducted study on pashmina goats. Age, breed, sex and season significantly ($P < 0.01$) affected body weight of Pashmina goats. Body weight was highest (20.1±0.7 kg) for kids born during July-October followed by kids born during March-June (18.3±0.5 kg) and lowest (16.7±0.7 kg) for winter (November-February) born kids. Correlation coefficient between all possible combination of conformation traits and body weight were significant ($P < 0.01$). The correlation (r) between conformation traits (heart girth, body length and height) and body weight were 0.94, 0.90 and 0.91 respectively. The correlation between heart girth and heart girth / length was significantly high ($r = 0.95$). These indicated that only heart girth can be used for predicting body weight with sufficient accuracy.

Singh (1998) the study was conducted on 538 yearling goats (134 Black Bengal, 260 Jamunapari x Black Bengal and 144 Beetal x Black

Bengal). Variation in yearling body weight due to genetic group ($P < 0.01$), sex ($P < 0.01$) and type of birth ($P < 0.05$) were significant, sex had significant effect ($P < 0.01$) on body length, (51.07 ± 0.36) cm, height at withers (52.55 ± 0.35) cm, heart girth (53.08 ± 0.36) cm and paunch girth (54.45 ± 0.36) cm. The effect of genetic group on these body biometrics was also significant except at heart girth whereas, season of birth and filial generation influenced body length ($P < 0.01$) and paunch girth ($P < 0.05$) respectively.

The averages for various body measurements in Osmanabadi goats were reported as below (Anonymous, 1999).

Age		Body length (cm)	Body height (cm)	Chest girth (cm)
3 months	M	47.61±0.06	51.48±0.09	51.15±0.09
	F	46.74±0.07	49.72±0.07	49.22±0.08
	P	46.99±0.02	50.23±0.04	49.78±0.15
6 months	M	55.59±0.02	60.95±0.12	59.42±0.01
	F	54.60±0.01	57.65±0.01	58.33±0.01
	P	54.94±0.07	58.48±0.14	58.60±0.21
12 months	M	65.83±0.01	67.63±0.09	68.69±0.02
	F	63.73±0.01	67.04±0.01	66.82±0.01
	P	64.14±0.01	67.15±0.04	67.18±0.23

Singh (2002) the study was conducted on 570 kids (128 Black Bengal, 285, Jamunapari x Black Bengal and 157, Beetal x Black Bengal). Variations in weight and body dimensional traits at 6-months of age due to genetic group and type of birth were significant. Body weight at this age was also influenced significantly ($P < 0.01$) by sex and season of birth. Whereas, height at withers ($P < 0.05$) and heart-girth ($P < 0.05$) varied significantly due to sex of kids and season of birth, respectively. Effect of generation and interactions of genetic group with sex and type of birth on weight and body dimensional traits were not significant. Phenotypic correlations of weight with linear body measurements were positive and significant. Similarly genetic

correlations were positive and moderate to high in magnitude except its value between weight and paunch-girth, which exceeds the theoretical limit.

Banait *et al.* (2002) reported the informaiton on 250 goats (does) of five different breeds for body conformations traits. The average birth weight, body weight, body length, withers height, heart (chest) girth, paunch-girth and body dimensions score were 2.47±0.28 kg,26.8±0.0277 kg, 46.37±0.193 cm, 71.13±0.350 cm, 70.31±0.286 cm, 77.15±0.422 cm and 264.99±1.048 cm, respectively. The average index values for Osmanabadi, Jamnapari, Local, Sirohi and Barbari were 1049.23±5.350 and 1046.17±8.142, 1036.16±6.295, 1004.34±6.178 and 927.23±6.159 respectively. Barbari was significantly lower than all other breeds.

Badi *et al.* (2002) studied the body measurement were taken from 496 goats of Barka and After types in order to find out the live body weight from heart girth and height at withers. The animals were divided into types (Barka and Afer), sex (male and female) and age (from less than 1 year, 1 ½ to 2.0, 2.0 to 2 ½ and over 3 years old). Linear equation of heart girth and height at wither accounted for 95% and 91% ($P < 0.01$) of the total variability in body weight.

Nahardeka *et al.* (2002) conducted study on Assam local goats and their crosses with Beetal. They found highly significant effect ($P < 0.01$) of type of birth on body measurements were observed males had higher values. All the body measurements at birth were significantly influenced ($P < 0.01$) by the parity of the dam. Sex of the kid had highly significant

influence ($P < 0.01$) on body measurement of kids males registering higher values.

Shettar and Rudresh (2003) conducted body measurements of Bidri goats and reported that the mean chest girth (cm) of five age groups were 36.41±0.52, 45.48±0.43, 57.37±0.29, 65.36±0.30 and 72.38±0.17. The chest girth as a trait in indicative of the animals physiological capacity to meet its production potential. The mean height at withers (cm) were 37.57±0.58, 47.24±0.44, 58.60±0.36 and 64.95±0.42 and 70.69±0.21 respectively. The prevailing agro-climatic conditions, base population of the breed and artificial selection for this trait usually determine the height at withers among different goat breeds. The mean height at wither for adult group in Bidri goats are relatively lower than those reported for Sangamneri breed. The mean height at wither of 12 months group were higher while of adult group were lower than those of Marwari breed. The mean body length (cm) obtained for five age groups in increasing age order were 21.51±0.28, 27.09±0.27, 33.49±0.25, 36.62±0.22 and 40.18±0.11 respectively. The results obtained for different quantitative traits in Bidri goat give considerable evidence for lack of systematic selection for meat yield.

Saha (2003) conducted study on 462 kids from 20 sires in the Malwa region of Madhya Pradesh. He reported that effect of dams weight at kidding significantly effect the body measurements parameters.

2.3 ECONOMIC TRAITS

Mittal (1976) conducted data on a flock of Barbari and Jamnapari goats were analysed to study the various factors influencing

mortality rate in kids. The results showed that breed, sex, type of birth and season of kidding had no significant effect on the mortality rate of kids. Birth weight of kids was an important factor; lighter kids had a significantly higher mortality than heavier ones. Mortality rate was highest in winter (52.1%) season in Jamnapari and in Barbari (35.1%) and in kids below one month in age 49.5 per cent in Barbari and 39.1 per cent in Jamnapari.

Singh *et al.* (1977) conducted study on birth weight of pure and crossbred kids. Highest birth weight was observed in Jamnapari x Saanen kids (Male – 3.107±0.073 kg and female – 3.040±0.162 kg). Highest twinning was observed among locals (53.33%). In all the groups males were heavier than females. The average birth weight of kids born single (2.155±0.093 kg) was higher than those born as twins (1.715±0.075 kg). This difference was not statistically significant. Effect of season of birth on birth weight was significant in Barbari but not in local goats.

Mittal and Pandey (1978) conducted study on live weight, cannon length and body length were recorded at birth and upto 9 months at monthly interval in Barbari kids. There was no significant effect of sex on birth-weight and live-weight of single and twin born kids at any age interval. Statistically non-significant male kids were heavier than female kids at every interval from 1 month to 9 months. Similarly no significant effect of sex could be observed on cannon and body length. Cannon which is an early maturing bone showed less post-natal development in comparison to vertebral column (body length). Highly significantly positive correlations were obtained

between growth of cannon and body length and cannon and body weight at almost all stages of growth studied.

Mittal (1979) a study was conducted to find out the effect of breed, sex, type of birth, season of kidding and age of dam on birth weight of Barbari and Jamnapari kids were significantly heavier than Barbari kids. Similarly, male kids were heavier than their females in both the breeds. The difference between single and twin born kids was non-significant. The season of kidding significantly influenced the birth weight, winter born kids showing superiority over summer-born kids. Age of the dam is not an important factor in determining the birth weight of kids. A correlation coefficient study was made between dams weight and birth weight of kids, which revealed that there exists a close association between the two.

Misra *et al.* (1980) Sirohi breed of goat has been characterized on the basis of physical characteristics, adult body measurements and body weights, growth, lactational performance, reproductive efficiency and survivability. Average for body weight at birth, weaning (3 months), 6 months, 9 months, 12 months and full grown adults were 2.71±0.064; 9.338±0.366, 15.352±0.526, 17.847±0.528, 22.937±0.865 and 44.120±0.760 kg respectively. The age of the animal had significant effect on adult body weight and measurements, viz., length, height, heart girth and paunch girth and there was consistent increase in body weight and linear measurements with advancement of age. The average for first 90 days of lactation was 48.221±1.48 kg. Kidding and twinning percentage were 80.5 and 4.3 respectively. Survivability was 92.4, 94.0 and 98.4 per cent for 0-3 months, 3-12 months and adults, respectively.

Sarma *et al.* (1981) conducted study on Assam local goats, kids born as single had higher body weight than twins and triplets. The difference in body weight between singles and twins increased gradually upto 135th day, but between singles and triplets it narrowed down after both day. Triplets were heavier than twins. The season of birth had non-significant effect on body weight at birth and at 45th and at 180th day of age but had significant influence at 90th and 135th days of age. The percentage of multiple births was high. The total gain in body weight upto 180th day was 6.3 kg in singles, 4.98 kg in twins and 5.84 kg in triplets. The regression of body weight on age was 35±2 gm for singles, 26±1 gm for twins, 33±1 gm for triplets, 34±2 gm for kids born in October-March and 31±1 gm for kids born in April-September.

Mukundan *et al.* (1981) records of birth weight of 473 kids belonging to Malbari and its Saanen half breds were investigated. Sex of the kid, type of birth and weight of dam at kidding had a highly significant effect on birth weight. The effect of genetic group of the kid and month and year of birth on birth weight was not significant. The interaction between sex and genetic group, genetic group and month of birth and genetic group and type of birth were significant. Adjusted mean birth weight of Malabari and its Saanen half breds was 1.761±0.024 kg and 2.007±0.027 kg respectively. Birth weight was positively correlated with other body weights, the relationship being stronger in early period.

