



Age-related changes in body weight, Body Conformation and Scrotal Circumference and Prepubertal Sexual behavior of Kundhi Buffalo Bull Calves

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**Abstract:** A study was planned to evaluate the production profile of Marecha camel maintained in desert ecosystem of Thal area. Reproductive efficiency is the most important factor in livestock production. Buffalo bulls of excellent genetic make-up possessing high fertility can significantly improve reproductive and productive efficiency in buffaloes. In this situation, an effort is needed to identify areas of male buffalo reproduction that are of applied importance. This study was conducted to investigate the relationship between age, body weight, scrotal circumference, body conformation and pre pubertal sexual behavior in Kundhi buffalo bull calves. A positive coefficient correlation ( $r = 0.90$  to  $0.95$ ) at  $P > 0.001$  were found between age and other traits (body weight, S.C., height at withers, body length and heart girth). Sexual interest and mounting was observed at the mean age of  $19.1 \pm 0.72$  and  $21.1 \pm 0.89$  months respectively. First ejaculation with  $>10\%$  sperm motility and onset of puberty in bulls was observed at the mean age of  $24.2 \pm 0.52$  and  $25.0 \pm 0.57$  months respectively, when the mean body weight and scrotal circumference reached  $381 \pm 27.60$  kg and  $23.17 \pm 0.87$  cm respectively. It was concluded that body weight, S.C. and body measurements increased linearly with age of the bulls. Generally, bulls gained about 15 kg body weight per month and that bulls grew faster from 12 to 20 months of age.

**Keywords:** Kundhi buffalo bull, body weight, scrotal circumference, body measurements and pre pubertal sexual behavior.

**Abbreviations:** height at wither (HTW), body length (BLT), heart girth (HGT).

## 1. INTRODUCTION

Buffalo is usually low cost production, to a large extent based on feeding of roughages with a high proportion of cellulose, which can hardly be digested by other ruminants. This makes the buffalo a very important animal for small holders, landless labourers, and their families (Settergren 1988). It is the major dairy animal in several countries including India and Pakistan (Hafez and Hafez 2013) and holds strategic place in overall livestock economy of Pakistan. It stands as a major contributor among livestock producing 27298 and 1085 thousand tonnes of milk and meat production respectively (GOP, 2017).

Performance testing of bulls requires evaluation of highly pedigreed calves for growth, age at sexual maturity, sexual behaviour, semen quality and fertility (Ahmed, 1987). The early production of semen of a bull calf depends largely on the growth of the animal. The bulls therefore should be grown out early and well, avoiding, as far as possible damage to the testicular tissue from any cause. The age at which puberty begins depends on many factors, but size for the breed seems to be the main controlling factor (Salisbury, *et al.* 1978). In buffalo, as in cattle, scrotal circumference is useful

indicator of potential sperm output and may serve as an important criterion for selecting young bulls as artificial insemination (AI) sires (Pant, *et al.* 2003). Buffalo bulls with higher scrotal circumference produce good quality semen (Hafez and Hafez 2013) and have a positive correlation with libido and mating behavior (Javed, *et al.* 1998). The above cited literature suggested that evaluation and selection system of buffalo bulls for their body weight, scrotal circumference, live weight gain and phenotypic parameters could easily be used for farmers in their herds and may be adjusted according to production goals and need for the number of males for reproduction.

The poor growth of kundhi male calves observed at private dairy farms is mainly due to negligence and poor management that could be improved tremendously by the introduction of standard feeding and management practices. The literature regarding growth performance of Kundhi buffalo breeding bull calves is lacking. The present study was therefore, undertaken to investigate the growth pattern of Kundhi buffalo bull calves raised under optimum management conditions. This study may help in early detection of the abnormally developing breeding bulls.

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## 2. MATERIALS AND METHODS

Ten buffalo bull calves born to the elite buffaloes were purchased at the age of 8 -12 months. These were raised at the Department of Animal Reproduction, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University Tandojam, Pakistan.

**Physical Examination** was done of all bull calves before putting them in actual research protocol of the current study. The buffalo bull calves were kept under optimal nutritional management and health care (Vaccines, deworming etc) during the period of research. They were fed seasonal green fodder such as Berseem and Maize, Wheat bhoosa and concentrates such as Wheat bran and Cotton seed cake, to meet the requirement of 62% TDN and 17% CP.

**Parameters;** Body weight, Scrotal circumference and Body conformation were recorded on fortnightly basis until onset of puberty.

