Assessment of morphometric, productive and reproductive characteristics of Azikheli Buffalo in Swat valley in Northern Pakistan

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Abstract: The current research was conducted to elucidate the morphometric, productive and reproductive characteristics of Azikheli buffalo in the Swat Valley - home tract of the breed. Morphometric assessment of the breed indicated that the mean heart girth, body length and height at wither were 191.36±1.26 cm, 140.39±0.94 cm and 131.35±0.57 cm respectively in adult female. Male were comparatively narrow at heart girth (177.68±3.76 cm), but longer (147.89±2.60 cm) with a comparable height to female (130.01±1.08 cm). Mean daily milk production based on standard 305-day lactation period is 7.19±0.18 liters and the buffalo produces 7.30 to 9.58 liters per day during first 6 months of lactation with maximum production during 3rd month (9.58 liters). Buffalo attain pubertal age at 1147.93±13.05 days of age. The expression of heat signs within 90 days postpartum (50% buffaloes), 64% first service conception rate, 1.55±0.04 number of services per conception with a mean calving interval of 489.16±5.82 days were main reproductive characteristics of the breed. The current study elucidated the basic morphometric, productive and reproductive charteristics of the local Azikheli buffalo in their home tract.
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1. Introduction

Pakistan, located at the crossroad of ancient civilizations, has a wide variety of well adapted world famous animal genetic resources. Nili-Ravi and Kundhi is two well known breed of Pakistan. Thirty seven percent of the total buffalo population in the country has been recognized as non-descript (Khan et al., 2007), including Azikheli, which is famous for its continued existence in the mountainous environment (Khan et al., 2011). Though Azikheli buffalo has been shown in the FAO genetic resources report (FAO Country report of Pakistan, 2003), phenotypic and genotypic characterization of the breed remained to be elucidated.

In developing countries, breed characterization is the important tool in designing appropriate management and conservation program for livestock. Available literature indicated that local breeds are adapted to local feed, perform well on poor quality roughages, resistant to prevailing diseases, unaffected by weather extremes and are well adapted to move in rugged terrain for grazing, caters to diverse needs of mountainous farmers, have low input at low cost, rely on the resources that are almost available within the system. Unfortunately, Pakistani animal genetic resources are not entirely elucidated and their main characteristics are not well described. It is therefore, necessary to evaluate local breeds for phenotypic characteristics, productive and reproductive performance potential especially in their home tracts and under existing management condition (Swaminathan, 1988; Zarate, 1996).

The aim of the current study was to explore the morphological, productive and reproductive characterization of the Azikheli buffalo in their home tract -Swat valley in northern Pakistan. Additionally the results obtained in current study would be useful to animal scientist and livestock producers for the efficient conservation and sustainable management of the local buffalo genetic resources by the appropriate use of these characteristics.

2. Material and Methods

Azikhel Tehsil, the home tract of Azikheli buffalo, is the selected area for the study. It includes Khwazakhela being its main town, with the livestock population scattered in the surrounding villages and

watershed. The approximate area of the Tehsil is 84 square km and is situated in the middle of Swat valley proper. It is located at 340 56 '1" North and 720 28 '0"with an elevation range of 1100 to 1600 m. The mean annual rain fall in the valley range from 1000-1750 mm/year. July is the hottest and January is the coolest month of the year. The temperature is, however, not uniform and inversely varies with increasing elevation; however, it never goes above 38 Co and below 10 Co. The two main dry seasons are from the end of May to mid July and start of October to the end of November. This is one of the most fertile valleys in the region. The valley bottom is near the river bid is the prime rice area, with orchard grown on the subsequent gentle slopes and silvi-pastoral production system on the hillside (Fig; 1).

During the study period, the Animals farmers associated with Azikheli buffalo farming were identified in study area through the staff of civil veterinary hospital Khwazakhela and civil veterinary dispensaries in its circle. Total of 108 Azikheli buffaloes were randomly selected in the study area during last month of pregnancy and were divided into three groups each of thirty six buffaloes in hill slope, undulating and plain ecological zones. Additionally Azikheli buffaloes bulls (n=27; 9 in each zone) were also randomly selected to explore the physical and morphometric characteristics.

Azikheli buffaloes and bulls were used for Physical and morphometric characteristics. Physical characteristics like color of the coat; forehead and horn, were recorded on each animal. Morphometric measurements (heart girth, body length and height at wither) were taken using measuring tap with animals standing on flat surface in normal position. In case of buffalo, measurements were taken within two to three months after parturition.

