

EFFECT OF BIRTH TYPE OF DESERT AND TAGGARI KIDS ON PRODUCTIVITY PERFORMANCE UNDER EXTENSIVE SYSTEM IN SOUTH KORDOFAN STATE

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Abstract. The effect type of birth on productive and reproductive performance of Sudanese Desert and Taggari goats has been studied during rainy season of South Kordofan state, Sudan. Twenty two female Sudanese goat kids (11 Sudanese Desert kids and 11 Taggari kids) were used in this experiment. The result inducted that birth weight, growth rate at 30, 60 and 90 of ages, pre-weaning average daily weight gain of kids and weaning weight were significantly ($p < 0.01$) affected by birth type where single kids were heavier than twins kids, but the birth weight of Taggari goats weren't affected by birth type. Also the results revealed body weight at puberty were not affected by type of birth, on the other side the age at puberty was significantly affected by birth type were single born kids had shorter days to maturity stage. Body weight at first kidding of single and twin kids weren't affected by birth type, but age at first kidding was significantly ($p < 0.01$) affected by birth type were single kids had significantly ($p < 0.05$) shorter days to attained puberty compared with twin kids. In conclusion the investigated on birth type showed different birth weight, body weight changes at different ages which affect reproductive and productive traits of the Taggari and desert goats under rangeland system during rainy season.

Keywords: Desert goat, Taggari, birth type, reproductive, Sudan.

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1. Introduction

Goats are livestock species that are well adapted to and reared in most parts of the world. They are efficient converters of forage feeds to meat and milk irrespective of the environment in which they are kept to serve mankind longer than cattle or sheep (Lebbie, 2004). In Sudan, goats are kept as an important component of farming activities, particularly by smallholder farmers (Bushara *et al.*, 2011). Goats are kept primarily for meat, thus production traits of interest are litter size per doe per year or the number of young weaned per breeding female per year and their growth rate (Bradford, 1993).

It is well known that reproductive efficiency is one of the important pre-conditions for increasing production potential in any given environment. In order to evaluate the productive ability of goats, prolificacy and birth weight are considered the most important and economic criteria. Reproductive performance is one of the main factors which determine the productivity of the goat irrespective of their use for meat, milk, skin or hair production (Sivaraj, 1991). Birth weight and body weight of goat is considered as important traits because there is a positive correlation between birth

weight and growth rate, age at maturity and mature body weight (Banergee, 1989), which influence the future productive and reproductive performance of the animal.

The number of young born alive per kidding is an important factor in increasing productivity as it contributes more to the total weight weaned per dam than the growth rate of the kid (Paul *et al.* 2014, Abdul Jalil *et al.*, 2016). Kid growth, birth and body weights of other ages are traits of breeding and economic importance in goat breeds, performance and morphological diversity in goat could be attributed to several genetic, non genetic factors and existence of many goat populations (Diken *et al.*, 2008, Traore *et al.*, 2008). Growth is an important trait affecting the productivity of animals. It is through growth that animals produce meat and cash income as sale of live animals (Belay & Mengistie, 2013). Therefore, understanding and documenting the growth performances of indigenous breeds of goats is very important to design improvement strategies for a particular breed. The objective of this research was to evaluate the birth weight, growth performance and some reproductive traits of Desert and Taggari goats under traditional management systems.

2. Materials and methods

The present study was conducted in South Kordofan state at Al Debabat locality (100 km south of ELObeid) which lies within the medium rain (500mm) woodland savannah (longitudes 12.39° N, Latitudes 29.48°E). The soil types varied from sandy (goz) in north to heavy clays (vertisoil) in the south. The mean monthly temperature ranged from 31.3 C° in April to 25.8 C° in July, annual rainfall ranging between 500-800 mm, with peak rain in August (S.K.D.P, 2000).

