The Journal of Animal & Plant Sciences, 23(3): 2013, Page: 692-698
ISSN: 1018-7081

ENVIRONMENTAL EFFECTS ON GROWTH TRAITS OF TEDDY GOATS

Z. H. Kuthu, K. Javed*. M. E. Babar*, Abdul Sattar** and M. Abdullah*

Department of Animal Husbandry, Azad Kashmir, Pakistan, *Department of Livestock Production, **Department of Theriogenology, University of Veterinary and Animal Sciences, Lahore, Pakistan

ABSTRACT

Data on 18702 kidding, performance and pedigree records of 5150 Teddy goats and progeny of 382 sires maintained as separate flocks at Livestock Experiment Stations: Rakh Ghulaman, District Bakkhar, Rakh Khariewala, District Layyahand and Chak Katora, District Bahawalpur, Punjab, Pakistan during the period 1972-2008 were utilized to study the phenotypic performance and environmental sources of variation on different growth traits. Statistical analyses were carried out by using mixed model procedure of the SAS statistical package program. The least squares means for birth weight (BWT), weaning weight (WWT), six month weight (6WT), nine month weight (9WT) and yearling weight (YWT) were 1.66±0.003, 9.59±0.01, 11.70±0.02, 16.69±0.02 and 21.03±0.03 kg, respectively. Least squares analysis revealed a significant (P<0.01) effect of year and season of birth, sex, flock and type of birth on BWT and WWT. The effect of flock, year and type of birth was significant (P<0.01) on 6WT, 9WT and YWT. Season of birth had a significant effect on YWT; however its effect on 6WT and 9WT was non-significant. The effect of BWT and WWT was significant (P<0.01) on 6WT and 9WT and YWT. A significant interaction (P<0.01) was noticed between sex and type of birth for birth weight and weaning weight, while the interaction was non-significant between season of birth and sex. The findings of this study revealed that improvement in growth traits is possible by minimizing the effect of environmental sources.

Key words: Teddy goats; growth traits; environmental effects.

INTRODUCTION

Pakistan is endowed with 25 recognized indigenous goat breeds (Hasnain, 1985).Teddy goat is one of the famous goat breeds of Pakistan. The home tract of Teddy goat is Punjab, but due to its small size, easy handling, docile nature, low input and better efficiency it has spread to different parts of the country, including Azad Kashmir and northern areas. It is a small size goat breed and some sporadic studies have shown that there exists a wider variation in different traits. Teddy goats are generally believed to have superiority over the other local breeds to thrive in harsh weather conditions in different environments, but they are still unable to cope with ever-rising demand of chevon made on them at commercial scale. This inadequacy could be due to little attention in the past for the improvement of these animals through selection.

Growth traits of economic importance related to the cost of production are birth, weaning and yearling weight, and efficiency of gains. Any program of breed improvement is based on maximum exploitation of genetic variation. However, the performance traits are also influenced by environment. Among these environmental factors climate and seasonal differences among different years affect the production of the whole flock, while sex, type of birth, age and weight affect the individual performance. Therefore, estimation of the magnitude of all such factors becomes very important for devising efficient and effective breeding plans for their improvement. The present investigation thus was planned to analyze the data on Teddy goats maintained at three different livestock experiment stations in Punjab, Pakistan.

MATERIALS AND METHODS

Data available on pedigree, breeding and performance records of Teddy goats (both male and female) kept at (I) Livestock Experiment Station Rakh Ghulaman, District: Bakkhar (1984-2008) (II) Livestock Experiment Station, Rakh Khariewala District: Layyah (1972-2008) and (III) Livestock Experiment Station Chak Katora, District: Bahawalpur (1974-2008) Pakistan were utilized in this study. The available recorded information pertaining to birth type, sex, birth weight, weaning weight, weight at six months, weight at nine months and yearling weight was used for estimating phenotypic parameters of different growth traits.

Hot and dry climate with a few scanty rains (average 352 mm per year) from July to September occur in the regions where these flocks are maintained. The temperature during summer days ranges from 32° C to 52°C, while mercury may dip to 0°C in winter, with temperature ranging from 0°C to 25°C. Selection of animals was mainly based on body conformation, breed characteristics and previous pedigree records (as per availability). Body size and growth characteristics were also given some emphasis during purchase of does. Farm produced bucks were mostly used for breeding, however time to time inception of some bucks and does was also carried out to minimize the inbreeding. Teaser bucks with

color bags were the main sources of heat detection in does. The does after being detected in heat by the teaser bucks were exposed for natural mating with the breeding bucks. It has been a general practice to select 5-7 bucks per year to be the parents of the next generation. Teddy being raised as a meat goat, therefore, the chevon production was the main priority in breeding plan.