### **Body weight:**

The body weight of each bull calf was taken early in the morning before feeding and watering by using weighing balance (Evary scale).

**Scrotal circumference:** To measure the scrotal circumference, the testes were pulled firmly into lower portion of the scrotum by encircling its neck with the hand and rubber band. The measurement was taken at the widest diameter of scrotum in cm using a measuring tape.

**Body conformation:** Following parameters were recorded for body conformation

**a) Height at wither:** Wither height of the animals is the highest point on the animal's shoulder, immediately above the front legs. Height of the bull was taken from wither to the point where front leg touches the ground by means of steel tape.

**b) Body length:** It is the distance, measured from the point of shoulder to the pin bone.

**c) Heart girth:** It is the circumference of the chest of an animal. To measure heart girth the tape was passed tightly around the body just back of the shoulders at the smallest circumference.

### **Behavioral changes prior to puberty:**

In this checkup program, the initiation of following behavioral changes were recorded.

- Sexual interest e.g. Smelling, licking, sniffing, flehmen, intermittent urination, tucking up of sheath, chin resting and bunting.
- Mounting attempts.
- Penile protrusion i.e. penile movement within sheath, partial and complete penile protrusion.
- Mounting for ejaculatory response and possible ejaculation.

**Statistical analysis:** The collected data was statistically analyzed to establish coefficient of correlation and regression between the parameters by using "Student Edition of Statistix" computer program.

## 3. RESULTS

### **Body weight:**

A positive correlation ( $r = 0.933$ ) was found between body weight and age of the animals (Figure-1). Generally bulls gained around 15 kg body weight per month. But a higher (around 19 - 24 kg) monthly weight gain was observed when they were between 15 to 18 months of age. The overall monthly and daily mean ( $\pm$ SEM) weight gain was found to be  $17.10 \pm 1.53$  and  $0.56 \pm 0.049$  kg respectively.

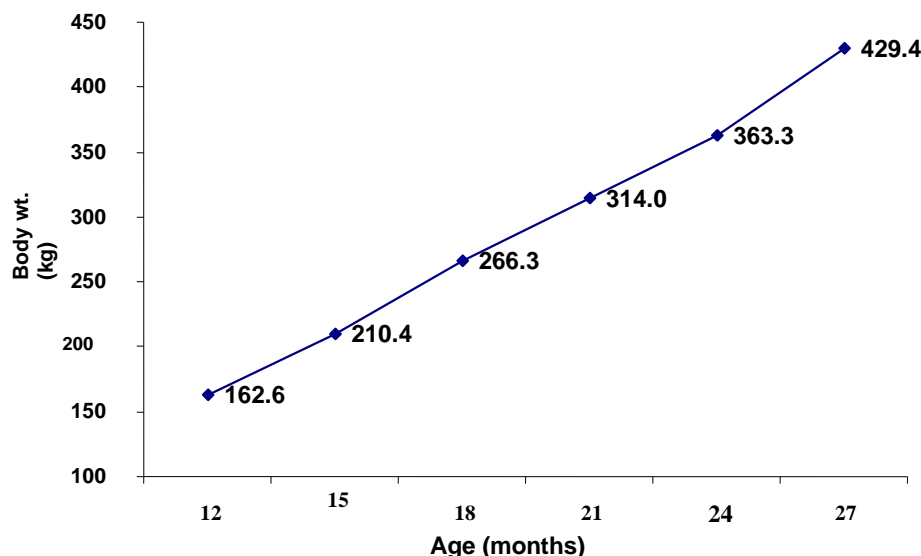


Fig.1: Correlation between body weight and age of male buffalo calves

## 2. Scrotal circumference:

A linear increase in the scrotal circumference was observed at the mean ages from 11.4–26.4 months. A positive correlation 0.9564) at  $P < 0.001$  was found between scrotal circumference and other variables under study.

## 3. Body Conformation:

It could be defined as proportionate shape of animals as compared to an ideal model. A Positive correlation coefficients ( $r = 0.93$  to  $0.95$ ) were found between height at withers, body length and heart girth in the current study. It was found that height at wither body length and heart girth increased parallel to the age of each bull.

