

## PHENOTYPIC CHARACTERIZATION OF INDIGENOUS PATERI GOAT IN VARIOUS REGIONS OF SINDH

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### ABSTRACT

Current study was conducted to evaluate the phenotypic features and linear measurements of Pateri goat from different regions of Sindh. Seven hundred adult Pateri goats (630 female and 70 male) were randomly selected from seven habitats of Sindh and data for skin color pattern, skin color type, body shape, hair type, hair length, horn shape, horn orientation, facial profile, ear orientation, rump profile, wattles, hooves, tail, and udder profile were recorded by visual appraisal. Results revealed that among all the regions of Sindh majority of female and male Pateri goats possessed plain white body with dark brown color patches at head, neck and leg regions of body, compact body shape, smooth and straight long hairs, spiral upward horns, straight facial profile, pendulous drooping ears, sloppy rump, dark colored hooves and straight medium tail, while females having wattles and compact udder, exceptionally few cases of female and male Pateri goat showed distinct morphometric traits. The live body weight and linear body traits including chest girth, body length, withers height, height at rump, ear length, facial length, horn length, tail length, head width, hooves length of both sexes, udder and teats of female and scrotum circumference of male Pateri goat at Shaheed Benazirabad vicinity were noted comparatively ( $P \leq 0.05$ ) higher, followed by Matiari, Tando Muhammad Khan, Hyderabad, Mirpurkhas, Tando Allahyar and Sanghar districts of Sindh. Similarly, significant ( $P \leq 0.05$ ) variations were noted in the quantitative traits between both sexes (male and female) and among all the habitats of Pateri goat at Sindh.

**Key words:** Indigenous, Pateri, goat, phenotypic, characteristics

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### INTRODUCTION

From many years, in Pakistan livestock as a subsector has surpassed the crop sector as the major competitor to worth added in the agriculture. Currently it supports 60.1% inclusively in the agriculture and 11.5% in the gross domestic production of the country during 2020-21. In the year of 2019 and 2020 the gross value addition of livestock was estimated as Rs.1,461 billion which was subsequently increased to Rs.1,505 billion in the year of 2020-21, which displayed an increase of 3.0% over the same period of last year (GOP, 2021). The significance of this sector can be comprehended from the fact that it is not only a source of foreign exchange earnings by contributing around 3.1% to the total exports, but also a vital source of 35-40% of income for over eight million rural families and providing them food security by supplementing high value protein of animal origin. All the livestock are fundamental components of agricultural system of the Pakistan and are reared in both mountainous and plain regions (GOP, 2020). The farm animals are considered as a much safe source of earnings for the small farmers and landless poor. With the rearing of all type of domestic animals in different regions of Pakistan, goats are mainly reared by poor families to meet their needs. According to the current economic

survey of Pakistan 80.3 million heads of goats are populated and contribute about 991 (000 tons) in milk, 765 (000 tons) combined share with sheep in meat production and 30,946 in skins (GOP, 2021). Sindh is the second largest province of Pakistan the ideal home for the diverse indigenous goat breeds, with 17.30 million heads kept under different production systems (Mari, 2013). Phenotypically thirteen (13) diverse breeds of goat are populated in the province, among them the Pateri goat is one of the heaviest and versatile breed with distinctive phenotypic physiognomies. It is found in Hyderabad, Mirpurkhas, Tando Allahyar, Tando Muhammad Khan, Sanghar Shaheed Benazirabad and Matiari districts of Sindh and mostly reared under backyard, agro-pastoralist, and rangeland-based systems (Iqbal *et al.*, 1994; Khan *et al.*, 2018). Morphometric classification is the first step for the documentation of qualitative and quantitative traits of the indigenous goat breeds. The phenotypic information of local goat breeds is one the main tool for mass collection, whereby individuals with better characteristic values are chosen to be parentages of the future generation (Carneiro *et al.*, 2010). These studies are important for designing, improvement, utilization, and conservation strategies of breed at provincial and national levels. Lack of baseline characteristic data regarding populations and distinctive characteristics of breed may

lead to significantly decline or loss of breed, before their values recognized, and measures taken to conserve them (FAO, 2012). Knowing morphological character and their differences among and within the goat populations is significant for effective breeding plans (Hosseini *et al.*, 2016; Lestari *et al.*, 2018). Despite, Sindh province has maximum goat breeds in Pakistan, little efforts have been made in a way of characterizing and determining the adaptive and productive potential of these breeds and there is limited information available regarding the morphometric measurements of these indigenous goat breeds (Moaeen *et al.*, 2016). Hence, the intention behind this study was to carry-out the morphometric characterization of Pateri goat by using linear body measurement and physical characteristics reared at various areas of Sindh, Pakistan.

## MATERIALS AND METHODS

**Portrayal of the study area:** For this study, seven (7) districts of Sindh province; Hyderabad, Tando Muhammad Khan, Mirpurkhas, Matiari, Tando Allahyar, Sanghar and Shaheed Benazirabad were selected based on the Pateri goat population. All these selected districts are well known dense livestock populated areas of the Sindh province of Pakistan.