Management and feeding practices at the experiment stations were almost identical and have been more or less the same since the introduction of Teddy goats. The adult animals were maintained in open enclosures throughout the year with sufficient area being covered to offer enough shade and shelter during the extremes of weather. Normal practice was to allow animals to graze for 7-9 hours daily on range except during harsh weather, wherein the animals were retained inside the sheds. In scarcity period animals were provided a concentrate mixture. The breeding females were also provided with concentrate mixture 45 days before breeding for flushing and 60 days after parturition at the rate of 250 to 500 grams per doe. Breeding bucks were also offered a concentrate mixture at the rate of 500-750 grams during breeding. The young kids were mostly kept indoors up to one month of age and remained with their dams to suckle freely from evening to morning of next day, when does were again taken out to graze. After one month of age the kids remained with their mothers for 24 hours up to weaning. The weaned kids were transferred to separate pens for rearing. The composition of feed varied according to the fodder crops available during the year. Green Jowar (*Andropogon sorghum*), Maize (*Zea mays*), Guara (*Cyamposispsor aliodes*), Moth (*Phaseolus aconitiflovis*) and Cow peas (*Vigna sinensis*) were fed during the months of May to October. During winter and spring Berseem and Lucern were major fodder crops for grazing. The concentrate mixture consisted of crushed gram (*Cicer arietium*), Barely (*Hordeum vulgare*), oats (*Avena sativa*), wheat bran and oilseed cakes (cottonseed, rapeseed). Lumps of common salt (Sodium Chloride) and mineral blocks were provided in mangers for free choice licking. The standard of feeding was reported to have been maintained, with little variations from time to time due to changes in management and shortage of concentrates and fodders during scarce periods. The animals were vaccinated against enterotoxaemia, foot and mouth disease, goat pox and pleuro-pneumonia. Drenching with anthelmentic drugs as a routine against internal parasites after every four months and dipping against external parasites was also carried out throughout the study period.

The data consisted of doe, service buck and kid identities, date of birth, weight at birth, monthly weight recordings. Derived variables included weight at weaning, weight at six and nine months and yearling weight. Obviously unacceptable records were eliminated. Initially 20455 breeding records of 5545 does sired by 406 bucks were available. Data on various performance traits were statistically analyzed to estimate magnitude of various environmental sources of variation on these traits. Prior to data analysis several edits were performed to remove the outliers. Edit criteria used for different growth traits were:1 kg ≥ birth weight ≤ 3.5 kg; 6 kg ≥ weaning weight ≤ 13 kg; 90 days ≥ weaning age ≤ 150 days.

The above given ranges were selected keeping in view the small size of Teddy goats and their ability of earlier maturation and kidding. Data with any recorded abnormality were also excluded from the analysis. For data entry and manipulation MS Excel spread sheets were used.

The traits under investigation were birth weight, weaning weight, weight at six and nine months and yearling weight. The data on above mentioned traits were statistically analyzed to estimate the magnitude of various environmental sources of variation (year and season of birth, type of birth (single, twin, triplets and quadruplet), age of dam (young, ≤ 24 months; mature, 25-42 months; old ≥ 42 months), weight of dam (light, 11-15 kg; medium, 16-20 kg; heavy, 21-26 kg) and weaning age (90-110 days; 111-130 days; 131-150 days) and birth weight (1.0-1.5 kg; 1.6-2.0 kg; and ≥ 2.1 kg), as appropriate, were considered as fixed effects. Weight of the dam was categorized into three groups Keeping in view the non-seasonal breeding behavior of the breed the year was divided into four seasons: Spring (February to March), Summer (April to August), Autumn (September to October) and Winter (November to January).

The mathematical model assumed was:

$$Y_{ij} = \mu + F_i + e_{ij}$$

Where,

Y_{ij} = measurement of particular trait

μ = population mean

F_i = the effect of all fixed effects with the restriction that $\sum Fi = 0$

e_{ij} = the random error associated with each observation.

Data were analyzed using the GLM procedure (General Linear Models) of the Statistical Analysis Systems (SAS, 2004).