Chawla *et al.* (1984) conducted study on body weights of 394 Beetal, 216 Alpine and 42 Saanen. Large and significant differences between sexes were observed at more than 6 months of age in the 3 breeds. The

influence of sex on the birth weight was significant in Beetal and Alpine. Growth rate (g/day) estimated at different intervals of age varied significantly ($P < 0.05$) in females of Beetal and Saanen and both sexes of Alpine. The effect of sex on growth rate was significant in Alpine between 2 and 4 months and in Saanen between 10 and 12 (males) and 12 and 15 months (Females) age. High (133 ± 27.89) and low (23 ± 3.88) values of growth rate were observed in Saanen males and females respectively. Among females, growth rate of Alpine was higher ($P < 0.05$) than in Beetal at 2 to 4 months of age. Beetal was superior ($P < 0.05$) to Saanen between 6 and 8, 10 and 12 and 15 months of age. Alpine and Saanen kids had little higher growth rate than Beetal from birth to 6 months of age.

Prakash *et al.* (1986) reported the overall percentage of multiple births in Barbari goats (53.01) was significantly higher than that in Jamnapari goats (39.39). Year and season of kidding significantly influenced the incidence of multiple births in Jamunapari goats but were non significant in Barbari goats. Dam's weight at kidding significantly affected the multiple births in both the breeds. Heavier does produces more multiple births than lighter does. The male : female sex ratio of kids was 50.8 : 49.2 in Jamunapari and 51.1 : 48.9 in Barbari goats. The effect of year, season, dam's weight at kidding and sire on sex ratio of kids born were non-significant.

Koul and Biswas (1987) conducted study on Indian pashmina goats and reported that the overall birth weight was 2.06 ± 0.01 kg. The primiparous or maiden does gave birth to kids of lighter weight than from other kiddings, though the difference was not significant.

Ruvuna *et al.* (1988) conducted study on 701 Small East Africa (SEA) and Somali female and 810 kids (SEA, Somali, Toggenburg x SEA, Toggenburg x Somali, Anglo-Nubian (AN) x SEA and AN x Somali) were studied. Birth weights, body weights at 30, 60, 90, 120, 150, 210 and 270 days of age and pre-weaning growth rate were significantly affected by breed type and sex of kid, litter size, year and month of birth and age of dam. Males grew faster and were heavier than female. Single kids were heavier and grew faster than twins. Kids from dams > 3 years of age were heavier than kids from younger dam's. Crossbred kids had higher pre-weaning growth rate than pure breds. The AN x Somali cross was heaviest and SEA kids were highest (15.1 and 11.9 kg at 270 days of age respectively). Toggen burg and AN sires produced kids with similar growth rates. Somali dams produced heavier kids than SEA dams but pre-weaning growth rates of their kids were not significantly affected.

Mishra and Ghei (1990) conducted study on Sikkim local goats. The overall rate of weight gain was highest in first week (91 g). The rate of growth in both the sexes decreased with the increase in the age of animals. Mean overall daily weight gain during 0-8, 8-16, 16-24 and 24-32 weeks was 72.02, 61.21, 46.09 and 40.29 gm respectively.

Hussain *et al.* (1996) reported growth performance of 892 Black Bengal kids. The effects of birth type and sex were significant for birth weight; single born kids were heavier that twins and males were heavier than females. Monthly body weights were similar among 3 regions and were significantly lower in the remaining region compared with the others. Birth

type and sex significantly affected monthly weights. Single born male kids had the highest weights during all periods. The average daily gain was lowest in triplets.

Husain *et al.* (1996) reported the growth performance of 892 Black Bengal kids, managed in 4 regions in Bangladesh was studied. Birth weights of kids in Mymensingh, Trisal and Tangail regions were similar (1.01 kg), and it was significantly lower in Rangpur (0.88 kg) than in the other regions. The effect of birth type and sex were significant for birth weight; single-born kids were heavier that twins and males were heavier than females. Monthly body weights were similar among 3 regions and were significantly lower in the remaining region compared with the others. Birth type and sex significantly affected monthly weight; single born male kids had a highest weights during all periods. The average daily gain was lowest in triplets.

Singh *et al.* (1997) conducted study on goats from 150 households in Mathura district were studied during 1992-93, 76% of goat keepers had small flocks (1-5 goats) only 35% of goats belonged to a distinct breed. The highest kidding rate (187%) was observed in Barbari goats kept in medium sized flocks. The overall mortality in adult goats and kids was 5.38 and 10.78%, respectively. The lowest mortality rate was observed in medium sized flocks and the highest mortality rate was observed in large flocks (> 10goats).

Koratkar *et al.* (1998[a]) analysed data on the reproductive performance of 171 females on the university Farm in Maharashtra during

1993-95 were analysed. Kidding rate (i.e. number of does kidding / number conceiving) was 92% and twinning percentage was 24.

Koratkar *et al.* (1998[b]) studied birth weights of 186 kids born on the University Farm in Maharashtra during 1993-95 were analysed. Overall least squares mean was 1.99±0.03 kg. Male kids were heavier ($P < 0.05$) than females, single born kids were heavier ($P < 0.05$) than twins. Kids born between July and December were heavier ($P < 0.01$) than those born between January and June and those born in 1995 were heavier ($P < 0.01$) than those born in 1993 and 1994. Birth weight was positively correlated with body weights at 1,3,6 and 12 months of age.

The agewise body weights in various age groups of Osmanabadi goats were studied at MPKV, Rahuri (Anonymous, 1999) under network project. In the above study males at 3 and 6 months of age were reported to be significantly higher body weight than that of females. The overall body weights for males averaged 7.29±0.04 kg and that of females as 6.83±0.05 kg at 3 months of age. The overall body weight at 6 months of age for male and female was 14.06±0.05 and 14.02±0.03 kg respectively. However, contrary to the above trends the overall weights of females (21.05±0.02 kg) were reported comparatively heavier than the males (20.54±0.06 kg). The heavier females at 12 months of age might be due to early sexual, physiological maturity resulting in pregnancies at comparatively early age.

Kuralkar *et al.* (2002) conducted study on kidding and growth pattern of kids and reported that the incidence of twins and triplets were highest in Jamunapari followed by Osmanabadi and Sirohi goats. The

twinning percentage was found to be higher in rainy (34%) followed by summer (28%) and winter (27%) season. The kids born as single were significantly heavier at birth than those born as twin and triplets. Though the effect was non-significant for body weight of 1 month to 6 months still the single birth were heavier than those of twins and triplets.

Ambhore *et al.* (2003) conducted study on Berari bucks, reported that highly ($P < 0.01$) significant difference between six and nine months of age with respect to live weight, heart girth and height at withers. Rest of the body measurements like body length, abdominal girth, ear length and distance between pin bones were observed to be non-significant, while the tail length and horn length observed to be significant ($P < 0.05$).

Jangam *et al.*(2003) conducted study on Berari goats and reported that the overall pooled body weights of male and female Berari goats at different age group were highly significant ($P < 0.01$) and averaged to 17.94 ± 0.29 (158 male) and 17.07 ± 0.26 (191 female), 25.38 ± 0.31 (146 male) and 23.72 ± 0.31 (141 female) and 32.95 ± 0.41 (107 male) and 28.58 ± 0.34 (157 female) kg for 3-6, 6-12 months and 1 year and above age group respectively. The overall body weights of Berari goats (pooled for sexes and districts) were 17.50 ± 0.20, 24.55 ± 0.22 and 3.77 ± 0.27 kg for 3-6, 6-12 months and 1 year and above age groups, respectively.

CHAPTER - III

MATERIAL AND METHODS

CHAPTER III

MATERIALS AND METHODS

3.1 SOURCE OF DATA

The data on physical characteristics, body measurements and economic traits were collected from the actual observations of each animal maintained at the goat unit of Nagpur Veterinary College, Nagpur and goat unit of Rural Institute, Amravati. The analysis was carried out at the Department of Animal Genetics and Breeding, PGIVAS, Akola. Thirty nine goats from goat unit of Nagpur Veterinary College, Nagpur and fourty goats from the goat unit of Diploma in Agriculture Science, Rural Institute, Amravati were taken as an experimental material. In all seventy nine goats were taken for physical characteristics and economic traits based on following traits.

3.2 PHYSICAL CHARACTERISTICS

The physical characteristics of the goat were observed and recorded with the help of questionnaire for each goat in Appendix-I.

3.2.1 Measurements of body characteristics

1. Colour : The colour of the goats were observed for black, red and brown colour and data was recorded.

2. Horns : The distance between base of horns to the tip of horns was measured in centimeters and observed shape and orientation of horns.

3. Ears: The distance between base of ear to end of ear was measured in centimeters and orientation of ear was also observed.

Plate 1 : Photo showing the flock of Osmanabadi goats indicating 100 per cent black colour

Plate 2 : Photo showing the measurment of horn length in Osmanabadi goat

Plate 3 : Photo showing the measurment of ear length in Osmanabadi goat

Plate 4 : Photo showing the measurment of body length in Osmanabadi goat

4. Eyes: Eyes of all the goats were critically observed for round and oval shape of the eyes and data was recorded.

5. Head: Head of all the goats were observed for forehead, wattles and beard and data was recorded.

6. Tail : The distance between base of tail to end of tail was measured in centimeters and type of tail also observed.

3.3 BODY MANAGEMENT

Simultaneously with physical characteristics, body measurement of each goat were taken. Each goat was controlled on the hard ground while taking the measurements in standing position. Measurements of following four parameters of each goat were carried out with measuring tape graduated in centimeters nearest to one centimeters as per Bhoite *et al.* (1994).

1. Body length (cm) X_1 : The distance between point of shoulder to point of hip was measured in centimeters.

2. Withers height (cm) X_2: Vertical distance between ground to point at withers in a straight line was measured in centimeters.

3. Heart-girth (cm) X_3: The circumference of the chest immediately behind the shoulder was measured in centimeters.

4. Paunch-girth (cm) X_4: Paunch girth was measured in centimeters a circumference in front of the sacrum so as to measure complete belly.