Experimental animal's management and diets

Twenty two female Sudanese goat kids (11 Sudanese Desert kids and 11 Taggari kids) were used in this experiment. The kids were born during the rainy season of year 2012 raised on traditional management. All animals were treated with the necessary medication against endo-and ecto-parasites (AGVET, USA 1.0 ml/50 kg body weight subcutaneously Ivomec super drench) and vaccinated against Anthrax and Hemorrhagic Septicemia. The animals were ear tagged, weighted and divided into two groups as group A is Taggar goats (does and kids) group B is Desert goats (Does and kids). The grazing zone of these animals was in the around the study area. The two breed were divided into two groups. All goats and their kids were allowed day grazing from 0800 to 1800 hr and in the evening they were kept indoors in enclosures. Watering was once a day from running surface water (Khors) during the early wet season and from excavated ponds at the end of the season. Kids born to these goats were allowed to freely suckle colostrum for the first three days after parturition, thereafter they were separated from their dams during the day. Kids were weaned at three month of age. The birth weight was taken immediately after birth and when kids were dry. All kids were then weighed at weekly intervals up to age at first kidding; the animals were weighed in the morning.

Statistical analysis

All the data obtained from the experiment were analyzed as means and standard errors of the different traits using. T-test was used to analysis of data performed from the experiment. All techniques of the statistical analysis were conducted using Statistical Package for the Social Sciences, software package (SPSS, 2005).

3. Results

Effect of type of birth on birth weight of Sudanese goats

The results show that the live body weight at birth were significantly ($P<0.05$) affected by birth type (Table 1). Desert kids born as single and twin were heavier ($p\leq 0.05$) than Taggari single and twin's kids. Desert single kids were heavier ($p\leq 0.05$) than twin kids, however single and twin's kids born to Taggari goat were not significantly different.

Table 1. Effect of birth type on birth weight of Sudanese goats

Variable	No.	Single born kids	No.	Twin born kids
Taggari goats	6	1.96±0.08 ^b	5	1.94±0.04 ^b
Desert goats	7	2.30±0.05 ^a	4	2.06±0.10 ^a

^{ab} Values in the same columns followed with different letters are significant at $P<0.05$

Effect of type of birth on growth performance and weight at weaning of Sudanese goats

Effect of birth type on growth performance during 90 days after kidding were tabulates on (Table. 2). During the whole period of 30, 60 and 90 days Desert kids exerted significant effects ($p<0.05$) on growth rate. Where heavier ($p<0.05$) body weight gain recorded in same breed than Taggari kids. Weaning weight at three months of age for Desert kids single and twins were heavier ($p\leq 0.05$) than Taggari single and twin's kids (Table. 2). But within breed there were no different between single and twin kids at body weight at weaning.

Table 2. Effect of birth type on growth rate of Sudanese goats (means ± SE)

Variable	No	30 days	60 days	90 days	Gain /day/ g	Weaning weight/kg
Bred type		Single born kids				
Taggari	6	3.56±0.32 ^b	5.68±0.35 ^b	8.41±0.19 ^b	74.93±2.74 ^b	8.41±0.19 ^b
Desert	7	4.47±0.15 ^a	7.17±0.33 ^a	10.71±0.84 ^a	96.11±8.76 ^a	10.71±0.84 ^a
		Twin born kids				
Taggari	5	3.16±0.25 ^b	5.10±0.18 ^b	8.21±0.23 ^b	70.14±1.85 ^b	8.21±0.23 ^b
Desert	4	4.10±0.32 ^a	6.54±0.18 ^a	10.70±0.34 ^a	93.38±3.43 ^a	10.70±0.34 ^a

^{ab} Values in the same columns with different letters are significant at $P<0.001$

Effect of type of birth on body weight and age at puberty of Sudanese goats

Effect of birth type on some reproductive traits was showed on (Table. 3). There was no any significant different between single and twin kids within breed on body weight at puberty. However Desert kids exerted significant higher ($p < 0.001$) body weight at maturity stage compared with Taggari kids. There was significant ($p < 0.001$) difference between single and twin kids of Taggari and Desert goats on age of maturity, whereas single kids had significantly ($p < 0.05$) shorter days to attained puberty compared with twin kids, Single kids of Taggari and desert goat had ($p < 0.05$) shorter days to puberty than twin kids for same breeds (Table. 3).

