



# Assessment of Female Reproductive Performances of Kamohri Goat Maintained at Kamohri Goat Farm Khudabad Dadu Sindh Pakistan

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**Abstract** – The study was conducted to investigate the reproductive performance of Kamohri goat managed under semi-intensive management conditions at Kamohri Goat Farm, Khudabad, Dadu. The data were collected on the basis of performance records and utilized for this study. The result revealed that the mean age at puberty was found to be as  $360.09 \pm 5.453$  days and age at first kidding as  $514.11 \pm 5.164$  days. The mean kidding interval was recorded to be  $252.47 \pm 2.983$ ,  $258.65$  days, gestation length  $150.015 \pm 0.76$  days. The kidding interval was reduced from 1<sup>st</sup> to 4<sup>th</sup> parity. The difference between the parity found was significant for kidding interval while for gestation period no significant difference was found. It was concluded that in Kamohri goat the age of puberty was delayed and other reproductive performance were suitable and indicating efficient performances to be as utilized for sustainable forming in the home tract area of the breed.

**Keywords** – Goat, Kamohri, Breed, Reproductive Performance, Intensive-management.

## I. INTRODUCTION

Sindh is predominantly an agricultural province where majority of population is directly or indirectly engaged in agriculture and livestock raising. The landless farmers depend on livestock for their subsistence. Sindh province forms the lower Indus basin and lies between 23° and 28° north latitudes and 66° to 71° east longitudes. Its' climate is semi-arid and subtropical. Annual rainfall from 90 to 250 mm, which with decreasing trend from north (90–100 mm) in upper Sindh and increases (250 mm) in coastal area of lower Sindh due to mainly of sea. The average temperature ranges from 12 to 47°C and humidity in the interior of the province varies from 40 to 70 per cent during April and May, and it falls below 40 percent in Hyderabad in April only and it increases after monsoon from July to August (Khan, 1983). Domestic ruminant farm animals like cattle, buffaloes, sheep and goats plays an important role in the economic activity of different countries including Pakistan (Kioumaris *et al.*, 2011). The Sindh province is bestowed with very fine breeds of goats namely: Barri, Bugitoori, Bujri, Chappar, Jattan, Kacchan, Kamohri, Kurri, Lori, Pateri, Tharki, and Tapri. These breeds can be divided in to three different categories like: Dairy, Meat, Hair and multi-purpose breeds (Devendra, 2007, Issani and Baloch, 1996). Goat (*Capra hircus*) is one of the earliest (before 7500 B.C) domesticated animals in Western Asia (Zeshamani *et al.*, 2007; Harris and Springer, 2004). The goat population is continuously increasing throughout the world as compared to other ruminant (Boyazoglu *et al.*, 2005). Approximately 879

million goats are found all over the world (FOASTAT, 2011), of these 90% are from developing countries (Zaraimedia, 2013). Pakistan has 64.9 million goats (GOP, 2012-2013) and is third largest goat producer after China and India (Zaraimedia, 2013).

Goats are primarily reared for meat and milk purpose (Hossain *et al.* 2004; Sodiq *et al.* 2002). Its meat is tender, leaner and has human preference over beef and is considered as prized meat in Pakistan (Waheed and Alvi, 1988). Next to dairy cattle, goats are the most important milk producing animal in both temperate and tropical environments (Devendra and Burns, 1983). Some goat breeds are considered as an above-average milk producer hence called poor man's cow (Zaraimedia, 2013). Goat is a small size, early maturing animal (6-10 months), having low capital investment required per head as compared to cow and buffalo (Khanum *et al.*, 2000). Goats are kept for savings, investment, social functions and are considered as a cash crop animal of rural families (Greyling, 2004). The goat is prolific domestic ruminant (Delgadillo and Malpoux 1996; Akusu and Ajala, 2000) and having two distinct peak breeding and kidding seasons (Zarkawi and Soukouti, 2001; Chikura, 1999). Under tropical and sub-tropical conditions, certain goat breeds are able to breed throughout the year (Devendra and Buruns 1983). It has short gestation period (Greyling, 2000) having less reproductive problems and can easily be managed by housewives and/or middle age children (Faiz *et al.*, 1994). The reproductive performance of goat dependent on the interaction of genetic and management factors affect reproduction (Ribeiro *et al.*, 2000). Reproductive efficiency in female goat is determined by cyclic activity, conception rate, fertilization, post-partum period and viability of the offspring and it can be measured and expressed as kidding rate, kidding interval, live weight of kids born and the length of the reproductive cycle (Sovi *et al.*, 2002; Greyling, 2000).