Milk was recorded according to ICAR A4/2 method with help of 4 enumerators. Milk output was recorded from parturition till 305th day of lactation with first record within first two weeks of parturition. Morning and evening milk was added to obtain daily milk yield for individual buffalo. Reproductive charteristics including puberty age, postpartum estrus interval, first service, conception rate, number of services per conception, calving interval and dry period were collected from farmers randomly selected through pre-designed tested questionnaires. Data was tabulated according to ecological zones and seasons to study their effects.

Statistical analysis was conducted with the Statistical Package for Social Science (SPSS for Windows version 12, SPSS Inc., Chicago, IL, USA). The data is presented as mean ± SE. The data was analyzed using one-way analysis of variance. The differences were compared by Student's t-test.

3. Results

The home tracts where the buffaloes are found include the watershed of River Swat and Panjkora that encompasses the districts of Swat and Dir (upper and lower) and also found in district Shangla and Malakand agency. The breed can also be found in district Mardan, Charsadda, Nowshera and Sawabi with transhumant coming during winter for grazing of livestock from upland of district Swat and Dir. The breed is conserved by local communities. On the other hand, its population is plunging, and it is becoming increasingly difficult for the custodian communities to protect the breed.

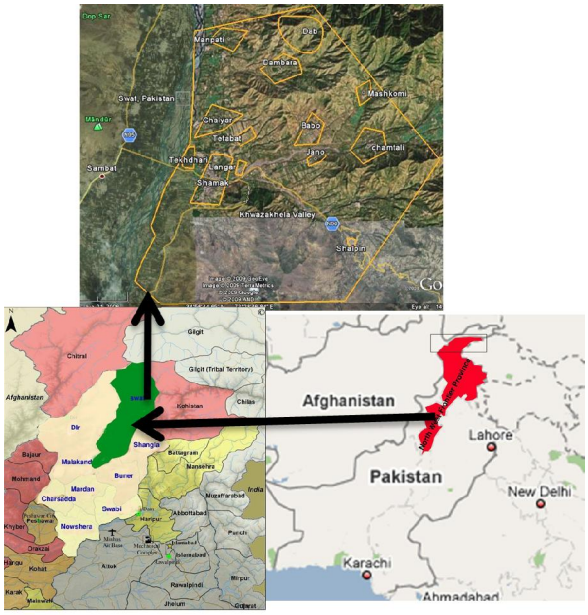

Fig 2: Azikheli buffalo.

Fig 3: Azikheli buffalo bull.

Mean heart girth, body length and height at wither were 191.36±1.26 cm, 140.39±0.94 cm and 131.35±0.57 cm in buffaloes whereas in bulls, it was 177.68±3.76 cm, 147.89±2.60 cm, 130.01±0.78 cm respectively. Buffaloes have significantly higher values for heart girth (t (133) = 4.36; P<0.001) than bulls. However, bulls are longer (t (133) = 3.28; P<0.001) than buffaloes. The difference in height at withers between buffalo and bull was not significant. Azikheli buffalo were found broader than bull at heart girth.

Table 1. Daily milk productions (liter) of Azikheli buffaloes in hill slope, undulating and plain ecological zones in Khwazakhela valley of District Swat Khyber pakhtunkhawa. N, number of observation

Ecological zones	Mean milk production	N
Hill slope	6.40±0.29 (3.82-11.59)	36
Undulating	7.43±0.29 (4.19-10.74)	36
Plain	7.87±0.30 (3.69-11.37)	36

Table.1.shows means daily milk production in hill slope, undulating and plain ecological zones. Mean daily milk production is 7.23±0.18 liters ranging from 3.69-11.59 liters. Higher mean daily milk production is recorded in plain (7.87±0.30) and lower in hill slope ecological zone (6.40±0.29 liters). Daily milk production recorded in hill slope was significantly lower than milk recorded in undulating (7.43±0.29 liters; t (70) =2.49; (P<0.05) and plain ecological zone (7.87±0.30 liters; t (70) =3.50; (P<0.001). on the other hand, the difference between undulating and plain was non-significant (t (70) = 1.04; p >0.05).

The higher mean daily milk yield is observed in summer season (7.44±0.23 liters) followed by winter season (7.15±0.42 liters) and spring (7.09±0.76 liters). The least daily milk yield was recorded during autumn (6.80±0.38 liters) (Table.2). During current study no significant effect of the season was observed on daily milk production.