Table 3. Effect of birth type on body weight and age at puberty (means \pm SE)

Variable	Body weight at puberty		Age at puberty	
	Taggari	Desert	Taggari	Desert
Single kids	18.59 \pm 0.34 ^b	23.15 \pm 0.42 ^a	202.50 \pm 7.50 ^a	239.50 \pm 7.26 ^a
Twin kids	18.55 \pm 0.44 ^b	23.00 \pm 1.01 ^a	215.75 \pm 2.14 ^b	246.67 \pm 4.97 ^a

^{ab} Values in the same rows followed with different letters are significant at $P < 0.001$ and $P < 0.05$

Effect of type of birth on body weight and age at first kidding of Sudanese goats

Effect of birth type on body weight and age at first kidding were monitored on (Table. 4). There was no any significant different between single and twin kids on body weight at puberty for Taggari goats, where this issue showed significant ($p < 0.001$) effect in Desert goats. However Desert kids exerted significant higher ($p < 0.001$) body weight at 1st kidding compared with Taggari for single and twin kids. Whereas single and twin born kids exerted non significant effect on days to 1st kidding (Table. 4).

Table 4. Effect of birth type on body weight and age at first kidding (means \pm SE)

Variable	Body weight at 1 st kidding		Age at 1 st kidding	
	Taggari	Desert	Taggari	Desert
Single kids	22.98 \pm 0.48 ^b	26.13 \pm 0.40 ^a	377.50 \pm 22.50	383.00 \pm 26.63
Twin kids	22.75 \pm 0.41 ^b	25.75 \pm 0.31 ^a	387.75 \pm 3.17	408.75 \pm 8.07

^{ab} Values in the same rows followed with different letters are significant at $P < 0.001$

4. Discussion***Birth weight***

Birth weight has very important meaning since birth weight is correlated with the growth of the kid after birth up to adult size, and correlated with the ability of the kid to survive. In this study birth weight of different litter size of desert and Taggari goats was significantly affect by birth type, same results were obtained by 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, Birteeb *et al.* (2015) found birth weight for single 1.56 \pm 0.02 kg, Twins 1.33 \pm 0.03kg and Triplets 1.50 \pm 0.50 kg and Kuthu *et al.*, (2014) who said that single born kids were heavier (1.77 \pm 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. Paul *et al.* (2014) reported that birth weight of kids was significantly affected by type of birth. Among the different types of birth, single kids showed the highest weight at birth followed by twins and triplets. 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 multiple births. Deribe and Taye (2013) stated that because of the finite capacity of the maternal uterine space to gestate offspring, as litter size increases individual birth weights decline. Zhang *et al.* (2006) and Mahal *et al.* (2013) showed that, this difference is probably due to the intrauterine environment where a higher availability of nutrients to the single kid, lack of competition as well as more space may facilitate growth. The uterine space and available nutrient shared by more than one kid may be responsible for the reduced birth weight with increasing litter size. Single kid wills has high birth weight due to condition where dam will give nutrient intake directly to kid during pregnancy. So the birth weight of single kid is high compared to twin and triplet kids because they don't need to compete for nutrition during pregnancy (Syahirah *et al.*, 2016). The differences in the pre-weaning weight gains are closely associated with the differences in level of milk intake during milk feeding period and the nutritional status of the doe. Generally when litter size increases, the birth weight decreased, and the birth weight of kids is highly variable, and is mostly under the influence of breed.

Growth and weaning weight

Growth during pre-weaning period is largely determined by maternal milk production and competition for it amongst litter mates and hence, the differences in their post-weaning growth rate (Luginbul, 2002; Steve, 2001). In this study the growth in different ages were significantly affected by birth type where single born kids grew faster and reached weaning age earlier than multiple births. Type of birth influenced body weights of kids significantly from 30 to 90 days of age, and thereafter its effect disappeared. Single born kids were heavier birth weight compared to multiple counterparts and they maintained their superiority at 30, 60 and 90 days of age. Desert kids were heavier in weaning weight and weights and 30, 60 and 90 days of age than Taggari kids.