**Sampling Protocol:** A multi-stage sampler method was chosen for data collection from Pateri goat's farmers (Iyoke *et al.*, 2006). The data was collected from adult male and female goats; identified on the basis of literature reviewed (Issani and Baloch, 1996) however, the goat population, neutered goats, gravid doe, offspring, male, and female kids were not included. Collectively, 700 Pateri goats (100 from each area) were recorded for evaluating the qualitative and quantitative traits. The Pateri goat breed was selected in 10:90 ratios of adult male and adult female goats according to the protocol of FAO (2012) for the observation of morphometric traits from all selected areas.

**Morphometric/phenotypic characterization of Pateri goat:** For the selection of qualitative and quantifiable characteristics of Pateri goat, the standard breed descriptor list was meticulously followed (FAO, 2012). Data for qualitative characteristics of male and female goats; coat/skin color pattern, skin color type, body shape, hair type, hair length, horn shape, horn orientation, head/facial profile, ear orientation, rump profile, wattles, hooves, tail, and udder profile were recorded by pictorial observation of the Pateri goats (CGRF, 2011). All the rectilinear physique dimensions of male and female Pateri goat were recorded in the morning before the animals were fed, while animals standing on a flat surface with head held up. The body length, chest girth, withers height, height at rump, ear length, head/facial length, horn length, tail length, head width, hooves length, udder

size, teat length and scrotum circumferences were measured by using plastic measuring tape while body weight was recorded by using electronic weighing balance. All the goats were recognized by their sex and different locations.

**Data orientation and statistical analysis:** The data were analyzed by using SPSS version-20 (IBM, 2017). The qualitative data for each individual variable were analyzed by SPSS version-20 and Chi-square test was applied to evaluate the statistical implication among qualitative / categorical variables using vicinity as a fixed effect and significant difference was computed at ( $P < 0.05$ ). Live body weight and linear body measurements were subjected to factorial analysis of variance by using SPSS version-20 with sex and locations as fixed effects. The Tukey's simultaneous test was used to separate significance of means. The least significant difference between and among the means was computed at 5% level of significance.

## RESULTS AND DISCUSSION

**Morphometric characterization of Pateri goat:** Qualitative characteristics of male and female with the ratio of 10:90 Pateri goats from individual vicinity of Sindh were analyzed and results are depicted in Table-1. Coat color influences radiant heat loss exerting its effect on body weight and other productive adaptability factors in livestock species most especially in the tropical environment (Odubote, 1994). The results regarding coat color indicated that the majority of female and male Pateri goat's skin coat pattern was non-spotted at Hyderabad, Tando Muhammad Khan, Matiari, Mirpur khas, Tando Allahyar, Sanghar and Shaheed Benazirabad. Statistically non-significant ( $P > 0.05$ ) variation was noted in the coat color pattern of both male and female Pateri goats at various locations of Sindh. Contrary to current results Gebreyowhens and Kumar (2017) noticed spotted and pied skin color pattern with light brown, black and gray coat of Maefur goats at Abergelle and Central Highland areas. Comparatively higher percentage of Pateri goat's skin type was observed as white with dark brown head, neck, and hooves in both female and male at Hyderabad, Tando Muhammad Khan, Matiari, Mirpur khas, Tando Allahyar, Sanghar and Shaheed Benazirabad. The white coloration could be an advantage in an intense radiant environment due to its reflectance property as reported by Hensen (1990) that animals with higher percentage of light color offer a better resistance to heat in environment characterized by higher solar radiation. Numerically but not statistically variation was noted in the coat color pattern of both male and female Pateri goats at various vicinities of Sindh. Similarly, Ahmed (2013) reported plain coat color pattern in goat population at Horro, Guduru and Wollega areas.

Bekalu (2014) cited red and white coat color type in goat habituated at Minjarshenkora.

Maximum percentage of female and male Pateri goat's possessed compact body shape among all regions with slight variation contrast to both sexes having leggy body mass. Nazir and Shah (2018) reported medium to large size with compact body shaped goat breeds with different morphometric characteristics existed in different parts of Pakistan. Kemp *et al.* (2007) documented dominant compact body shapes had some implication to distinguish in Maefur indigenous goat from other indigenous goat breeds. In both sex female and male Pateri goats characterized with smooth and straight hairs with high to medium length, only few cases were observed with small and curly hairs among all the regions of Sindh. In contrast to present results Tilahun *et al.* (2019) noted majority of goat population had smooth hair coat type in Berehet, Basona-worena, and Minjarshenkora districts with small proportion of curly rough, glossy, and dull haired goat types. Contrarily, Getahun *et al.* (2020) cited goats with medium sized hair length and small portion of goats had long hair across the study area. Solomon (2009) reported smooth hairs with good size in Afar goats with pockmarked skin color.