5. Body dimension score (cm) (BDS)X_5:

Combinations of four body measurements i.e. summation of X_1, X_2, X_3 and X_4 to obtain the complete score were calculated and considered as body dimension score in centimeters.

Plate 5 : Photo showing the measurment of height at wither in Osmanabadi goat

Plate 6 : Photo showing the measurment of heart girth in Osmanabadi goat

Plate 7 : Photo showing the measurment of paunch girth in

3.3 ECONOMIC TRAITS

1. Birth weight (kg)

Birth weights recorded at the time of birth and mentioned as per the kidding and growth resisters maintained at the farm office, for each goat.

2. Growth rate (kg)

The growth rate was recorded from the growth registers maintained at the farm office for each goat.

3. Twinning ability

It was recorded from the registers maintained at the farm office.

4. Mortality

It was recorded as per the data available at the farm.

3.4 STATISTICAL METHODS

a. Statistical Norms: The mean standard deviation and standard error were calculated by standard statistical procedure (Snedecor and Cochran, 1994).

b. X^2 (chi) square test: Testing of homogen city for various physical characteristics were tested by 2 x n and m x n contingency table as per Chandel (1995)

c. Growth rate : Growth rate of kids was calculated as per following formula.

$$\text{Growth rate} = \frac{W_2 - W_1}{W2} \times 100$$

Where, W_1- previous months weight

W2- weight after one month .

d. Effect of various factors on growth rate characteristics

The variance in body weight, weight gain and growth rate in Osmanabadi goat were analysed by analysis of variance technique by 3 way Factorial Unequal CRD with the help of following model.

$$Y_{ijKl} = \mu + A_i + F_j + P_k + (AF)_{ij} + (AP)_{ik} + (FP)_{jk} + (AFP)_{ijk} + e_{ijkl}$$

Where,

Y_{ijkl} – Observations of the individual in relation to various effects

μ - Population mean

A_i - Fixed effect of i^{th} age group (i = 1,2)

F_j - Fixed effect of j^{th} farm (j = 1,2)

P_k - Fixed effect of k^{th} period (k = 1,2,3,4)

$(AF)_{ij}$ - Interaction effect of i^{th} age with j^{th} farm

$(AP)_{ik}$ - Interaction effect of i^{th} age with k^{th} period

$(FP)_{jk}$ - Interaction effect of j^{th} farm with k^{th} period

$(AFP)_{ijk}$ - Interaction effect of i^{th} age in j^{th} farm in k^{th} period

eijkl - Random error with mean zero and variance e.

The skeleton of Analysis of variance table is presented below.

Source of variation	d.f.	S.S.	M.S.S.	F.Cal.
Age	A-1	SSA	SSA/A-1 = a	a/e
Farm	F-1	SSF	SSF/F-1=f	f/e
Period	P-1	SSP	SSP/P-1=p	p/e
Age x farm	(A-1) (F-1)	SS(AF)	SS(AF) / (A-1) (F-1) = af	af/e
Age x period	(A-1) (P-1)	SS (AP)	SS(AP) = ap (A-1) (P-1)	ap/e
Farm x period	(F-1) (P-1)	SS(FP)	SS(FP) (F-1) (P-1) = fp	fp/e
Age x farm x period	(A-1) (F-1) (P-1)	SS(AFP)	SS(AFP) (A-1) (F-1) (P-1) = afp	afp/e
Error	(N-1) (C-1)	SSE	SSE (N-1) (C-1) = e	
Total	n-1			

C = Combination

Critical difference

Critical difference for the three way unequal factorial completely randomized design was calculated by the following formula

$$CD = \sqrt{\frac{2\,MSE}{K}} \times t_{\alpha 0.05}$$

Where,

$$K = \frac{1}{N-1}\left(m - \frac{\Sigma mi^2}{m}\right)$$

N: Total no. of groups.
M: Total no. of records.

e. Estimation of correlation coefficient, standard error

Coefficient of correlation's between any two characters were calculated according to following formula (Snedecor and Cochran, 1994).

$$r_{xy} = \frac{\Sigma xy - \frac{(\Sigma x)\,.\,(\Sigma y)}{n}}{\sqrt{\left(\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right)\,.\,\left(\Sigma y^2 - \frac{(\Sigma y)^2}{n}\right)}}$$

Where,

r_{xy} = correlation coefficient between X and Y variables

n = number of observations per variable

Standard error (SE) values were estimated as per the formula

$$SE = \frac{1-r^2}{\sqrt{n}}$$

Where,

SE = Standard error

n = Number of total observations per variable

r = Correlation coefficients

f. Simple regression equation

Simple regression equation was used to predict the estimates of body weight (Y) from particular value of variable (x).

$$Y = a + bx$$

The constant `b' was termed as coefficient of regression and describe the rate of change of `y' per unit change of `x' while constant `a' was independent of `x' and might be influenced by other extraneous factors.

The coefficient of regression `b' was calculated by following formula .

$$b = \frac{\Sigma xy - \frac{(\Sigma x)(\Sigma y)}{N}}{\Sigma x^2 - \frac{(\Sigma x)^2}{N}}$$

Coefficient of determination indicated the extent of dependence of Y on selected independent variables of correlation (linear) and were determined as follows.

$$R^2 = \frac{b\left[\Sigma xy - \frac{(\Sigma x)(\Sigma y)}{N}\right]}{\Sigma y^2 - \frac{(\Sigma y)^2}{N}}$$

g. 't' value estimate

't' value was estimated by paired 't' test by following formula as per Snedecor and Cochran (1994)

$$t = \frac{\bar{D}}{S_{\bar{D}}}$$

Where,

$\bar{D}$ = Difference mean

$S_{\bar{D}}$ = Difference standard error

CHAPTER - IV

RESULTS AND DISCUSSION

CHAPTER IV

RESULTS AND DISCUSSION

4.1 PHYSICAL CHARACTERISTICS OF OSMANABADI GOAT

The details of physical characteristics of Osmanabadi goats of Nagpur Veterinary College, Nagpur (NVC, Nagpur) and Goat Unit of Rural Institute, Amravati as per questionnaire were recorded and the average per cent value and chi-square test were calculated and presented.

The colour pattern, horn length and orientation, ear length and orientation, eye shape, head, tail length and type of tail of Osmanabadi goats are presented in Table 1.

4.1.1 Colour

The coat colour of goat mostly found as black i.e. 100 per cent. The chi-square was applied and found non-significant indicating the similar coat colour in both centers. The present findings are in agreement with Banerjee (2002) as they reported black coat colour as 73 per cent in Osmanabadi goat. It is in agreement with Shettar and Rudresh (2003) as they reported that black colour constituted 55 per cent in Bidri goats, Reddy *et al.* (1991) reported that goats in rural areas of Andhra Pradesh having black colour. Ghef and Bhushan (1989) reported that local goats of Sikkim having black and brown colour.

Table 1: Different physical characteristics of Osmanabadi goat along with χ^2 value

Characteristics	No.	%	χ^2	Significance
Colour				
Black	79	100	0	N.S.
Red	0	0		
Brown	0	0		
Horn				
Shape				
Straight	61	98.39	0.78	N.S.
Curved	01	1.61		
Horn Orientation				
Upward	62	100	0	NS
Backward	0	0		
Downward	0	0		
Eyes				
Round	0	0	0	NS
Oval	79	100		
Ear Orientation				
Horizontal	0	0	0	NS
Pendulus	0	0		
Erect	0	0		
Dropping	79	100		
Head Forehead				
Convex	0	0	0	NS
Concave	0	0		
Straight	79	100		
Wattles				
Present	00	0	0	NS
Absent	79	100		
Beard				
Present	03	3.80	0.36	NS
Absent	76	96.20		
Tail Type				
Short	79	100	0	NS
Long	0	0		

NS – Non-significant

4.1.2 Horn

The shape of horns mostly found straight 98.39 per cent however, 1.61 per cent were observed curved. The horns are mainly upward 100 per cent in orientation. The chi-square was applied and found non-significant. The average length of horn of Osmanabadi goat is presented in Table 2 and

indicated as 5.11±0.32 and 5.8±0.29 cm for NVC farm and Amravati farm respectively with a pooled mean as 5.45±0.34 cm. The present findings are not in agreement with Shetter and Rudresh (2003) reported that 60.83 per cent Bidri goats having curved horns and 22.35 per cent straight.

The present findings are in agreement with the Jain *et al.*(2000) reported the horns of Kodi Adu goats having upward, backward, curve down or up sharply at the tip, however, the length of horn was shorter than reported by Jain *et al.* (2000) in Kodi Adu goats.

4.1.3 Ear

The ear of Osmanabadi goat were mostly found dropping 100 per cent (Table 1). The Chi-square was found to be non-significant. The average ear length for goats at the NVC, Nagpur was 6.19±0.091 and at Rural Institute, Amravati was 6.35±0.18 cm. The average length of ear in Osmanabadi goats were less than Bidri and Adu goats as reported by Shettar and Rudresh (2003) and Jain *et al.* (2000). Medium size ear of Osmanabadi goats may be considered as phenotypic character for this breed.

4.1.4 Eyes

The eyes of Osmanabadi goats were mostly found oval 100 per cent. The chi-square was applied and found non-significant.

4.1.5 Head

The forehead of all Osmanabadi goats were mostly found straight 100 per cent. The wattles were absent in both the sexes and the beard were mostly found absent (96.18%). However, 3.82 per cent observed present. These findings are in agreement with the findings of Shetter and Rudresh (2003) as they reported that Bidri goats with straight forehead was

98 per cent and wattles and beared were 5 per cent and 2 per cent respectively.

These findings are not in agreement with the findings of Mazumdar and Mazumdar (1983) reported that beard is present in both the sexes of Pashmina goats. Wattles are absent in case of Jamunapari goat reported by Bhat (1988). Thiruvenkadan *et al* (2000) reported that wattles are absent in case of Kanni Adu goats.