Kamohri is a dairy goat bred and is found in Hyderabad, Bith Shah, Hala, Saeedabad, Matiyari, Tando Adam, Tando Allah Yar, Tandojam and Dadu, Sindh Province in Pakistan (Mahgub *et al.*, 2005; Issani and Baloch 1996). The name KAMOHRI is given to this breed because of choosing, picking and eating with interest the grass "KAMOOH" hence the breed is named "KAMOHRI" (Personal communication 2015). The animals of this breed are described as reddish brown in color, ears are long pendulous and of reddish brown color spot marking all over the body like Sindhi 'AjraKh' design. Hence the native place of this breed is considered as Halla, Bith Shah, Saeedabad and Matiyari, Sindh. It is one of the



heavy goat breed of Sindh (Personal communication 2015). The adult live body weight is about 70.0 kg in male and 45-60 kg in female. The female goats of this breed produces 2-3 liters of milk per day hence this breed is remembered as “Poor man’s cow” ((Devendra, 2007, Issani and Baloch, 1996; Raats *et al.*, 1983). In past goat has been remained neglected animal and its average production per animal remained very low (Faize *et al.*, 1994). In present scenario people prefer goat meat over the poultry or beef. Hence goat production has become alternate livestock farming. There is a shortage of goat’s meat to satisfy the demand of people in the country. In spite of its importance and useful role the goat has not been given due consideration and are mostly kept for traditional activity without knowing their reproductive potential. In order to determine the reproductive performances of goat, a thorough knowledge of reproductive physiology is essential. A very little information is available on reproductive performance of Kamohri goat. The study was therefore planned to assess reproductive performance of Kamohri goat reed.

## II. MATERIAL AND METHODS

**Study area:** Study was conducted at Department of Animal Reproduction Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam, Sindh. The data were collected on reproductive performance of Kamohri goat breed maintained under semi intensive management conditions at Kamohri goat farm Khudabad, Dadu. Kamohri goats are maintained with principal objectives as to improve breed, animal health and reproductive traits and to supplying genetically superior bucks to private goat farmers. The performance records of goats for last five (2008-13) years were studied. Only those records of goats were selected and included for performance analysis, which deemed to be complete in all respects.

**Housing and feeding:** The goat flock was raised under semi stall or intensive management conditions, which were scientifically designed to provide an adequate spaces, ventilation and sanitation. Space per animal was specifically maintained. In summer season the goat flock was allowed for grazing in day time and on return to sheds was fed stall feeding. During the winter season, the animals were kept in the animal sheds. The goats were fed green fodders according to the season commonly were made available at the farm. The concentrates ration such as barley, cotton seed cake and wheat bran at the rate of 250 gm were given daily/animal and common salt blocks was placed in mangers for licking. Water was provided ad libitum in plastic tubs in the shed and though from nearby irrigation channel, during the grazing period. All goats were identified with ear tags or numbers. The vaccination of the goat flock at the farm was performed regularly as per scheduled against the diseases such as Caprine Contagious Pleuropneumonia, Enterotoxaemia, Anthrax and Foot and Mouth diseases. The deworming was also practiced at regular interval (twice a year) against gastrointestinal parasites.

**Breeding:** The natural breeding was practiced at the farm. The bucks were allowed with the goat flock for breeding. The flock was maintained in a year-round free mating system. As only Kamohri goat was maintained at the farm and the herd was bred strictly from the bucks of same breed.

**Recording the data:** The herd record maintained at farm (2008-2013) were utilized for this study, regarding date of birth of kid, date of estrus, age at puberty and first kidding and kidding interval. The data were recorded on separate proforma specially designed for this purpose. The Statistical Analysis: The data from questioners were coded and recorded on spread sheets of Microsoft window word excel for analysis. The collected data was subjected to statistical analysis using MS tat-C statistical package for analysis of variance to ascertain the significance of differences.

## III. RESULTS AND DISCUSSION

The study was conducted to investigate the reproductive performance of Kamohri goat managed under intensive management conditions at Kamohri Goat Farm, Khudabad district Dadu. The results found in this study for different parameters are described under following headings.