**Table 1: Mean monthly gains of height at withers, body length and heart girth of bull calves.**

Bull No.	Monthly gains		
	Height at withers (cm)	Body length (cm)	Heart girth (cm)
1	$1.7 \pm 0.21$	$1.6 \pm 0.33$	$3.3 \pm 0.36$
2	$1.7 \pm 0.27$	$2.4 \pm 0.31$	$3.2 \pm 0.33$
3	$2.1 \pm 0.24$	$2.2 \pm 0.40$	$2.9 \pm 0.45$
4	$1.4 \pm 0.22$	$2.1 \pm 0.27$	$2.8 \pm 0.35$
5	$1.5 \pm 0.27$	$2.3 \pm 0.29$	$2.6 \pm 0.35$
6	$1.2 \pm 0.14$	$2.11 \pm 0.24$	$2.4 \pm 0.26$
7	$1.7 \pm 0.21$	$2.07 \pm 0.26$	$2.7 \pm 0.31$
8	$1.5 \pm 0.23$	$1.96 \pm 0.25$	$3.2 \pm 0.24$
9	$1.9 \pm 0.24$	$2.25 \pm 0.25$	$3.2 \pm 0.28$
10	$2.0 \pm 0.28$	$1.83 \pm 0.47$	$3.1 \pm 0.28$

Correlation coefficient with P-values between age, body weight, S.C., height at wither, body length and heart girth, are shown in (Table-2). A positive correlation ( $r = 0.9015 - 0.9571$ ) at  $P < 0.001$  was found between body conformation traits and other variables under study.

**Table 2: Correlation coefficient with P-values between body conformation, age, body weight and S.C. in Kundhi bull calves.**

Parameters	Correlation between measurements					
	Height at wither (cm)	P-values	Body length (cm)	P-values	Heart girth (cm)	P-values
Age (months)	0.9015	<0.001	0.9561	<0.001	0.9346	<0.001
Body weight (kg)	0.9502	<0.001	0.9317	<0.001	0.9551	<0.001
S.C. (cm)	0.9358	<0.001	0.9169	<0.001	0.9564	<0.001
Height at wither (cm)	--	--	0.9366	<0.001	0.9571	<0.001
Body length (cm)	--	--	--	--	0.9231	<0.001
Heart girth (cm)	--	--	--	--	--	--

The overall mean ( $\pm$ SEM) height at wither ( $120.8 \pm 0.83$  cm) at the mean age of  $19.4 \pm 0.38$  months found in the Kundhi buffalo bulls. The body length is a breed character, preferred by farmers. The overall mean body length ( $117.6 \pm 0.92$  cm) was recorded at the average age of  $19.4 \pm 0.38$  months. The heart girth indicates typical male characteristics of a breeding bull. The overall mean values for heart girth  $160.9 \pm 1.36$  cm were observed at the mean age of  $19.4 \pm 0.38$  months.

## 4. PREPUBERTAL SEXUAL BEHAVIOUR

The age in months of first appearance of some prepubertal sexual characteristics of Kundhi buffalo bulls are shown in table-3. The characteristics seen were smelling, licking, sniffing, flehmen, intermittent urination, tucking up of sheath, chin resting and bunting. Some of the bulls were also mounting on each other.

**Table 3: The Age (in months) at first appearance of some Prepubertal Sexual Characteristics among Kundhi buffalo bulls.**

Bull No.	Characteristics			
	Sexual interest	Mounting	Partial protrusion of penis	Complete protrusion of penis
1	17.0	18.0	22.0	23.0
2	15.5	16.5	24.3	24.5
3	19.5	23.0	24.0	25.0
4	20.5	25.0	26.0	--
5	19.5	20.6	21.0	21.5
6	22.0	23.0	--	--
7	18.5	22.0	24.0	26.0
8	16.0	18.0	20.0	21.0
9	20.0	21.0	21.5	22.0
10	22.0	24.0	--	--
Mean ( $\pm$ SEM)	$19.1 \pm 0.72$	$21.1 \pm 0.89$	$22.8 \pm 0.71$	$23.3 \pm 0.72$

## 5. FIRST EJACULATION:

The age, body weight and S.C. of Kundhi male buffaloes at first ejaculation are shown in table-4. The means ( $\pm$ SEM) of age, body weight and scrotal circumference at first ejaculation were found to be  $24.2 \pm 0.52$  months,  $369.2 \pm 27.3$  kg and  $22.6 \pm 0.82$  cm respectively.