4.1.6 Tail

The tail of Osmanabadi goat mostly found short 100 per cent. The result were found non-significant. The average length of tail was 6.47±0.21 and presented in Table 2. The present findings are in agreement with the findings of Ghei and Bhushan (1989) as they reported that the tail is short in case of local goats of Sikkim. Bhat (1988[a]) reported that the tail is short and thin and the average tail length is 9 to 16.9 cm. Which is more than present findings. The tail of Jamunapari goat was short and average length was 10 to 21 cm reported by Bhat (1988[b]).

Table 2: Mean and standard error of physical characteristics of Osmanabadi goat at different farms

Traits	Units	Nagpur farm	Amravati farm	Pooled mean	't' value
Horn length	cm	5.11±0.32	5.8±0.29	5.45±0.34	2.38**
Ear length	cm	6.19±0.091	6.35±0.18	6.7±0.08	0.055^{NS}
Tail length	cm	6.69±0.089	6.26±0.16	6.47±0.21	2.68**

** - Significant at 1% level
NS – Non-significant

These findings are not in agreement with the findings of Shettar and Rudresh (2003) as they reported that 84 per cent of Bidri goat having medium tailed and remaining were short tailed.

4.2 BODY MEASUREMENTS

The average values for body length, height at withers, heart girth, paunch-girth and body dimension score for Osmanabadi goats were calculated and presented in Table 3.

Table 3: Mean and standard error of body measurements of Osmanabadi goats at different farms

Traits	Units	Notations	Nagpur farm	Amravati farm	Pooled mean	't' value
Body length	cm	X_1	45.90 ±0.89	50.83 ±0.81	48.11 ±2.21	3.92**
Height at wither	cm	X_2	67.65 ±2.04	72.77 ±1.04	70.21 ± 2.56	2.58**
Heart girth	cm	X_3	65.58 ±1.99	68.92 ±2.03	67.25 ±1.67	2.74**
Paunch girth	cm	X_4	75.42 ±1.66	77.41 ±0.98	76.41 ± 0.99	1.16^{NS}
Body dimension score	cm	X_5	254.5 ±6.49	271.81 ± 3.79	263.15 ± 8.65	0.46^{NS}

** - Significant at 1% level
NS – Non-significant

4.2.1 Body length (x_1)

It is observed from the Table 3 that the average body length of Osmanabadi goats was highest in Rural Institute, Amravati farm (50.83±0.81 cm) than NVC, Nagpur (45.90±0.89 cm) whereas overall average body length was reported 48.11±2.21 cm. The average body length found under study was lower than that reported by Acharya (1982) in Osmanabadi goat (male 69.5±1.93 cm and female 67.51±0.38 cm). It was also lower than that reported by Anonymous (1999) in Osmanabadi goats as they reported 64.14±0.01 cm for 12 months of age. Banait *et al.*(2002) reported in Osmanabadi goat were 46.37±0.193 cm. It was also lower than that reported by Bhoite *et al.*(1994) reported in Sangamneri goats, Varade *et al.* (1997) in local goats, Singh (2002) in kids at 6 months of age. Biswas *et al.* (1990) in Cheghu Pashmina goats.

4.2.2 Height at withers (x_2)

It is observed from the Table 3 that average withers height was more in goats of Rural Institute, Amravati (72.77±1.04 cm) than the NVC, Nagpur (67.65±2.04 cm). The average height at wither was 70.21±2.56 cm. The height at wither found under this study was more than that reported by Shettar and Rudresh (2003) in Bidri goats at the age of above 12 months and by Singh (1998) in Black Bengal and their half breds.

The height at wither found under this study was lower than that reported by Acharya (1982) and Banait *et al.* (2002) in Osmanabadi goats, and Badi *et al.* (2002) in Eritrean goats. The variation for withers height of present study with that of the findings of author discussed above may be due

to variation in age at the time of measurement, agro-climatic conditions of the farms and the adaptations of the particular breeds for the native areas.

The goats were classified into 3 categories according to height as large (over 65 cm), small (51-65 cm) and dwarf (under 50 cm) ( ). The Osmanabadi goats found to be large in present finding which is also supported by Banerjee (2002).

4.2.3 Heart girth (x_3)

It is observed from the Table 3 that average heart girth in goats was more in Rural Institute, Amravati (68.92±2.03 cm) than the NVC, Nagpur (65.58±1.99 cm). The average heart girth was 67.25±1.67 cm. The recorded heart girth under study was more than Singh *et al.*(1979) in Black Bengal goats and Singh (1998) in Black Bengal and their half breds.

The recorded heart girth under study was lower than the heart girth reported by Acharya (1982) and Banait *et al.* (2002) in Osmanabadi goats. Similarly the findings of Mukherjee *et al.* (1979) in Grey and Black Bengal goats, Bhoite *et al.* (1994) in Sangamneri goats, Badi *et al.* (2002) in Eritrean goat, Singh (2002) in Black Bengal and its half breds with Beetal and Jamunapari, Biswas *et al.* (1990) in Cheghu Pashmina goat and Varade *et al.* (1997) in local goats also reported higher values of heart girth than the present findings. The differences in the heart girth with other breeds justified the breed variation however according to Acharya (1982) and Banait (2002) for the Osmanabadi breed might be due to the variation in age group, between the flocks.

4.2.4 Paunch girth (x_4)

It is observed from the Table 3 that average paunch girth in goats was more in Rural Institute, Amravati (77.41±0.98 cm) than NVC, Nagpur (75.42±1.66 cm). The average paunch girth was 76.41±0.99 cm. The recorded paunch girth under study was more than reported by Singh (1998) in Black Bengal and its half breds. The paunch girth measured under this study was in agreement with Banait *et al.* (2002) in Osmanabadi goats.

Paunch girth was lower than reported by Singh (2002) in Black Bengal and its half breds with Beetal and Jamunapari. Singh *et al.* (1979[a]) in Black Bengal goats and Singh *et al.*(1979[b]) in Jamunapari and Barbari goats.

4.2.5 Body dimension score (x_5)

Body dimension scores were estimated as sum of body length, height at wither, heart girth and paunch girth.

It is observed from the Table 3 that average body dimension score of Osmanabadi goats at Rural Institute, Amravati was more (271.81±3.79 cm) than at NVC, Nagpur (254.5±6.49 cm). The average body dimension score was 263.15±8.65 cm.

The present findings found to be lower than recorded by Banait *et al.*(2002) in Osmanabadi goat at Shivaji Estate Livestock Farm, Nagpur. These differences might be due to the variation in age of the goats.

4.3 ECONOMIC TRAITS

The average values for birth weight, growth rate and twinning ability in per cent were calculated.

4.3.1. Birth weight

The data on birth weights of the kids was available at Rural Institute Amravati farm only. The average birth weight of Osmanabadi kids at Rural Institute, Amravati was found to be 1.825±0.037 kg with a standard deviation of 0.10. The coefficient of variation as 5.86 per cent indicate the low variability of birth weight in Osmanabadi goats.

The findings under study were higher than those reported by Mukundan *et al.* (1981) in Malbari goats and its half breds Mishra and Ghei (1990) in Sikkim local goats and Husain *et al.* (1996) in Black Bengal goats.

The findings under study were lower than reported by the Banait *et al.* (2002) in Osmanabadi goats, Kuralkar *et al.* (1994) in Osmanabadi goat, Singh *et al.*(1977) in pure and cross bred kids, Mittal (1979) in Barbari and Jamunapari kids, Mishra *et al.* (1980) in Sirohi goat and Koul and Biswas (1987) in Pashmina goat.

4.3.2 Growth rate

The body weights of the kids were recorded in kg from 2 age groups as Age 1 and Age 2 i.e. below 2 months of age and above 2 months of age respectively, for F_1 and F_2 as Goat Farm, Rural Institute,Amravati and Goat Unit, Nagpur Veterinary College, Nagpur. Then the body weights of each kids were recorded at an interval of one month for consequent four months as P_1, P_2, P_3 and P_4. The body weights, gain in weights and growth rates were calculated and presented.

4.3.2.1 Body weight

The age, farm and period wise mean and SE of the body weights of Osmanabadi goats were calculated and presented in Table 4.

Table 4: Age, farm and periodwise mean and SE of body weight in Osmanabadi kids

Age	Farm	Period (kg)				Pooled for farm wise period	Pooled for farms	Pooled for age
		P_1	P_2	P_3	P_4			
Age 1	F_1	3.58± 0.096	4.93± 0.10	6.35± 0.23	8.00± 0.25	5.71± 0.94	F_1 = 6.28± 0.67	5.81± 0.66
	F_2	3.57± 0.14	5.07± 0.18	6.79± 0.16	8.5± 0.23	5.98± 1.06		
Age 2	F_1	4.85± 0.09	6.34± 0.16	7.82 ±0.13	9.30± 0.21	7.07± 0.95	F_2 =6.86± 0.76	7.37±0.66
	F_2	5.26± 0.35	7.00± 0.54	8.52± 0.56	10.17± 0.62	7.73± 1.04		
Pooled for period		4.23± 0.43	4.72 ±0.50	7.24± 0.49	8.86± 0.47	GM = 6.56±0.47		

The mean for age below 2 months were found to be 5.81±0.66 kg and above 2 months of age were 7.37±0.66 kg with a pooled mean as 6.86±0.76 kg and 6.28±0.67 kg for Rural Institute, Amravati and NVC, Nagpur farm respectively. The body weights of the kids at monthly interval were taken and mean body weights of subsequent periods were found to be 4.23±0.43, 4.72±0.50, 7.24±0.49 and 8.86±0.47 respectively for P_1, P_2,P_3 and P_4 periods. The variation in body weight due to the age, farm and period was analyzed and the analysis of variance is presented in Table 5.