RESULTS AND DISCUSSION

The unadjusted means±SD, least squares means±SE and coefficient of variation for different growth traits in Teddy kids in the present study are presented in Table 1.

Birth weight: The analysis of variance indicated a significant ($P<0.01$) effect of year of birth, season of birth, sex, flock and type of birth on birth weight in kids, whereas interactions birth type with sex and season ob birth were also significant, however, the effect of weight

and age of the dam categories (fixed effects) was non-significant on this trait (Table 2). Similar findings have been reported by Hyder *et al.* (2001) in Teddy goats; Ssewannyana *et al.* (2004) in Teso goat breed, Zhang *et al.* (2008) in Boer goat kids and Wenzhong *et al.* (2005) in Angora goats. The variation in birth weight during different years and locations reflected the level of management and other environmental conditions like temperature, humidity, availability of feed, rains in the area which naturally affects the fodder production. It is worthwhile to mention, that the level of management is bound to vary according to the ability of the farm manager, the system of crop husbandry, the methods and criteria of culling and his overall supervision at the farm, availability of farm resources and their mobilization (Javed *et al.*, 2000). The management of farms have been changed frequently, which has resulted in its effects on the performance traits, furthermore, the data have been collected from three different location at different time periods, which also has its own effect. The summer born kids were heavier compared to others, which can be attributed to the availability of ample quantity of good quality green fodder (Berseem and Lucerne) in spring for the pregnant does which were in last stage of pregnancy and were in need of more sources of energy and protein for the growing fetus. Furthermore, the ambient temperature during spring at all the three locations does not go beyond 25^{o}C, resulting in minimum stress due to weather on the pregnant dam as well as the growing fetus. In spring there is ample opportunity for pregnant does to graze for longer periods of time as temperatures are bearable for both animals as well as the shepherd, while in scorching heat of summer they both (animals as well as shepherds) prefer the cool environment of sheds. Kids born in autumn season were lighter in weight in this study, which can be attributed to the stress being exerted by the hot humid months of summer, when temperatures usually go beyond 50^{o}C and there is lot of stress on pregnant does and their growing fetuses inside. The birth weight also varied with sex and type of birth. Male kids were heavier (1.62±0.01 kg) as compared to female (1.54±0.01 kg) kids. Single born kids were heavier (1.77±0.01 kg) than multiple births, as they have got better opportunity, no competition for nourishment in the uterus of their dams as compared to multiple births. Analysis of data for birth weight revealed a highly significant effect of interaction of type of birth with sex, with male kids born as single being heavier (1.80±0.06 kg), while female kids born as quadruplets were lighter in weight (1.38±0.06 kg). Robinson *et al.* (1977) pointed out that, as the number of fetuses increases, the number of caruncles attached to each foetus decrease thus resulting in the reduction of feed supply to the foetus and hence the birth weight of those lambs decreases in

Table 1. Unadjusted and LSM and C.V% for growth traits in Teddy goats

Traits	No.	Un adjusted Mean ± S.D.	LS Mean ± S.E	C.V%
Birth weight (kg)	18701	1.72±0.32	1.66±0.003	19.23
Weaning weight (kg)	16354	9.19±1.52	9.59±0.01	15.83
Weight at six months (kg)	15673	11.66±1.78	11.70±0.02	15.29
Weight at nine months (kg)	14498	16.99±1.79	16.69±0.02	10.72
Yearling weight (kg)	7566	21.45±2.05	21.03±0.03	9.74

Kg= kilograms, SE= Standard Error, C.V = coefficient of variation

Table 2. Significance level and F values for different growth traits in Teddy goats.

SOV	DF	BWT	WWT	6WT	9WT	YWT
Year of birth	33	1.84**	6.97**	7.24**	7.27**	3.86**
Season of birth	3	4.93**	3.96**	5.7**	5.89**	1.18
Sex	1	28.83**	12.02**	33.07**	34.15**	673.03**
Flock	2	12.82**	7.26**	9.1**	9.82**	17.48**
Type of birth	3	659.35**	353.1**	5.59**	5.36**	7.34**
Weight of dam	2	1.27	0.78	-	-	-
Age of dam	2	0.61	1.95	-	-	-
Birth weight	2	-	476.18**	43.28**	43.99**	31.77**
Weaning weight	2	-	-	17611.8**	17502.9**	9108.28**
Age at weaning	2	-	26.97**	-	-	-
Season of birth*Sex	3	2.48	1.23	-	-	-
Sex*Type of birth	3	10.87**	10.47**	-	-	-
Season of birth*Type of birth	9	5.61**	1.41	-	-	-