Table 2. Daily milk productions (liter) of Azikheli buffaloes calved in spring, summer, autumn and winter season in Khwazakhela valley of district Swat Khyber Pakhtunkhawa. N, number of observation

season	Mean milk production	N
Spring	7.09±0.76 (4.03- 9.66)	8
Summer	7.44±0.23 (3.69-11.59)	64
Autumn	6.80±0.38 (3.82-11.37)	25
Winter	7.15±0.42 (4.95- 9.91)	11

Table 3. Reproductive performance of Azikheli Buffaloes in hill slope, undulating and plain ecological zones of Khwazakhela valley, district Swat

Reproductive parameters	Hill slope	Undulating	Plain	Total Mean
Pubertal age	1178.16±18.17 (540-1800)	1188.14±25.86 (540-1800)	1042.02±24.59 (540-1800)	1147.93±13.05 (540-1800)
Postpartum estrus interval	163.12±8.29 (20-465)	135.79±10.16 (20-555)	132.02±11.57 (20-570)	148.41±5.66 (20-570)
Number of services per conception	1.57±0.07 (1-5)	1.53±0.08 (1-5)	1.53±0.08 (1-5)	1.55±0.04 (1-5)
Calving interval	503.55±9.10 (345-750)	468.41±10.10 (345-675)	468.41±10.10 (345-750)	468.41±10.10 (345-750)
Dry period	118.98±3.76 (15-255)	122.53±5.20 (10-255)	119.61±4.88 (20-270)	119.74±2.58 (10-255)

Table4. Reproductive performance of Azikheli Buffaloes calved in spring, summer, autumn and winter seasons in Khwazakhela valley of district Swat

Rep parameters	Spring	summer	autumn	winter
Postpartum estrus interval	157.76±15.03 (20-570)	142.34±8.27 (20-555)	169.85±23.03 (20-450)	161.62±17.39 (20-465)
Number of services per conception	1.57±0.11 (1-5)	1.52±0.06 (1-5)	1.65±0.18 (1-5)	1.71±0.14 (1-5)
Calving interval	483.00±13.86 (345-705)	483.00±13.86 (345-750)	483.00±13.86 (390-720)	483.00±13.86 (360-720)
Dry period	128.94±7.36 (20-255)	120.90±3.72 (15-255)	107.31±9.58 (15-255)	121.23±8.42 (10-255)

4. Discussions

To the best of our knowledge, it is the first report to elucidate the morphometric, productive and reproductive characterization of the Azikheli buffalo in its home tract –Swat valley. Coat colour is one of important trait. The color pattern of Azikheli buffalo observed in current study was characteristically different from the common buffalo breeds of Pakistan (Khan et al., 2005). Majority of Azikheli buffalo and bull were of brown coat color (62.04%) with white forehead (61%), blue shining eyes (80%) and black horns (52%). Nili-Ravi and Kundi buffalo breeds of Pakistan are mainly black (Khan et al., 2005) with intermittent amount of brown coats (Maqsood, 1980) whereas the coat colour of swamp buffaloes ranges from grey to completely black, with very few having a white coat (Miao et al., 2010). The dominant brown coat colour (62.04 percent) in Azikheli seems to be an adaptation to the mountainous environment.

During current investigation, Azikheli buffalo were found to have higher values for heart girth than bulls. This variability in the heart girth could be attributed to nutritional effect as the circumference traits are more affected by nutrition (Kamalzadeh et al., 1998). Furthermore, bulls are only used for breeding purposes in which slim and less fleshy are preferred for mounting. Also, Azikheli buffalo is smaller in stature than Nili-Ravi (heart girth 225 cm, body length 149 cm, height at wither 136 cm) (Khan et al., 1982) whereas at wither height (125 cm) it is comparable to Kundi buffalo (Moioli and Borghese, 2005).

It seems reasonable that s Small stature of Azikheli buffalo in the home tract support the hypothesis that the breed has been evolved in its home tract during a course of many centuries. Consequently, the short stature shows adaptation to the mountain terrain for grazing. The transhumant farmers also has the Azikheli buffaloes but because of the encroachment of the key upland grazing area used by the buffaloes during the past century by cash crops like potatoes and turnip has reduced the buffalo shifting to upland pastures nominal. The short stature evolved as a result of its long distance, seasonal mobility is still in place despite its gradual sedenterization.