Table 5: Analysis of variance for body weight in Osmanabadi kids

Source of variation	d.f.	S.S.	M.S.S	F.cal.	CD
Age	1	47.89	47.89	266.05**	0.21
Farm	1	6.37	6.37	35.38**	0.02
Period	3	237.07	79.02	439.00**	0.048
Age x Farm	1	0.00	0	0^{NS}	
Age x Period	3	0.12	0.04	0.22^{NS}	
Farm x period	3	14.68	4.89	27.16**	0.11
Age x farm x period	3	0.00	0	0^{NS}	
Error	63	11.56	0.18		

**- Significant at 1% level, NS – Non-significant

It is observed from Table that the variation in body weight due to age, farm and period were found to be statistically significant. However, the interaction between farm and age, period and age were non-significant. The interaction between farm and period was found to be statistically significant. The critical differences for the significant source of variation were calculated and the mean body weights are compared in Table 6.

Table 6: Mean comparison for body weight in Osmanabadi kids

Groups		Body weight (kg)				C.D.
Age		Age 1		Age 2		0.21
		5.81		7.37		
Farm		F_1		F_2		0.02
		6.28		6.86		
Period		P_1	P_2	P_3	P_4	0.048
		4.23	4.72	7.24	8.86	
Farm x period	F_1	4.1	5.52	6.9	8.54	0.11
	F_2	4.4	6.03	7.65	9.33	

It is observed from the table that the body weight in both the farms and pooled body weight for the different period were presented in Fig. 1. The body weight of below 2 months of age were significantly lower than above 2 months of age (Fig.2). Similarly, the mean body weight of goat at Rural Institute, Amravati found to be significantly more than goats at NVC, Nagpur irrespective age groups (Fig.3). The critical difference for the period indicate that the body weight in Osmanabadi goats increased in linear fashion irrespective of the age and farm. The critical differences for the interaction between farm and period were also found to be significant and the variation in

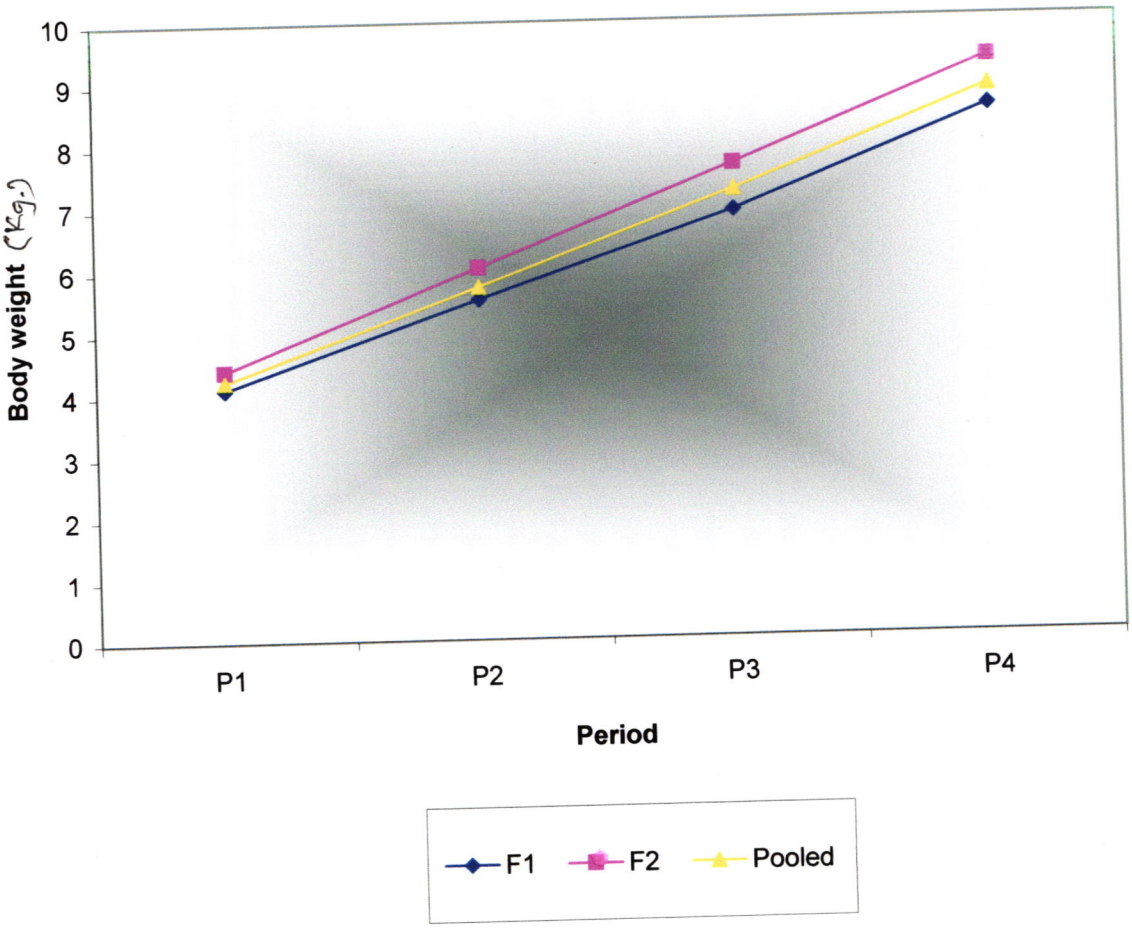

Fig.1: Graph showing body weight in different periods and farm in Osmanabadi kids