SOV= Sources of variation; DF= Degrees of freedom; BWT= Birth weight; WWT= Weaning weight; 6WT= Weight at six months, 9WT= Weight at nine months; YWT= Yearling weight; * = significant ($P < 0.05$)' ** = significant ($P < 0.01$)

multiple births. The results of present study that birth weight was significantly (P<0.01) effected by type of birth were substantiated by the studies of Wenzhong *et al.* (2005) in Angora, Zeleke (2007) in Somali goats, Ali and Khan (2008) in Beetal, Zhang *et al.* (2008) in Boer goats and Singh *et al.* (2011) in Jamunapari in India. Gestation period has been reported to be longer (1-2 days) when a dam carries a male as compared to female foetus (Babar, 1994), which may be a possible cause of heavier birth weight in males as compared to their opposite sex, as male foetus spends more time in the dam's womb, hence more chances of production of heavier male kids. The findings of present studies that sex of the kid had a significant effect on the birth weight were supported by the findings of most of the studies by scientists in different parts of the world on different goat breeds. (Al-Shorepy *et al.* 2002; Ssewannyana *et al.* 2004; Wenzhong *et al.* 2005; Zeleke, 2007; Ali and Khan 2008; Thiruvenkadan *et al.* 2009) in Emirati, Teso, Angora, Somali, Beetal and Tellicherry goat breeds, respectively. In present study flock (location) also had a significant effect on the birth weight and kids born at Chak Katora were heavier (1.60±0.01) as compared to kids born in other two flocks. This may be attributed to the presence of green fodder availability in area during scarcity period as ample water is available for irrigation during dry periods at Chak Katora. The other possible reason may be better management of available resources. The age and weight of the dam had a non-significant effect on birth weight, which were supported by the findings of (Al-Shorepy *et al.* 2002; Hongping 2002; Hyder *et al.* 2002a; Bharathidhasan *et al.* 2009).

Weaning weight: The analysis of variance revealed a significant effect of year, season, sex, flock and type of birth on weaning weight, while effect of age of dam was non-significant. The findings of present study were in partial agreement with the findings of many researchers (Wenzhong *et al.* 2005; Ali and Khan 2008; Thiruvenkadan *et al.* 2009; Adenaike and Bemji 2011). Ali and Khan (2008), reported that season of birth had a non-significant effect on weaning weight, however effect of year of birth, sex, type of birth was significant (P<0.01) in Beetal goat breed in Pakistan. The findings of present study were in partial agreement with many scientists (Mavrogenis *et al.* 1984a, b; Das *et al.* 1994; Gerstmayr and Horst 1995; Hyder *et al.*, 2001; Zeleke, 2007; Thiruvenkadan *et al,*. 2009; Adenaike and Bemji, 2011). Hyder *et al.* (2001), in a study on Teddy goat kids, concluded that effect of year and season of birth and sex were significant but the effect of type of birth was non-significant. Thiruvenkadan *et al.* (2009) and Adenaike and Bemji (2011) documented a significant effect (P<0.01) of year, season, birth type, sex and age of dam on weaning weight. The difference in weaning weight during different years indicates variation in feeding and management practices. The influence of year on the trait is also indicative of change in weather during different years, like abundance of rains during some years and dry spell during some others. The abundance of rains would have naturally boosted the fodder production with lowering of temperatures to minimize the heat stress on new born kids. The mothering ability of a doe is also responsible for the weaning weight, while this also reflects on the inherent growth potential of the kid. Birth weight and age at weaning also had a significant effect on the trait. The kids having larger birth weight gained more body weight during pre-weaning period, while those lighter in weight at birth were lighter in weight at weaning. Age at weaning also had a significant effect on weaning weight, with kids getting less days to suckle were lighter in weight at weaning as compared to kids who were weaned at 120 days or more. The significant effect of season of birth on weaning weight in present study was supported by sixteen reports on different goat breed in different ecological regions. Shafiq and Sharif (1996), reported a significant effect of season of birth on weaning weight in Teddy goat kids in Pakistan. Weight and age of dam had a non-significant effect on the trait. The findings of present study that age of dam had a non-significant effect on weaning weight were also substantiated by the findings of Al-Shorepy *et al.* (2002) in Emirati, Bharathidhasan *et al.* (2009) in Barbari and Hyder *et al.* (2001) in Teddy goats. The interaction between sex and type of birth had a significant effect on weaning weight in this study. Male kids born as singles were heavier at weaning as compared to the others, while females born as quadruplets and triplets were lighter in weight when weaned, which is quite natural as triplets and quadruplets get lesser chances to suckle and hence lesser quantity of milk, necessary for growth.