Daily milk production of Azikheli buffalo obtained in this study was in accordance with milk production in Nili-Ravi buffalo (Khan, 1994; Khan et al., 2008). It seems reasonable that Azikheli buffalo could therefore be considered a comparable buffalo breed to Nili-Ravi in terms of milk production despite their short stature. During the current study, highest milk production in the Azikheli buffalo was recorded in plain ecological zone. This high milk production might be due to mangemental practices and availability of more fodder and concentrate feed in that region.

Likewise, the current study indicated visible seasonal effect on milk production. High milk production of Azikheli buffalo was recorded in summer and winter seasons. The high milk yield in these seasons might be associated with ample availability of the fodder in these seasons when the lactation is at its peak. For summer calvers green fodder in the form of weed thinning is available from the maize and rice crops in autumn season and for winter calvers from wheat crops in spring season. Barseem/Shaftal is also available in spring season. Summer is also the normal calving season of Azikheli buffalo and it has been reported that buffalo produces more milk when calved in normal breeding season than buffaloes calved in off breeding season (Nagasaku et al., 2007). Recent review of literature indicated the variable effect of calving season on milk production in buffalo in diverse environmental condition. Some authors reported this effect to be significant (Tomar et al., 2006; Nagasaku, et al., 2007; Afzal et al., 2007) whereas others group of scientist demonstrated this to be non-significant (Raheja et al, 1983; Dutt and Yadav, 1986; Ghaffar et al, 1991). In our current study, the effect of calving season on milk production of Azikheli buffalo was non-significant. The absence of significance indicated that the breed is less affected by seasonal variation and is well adapted to the area.

During current study, the reproductive characterizations of the breed were investigated in

three ecological zones in different seasons of the year. Visible differences in reproductive performance have been demonstrated from other breed of buffalo. Current study indicated that Azikheli buffaloes reached pubertal age comparatively late than Nili-Ravi buffalo breed (Afzal et al., 2007). This difference might be due to variation of breed, climatic change and feeding system (Borghese et al. 1994). Likewise, this study further demonstrated that buffaloes in plain ecological zone (1042.02±24.59 days) attained puberty at an earlier age than buffaloes in hill slope (1178.16±18.17 days) and undulating (1188.14±25.86 days) ecological zone whereas no significant differences in puberty age in buffaloes of hill slope and undulating ecological zone was recorded. The disparity in pubertal age in different ecological zones might be due to differences in feed availability and environmental stress **(**Ingawale and Dhoble, 2004; Akhtar et al, 2007).

Mean postpartum estrus interval was 148.41±5.66 days ranging from 20 to 570 days of azkikheli buffalo. Postpartum estrus interval ranging from 52.22±4.12 to 153.65±4.10 days has been reported in Nili-Ravi buffalo (Chaudhry et al., 1988; Chaudhry et al., 1990). However, in Kundi buffalo, Bughio et al. (2000) recorded shorter postpartum estrus interval (84.20 to 102.73 days) than the findings of the current study. The long postpartum estrus interval in Azikheli buffalo might be attributed to several factors including pre- and postpartum nutrition, suckling and calving season (Hegazi, 1994;Barkawi, 1993; Khattab et al., 1995; Barkawi et al., 1996; Qureshi et al., 1999). Fifty percent of Azikheli buffalo showed first estrus within 90 postpartum whereas, 75% of the buffaloes were cyclic by 180 days postpartum. Ahmad et al. (1983) also reported 49% Nili-Ravi buffaloes cyclic by 90 days postpartum whereas, Chaudhry et al. (1990) recorded a higher percentage (92.60%) of buffaloes cyclic by 90 days postpartum at Livestock Experiment Station Bahadurnagar, Pakistan. Buffalo not showing estrus 180 days postpartum was consider as anestrous buffaloes. In current study, almost 25% of Azikheli buffaloes were recorded as anestrous which was lower than that reported in Nili-Ravi buffalo (35%) under rural management system (Anwar et al., 2003). The period of postpartum anoestrus or acyclicity is highly variable in the buffalo. Poor nutrition, body condition, suckling management and climate might be associated with postpartum anoestrus (Baruselli et al, 2001, Perera, 2008, Usmani et al, 1990). Perera et al. (1987) reported that buffaloes under harsh conditions with free suckling by the calves remained acyclic for 150-200 days. Routine management of suckling during milking in Azikheli buffalo with harsh climatic conditions and feed scarcity particularly at hill slope were the probable reasons for long postpartum estrus interval observed in current study.