**Table-4: Age, body weight and S.C. at first ejaculation of Kundhi buffalo bulls (n=6).**

Bull No.	Age (months)	Weight (kg)	SC (cm)
B - 1	26.0	461	24.5
B - 2	24.0	379	23.5
B - 3	25.0	386	21.5
B - 5	23.0	320	19.0
B - 8	24.5	401	24.0
B - 9	22.5	268	23.0
<b>Mean (<math>\pm</math>SEM)</b>	<b><math>24.2 \pm 0.52</math></b>	<b><math>369.2 \pm 27.3</math></b>	<b><math>22.6 \pm 0.82</math></b>

## 6. ONSET OF PUBERTY:

The age, body weight and scrotal circumference of Kundhi buffalo bulls at puberty are shown in table -5.

**Table 5: Age, weight, scrotal circumference (S.C.) of Kundhi buffalo bulls at puberty.**

Bull No.	Age (months)	Weight (kg)	SC (cm)
1	27	471	25.5
2	25	392	24.0
3	26	404	22.0
5	24	330	19.5
8	25	411	24.6
9	23	278	23.4
<b>Mean (<math>\pm</math>SEM)</b>	<b><math>25 \pm 0.57</math></b>	<b><math>381 \pm 27.60</math></b>	<b><math>23.17 \pm 0.87</math></b>

Out of ten bulls, six attained the age of puberty. Four of the six bulls reached puberty by around 400 kg body weight, while one bull attained it at 330 kg and remaining one attained it by least body weight (278 kg). Bulls attained onset of puberty by mean scrotal circumference (S.C.) of 23.17 cm, while one of six bulls attained it by S.C. of 19.5 cm, remaining four of ten bulls, were younger at the end of study period and did not complete these stages.

## 7. DISCUSSION

Our study revealed a highly significant ( $P < 0.01$ ) correlation ( $r = 0.93$ ) existed between the body weight and age of the bulls. These findings are in agreement with those reported in the literature (Ahmed, *et al.* 1985, Ahmad, *et al.* 1989, Kodagali, *et al.* 1997). In the present study mean body weights ( $166.8 \pm 12.8$ ,  $287.1 \pm 16.7$  and  $366.5 \pm 20.2$ ) found in Kundhi buffalo bulls at 12.4, 18.4 and 24.4 months of age were lower as compared to Nili-Ravi breed, reported by Ahmed, *et al.*

(1983), who found mean ( $\pm$ SEM) body weight as  $217.0 \pm 13.3$ ,  $337.0 \pm 18.8$  and  $454.4 \pm 20.2$  kg at the 12, 18 and 24 months of age respectively. Similar findings with higher body weights at different age levels have been reported by (Ahmed, Latif *et al.* 1985, Asghar, Shah *et al.* 1988). While mean ( $\pm$ SEM) body weight of Murrah buffalo bulls ( $187.3 \pm 2.7$ ,  $244 \pm 4.6$  and  $353.1 \pm 6.3$  kg) at 12, 16 and 24 months of age are in line with our findings (Oliveira, *et al.* 1997).

In the present study, mean daily weight gain ( $0.56 \pm 0.01$  kg/day) is similar to that recorded ( $0.47$  to  $0.68$  kg/day) in Nili-Ravi buffalo bulls (Shah *et al.* 1988). Corresponding results have also been published by (Ahmed, *et al.* 1985, Bunyavejchewin, Tanta-ngai *et al.* 1991). The maximum mean daily weight gain of Kundhi buffalo bulls recorded ( $0.74$  kg/day), during the age between 15.4 to 17.4 months. Similar average daily weight gains ( $0.74$  kg/day) were reported in Nili-Ravi buffalo bulls (Ahmed, *et al.* 1985).

The S.C. is major tool in the evaluation of a bull, because a positive correlation exists between scrotal circumference and semen quality (Pant, Sharma *et al.* 2003). The current study found the mean S.C. ( $13.2 \pm 0.46$ ,  $18.5 \pm 0.65$  and  $21.6 \pm 0.89$  cm) in the Kundhi buffalo bulls at 12.4, 18.4 and 24.4 months of age. In contrast high values of S.C. have been reported by Ahmed, *et al.* (1983), who found the mean S.C.  $16.6 \pm 0.46$ ,  $23.2 \pm 0.55$  and  $26.74 \pm 0.41$  cm of Nili-Ravi buffalo bulls at the age of 12, 18 and 24 months respectively. Similar findings have also been reported by Arslan, *et al.* (1987). The values found in the literature are also higher than the current study reported by Valefilho and Melo, (1993) who found the S.C. in crossbred buffalo bulls as 17.1, 20.7, 21.6, 23.5 and 26.2 cm at the age of 10-12, 13-15, 16-18, 19-21 and 22-24 months respectively. The discrepancies found between current study and available literature might be due to breed variation, as Kundhi buffalo is a medium size breed, and this study was started at earlier age as compared to studies reported here by other authors. The average ( $\pm$ SEM) S.C.  $20.0 \pm 0.79$  cm found in the present study at later age of 21.4 months are in agreement to (Pant, *et al.* 2003), who reported mean S.C.  $19.4 \pm 0.35$  cm at the mean age of  $21.0 \pm 0.23$  months in Murrah buffalo bulls.