The kids born single grow faster than those born twins may be due to milk yield of dam and milk received differences and heavy birth weight (Zeshmarani *et al.*, 2007). This implies that twins receive less milk as compared to kids born single and thus affects their growth rate before weaning (Gimenez & Rodning, 2007). This effect might be because of nutrition that multiple born kids need to compete for milk consumption from their dam while single born kids are sole users of milk from their dam. This results online with Syahirah *et al.* (2016) , Birteeb *et al.* (2015) and Belay and Mengistie (2013) who reported that the differences in the pre-weaning weight gains are closely associated with the differences in level of milk intake during milk feeding period and the nutritional status of the doe. After weaning maternal influence decreased twins kid tend to compensate for growth and there is no difference in terms of age at puberty and at first kidding between twin female kids and those born single (Dadi *et al.* 2008). The slow growth rate mainly attributed to poor nutrition, management and other non-genetic factors (Gbangboche *et al.*, 2006).

Body weight and age at puberty

Puberty is the point of sexual development at which the animal becomes capable for reproduction and starts sexual activity. The onset of puberty is related to body weight which in turn depends on the level of nutrition, age, type of birth and season of birth (Dereje *et al.* 2015). Results of the effects of birth type on body weight at puberty showed that there was non significant different of body weight at puberty, same results were obtained by Mabrouk *et al.* (2010) and this results; however, contradict with results of Alexandre *et al.*, (1997) reported that single-born kids were found to be heavier at all ages than twin-born kids. As after 90 days of age (post weaning growth), the significance effect of type of birth disappeared. Mabrouk *et al.* (2010) reported the non-significant differences between single and multiple kids in adult ages, similar to our findings. This could be explained by the compensatory growth in the older periods of growing (Talore *et al.*, 2014). Generally the growth rate of the ruminant grazing tropical pastures or consuming crop residues alone are generally low and represent only about 10% of the animals genetic potential (Tedonkeng Pamo *et al.*, 2002). Smaller sample size responsible for non-significant between these seasons, in spite of significant, similar results reported by Chowdhury *et al.* (2002) for Black Bengal goats and Papachristoforou *et al.* (2000) for Damascus goats.

Puberty is generally considered to be related more to growth and body weight rather than age in tropical goats (Bushara & Abu-Nikhaila, 2012). Age at puberty in this study showed that single kids from both breed exhibit early estrus cycle (6.7-7.2 months) than twin kids whose take longer days to show first estrus (8-8.2 months), but the black Taggari goat attained sexual maturity at an early age than Desert goat. The results agreed with Zeshmarani *et al.* (2007) for Assam goats (259 ± 2.5 , 265 ± 2.4 and 269 ± 3.66) for single, twin and triplets kids. The results also agreed with many authors whom reported that age at puberty was reported from 180-540 days (6- 18 months) in different breeds of goats under different ecological and management conditions (Dereje *et al.*, 2015; Baloch, 2014, Zarkawi & Al-Saker, 2013), and disagreed with (Abdul Jalil *et al.*, 2016) This might be because the growth of kids after weaning is largely dependent on their genetic make (Chowdhury *et al.*, 2002). The dependency of kids on their dams gets diminished as age of kid increases from weaning and this may be due the slow growth of twin and triplets kids due to the compete between kids for mother milks. Generally the tropical goat breeds reach puberty age at approximately 97 days and sexual maturity at 132 days of age (Payne and Wilson, 1999 and Moaeen-ud Din *et al.*, 2008). However the goats may not be fully sexually competent at this stage and puberty may often reach before animals were grown enough to physically support the reproduction (Kunbhar *et al.*, 2016). Relationship of age and body weight to onset of puberty and attainment of sexual maturity is prerequisites for improvement of reproductive performance. The delayed age at puberty may be due to genetic factor, climate and management practices at the farm (Miah *et al.*, 2016, Kunbhar *et al.*, 2016).