During current study, Buffaloes calved during summer season have the shortest postpartum estrus interval (142.34±8.27 days) followed by spring calvers (157.76±15.03 days) and winter calvers (161.62±17.39 days) whereas the autumn calvers took more days to show postpartum heat (169.85±23.03 days). Contradictory results had been reported on the influence of calving season on postpartum estrus interval in buffaloes. El-Wardani (1990) and Qureshi et al. (1999) reported a non-significant effect of calving season on postpartum estrus interval. On the other hand, Khattab et al. (1995) and Barkawi et al. (1996) found that calving season significantly affect the trait in buffalo. Bughio, et al. (2000) described that there was a marked effect of climatological factors on reproductive behavior of buffaloes with postpartum estrus interval increased in warmer months. They further reported first postpartum estrus interval as 102.73 days in summer, 100.19 days in spring and 84.20 days in autumn in buffaloes with non significant effect of season on the trait. Ahmed et al. (1982) demonstrated that the postpartum estrus period in buffalo during spring, summer, autumn and winter was 147.60, 124.65, 104.74 and 151.57 days respectively. Azikheli buffaloes calved in summer and spring have short postpartum estrus interval as the summer season is less hot in the study area in comparison to the home tract of other buffalo breeds. In addition, feed availability is also better compared to other seasons which play a vital role in resumption of cyclicity postpartum (Robert, 1986; Baruselli et al., 2001).

Higher ranges for number of services per conception (1.9-2.8) and (1.6-3.1) were reported by Singh et al, (1988) and Khatab (1980) respectively in buffaloes compared to Azikheli buffalo in this study (1.53±0.08-1.57±0.07). This is one of the peculiar characteristic, the Azikheli buffalo breed has adapted since immemorial during the process of evolution which takes centuries for acclimatized with local environment of the mountain region. This higher conception rate has given preference to Azikheli buffalo breed in the local area on Nili-Ravi buffaloes. Nili-Ravi buffaloes brought to the area from down districts do not conceive and hence goes to butchers. The adaptability of the Azikheli buffaloes with higher conception rate is evident from the fact that in local market it does not go to the butcher in their active life except in disease condition or the aged one. Usmani et al. (2000) reported a low first service conception rate (53.4%) and high number of services per conception (1.7±0.12) in Nili-Ravi buffalo.

Calving interval is influenced by postpartum estrus interval and conception rate or a combination of both (Azam et al., 2001). In hill slope longer mean postpartum estrus interval could be a causative factor for prolonged calving interval compared to undulating and plain ecological zones as the conception rate have minor fluctuation in these three ecological zones. Calving interval reported in Azikheli buffalo in this study was longer than Murrah buffaloes (455 days; Singh et al., 1988) and Anatolian buffaloes (441.97±7.93 days; Tekerli et al., 2001). Buffaloes calved during autumn season has the longest calving interval (526.96±21.06 days) followed by winter calvers (492.36±17.79 days) and summer calvers (486.51±07.76 days). Buffaloes calved during spring season have the shortest calving interval (483.00±13.86 days) compared to other seasons. Analysis of variance (t (3, 274) =1.17; P>0.05) revealed no significant difference in mean calving interval among these seasons. Shortest calving interval was also recorded in Nili-Ravi buffaloes calved in summer season (491.82±7.12 days; Chaudhry et al., 1990; 506.6 days; Ahmad et al., 1981; 486.33 days; Shah et al., 1989) and longest calving interval in spring calvers (570days; Ahmad et al., 1981) and winter calvers (571.33±10.88 days; Chaudhry et al., 1990; 539.18 days ; Shah et al., 1989). The desirable calving interval for buffalo has recorded as 12-14 months (365-420 days) and a longer or shorter calving interval is unprofitable (Yadav, 2008). Mean calving interval reported in Azikheli buffalo in this study is longer than the desirable calving interval. Only 35% of Azikheli buffaloes were in the desirable calving interval range (<430) where 65% of Azikheli buffaloes have calving interval >430 days. Postpartum estrus interval is quite longer in Azikheli buffalo (148.41±5.66 days) with 25% buffalo cyclic by more than 180 days. Hence, postpartum estrus interval seems to be a major factor in prolonging calving interval and need immediate attention with improvement in conception rate also.

In conclusion, this study demonstrated distinct morphological characterization of the Azikheli buffalo. Additionally, Azikheli buffalo has comparable productive and reproductive performance to Nili-Ravi with better conception rate, short calving interval and dry period. Further study would be needed to characterize the breed both phenotypically and genetically. Exploration of productive and reproductive performance would pave the way to find out the loopholes and the underlying causes to enhance its productivity in diverse climatic condition in their home tract.

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