Weight at six months: There are only a few studies pertaining to weight at six months in different goat breeds around the world; however the trait has been extensively studied in sheep. Analysis of variance revealed a significant (P<0.01) effect of year, season, sex, flock and type of birth on weight at six months in Teddy goats. The results of present study were in agreement with the findings of Rashidi *et al.* (2008) and Thiruvenkadan *et al.* (2009), who reported a significant effect of year, type of birth and sex on weight at six months in Markhoz and Tellicherry goat breeds, respectively. The results of present study were also in line with other workers (Horst *et al.*, 1993; Hermiz, 2001; Hermiz *et al.*, 2009) who reported a significant effect of year and season of birth on weight at six months in different goat breeds. The effect of year, type of birth and sex were significant (P<0.01) on weight at six months as reported by Das *et al.* (1994) in Blended goats. The analysis of variance revealed that male kids were heavier at six months of age (11.97±0.11 kg) as compared to the females. The effect of birth

weight and weaning weight taken as co-variables was also significant on weight at six months. In present study the kids having a weaning weight ranging from 12 to 13 kg, were heavier in weight at six months (14.44±0.04), while kids having a weaning weight ranging from 6 to 8 kg were lighter in weight (9.58±0.02 kg) at six months of age, which clearly shows that kids born heavier and having more weight at weaning are naturally growing quickly and gaining more weight as compared to those who are lighter in weight at birth and weaning. The trait seems to be under stronger influence of environment as has been the case with other growth traits, which suggests that by improving managmental factors better results can be achieved.

Weight at nine months: Weight at nine months in Teddy goats in present study was also influenced by all the factors affecting weight at six months. A significant effect (P<0.01) of year of birth, season of birth, sex, flock, type of birth on weight at nine months was found in the present study, while effect of birth weight and weaning weight (Co-variables) was also significant (P<0.01) on the trait. The results of present study were in partial agreement with the findings of many workers on different breeds of goats maintained at different locations and under different climatic conditions. Horst *et al.* (1993) reported a significant effect of year and season of birth on weight at nine months in Angora goats. Hermiz, (2001) also reported that year and season of birth had a pronounced effect on the trait in crossbred goats in Iraq. Singh *et al.* (2011), reported that season of birth, type of birth and sex of kid had a significant effect (P<0.05) on weight at nine months in Jamunapari goats. The results of present study were also in partial agreement with the findings of Hermiz, (2005) and Hermiz *et al.* (2009), in local Iraqi goats. The results of present study were also comparable with the findings of Rashidi *et al.* (2008) and Thiruvenkadan *et al.* (2009), who reported a significant effect of year of birth, type of birth and sex of kid on the trait in Markhoz and Tellicherry goat breeds, respectively. Male kids were heavier (11.97±0.11 kg) as compared to females (11.92±0.12 kg) at nine months of age, while kids born as single were heavier (11.99±0.12 kg) as compared to multiple births at nine months of age, while kids born as quadruplets were lighter in weight (11.93±0.12 kg). Male kids were heavier at birth as compared to females, so were the single born kids as compared to multiple births. This trend continued in the same way resulting in heavier male and single born kids at six and nine months of age. The effect of birth weight and weaning weight still remained influential on the trait as was reported in weight at six months, with the kids heavier at birth and weaning accumulated more weight at nine months of age. The trait seems to be under influence of environment and a better managmental regime will have positive consequences.