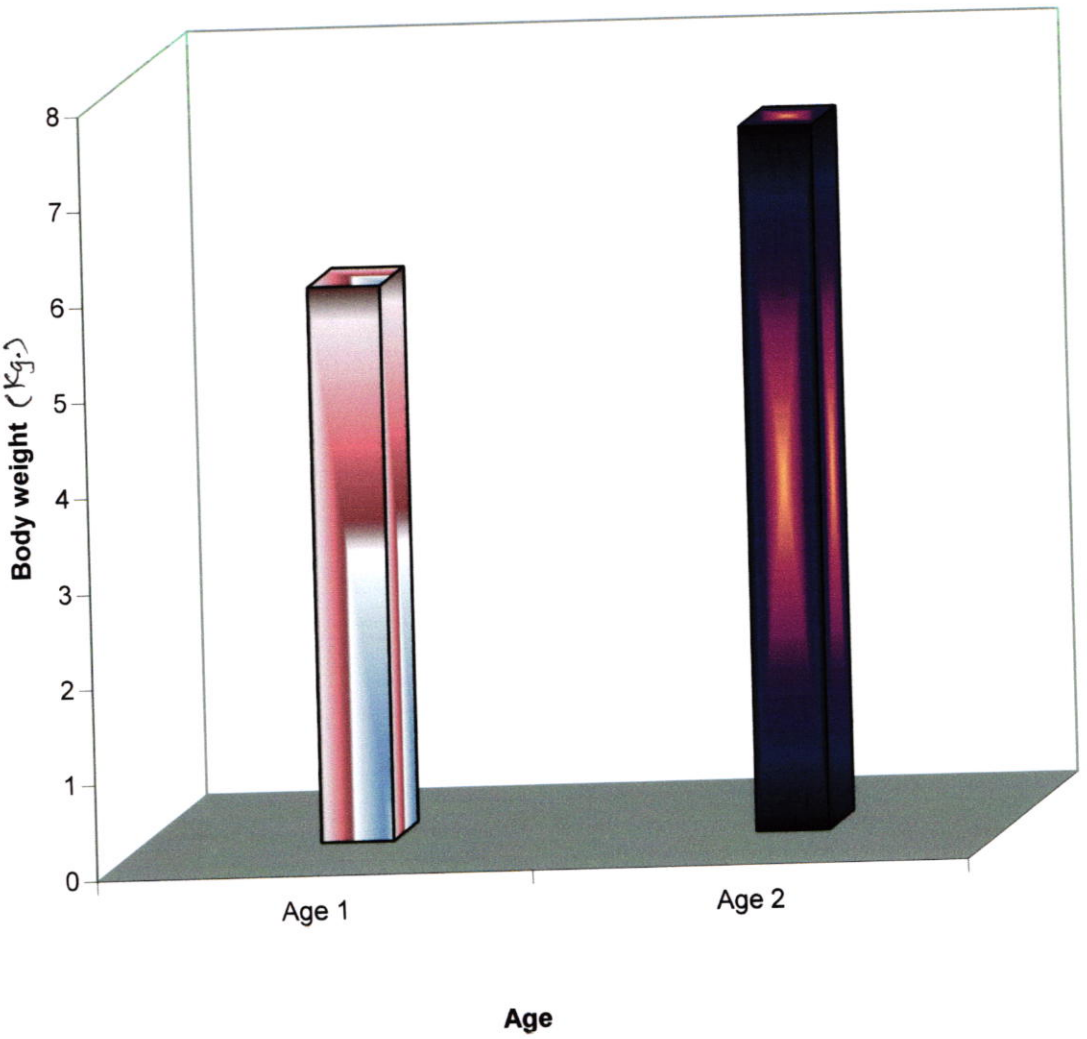

Fig.2: Graph showing body weight in different age groups of Osmanabadi kids

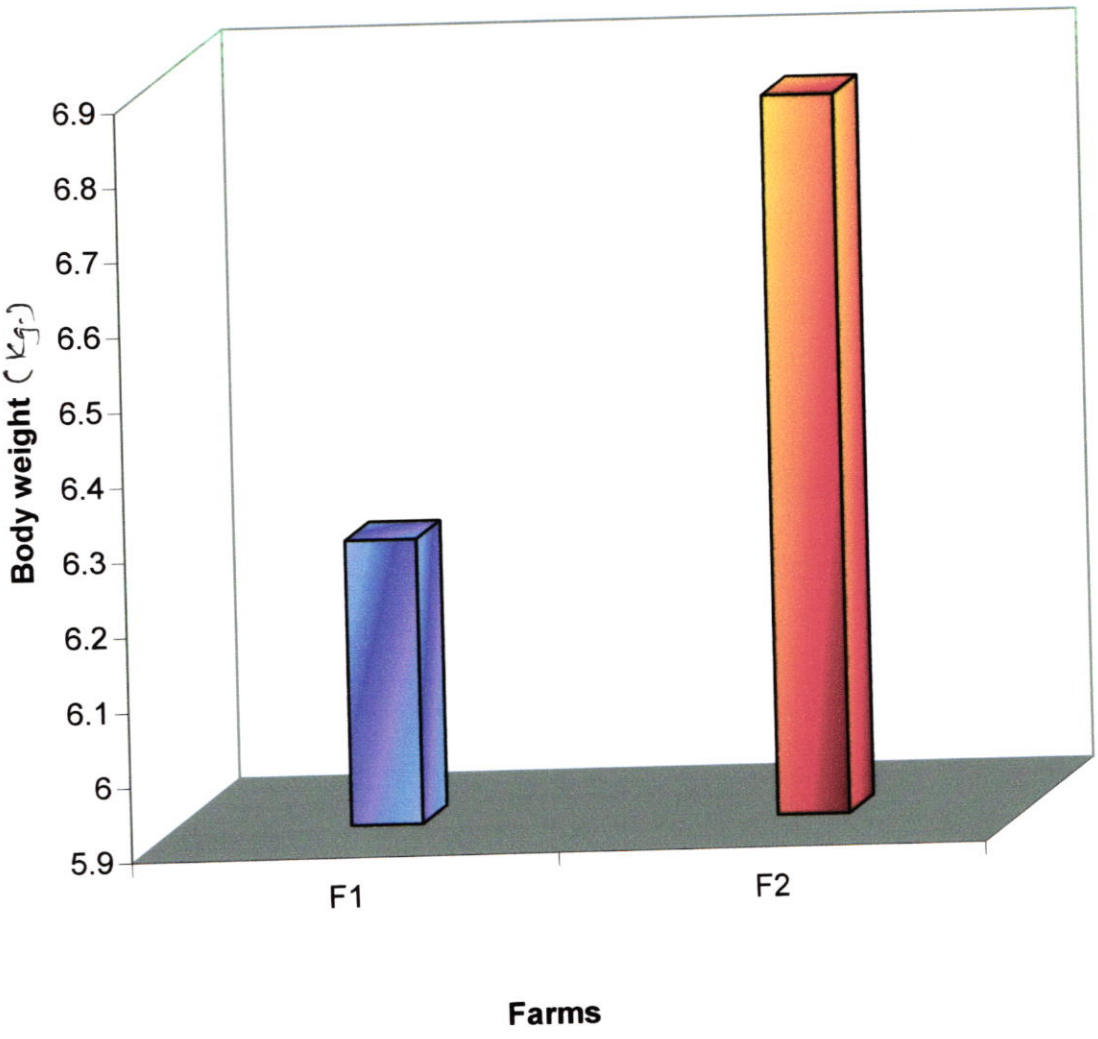

Fig.3: Graph showing body weight in different farms of Osmanabadi kids

body weights in both the farms between the period was statistically significant.

The findings of body weights in the present study are in agreement with the findings of Darokhan and Tomar (1983), Khan and Sahni (1983), Bhoite *et al.* (1994), Deb *et al.* (1998) and Jamgam *et al.* (2003). The variation in body weights may be attributed to the variation in breed, location and managemental conditions.

4.3.2.2 Monthly gain in weight in Osmanabadi kids

The difference between the two consequent body weights at a monthly interval were calculated and considered as monthly gain in weight of the Osmanabadi goats. The average monthly gain in weight according to age, farm and different periods were calculated and presented in Table 7.

Table 7: Age, farm and period wise average monthly gain in weight (kg) in Osmanabadi kids

Age	Farm	Periods			Pooled for farm wise period	Pooled for farms	Pooled for age
		P_1	P_2	P_3			
Age 1	F_1	1.35± 0.12	1.44± 0.15	1.62± 0.13	1.47± 0.07	F_1=1.47 ± 0.03	1.55± 0.05
	F_2	1.5± 0.07	1.71± 0.09	1.70± 0.08	1.63± 0.06		
Age 2	F_1	1.49± 0.13	1.48± 0.09	1.48± 0.10	1.48± 0.003	F_2 =1.63 ± 0.03	1.55± 0.04
	F_2	1.71± 0.23	1.52± 0.02	1.65± 0.06	1.62± 0.05		
Pooled for period		1.51± 0.07	1.53± 0.05	1.61± 0.04	GM = 1.55±0.04		

The overall monthly gain in weight of Osmanabadi goats were found to be 1.55±0.04 kg. The monthly gain in body weights in both the age

groups were found to be similar i.e. 1.55±0.05 and 1.55±0.04 kg respectively in age 1 and age 2. However, the monthly gain in weight in goats of NVC, Nagpur found to be lower (1.47±0.03 kg) than goats of Rural Institute, Amravati (1.63±0.03 kg). The monthly gain in weight in different periods ranged from 1.35±0.1 to 1.71±0.23 kg. The analysis of variance for the variation in monthly gain in weight were carried out and presented in Table 8.

Table 8: Analysis of variance for monthly gain in weight in Osmanabadi kids

Source of variation	d.f.	S.S.	M.S.S	F.cal.
Age	1	0	0	0^{NS}
Farm	1	0.36	0.36	5.8^{NS}
Period	2	0.15	0.075	1.2^{NS}
Age x Farm	1	0	0	0^{NS}
Age x Period	2	0.22	0.11	1.7^{NS}
Farm x period	2	0.02	0.01	0.16^{NS}
Age x farm x period	2	0.07	0.035	0.5^{NS}
Error	67	4.26	0.062	

NS- Non-significant

It is observed from the table that the analysis of variance in monthly gain in weight due to age, farm, period and their all possible interaction were found to be non-significant. This indicate that although there was a variation in body weight in Osmanabadi goat but monthly gain in weight was found to be non-significantly affected by the non-genetic factors like age, farm and period. It was also suggested that the monthly gain in weight in Osmanabadi kids was found to be uniform irrespective of age, farm and period.

This uniform gain in weight indicate the better adaptability of the kids as a physiological parameters.

Thse findings are in agreement with the findings of Sarma *et al.* (1981) and Mishra and Ghei (1990) as they reported a monthly gain in weight ranged from 1.2 to 1.85 kg in local goats.

4.3.2.3 Growth rate (%)

The age, farm and period wise growth rate were calculated and expressed in percentage. The mean growth rate per cent were calculated and presented in Table 9.

Table 9: Age, farm and period wise average growth rate (%) alongwith SE in Osmanabadi kids

Age	Farm	Periods			Pooled for farm wise period	Pooled for farms	Pooled for age
		P_1	P_2	P_3			
Age 1	F_1	27.20± 2.15	22.2± 1.80	20.26± 1.58	23.22 ± 2.06	F_1 = 21.31 ± 1.58	24.09± 1.58
	F_2	29.56± 1.06	25.32± 1.51	20.05± 0.56	24.9± 2.75		
Age 2	F_1	23.38± 1.63	18.94 ±1.24	15.9± 0.73	19.40± 2.17	F_2 =22.24 ±2.03	19.45± 1.44
	F_2	24.18± 1.99	18.06 ±0.88	16.27 ±0.38	19.50± 2.39		
Pooled for period		26.08± 1.42	21.13± 1.65	18.12± 1.17	GM = 21.77±1.37		

The overall growth rate per cent in Osmanabadi goats were found to be 21.77±1.37 per cent whereas for age below 2 months and for the above 2 months of the age were 24.09±1.58, 19.45±1.44 per cent respectively. The mean growth rate for period 1 (P_1), period 2 (P_2) and period 3 (P_3) were found to be 26.08±1.42, 21.13±1.65 and 18.12±1.17 per cent respectively

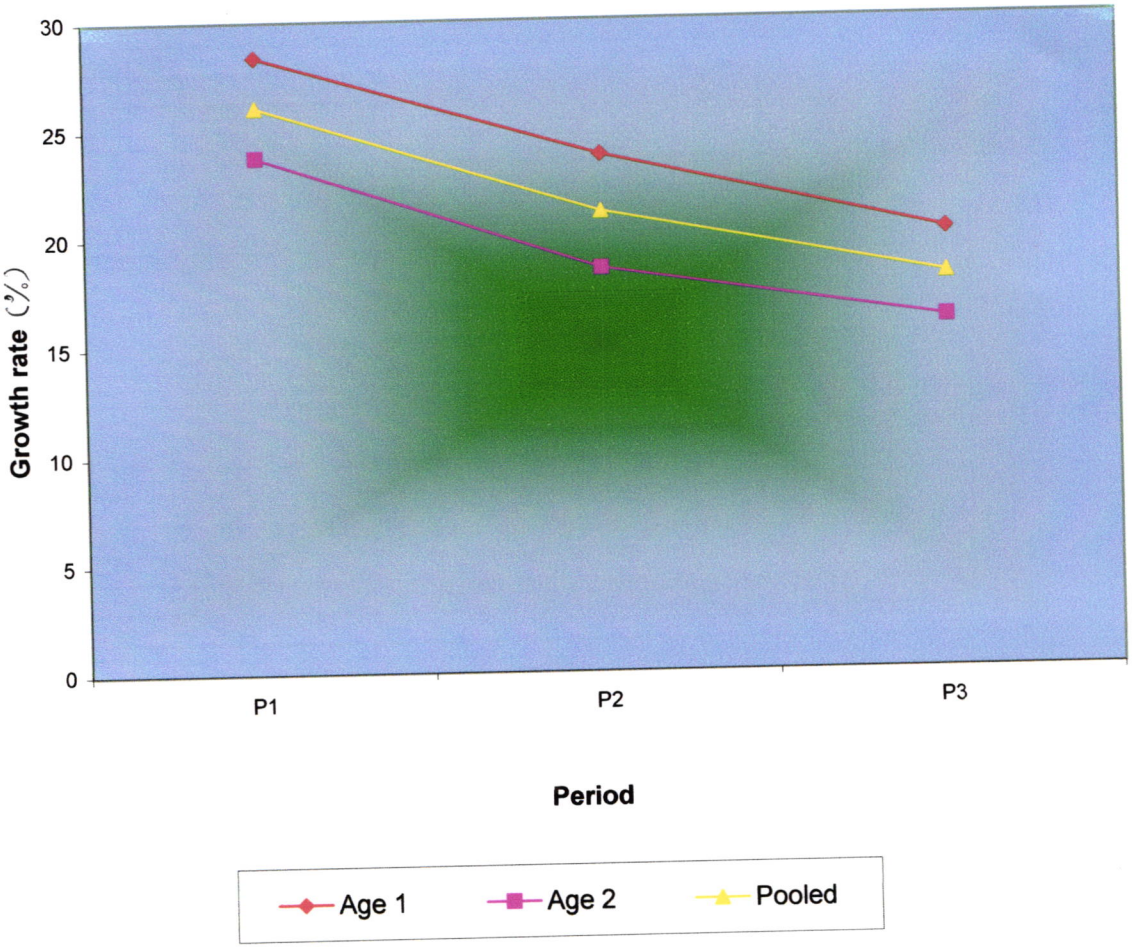

Fig.4: Graph showing growth rate (%) in different periods and age in Osmanabadi kids