**Age at Puberty:** Puberty is the point of sexual development at which the animal becomes capable for reproduction and starts sexual activity. It is the time in female when estrus is detected for first time followed by characteristic ovarian activity and ovulation (Bielli *et al.*, 2001; Greyling, 2000). It has great importance in breeding and permits defining management practices for effectiveness in the improvement of the flock (Peacock, 2005). Sexual development is a process of gradual maturation and interaction between the hypothalamus, pituitary and gonads. The direct cause of sexual maturation at puberty is a rise in the output of the pituitary hormones, leading to an increase in size and activity of the gonads (Hunter 1980 and Cupps, 1991). Puberty is generally considered to be related more to growth and body weight rather than age in tropical goats (Bushara and Abu-Nikhaila, 2012, Delgadillo *et al.*, 2007, Zeshmarani *et al.*, 2007; Sodique, 2002). Generally breeding may be delayed until the animal has attained the body weight of 60 to 70% of its adult body weight (Greyling, 2002, Devendra and Burns, 1983).

Age at puberty was reported as from 6-18 months (180-540 days) in different breeds of goats under different ecological and management conditions (Ali, 2006, Lund, 2006, Baloch, 20014, Zarkawi and Al-Saker, 2013; Sodique, 2002). In Kamohri goat the mean age at puberty was found to be as  $360.087 \pm 5.453$  days (Table-1). The results of present investigations are very in close to those reported by Webb and Mamabolo (2005), they reported that the West African Dwarf Goat reach puberty age between 330-390 days and produced kid first time at the age of 489-540 days. The figures reported for age at puberty by Zarkawi and Al-Saker (2013) in Mountains goat were not too much different from the results obtained in the current study. Same trend was reported in Saanen,



Red Sokoto and Norwegian goats (Torees *et al.*, 2009, Dadi *et al.*, 2008; Kango, 1989). The findings of present study were quite different from the results reported by various authors. The age of puberty in Kamohri goats were found higher as compared to those reported in literature that most of the goat breeds reach puberty at relatively young age between 150-300 days (Harris and Springer, 2004; Iqbal, 1994) and are usually bred at 210-300 days of age (Song *et al.*, 2003). The tropical goat breeds may reach puberty age at approximately 97 days and sexual maturity at 132 days of age (Payne and Wilson, 1999). Same trend was reported as 97 to 216 days in Mathau goat in China (Moaeen-ud Din *et al.*, 2008). Furthermore, it was reported that goats reach puberty age at approximately 160–192 days and sexual maturity 240 to 255 days and 214 days in goats (Madani and Rahal, 1988).

The kids of Creole goat breed reach puberty age between 172 to 250 days (Tesafe, 2009) and similar results (157.1-191.2 days) were reported in Boer goat does. The kids weaned during the normal breeding season showed first estrus at earlier age of 157.2 days (Greyling and Van Nieckerkeu, 1990). Same trend was reported for age at puberty in Saanen (217.9 days), Angora (240 days), Black Bengal (190.2 days), Assam Hills (264+1.68), Mani-Puri (317+1.7) and Barbari (213 days) does (Zeshmarani *et al.*, 2007). However animals may not be fully sexually competent at puberty since puberty may often be reached before animals grown enough, to physically support reproduction. The average age of puberty in Pakistani indigenous goat breeds were higher than the European breeds (Lund, 2006; Pahanwer, 2005). Breed and body size at maturity are the main factors that cause considerable variations in the time taken to display first estrus in goats (Greyling 2000). Age and body weight had a consequent effect on lifetime production (Gimenez and Rodning, 2007). The time taken for goats to reach puberty varies based on genotype, nutrition; season, health management and environmental factors (Wildeus, 2000; Abi-Saab *et al.*, 1997). There are several factors that could play a role in the attainment of puberty in the female goat. The temperature is hot in summer may rise up to 50 °C at the location of the farm where this breed is maintained. The hot and harsh climatic condition at the area of the farm may be the major cause of delay the age at puberty in Kamohri goat in the area under investigation. It is difficult to isolate a single factor involved in the attainment of puberty, as a sequence of events is involved in sexual maturation and an interaction possibly exists between male effect, seasonality and nutrition. The management practices at the farm need to be improved for better reproductive and productive performance of the flock.