Yearling weight: Yearling weight in Teddy goats in present study was influenced by year of birth, sex of kid, flock, type of birth, the effect being significant (P<0.01), however, a non-significant effect of season of birth on the trait was observed in present study. Birth weight and weaning weightalso had a significant effect on the trait, which is indicative of the fact that kids heavier at birth and at weaning were heavier at six, nine and twelve months of age.The results of present study that effect of year was significant, while the effect of season was non-significant were substantiated by Shafiq and Sharif (1996) in Beetal goats in Pakistan and Wenzhong *et al.* (2005) in Angora goats. The results of present study were in partial agreement with the findings of Hyder *et al.* (2002b), who reported a significant effect of both year and season of birth on yearling weight in Teddy goats. Ali and Khan (2008) also concluded that year of birth, sex of kid, type of birth were the important sources of variation and had a significant effect (P<0.01) on yearling weight in Beetal goats.A non-significant effect of type of birth has been reported in three studies Shafiq and Sharif (1996) in Beetal and Teddy and Hyder *et al.* (2002b) in Teddy goats, while twelve other studies have pointed out a significant effect of type of birth on yearling weight in different goat breeds maintained at different locations in different regions of the world (Das *et al.* 1994; Yadav *et al.* 2003; Sawalha and Tabbaa 2004; Wenzhong *et al.* 2005; Rashidi *et al.* 2008; Thiruvenkadan *et al.* 2009; Singh *et al.* 2011). Sex of the animals has been reported to have a significant effect on yearling weight except the report of Oluka *et al.* (2004) who reported a non-significant effect of sex on yearling weight in Mubende goat breed. The difference of effect of different factors on yearling weight in goats may be attributed to breed differences or to the sampling size and criteria of data editing. Most of the studies on goats have problems of small samples and therefore generalization may be difficult.

Conclusion: In present study most of the growth traits were under influence of year, season, type of birth, sex of kid, flock, while effect of birth weight and weaning weight (where applicable), which points out that by minimizing the effects of environmental factors better performance can be attained. As environment cannot be totally taken out but effective measures like good management at the farm with better feeding regime, availability of green fodder during scarcity periods, provision of multivitamin and mineral supplements during the pregnancy and availability of ample water during the summer and dry period for the flock will result in better performance. The findings of present study on phenotypic performance and environmental effects on growth traits were supported by reports documented by many scientists and research workers, however findings not in accordance with present study may mainly be

attributed to the location of flocks and management practices being carried out, the availability of resources and their better utilization and the size of the data set being analyzed.

REFERENCES

Adenaike, A. S. and M. N. Bemji (2011). Effects of environmental factors on birth weights and weaning weights of West African dwarf goats under intensive and extensive management systems. Advances in Agri. Biotech., 12011:9-14

Ali, A. and M. S. Khan (2008). Environmental factors affecting growth and reproductive traits of Beetal goats in Pakistan. Ind J Anim Genet & Breed 271-2:26-37

Al-Shorepy, S, A., G. A. Alhadrami, and K. Abdulwahab (2002). Genetic and phenotypic parameters for early growth traits in Emirati goat. Small Rumin Res 453: 217-223 CAB Abst 20023141182

Babar, M. E. (1994). Genetic and phenotypic parameters of some performance characteristics of Lohi sheep PhD Thesis Univ of Agric Faisalabad Pakistan

Bharathidhasan, A., R, Narayanan, P. Gopu, A. Subramanian, R. Prabakaran, and R. Rajendran (2009). Effect of non genetic factors on birth weight weaning weight and pre weaning gain of Barbari goat. Tamilnadu J. Vet. Anim. Sci., 5 (3): 99-103

Das, S. M., J. E. O. Rege and M. Shibre (1994). Phenotypic and Genotypic Parameters Of Growth Traits of Blended Goats at Malya Tanzania In: Proceedings Of The First Biennial Conference of The African Small Ruminant Research Network UICC Kampala Uganda 5 – 9 December 1994 Pp 63–69

Gerstmayr, S. and P. Horst (1995). Estimates of performance traits in Turkish Angora goats Small Rumin Res 162: 141-157

Hasnain, H. U. (1985). Sheep and goats in Pakistan Fao Animal Production and Health Paper 56 FAO Rome

Hermiz, H. N., J. E. Alkass, A. A. Hobi and M. K. Asofi (2009). Genetic and phenotypic parameters of body weights in Iraqi local goat and their crosses with Damascus J Duhok Univ 121: 189-194.