(Fig.4). Whereas, it was observed that the goats at Rural Institute, Amravati (22.24±2.03%) was found to be comparatively better than goats at NVC, Nagpur (21.31±1.58%). The analysis of variance for the growth rate per cent due to various factors like age, farm, period and their interaction were carried out after transforming the values in Arc sin and presented in Table 10.

Table 10: Analysis of variance for growth rate in Osmanabadi kids

Source of variation	d.f.	S.S.	M.S.S	F.cal.	CD
Age	1	138.66	138.66	31.44**	0.10
Farm	1	2.57	2.57	0.58^{NS}	
Period	2	295.06	147.53	33.45**	0.25
Age x Farm	1	8.86	8.86	2.01^{NS}	
Age x Period	2	0.62	0.31	0.07^{NS}	
Farm x period	2	2.5	1.25	0.28^{NS}	
Age x farm x period	2	6.1	3.05	0.69^{NS}	
Error	67	300.13	4.48		

** - Significant at 1% level
NS – Non-significant

It is observed from the Table that effect of age and period was found to be statistically significant on the growth rate per cent in Osmanabadi kids. However, the farm effect and the effect of all possible interaction between age, farm and period on the growth rate of Osmanabadi kids was found to be statistically non-significant. The critical difference were calculated and the means are compared in Table 11.

Table 11: Mean comparison of Arc sin value for growth rate (%) in Osmanabadi kids

Groups	Growth rate (%)			C.D.
Age	Age 1		Age 2	0.10
	29.08		26.03	
Period	P_1	P_2	P_3	0.25
	30.62	27.28	25.24	

It is observed that the growth rate found to be significant in early age (below 2 months of age) as compared to later age group (above 2 months of age), similarly the growth rate irrespective of the age group in period found to be statistically superior in P_1 followed by P_2 and lowest in P_3. These findings clearly indicate that as the growth rate in early age and period 1 was highest so the care and management during this period with respective to proper feeding and health should be taken to optimise the growth in Osmanabadi kids and the findings of the growth rate in Osmanabadi goats are in agreement with the findings of Chawla *et al.*(1984) in Beetal male goat, and Mishra and Ghei (1990) in local goats as they reported that growth rate varied significantly between the different intervals upto 6 months of age. However, the Prakash *et al.* (1986) reported the higher per cent of the growth rate in Barbari goats. The variation in growth rate of Osmanabadi goat suggested the proper management with the special reference to feeding and management.

4.3.3 Twinning ability

Kidding pattern in Osmanabadi goats at Rural Institute, Amravati were analysed with respect to single, twinning and triplets kidding pattern and the percentage along with the number of kids born are presented in Table 12.

Table 12: Kidding pattern in Osmanabadi goats

Kidding pattern	No.	%	No. of kids born	Contribution of kids in newflock (%)
Single	14	45.17	14	29.0
Twins	17	54.83	34	71.0
Triplets	0	0.00	0.00	0.00
Total	31	100.00	48	100.00

It is observed from the Table that the percentage of twinning in Osmanabadi goats found to be 54.83 per cent while single kidding was 45.17 per cent. The contribution of the kids in new flocks based on the twinning pattern also calculated and it was observed that 71 per cent of the kids contributed from the twin kidding whereas 29 per cent from single kidding. It is therefore, suggested that special managemental care should be taken to reduce the mortality in kidding.

The findings in the present study on twinning ability found to be comparatively more than reported by Kuralkar *et al.* (2002) and Koratkar *et al.* (1998[a]) in Osmanabadi goats as 29 per cent and 24 per cent respectively. However, Gaikwad (1999) have reported very low per cent of twinning i.e. 5.27 per cent in Osmanabadi goats. The variation in twinning ability reported by the workers might be due to the variation in the flock and also due to the smaller size.

4.3.4 Mortality

The yearwise data on mortality of both the farm were collected and per cent values were presented in Table 13 along with the χ^2 values.

Table 13: Yearwise per cent of mortality in different farms along with χ^2 value

Year	Nagpur		Amravati		Pooled for farms (%)	χ^2
	%	χ^2	%	χ^2		
2000	44.44	15.43^{NS}	30	19.16*	41.30	21.18*
2001	25.00		17.64		21.62	
2002	29.54		2.77		16.25	
2003	17.69		28.00		23.80	
Pooled for year	29.16± 5.64		19.60± 6.23		25.74± 5.42	

* Significant at 5% level
NS – Non-significant

It is observed from the Table that the mortality per cent in goats were low in goats of Rural Institute, Amravati than NVC, Nagpur farm. The mortality observed between the years found to be non-significantly varied at NVC, Nagpur while significantly varied between the year at Rural Institute, Amravati. These variation clearly indicate that managemental variation at Rural Institute, Amravati farm. It is therefore suggested that uniform care and management of new born kids should be taken.

The overall mortality of Osmanabadi goats found to be 25.74±5.42. These findings were lower than the findings reported by Mittal (1976) in Jamunapari kids (52.1%) and Barbari kids (35.1%)

4.3.5 Correlation coefficient

Correlation coefficient between body measurements viz., body length, height at wither, heart girth, pouch girth and body dimension score of Osmanabadi goats were calculated and presented in Table 14, 15 and 16 for NVC, Nagpur, Rural Institute, Amravati and Pooled data, respectively.

It is observed from the tables that the body measurements including body weight of the goats were positive and significantly ($P < 0.01$) correlated with each other at both the farm and pooled data.

The findings are in agreement with Singh *et al.* (1979), Mishra (1980), Mukherjee *et al.* (1981) and Singh (2002).

Table 14: Correlation coefficient of all body measurements (above diagonal) along with S.E. (below diagonal) in Osmanabadi goats of Nagpur farm

Traits	BL	HAW	HG	PG	BDS
BL	1	0.98**	0.96**	0.91**	0.98**
HAW	0.006	1	0.97**	0.94**	0.99**
HG	0.012	0.009	1	0.94**	0.99**
PG	0.027	0.018	0.018	1	0.96**
BDS	0.006	0.003	0.003	0.12	1

** - Significant at 1% level

Table 15: Correlation coefficient of all body measurements (above diagonal) along with S.E. (below diagonal) in Osmanabadi goats of Amravati farm

Traits	BL	HAW	HG	PG	BDS	Body weight
BL	1	0.70**	0.69**	0.73**	0.77**	0.79**
HAW	0.08	1	0.99**	0.95**	0.97**	0.89**
HG	0.08	0.03	1	0.95**	0.97**	0.90**
PG	0.07	0.01	0.01	1	0.97	0.88**
BDS	0.06	0.009	0.009	0.009	1	0.92**
Body wt.	0.05	0.03	0.03	0.03	0.02	1

** - Significant at 1% level

Table 16:Correlation coefficient between body measurements (above diagonal) along with SE (below diagonal) of pooled data in Osmanabadi goats.

Traits	BL	HAW	HG	PG	BDS	Body weight
BL	1	0.84**	0.83**	0.79**	0.87**	0.79**
HAW	0.03	1	0.98**	0.93**	0.98**	0.89**
HG	0.03	0.004	1	0.93**	0.98**	0.90**
PG	0.04	0.01	0.01	1	0.96**	0.88**
BDS	0.02	0.004	0.04	0.08	1	0.92**
Body wt.	0.05	0.03	0.03	0.03	0.02	1

** - Significant at 1% level

4.3.6 Simple regression equation

The simple regression of body weight on body length (BL), height at withers (HAW), heart girth (HG), paunch girth (PG) and a body dimension score (BDS) were 1.55, 1.53, 1.53, 1.65 and 0.44 cm respectively. The prediction equation were constructed and present in Table 17 along with R^2 values.

Table 17. Simple prediction equations along with their R^2 values

Traits	Prediction equations for Y = a + bx	R^2
Body length (x_1)	Y = -49.62+1.55 (x_1)	0.63
Height at withers (x_2)	Y = -15.20+1.53 (x_2)	0.78
Heart girth (x_3)	Y = -80.08+1.53 (x_3)	0.80
Paunch girth (x_4)	Y = -99.55+1.65 (x_4)	0.77
Body dimension score (x_5)	Y = -91.49+0.44 (x_5)	0.85

The prediction equation and the coefficient of determination (R^2) indicated that the body weight could be predicted from the body measurement with comparatively higher degree of reliability.

It is also indicated from the Table that body weight of Osmanabadi goat could be predicted from any of the body measurements (x_1 to x_5) from prediction equation given with at least 63 per cent reliability. However, the value of reliability found to be more with body dimension score i.e. 0.85. These findings of association at correlation of body weight with body measurements were also reported by Singh *et al.* (1979) and Bhattacharya *et al* (1987).