Body weight and age at first kidding

The age at first kidding is expressed as the age when does produce off-spring for the first time. Age at first kidding is an important indicator in determining of sexual maturity and life time productivity in does, the earlier the doe starts to kid it will produce more kids in life time and longer would be the productive life time period. ((Dadi *et al.*, 2008; Deribe & Taye, 2014). Finally, the results of the effects of litter size on body weight at first kidding shows that there was a significant different this means

that kid who has been born with single has high body weight at first kidding compared to twin kids. These results agreed with Dadi *et al.* (2008) and Zeshmarani *et al.* (2007) for Assam goats. But female born as single and twin were not affected the age at first kidding of does, this result agreed with Deribe and Taye (2014). In spite of significant single kids delayed age at first kidding compared with twin kids which had longer days to first kidding same results obtained by Kuthu (2017), Dadi *et al.* (2008) and lower than the results of Marai *et al.* (2002) 492±33 and 656±24 days for single and twin Nubian kids respectively, Zeshmarani *et al.* (2007) for Assam goats (437±3.40 and 440±3.27 days) for single and twin kids and agreed with Zeshmarani *et al.* (2007) who reported that the indigenous goat breeds producing off-spring at the age of 24 months. This variation may be due to slow growth rate of kids born twins with lighter birth weight because of goat flock was managed under traditional management on grazing only, which agreed with Bushara and Abu-Nikhaila (2012), Kunbhar *et al.* (2016) and Devendra (2007) who stated that the goats usually delayed to reach the age of first kidding because they were raised in hot and harsh environmental conditions. Generally the an average age at first kidding of 391.02±9.32 days is indicative of the ability of local goats to reach sexual maturity early, and this may be due to the available of breeding male running with female in the flock all times.

5. Conclusions

The results showed that the single born kids had superior reproductive and productive traits than twin kids under grazing condition. However, single and twin Taggari kids had lighter body weight at different ages of period compared with single and twin of Desert kids. Further studies may be conducted using large number of animals for a longer period to get more detailed information related to reproductive performance

References

- Alexandre, G., Aumont, G., Mainaud, J.C., Fleury, J., & Naves, M. (1999). Productive performances of Guadeloupean Creole goats during the suckling period. *Small Ruminant Research*, 34(2), 155-160.
- Ali, A., Khan, M.S. (2008). Environmental factors affecting growth and reproductive traits of Beetal goats in Pakistan. *Ind J. Anim. Genet. & Breed*, 27(1-2), 26-37.
- Baloch, S.N., (2014). Study on performance analysis of Kamohri goat flock under semi intensive management at Government Bhagnari Cattle farm Usta Muhammad Baluchistan. M. Sci. Thesis, Sindh Agriculture University Tandojam.
- Banerjee, G.C. (1989). *A Text Book of Animal Husbandry*. 7th. Edn. Oxford and IBH publishing Co. India.
- Birteeb, P.T., & Lomo, R. (2015). Phenotypic characterization and weight estimation from linear body traits of West African Dwarf goats reared in the transitional zone of Ghana. *Livestock Research for Rural Development*, 27(9).
- Bradford, G.E. (1993, August). Small ruminant breeding strategies for Indonesia. In *Proceedings of a Workshop Held at the Research Institute for Animal Production. Bogor* (pp. 83-94).
- Bushara, I., Abdelhadi, O.M.A., Elemam, M.B., Idris, A.O., & Nikhiala, A.A. (2011). Effect of environmental factors on body condition score of Taggar goats under dry land farming in western Sudan. *Online Journal of Animal and Feed Research*, 1(5), 231-234.