Hermiz, H. N. (2001). Genetic evaluaion of Iraqi local goats and their crosses using some productive traits PhD Thesis University of Baghdad Iraq

Hermiz, H. N. (2005). Genetic evaluaion of Iraqi local goats and their crosses depending on their growth rates Iraqi J Agric Sci 366:181-189

Hongping, Z. (2002). Estimation of genetic parameters of Boer goat reproductive traitsSichuan Agricultural University Yaan Sichuan 652000 China103-107

Horst, P., A. V. Zarate, H. Gunes and C. Yalcin (1993). Growth rate and wool production of crossbred progeny from Turkish and North American Angora goats Anim Res Dev38: 92-99.

Hyder, A. U., P. Akhtar and K. Z. Gondal (2002a). Influence of some non-genetic factors on birth weight of Teddy goat kids Pak Vet J 22 3:116-119.

Hyder, A. U. Z. Ahmad and P. Akhtar (2002b). Factors affecting yearling weight in Pakistani Teddy goatsIn:Proc 7th World Cong Applied to Livest Prod 19-23 August Montpellier France0-4 CAB Abst 20033053259

Hyder, A. U., P. Akhtar and M. Abdullah (2001). Environmental factors influencing weaning weight in Teddy goat kids. The J Anim. Plant Sci., 114: 151-154

Javed, K., G. Mohiuddin and M. Abdullah (2000). Environmental factors affecting various productive traits in Sahiwal cattle. Pakistan Vety J., 20 (4): 187-192.

Mavrogenis, A. P., A. Constantinou and A. Louca (1984a). Environmental and genetic causes of variation in production traits of Damascus goats 1 Pre-weaning and post-weaning growth Goat productivity Anim Prod 381: 91-97 Anim Breed Abst 52: 1879 1984

Mavrogenis, A. P., A. Constantinou and A. Louca (1984b). Environmental and genetic causes of variation in production traits of Damascus goats 2 Goat productivity Anim Prod 381: 99-104 Anim Breed Abst 52: 1878 1984

Oluka, J., P. H. Peterson, G. H. Kiwuwa and F. B. Bareeba (2004). Population screening for selection of bucks and does of the Mubende goats in Uganda Uganda J Agric Sci 9: 543-548

Rashidi, A., M Sheikhahmadi, J. Rostamzadeh, J. N. B. Shrestha (2008). Genetic and Phenotypic parameter estimates of body weight at different ages and yearling fleece weight in Markhoz goats Asian-Aust J Anim 1396 Sci 2110:1395-1403

Robinson, J. J. I. Mcdonald and R. M. J. Crafts (1977). Studies on reproduction in prolific ewes 1 Growth of products of conception J of Agricultural Science Cambridge 88: 539 – 552

SAS (2004) Version 90 SAS Institute Inc Cary NC

Sawalha, R. M. A. and M. J. A. Tabbaa (2004). Genetic and some environmental factors affecting body weights and dimensions of growing Damascus kids in Jordan Dirasat Agri Sci 311:74-87 CAB Abst 20043033660

Shafiq, M. and M. Sharif (1996). Genetic evaluation of goats on productive traits by BLUP procedures.

17th Annual Report Livestock Production Research Institute Bahadurnagar Okara Pakistan

Singh, S. K., P. K. Rout and N. Shivasharanappa (2011). Genetic improvement of Barbari goats for meat and milk production Annual report 2010-11 Central Institute for Research on Goats Makhdoom Farah Mathura UP India: pp25

Ssewannyana, E., J. Oluka and J. K. Masaba (2004). Growth and performance of indigenous and crossbred goats Uganda J Agri Sci 9: 537-542

Thiruvenkadan, A. K., M. Murugan, K. Karunanithi, J. Muralidharan and K Chinnamani (2009). Genetic and non-genetic factors affecting body weight in Tellicherry goats South AfrJAnim Sci 391:107-111

Wenzhong, L., Y. Zhang and Z. Zhou (2005). Adjustment for non-genetic effects on body weight and size in Angora goatsSmall Rumin Res 591:25-31

Yadav, J. S., B. Rai, M. K. Singh, M. C. Yadav and B. U. Khan (2003). Factors affecting body weights at different ages in flock of Kutchi goatsInd J Small Rumin 91: 53-55 CAB Abst 20033213811

Zeleke, Z. M. (2007). Environmental influences on pre-weaning growth performances and mortality rates of extensively managed Somali goats In Eastern Ethiopia Livestock Res Rural Dev 1912

Zhang, C. L. Yang and Z Shen (2008). Variance components and genetic parameters for weight and size at birth in the Boer goat. Livestock Science 115 73–79.