The body confirmation in context of height at withers, body length and heart girth are supportive parameters to check growth and development of an animal. Our study found a positive correlation coefficients ( $r = 0.93$  to  $0.95$ ) between height, length and heart girth. Similar findings have been reported in the literature by others (Poonia and Rao 1999, Mézes, Gábor *et al.* 2000, Omeje, *et al.* 2001). The overall

mean ( $\pm$ SEM) height at wither ( $120.8 \pm 0.83$  cm) at the mean age of  $19.4 \pm 0.38$  months found in the Kundhi buffalo bulls is similar to that reported ( $121.7$  cm) in Murrah buffalo calves at the age of 18 months (Sirohi and Rai 1997). Similar findings have also been reported in crossbred (Murrah $\times$ Lunka) male buffaloes (Kuruwita, 1994). However, the overall mean ( $\pm$ SEM) body length ( $117.6 \pm 0.92$  cm) at the mean age of  $19.4 \pm 0.38$  months observed in the present study are higher than (Sirohi and Rai 1997) and (Kaschab 1994), who reported body length 106.5 cm in Murrah at 18 months and 104.7 cm in Egyptian buffalo bulls at 45.6 months of the age respectively. The heart girth is a distinctive physiognomies of a breeding bull, which indicates vigor of the animal. The heart girth of Kundhi bulls observed in this study are in line to those of (Sirohi and Rai 1997) and Kuruwita, (1994) who found the heart girth 151.1cm at the 18 months in Murrah and 140 cm at the 14 months of age in crossbred (Murrah  $\times$  Lanka) male buffaloes respectively.

The Kundhi buffalo bulls started donating semen at earlier age ( $24.2 \pm 0.52$  months) than reported in Nili-Ravi ( $26.5 \pm 0.80$  months) and Surti (55.1 months) by (Ahmed, Latif *et al.* 1985) and (Kodagali, Doshi *et al.* 1997) respectively. However mean body weight ( $369.2 \pm 27.3$  kg) and S.C. ( $22.6 \pm 0.82$  cm) of Kundhi buffalo bulls at the time of first ejaculation was lower as compared to Nili-Ravi (515.0kg, 26.3cm) buffalo (Asghar, Shah *et al.* 1988).

The average onset of puberty in Kundhi buffalo bulls of current study is similar to the findings of (Ahmad, Shahab *et al.* 1989) and Arslan, *et al.* (1990), who found mean age  $22.8 \pm 1.1$  and  $23.6 \pm 0.9$  months at puberty in Nili-Ravi buffalo bulls respectively. Similar findings for Swamp and Egyptian buffalo bulls have also been reported (McCool and Entwistle 1989, El-Shamaa, Khattab *et al.* 1997). However, short ages (14 to 17 months) at puberty have been reported (Ali, Ahmed *et al.* 1981, Devaraj and Janakiraman 1986, Ohashi 2001, Helbig 2005) in Egyptian, Surti, crossbred and Bison bulls. While, (Nordin, Hilmi *et al.* 1990) reported  $29 \pm 3$  months long age at puberty in Swamp buffalo bulls. The average body weight at puberty ( $381 \pm 27.6$  kg) of Kundhi buffalo bulls found in the present study is low as compared to Nili-Ravi ( $421 \pm 19$  kg) (Ahmad, Shahab *et al.* 1989). However the lower findings (135, 229 kg) have been reported in Swamp (McCool and Entwistle 1989) and Surti (Devaraj and Janakiraman 1986) buffalo bulls as compared to our findings. The mean S.C. (23.17 cm) at onset of puberty in the present study is higher than reported (16 cm) in Swamp buffalo bulls (McCool and Entwistle 1989).

## 8. CONCLUSION

It was concluded that the period from 12 to 20 months of age is a crucial stage in which bulls grew faster than other periods of study and that Kundhi bulls attained puberty within the range of age reported for other breeds.

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