Table 1. Age at puberty and first kidding in Kamohri goat

Variable / parameters	No of goats observed	Mean $\pm$ S.E (days)	Range (days)
Age at puberty	46	360.087 $\pm$ 5.453	280-450 days
Age at first kidding	46	514.11 $\pm$ 5.164	430-600 days

**Age at first Kidding:** The age at first kidding is expressed as the age at which does producing off-spring for the first time. The earlier the doe starts to kid it will

produce more kids in life time and longer would be the productive life time period. Age at first kidding is an important indicator in determining of sexual maturity and life time productivity in does (Deribe and Taye, 2014). Kidding makes the beginning of a goat production. The age at first kidding was reported in between 387-693 days among the various production patterns and goat breeds (Baloch, 20014, Zarkawi and Abu-Saker, 2013, Ali, 2006, Sodiq, 2002, Song *et al.*, 2003). In present study the mean age at first kidding was recorded as 514.11  $\pm$ 5.164 days in Kamohri goat (Table-2). The results of present study are in close range to those reported figures of 480-540 days in West African Dwarf goat breed (Webb and Mamabolo 2005; Zarkawi and Abu-Saker, 2013), 504+5.14 days in Kamohri goat (Baloch, 2014), The age at first kidding recorded as 300-365 days in Korean Native Goat doe ((Song *et al.*, 2006) and between 303 and 556 days and 600 days for Sub-Sahara African goat (Wilson, 1989). However the results recorded in current study for age at first kidding were higher than the figures reported (Tesafy, 2009) and Chowdhury *et al.* (2002), the reported figures were as 408 days in Ethiopian goat breed under semi-intensive management system and 387 days in Black Bengal goats (Dhara *et al.*, 2011). This variation may be due to slow growth rate and kids born twins with lighter birth weight.

The mean age at first kidding of Abergelle goats was found to be 448 days (Deribe and Taye, 2014). These reported figures were lower as compared to the result of current study for age at first kidding. However in contrast to findings of present work, it was reported that the best time of producing off-spring is at the age of two years (Panhanwar, 2005). It is usually delayed to reach age at first kidding in goat they were raised in hot and harsh environmental conditions. Female kids born in the season with ample feed availability grow faster and attain sexual maturity earlier and produce first time kids at its younger age as compared to those born during cool and dry season (Bushara and Abu-Nikhaila, 2012). The slow growth rate was mainly attributed to poor nutrition, management and other non-genetic factors (Gbangboche *et al.*, 2006). However, the effect of season was more pronounced in extensive than in intensive management system. However results obtained in this study was lower than the reported figures for Arsi Bale goats. The effect of parity of mother (doe) born and her birth type did not affect the age at first kidding of does (Deribe and Taye, 2014). 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 little milk as compared to the kids born single and this affects their growth rate before weaning (Gimenez and Rodning, 2007). After weaning maternal influence decreased twins' kids tend to compensate for growth and there is no difference in terms of age at first kidding between twin female kids and those born singles born kids (Dadi *et al.*, 2008). This happens because the effect of litter size decreases with increase in age of the kids. Nutrition influences the onset of puberty, conception rate, health and vigor of new born kid (Gimenez and



Rodning, 2007). Age at first kidding is influenced by age at maturity, body weight gain, mating, growth rate, nutritional level feeding, disease control and management of doelling. If goats gain an optimum weight, breeding should be delayed till the does attained the adult body weight. However, delaying breeding for a long time period may decrease the margin of profit by decreasing lifetime production (Mruttu, 2001).

**Kidding Interval:** Kidding interval is the period expressed in number of days between two successful kiddings. It is an important reproductive trait in animal production due to its effect on animal population turnover rate, total lifetime productivity and has significant influences on production performances (Jackson, 2013). Kidding interval (KI) is a function of many aspects of reproduction. Thus lactation length and dry period are components of KI (Jackson *et al.*, 2012; Ribeiro *et al.*, 2000). In present study the mean kidding intervals were found to be  $252.47 \pm 2.983$  days (Table-2). These results are in close agreements with the results reported by Tesfaye (2009) and Ahuya *et al.* (2009). They reported KI was 252 and 250 days respectively, for goats managed under plenty of feed. Whereas similar trend of findings was reported for kidding interval which was ranged from 162 to 354 days in Korean Native goat breed (Songs *et al.*, 2006). The figures reported for KI which seems to be as much longer as 314 days for goats under feed shortage areas and grazing lands (Ahuya *et al.*, 2009), whereas in Small East African goats the reported figures were in between from 236-265 days (Wilson and Durkin, 1988). However slightly higher figures (276) was reported for KI (Ince, 2010). A short KI was reported as 204 days in goats raised on traditional management system (Sodiq, 2004).