These prediction equation for predictions the body weight of Osmanabadi goats from any of the body measurement can be used in mass selection for body weights where weighing balance is not available as a selection tool.

The association and correlation of body weight with body measurements were also reported by Singh *et al.* (1979), Bhattacharya *et al.* (1984) and Varade *et al.* (1997).

CHAPTER - V

CONCLUSIONS

CHAPTER V

CONCLUSIONS

1. Osmanabadi goats were found to be large sized goats.
2. The coat colour of Osmanabadi goat was observed to be black.
3. The ear were found to be dropping with average length 6.23±0.04 cm.
4. In most of the Osmanabadi goat wattles and beard were absent.
5. Average of body length, height at wither, heart girth, paunch girth and body dimension score were 48.11±2.21, 70.21±2.56, 67.25±1.67, 76.41±0.99 and 263.15±8.65 cm respectively.
6. The birth weight was found to be 1.825±0.03 kg in Osmanabadi goat.
7. Twinning was 54.83 per cent in Osmanabadi goats.
8. There was positive and significant correlation between various body measurement traits.
9. Body weight of Osmanabadi goats can be predicted from any of the body measurements with higher reliability (R^2).
10. The physical characteristics and economic traits indicates that although Osmanabadi goats belongs to Marathwada region of Maharashtra but it performs well in Vidarbha climatic conditions indicating the adaptability to this region.

CHAPTER - VI

SUMMARY

CHAPTER VI

SUMMARY

Although Osmanabadi goat is breed of Marathwada region of Maharashtra State is also well distributed in Vidarbha region of Maharashtra State and hence to study the performance of Osmanabadi goat in Vidarbha region the present study was undertaken for physical characteristics and some of the economic traits of Osmanabadi goats in Vidarbha region. The physical characteristics viz., colour pattern, horn length and orientation, ear length and orientation, eye shape, head, tail length and type of tail were actually observed at the farm and the body measurements viz., body length, height at wither, heart girth, paunch girth of the goats maintained at Nagpur Veterinary College, Nagpur were actually measured using measuring tape and body dimension score was calculated for each goat.

Osmanabadi goats having black coat colour (100%). Whereas 98.39 per cent horns of Osmanabadi goats were found straight whereas 1.61 per cent observed curved. The orientation of horns were upward. The average length of horn were found to be 5.11±0.32 and 5.8±0.29 cm for NVC, Nagpur farm and Rural Institute, Amravati farm respectively with pooled mean were 5.45±0.34 cm. The average length of ear at NVC, Nagpur farm were 6.19±0.91 and 6.35±0.18 for Rural Institute, Amravati farm and mostly found dropping in orientation. The eyes were found to be oval in shape. The forehead was found to be straight and wattles were absent in both the sexes, 96.10 per cent Osmanabadi goats were found to be without beard whereas 3.80

per cent animal were found to be beard. The average length of tail was 6.47±0.21 and found short type.

The averaged body length, height at wither, heart girth, paunch girth and body dimension score for Rural Institute, Amravati and NVC, Nagpur farm were 50.83±0.81 and 45.90±0.89 cm, 72.77±1.04 and 67.65±2.04 cm, 68.92±2.03 and 65.58±1.99 cm, 77.41±0.98 and 75.42±1.66 cm and 271.81±3.79 and 254.5±6.49 cm respectively. Whereas overall body length, height at wither, heart girth, paunch girth and body dimension score were found 48.11±2.21, 70.21±2.56, 67.25±1.67, 76.41±0.99 and 263.15±8.65 cm respectively.

The average birth weight of Osmanabadi kids were found to be 1.825±0.03 kg. The mean for the body weight were 5.84±0.66 and 7.[illegible]±0.66 kg for below 2 months and above 2 months of age respectively with a pooled mean 6.80±0.76 kg and 6.[illegible]±0.67 kg for Rural Institute Amravati and NVC, Nagpur farm, respectively. Mean body weights of subsequent periods were found to be 4.[illegible]±0.43,, [illegible]±0.50, 7.[illegible]±0.49 and 8.[illegible]±0.47 respectively for P_1,P_2, P_3 and P_4 periods. The interaction between farm and period found to be statistically significant. The overall gain in weight were 1.55±0.04 kg, gain in weight in both the age groups were found to be similar i.e. 1.55±0.05 and 1.55±0.04 kg respectively for below 2 months and above 2 months of age. The mean gain in weight at Rural Institute, Amravati farm were found to be 1.63±0.03 kg and for NVC, Nagpur farm were 1.47±0.03 kg. The range of monthly gain in weight in different periods were 1.35±0.1 to 1.71±0.23 kg.

The overall growth rate of Osmanabadi kids was found to be 21.73±1.37 per cent whereas 24.09±1.58 and 19.45±1.44 per cent for below 2 months and above 2 months of age respectively. The mean growth rate for P_1, P_2 and P_3 periods were found to be 26.08±1.42, 21.13±1.65 and 18.12±1.77 per cent respectively. Whereas growth rate for Rural Institute, Amravati farm and NVC, Nagpur farm were 22.24±2.03 and 21.31±1.58 per cent respectively. Age and period were found to be statistically significant on growth rate in Osmanbadi kids. The twinning ability for Osmanabadi goat were found to be 54.83 per cent whereas for single were found 45.17 per cent. The overall mortality were found to be 25.74±5.42 per cent. The mortality observed between the years found to be non-significant.

The correlation coefficient of all the body measurements were positive and significant in both the farms. The simple regression equation were constructed for prediction of body weight from body length (x_1), height at wither (x_2), heart girth (x_3), paunch girth (x_4) and body dimension score (x_5) in Osmanabadi goats as

$Y = -49.62 + 1.55\ (x_1)$,

$Y = -15.20 + 1.53\ (x_2)$, $Y = -80.08 + 1.53\ (x_3)$,

$Y = -99.55 + 1.65\ (x_4)$ and $Y = -91.49 + 0.44\ (x_5)$ respectively.

The coefficient of determination (R^2 values) indicated that the body weight could be predicted from body measurements with higher degree of reliability.

The physical characteristics and economic traits indicate that although Osmanabadi goats belongs to Marathwada region of Maharashtra State but it performs well in Vidarbha climatic conditions indicating the adaptability to this region.

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APPENDICES

APPENDIX – I

Name of the Institute : Nagpur Veterinary College, Nagpur / Rural Institute, Amravati

Goat No. : Dam : _____ / Sire : _____

Date of Birth : _____

Sex : _____

PHYSICAL CHARACTERISTICS:

1. Colour : Black / Red/ Brown .....
2. Horns : .....
   a. Length (cm): .....
   b. Shape (straight / Curved): .....
   c. Orientation (upward / backward/ downward): .....
3. Ears : .....
   a. Length (cm): .....
   b. Orientation (Horizontal / Pendulus / Erect/Dropping) : .....
4. Eyes (Round / Oval) .....
5. Head: .....
   a. Forehead (Convex / Concave/ Straight): .....
   b. Wattles (Present / Absent): .....
   c. Beard (Present / Absent): .....
6. Tail : .....
   a. Length (cm):
   b. Type (short / long):

BODY MEASUREMENTS:

	Male	Female
I. Body measurements		
a. Body length (cm)	.....	.....
b. Height at wither (cm)	.....	.....
c. Heart girth (cm)	.....	.....
d. Paunch girth (cm)	.....	
e. Body dimension score (cm)	.....	

Economic traits:

1. Birth weight : _____
2. Growth rate : _____
3. Twinning ability : _____
4. Mortality : _____

VITA

VITA

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THESIS ABSTRACT

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ABSTRACT

The present study for physical characteristics and some of the economic traits of Osmanabadi goats in Vidarbha region was carried out at the Department of Animal Genetics and Breeding, PGIVAS,

Akola. The information on body confirmation traits were taken from Nagpur Veterinary College, Nagpur and Rural Institute Amravati.

The coat colour of Osmanabadi goats were found to be black. The shape of horns mostly found straight 98.57 per cent. The orientation of horns were mainly upward. The average length of horn were found to be 5.45±0.34 cm. The average length of ear were found to be 6.23±0.04 and mostly found dropping in orientation. The eyes were oval in shape, the forehead was straight whereas wattles were absent, 96.18 per cent animal were without beard, while 3.82 per cent animal leaving beard and the tail was short (6.47±0.21 cm).

The overall body length, height at withers, heart girth, paunch girth and body dimension score were 48.11±2.21, 70.21±2.56, 67.25±1.67, 76.41±0.99 and 263.15±8.65 cm respectively.

The average birth weight of Osmanabadi goats were observed to be 1.825±0.03 kg. The mean for the body weight was 5.84±0.66, 7.40±0.66 kg, respectively for below 2 month of age (Age 1) and above 2 months of age (Age 2) respectively. Mean body weight of subsequent periods were found to be 4.31±0.43, 5.83±0.50, 7.37±0.49 and 8.9±0.47, respectively for at monthly interval as P_1, P_2, P_3 and P_4 periods. The overall gain in weight was found to be 1.55±0.04 kg. Gain in weight in both the age groups were found to be similar i.e. 1.55±0.05 and 1.55±0.04 kg respectively in Age 1 and Age 2.

The overall growth rate of Osmanabadi kids were found to be 21.75±1.37 per cent whereas 24.09±1.58 and 19.45±1.44 per cent for age below 2 months and above 2 months respectively. The mean growth rate for P_1,P_2 and P_3 periods were found to be 26.08±1.42, 21.13±1.65 and 18.12±1.77 per cent respectively. The percentage of twinning were found to be 54.83 per cent while for single were found 45.17 per cent. The overall mortality were found to be 25.74±5.42 per cent

The correlation coefficient of all the body measurements were positive and significant. The simple regression equation constructed were high reliable for prediction of body weight from any of the body measurements as the coefficient of determination (R^2) values were found to be high.

The physical characteristics and economic traits indicate that although Osmanabadi goats belongs to Marathwada region of Maharashtra State but it performs well in Vidarbha climatic conditions indicating the adaptability to this region.