- Bushara, I., Abu-Nikhaila, M.M.A.A. (2012). Productivity performance of Taggar Female Kid under grazing condition. *Journal of Animal Production Advances*, 2, 74-79.
- Chowdhury, S.A., Bhuiyan, M.S.A., & Faruk S. (2002). Rearing Black Bengal goat under semi-intensive management, physiological and reproductive performances. *Asian-Aust. J. Anim. Sci.*, 152, 477-484.
- Dadi, H., Duguma, G., Shelima, B., Fayera, T., Tadese, M., Woldu, T. & Tucho, T.S. (2008). Non- genetic factors influencing post weaning growth and reproductive performance of Arsi- Bale goat. *Livestock Research for Rural Development*, 20, 1-7.
- Dereje, T., Mengistu, U., Getachew, A., & Yoseph, M., (2015). Perceptions of households on purpose of keeping, trait preference, and production constraints for selected goat types in Ethiopia. *Tropical Animal Health and Production*, 46, 363-370.
- Deribe, B., Taye, M., (2013). Growth performance and carcass characteristics of central highland goats in Sekota District, Ethiopia. *Agricultural Advances*, 2(8), 250-258.
- Deribe, B., & Taye, M. (2013). Evaluation of growth performance of abergele goats under traditional management systems in Sekota District, Ethiopia. *Pakistan Journal of Biological Sciences: PJBS*, 16(14), 692-696.
- Deribe, B., Taye, M. (2014). Reproductive performance of Abergelle goats raised under Traditional Management Systems in Sekota District, Ethiopia. *Iranian J. Appl. Anim. Sci.*, 4(1), 59-63.
- Devendra, C. (2007). Small ruminants in Asia. Contribution to food security, poverty alleviation and opportunities for productivity enhancement. <http://www.mekarn.org/procsr/>.
- Diken, F., Ugur, F., Tolu, C., Akbulut, M.D. (2008). Effects of suckling schedule on growth characteristics of Saanen kids. *Arch. Tierz.*, 51, 55-63.
- Gbangboche, A.B., Adamou-Ndiaye, M., Youssao, A.K.I., Farnir, F., Detilleux, J., Abiola, F.S., Leroy, P.L. (2006). Non-genetic factors affecting the reproduction performance, lamb growth and productivity indices of Djallonke sheep. *Journal of Small Ruminant Research* 64, 133-142.
- Gimenez, D., Rodning, S. (2007). Reproductive management of sheep and goats. <http://www.ace.edu/pubs/docs/A/ANR-1316> site visited on 27/2/2012.
- Jalil, M.A., Kabir, M.M., Choudhury, M.P., Habib M.A. (2016). Productive and reproductive performance of Black Bengal Goat under farming condition in Bangladesh. *Asian Australas. J. Biosci. Biotechnol.*, 1(2), 235-245.
- Kunbhar, H.K., Memon, A.A., Bhutto, A.L., Rajput, Z.I., Suthar, V., Memon, A., & Leghari, R.A. (2016). Study on female reproductive performance of Kamohri goat managed under traditional management conditions in district Hyderabad, Sindh, Pakistan. *Int. J. Adv. Res. Biol. Sci.*, 3(3), 251-260.
- Kuthu, Z.H., Javed, K., Babar, M.E., Sattar, A., & Abdullah, M. (2013). Environmental effects on growth traits of Teddy goats. *JAPS, Journal of Animal and Plant Sciences*, 23(3), 692-698.
- Lebbie, S.H.B., (2004). Goats under household conditions. *Small Ruminant Research*, 51, 131-136.
- Luginbul, J.M. (2002). Monitoring the body condition of meat goats: A key to successful management. Publication of the Extension Animal Husbandry, Department of Animal Science, NCSU.
- Mabrouk, O., Sghaier, N., Costa, R.G., Amor, G., Amel, A.E., & Delgado, J.V. (2010). The effect of non-genetic factors on the early body weights of Tunisian local goats. *Revista Brasileira de Zootecnia*, 39(5), 1112-1117.
- Mahal, Z., Khandoker, M.A.M.Y., & Haque, M.N. (2014). Effect of non genetic factors on productive traits of Black Bengal goats. *Journal of the Bangladesh Agricultural University*, 11(1), 79-86.
- Marai, I.F.M., Abou-Fandoud, E.I., Daader, A.H., Abu-Ella, A.A. (2002). Reproductive Oetraits of the Nubian (Zaraibi) goats in Egypt. *Small Ruminant Research*, 46, 201-205.