Kidding interval was found to be affected by parity as the parity increases KI decreases. Bushara *et al.* (2010) conducted a field survey study and reported as 337.6 days kidding interval in 1<sup>st</sup> kidding, he also found that the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup>, parities had long KI as compared to 4<sup>th</sup> parity in goats. KI decreased as the parities progressive. However, contrast to this the findings of Alphonsus *et al.* (2010) indicated that KI increase as the parity increase. Furthermore they reported that the parities and birth types were no significant effect on kidding intervals (Webb and Mamabolo, 2005). The mean kidding interval was reported as  $289 \pm 17.03$  days of Abergelle goats. These results were higher as compared the results recorded in present study in Kamohri goat. The weight of doe (Abergelle goats) had significant effect on kidding interval, the does that had low weight at the previous parturition had longer kidding interval (Deribe and Taye, 2014). Under nutrition is another factor which can lead to longer kidding interval (Kamal and Nikhaila, 2009), which extends KI as long as 384 days in dairy goat breeds (Eiket *et al.*, 2008). The type of birth and parity of does had no an effect on the kidding interval. The kidding interval decreases by 4.4 days for every 1 kg body weight, increase in postpartum live weight of doe. Feeding balance ration after kidding reduces KI interval up to 7 days (Alphonsus *et al.*, 2010). If the doe

does not cycling, and not going to be conceived leads to increase in length of KI and had negative impacts on overall farm profit (Song *et al.*, 1998). This might be due to the fact that young animals take longer time to regain body conditions after kidding (Dadi *et al.*, 2008; Kiango, 1996). This alarm for preferential treatment of young does to shorten their KI (Dadi *et al.*, 2008). Kidding intervals contributes largely to the reproductive efficiency and it is affected by breed, age, season and level of nutrition (Ndlovu, 1990 and Jackson, 2013).

The does that gave birth to first kid in cool and dry season had a relatively longer kidding interval than those to wet or hot dry season (Deribe and Taye, 2014). This might be due to the fact that does having first kidding in the cool dry season, had to face shortage of fodder availability for a longer period of time as compared to does kidding in rainy and wet seasons (Wilson and Murayi, 1988). Variation in KI has been observed between intensive and extensive production system (Faruque *et al.*, 2010). The kidding interval could be affected by change in the quality and quantity of forages, the ratio of male to female, health and body weight and availability of buck. Under normal conditions and good management, both temperate and tropical goats should give kid at least three times in two years, hence the kidding intervals should not exceed beyond the eight months.

**Length of Estrus Cycle:** Estrus cycle is the period of recurring pattern of changes in physiological behavior of female resulting in repeated period of sexual receptivity in female for male. It is characterized by appearance of first estrus to coming in next estrus and subsequently of estrus symptoms (Pined and Dooley, 2003). The length of estrus cycle is documented and reported which ranged in between 19-24 days in various breeds of goat (Bukar *et al.*, 2012, Khanum, *et al.*, 2007, Zarkawi and Soukouti, 2001, Greyling 2000). Length of estrus cycle was recorded as 21.022 days in present study in Kamohri goat (Table-2). These results are very close to those reported by various authors (Bukar *et al.*, 2012, Zarkawi and Soukouti, 2001, Greyling, 2000; Akusu and Ajala, 2000). They reported the length of estrous cycle as  $20.58 \pm 2.63$  days which range from 17 to 25 days and similar trend was also reported as  $21.25 \pm 1.5$  days in Damascus does (Zarkawi and Soukouti, 2001). However the slightly shorter value ( $20.7 \pm 0.7$  days) than the results of present work for length of the estrous cycle were reported in Boer goat doe (Greyling and Van Nieckerke, 1990). The reported figure regarding estrous cycles were as  $19.7 \pm 1.5$  days in Dwarf does (Khanum *et al.*, 2007) and 19.7 days in Barbari goat breed, were significantly shorter than the figures found in current study in Kamohri goat doe. These shorter results were due to year with moderate climatic conditions as compared to extreme cold-dry and hot-wet weather (Greyling, 2000). Geographical location, particularly degree of latitude, was also had significant impact on timing and length of estrus and estrus cycle as reported by Khanum *et al.* (2007) in goats.