- Miah, G., Das, A., Bilkis, T., Momin, M.M., Uddin, M.A., Alim, M.A. ... & Miazi, O.F. (2016). Comparative Study on Productive and Reproductive Traits of Black Bengal and Jamnapari Goats under Semi-Intensive Condition. *Scientific Research Journal*, 4(2), 1-7.
- Moaeen-ud Din, M., Yang, L.G., Chen, S.L., Zhang, Z.R., Xiao, T.Z., Wen, Q. Y., & Dai, M. (2008). Reproductive performance of Matou goat under sub-tropical monsoon climate of central China. *Tropical Animal Health Production*, 40, 17-23.
- Papachristoforou, C., Koumas, A., & Photiou, C. (2000). Seasonal effects on puberty and reproductive characteristics of female Chios sheep and Damascus goats born in autumn or in February. *Small Ruminant Research*, 38(1), 9-15.
- Paul, R.C., Rahman, A.N.M.I., Debnath, S., Khandoker, M.A.M.Y. (2014). Evaluation of productive and reproductive performance of Black Bengal goat. *Bang. J. Anim. Sci.*, 43(2), 104-111.
- Payne, W.J., Wilson, R.T. (1999). *Animals Husbandry in the Tropics*. 5th Ed. Oxford, UK. Blackwell Science.
- Robinson, J.J., McDonald, I., Fraser, C. & Crofts, R.M.J. (1977) Studies on reproduction in prolific ewes. 1. Growth of the products of conception. *Journal of Agricultural Science*, 88, 539-552.
- S.K.D.P. (2000). Southern Kordofan Development Program, Volume (1), Main Report. No. January 2000. Ibid p. xiii.
- Singh, S.K., Rout, P.K., Shivasharanappa, N. (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, pp 25.
- Sivaraj, S. (1991). Reproduction techniques In: Goat Husbandry and Breeding in the Tropics. Papers presented in an international seminar carried out by German Foundation for International Development (DSE) at the Institute for Advanced Studies, University of Malaya, Kuala Lumpur.
- SPSS, (2005). Statistical Package for Social Sciences, windows evaluation program version 15, Michigan Avenue, Chicago, IL.19-182 <http://www.spss.com>.
- Steve, W.B. (2001). Reproduction in goats. Goats Online Publication, Division of Animal Science, University of New England.
- Syahirah, M.Y., Mat, K.B., Rusli, N.D., Hasnita, C.H. (2016). Preliminary Study on Birth Weight and Pre-weaning Growth Pattern in Crossed Boer Kids. *Journal of Tropical Resources and Sustainable Science*, 4, 6-9.
- Talore, D.G., Abebe, G., Tegegne, A. (2014). Early growth of Adilo kids under smallholder management systems, Southern Ethiopia: Influences of non- genetic factors. *Adv. Anim. Vet. Sci.*, 2(8), 468-476.
- Tedonkeng-Pamo, E., Tendonkeng, F., Kadjio, J.T.T., Kwami, H.N., Taboum, R.K., Kana, J.R. & Tegodjeu, A. (2002). Evaluation of the comparative growth and reproductive performance of West Africa Dwarf goats in the western highlands of Cameroon. In Development and field evaluation of animal feed supplementation packages, proceedings of the final review meeting of an IAEA, 25-29 Nov 2000, Cairo, Egypt, Vienna, 2002. P.87-96.
- Traore, A., Tamboura, H.H., Kabore, A., Royo, L.J., Fernandez, I., Alvarez, I., Sangare, M., Bouchel, D., Poivey, J.P., Francois, D., Sawadogo, L., Goyache, F. (2008). Multivariate analysis on morphological traits of goats in Burkina Faso. *Arch Tierz.*, 51, 588-600.
- Wenzhong, L., Zhang, Y., Zhou, Z. (2005). Adjustment for non-genetic effects on body weight and size in Angora goats. *Small Ruminant Research*, 59(1), 25-31.
- Zarkawi, M., Al-Saker, M.B., (2013). Determination of certain reproductive and productive parameters in female Mountain (Jabali) and crossbred goats during different age stages. *Archivs Zootechica*, 16(2), 15.
- Zeleke, M., (2007). Environmental influences on pre-weaning growth performances and mortality rates of extensively managed Somali goats in Eastern Ethiopia. *Livest. Res. Rural Dev.*, 19(12).

- Zeshmarani, S., Dhara, K.C., Samanta, A.K., Samanta, R., Majumder, S.C. (2007). Reproductive performance of goats in Eastern and Northeastern India. *Livestock Research Rural Development*, 19, 114.
- Zhang, C., Yang, L., & Shen, Z. (2008). Variance components and genetic parameters for weight and size at birth in the Boer goat. *Livestock Science*, 115(1), 73-79.
- Zhang, C.Y., Shen, Z., Zhou, Z.Q., Yang, L.G. (2006). Studies on the Growth and Developmental Rules of Young Boer Goat. *Journal Huazhong Agricultural University*, 12, 640-644.