Table 2. Length of estrus cycle, duration of estrus and kidding interval in Kamohri goat

Variables	No. of goats observed	Length of estrus (hrs)		Length of estrus cycle (days)		Kidding Interval (days)	
		Mean±S.E	Range	Mean ± S.E	Range	Mean ± S.E	Range
Mean values	136	21±0.043	18-22	23.206±0.307	16-30	252.47±2.983	190-360

**Duration of Estrus Period:** Estrus period duration is the onset of appearance of estrus symptoms to disappearance of estrus symptoms in the same estrus and same animal.

During estrus female doe shows typical characteristics sexual behavior and takes interest in male. Female doe in estrus, a mounting behavior, switching of tail and bleating are primary signs were observed in does in estrus (Greyling, 2010). The similar observations were recorded in doe used in present research work. This change in physic behavior of female is due to the hormonal influence on reproductive system. The dominant hormones are estrogen in estrus produced by mature follicles and progesterone by developed corpus lutum of cycle (Pined and Dooley, 2003). In goat it ranges from 10 to 36 hours, but in some goat breeds it varies from 22 to 60 hours ((Bukar *et al.*, 2012). The mean duration of the natural estrous period in Kamohri goat was found to be as 23.206 hrs (Table-2). These findings are close to the results reported as 24–56 hrs in Boer goat doe (Bukar *et al.*, 2012 and Greyling, 2010). No significant difference was recorded between multiparous, biparous and primiparous does (Greyling and Van Nieckerkeu, 1990). The estrous period of the Angora doe was shorter at the beginning and end of the breeding season. The climatic condition, day length, and health of animal, presence of male has great effect on the length of estrus time period.

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### AUTHOR'S PROFILE

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Published research paper: (of which very few listed here).

### Research Publications

Sr. No.	Name of Author	Research Topics	Name of Journal, Vol. No
1.	<b>Hamzo Khan Kunbhar</b> , Allah Bachaya Lasi and Akeel Ahmed Memon	Reproductive performance of crossbreed cattle maintained at Nagori cattle farm, Nagori Society Karachi	Journal of Veterinary and Animal Advances, 2015
2.	<b>Hamzo Khan Kunbhar</b> , Aziz-Ullah Memon, Syed Imam Shah	Incidence of placental retention in Kundhi buffaloes around Tandojam, Pakistan	Pak. J. Life. Soc. Sci., 9(1):21-23, 2011
3.	<b>Hamzo Khan Kunbhar</b> , T. H. Rahoo, M. U. Samo	In Vitro fertility assessment of Kundhi buffalo bulls semen	Research Opinion in animal and Veterinary sciences 01(02):102-106
4.	S. Mustafa, P. Khatri, I. Kaka, <b>H.K. Kunbhar</b> and A. Rajhani	Effect of exogenous estrogen on sexual behavior of Kundhi buffalo bull	Pakistan Journal of Agriculture, Agriculture Engineering and Veterinary Sciences, 2015. 30(1):104-112. 2015
5.	T. H. Rahoo, <b>Hamzo Khan Kunbhar</b> , Z. A. Qureshi, A. Kaka and D. H. Kahoro	Post-Thaw evaluation of Kundhi buffalo bull semen	Int. j. Biol. Biotech., 08(02):189-194, 2011
6.	<b>H.K. Kunbhar</b> , M.U. Samo, R. Rind and M.I Memon	Sex ratio, corneal implantation and stage of Pregnancy in Thari cows Slaughtered at Mirpurkhas	Pak. J. Bio. Sc. 4 (Suppl. Issue No.-5) 460, 2001.
7.	<b>H.K. Kunbhar</b> , M.U. Samo, R. Rind, I. Kaka and A.D. Chana.	Gross-pathological studies of female reproductive organs of Thari cows (Boss Indicus).	J. Anim. Vet. Adv., 2(2): 58-63, 2003.
8.	<b>H.K. Kunbhar</b> , M.U. Samo, A. Memon and A.A. Solangi	Biometrical studies of female reproductive organs of Thari cows.	Pak J. Bio. Sci.6 (4): 322-324, 2003.
9.	M.U. Samo, <b>H.K. Kunbhar</b> and A.A. Channa.	Effect of treatment of retention of placenta on Postpartum reproductive performance of buffaloes.	J. Anim. and Vet. Adv. 2(6) 362-365, 2003.
10.	M.U.Samo, R.A. Leghari, K.B. Mirbahar, <b>H. K Kunbhar</b> , T.A. Qureshi and I.Kaka,	Effect of gonadotropin releasing hormone on firstpostpartum estrus in Kundhi buffalo.	Pak. J. Agri, Agri .Engg. & Vet.Sc.21 (1), 2005.