Presence of horns in indigenous goats is an important self-defensive mechanism. Also, the presence of horn is an adaptive feature to fight predation especially in the tropical zones where production is characterized by extensive system (Carneiro, *et al.*, 2010). Statistical varied ( $P \leq 0.05$ ) and higher percent of female and male Pateri goats characterized with spiral horns, moderate number with spiral pooled horns with upward direction. and few cases were noticed with curved and pooled horns with backward orientation in both sexes among all vicinities. The presence of horns is an indication of their ability to defend themselves and survive the harsh environments in which they are reared. In accordance with current results Solomon (2009) noted straight and spiral horns in female occasionally polled in male Afar goats at Ethiopia. Alubel (2015) documented majority of Abergelle, and Central Highland goats were horned with curved, spiral, and straight horn shapes and backward, upward, and polled orientation. Hulunim (2014) reported straight horns in Bati indigenous goats. Under the facial profile head and face of female and male Pateri goats at different regions of Sindh has been shown straight contrast to few cases of concave face profile in both female and male. Nazir and Shah (2018) recorded that facial shapes were curved in Damani and Surguli goats' contrast to Gaddi and Kaghani goats having instant profile. Totally straight edged ears are observed in Damani goat, while straight to round shape ears were seen in Surguli, Gaddi and Kaghani breeds of goat. Tilahun *et al.*, (2019) reported straight head profile goat population in Ethiopia. All the female and male Pateri goats characterized with large and pendulous ears and not

a single goat either male or female had ears with erect orientation among all the vicinities. Alike, Tsegaye *et al.*, (2013) stated that Hararghe goats habited in Ethiopia region of the world have elongated and drooping ears along with instant facial shape. Alubel (2015) documented 98.16% of Abergelle goats had horizontal ear direction. Contrary to current results Tilahun *et al.*, (2019) noticed horizontal, erect, pendulous, and semi-pendulous ear orientation in the goat population. In majority of cases predominant rump profile with sloppy back was noticed in female and male Pateri goats at all areas, only few cases of flat rump profile in both female and male was observed at the study areas. In line with current study Tilahun *et al.*, (2019) recorded largest back rump profiles with straight, slopes up towards the rump and curved back rump profile. In majority of cases rump profiles were covered and sloping with little flat. Getahun *et al.*, (2020) characterized majority of goats with sloping rump while small portion of goats have flat rump presentation.

Numerous benefits are associated with the presence of wattles in goats reared under hot and humid environments. Prominent among these are the thermoregulatory functions of wattle and its association with reproduction such as higher prolificacy, milk yield, litter size, fertility index and conception rate (Yakubu *et al.*, 2010). All the female Pateri goats characterized with wattles among all regions while wattles were not characterized in male Pateri goats at the selected study areas. In agreement, Traore *et al.*, (2008) reported majority of female and few male goats in Burkina Faso state having wattles. Hagan *et al.*, (2012) also reported indigenous goats breeds with wattles at their study area. On the contrary, Tsegaye *et al.*, (2013) cited that majority of indigenous goats of Ethiopia were characterized without wattles. The hooves of female and male Pateri goats were noticed as brown in color at all the vicinities. Nazir and Shah (2018) reported that the indigenous goat breeds of Pakistan had good body conformation, coat/skin color and dark color hooves. Tsegaye *et al.* (2013) informed that in the phenotypic characterization like skin color, compact mass and dark hooves of goat having significant influence on marketing value. Significant ( $P \leq 0.05$ ) variation was noticed in the tail orientation for both sexes of Pateri goat. The predominant straight tail direction was seen in female and male Pateri goats, only few cases of both female and male were having curved tail at all study areas of Sindh. Khan and Okeyo (2016) documented that different goat breeds habited in Pakistan were judged as black and white spotted in color and having straight tail orientation in both male and female goats. Tsegaye *et al.*, (2013) recorded frequent sloppy back, straight tail and presence of wattle in both male and female populations.

Udder and teat characteristics are important determinants of milk yield and ease of milking or milking

ability in dairy animals (Upadhyay *et al.*, 2014). In majority of cases predominant compact udder was noted in female Pateri goats at Hyderabad, Tando Muhammad Khan, Matiari, Mirpur khas, Tando Allahyar, Sanghar and Shaheed Benazirabad, while only few goats were seen with loose udder among all the regions of Sindh. Similarly, Monau *et al.*, (2018) reported that the Tswana female goats were characterized with compact udder. In support Vlad *et al.*, (2014) evaluated the morphometric distinctiveness of Saanen breed of goat in the South region of Romania and reported compact udder in female goats.

**Quantitative traits of Pateri goat:** The body weight and linear body dimensions of Pateri goat are presented in Table-2A and Table-2B. The mean live body weight of Pateri male and female goat was statistically ( $P \leq 0.05$ ) different and recorded comparatively ( $P \leq 0.05$ ) higher at Shaheed Benazirabad in contrast to Matiari, Tando Muhammad Khan, Hyderabad, Tando Allahyar, Mirpurkhas and Sanghar. In line with current results Gebreyowhens and Kumar (2017) recorded higher body weight in male compared to female Maefur goat at Tigre district of Ethiopia; Hassen *et al.*, (2012) reported that the native Gumuz, Agew, Begia-Medir, Bati and Abergelle male goats characterized with heavy and compact body than female goats in different areas of Ethiopia. Similarly, Pesmen and Yardimci (2008) reported that the males were found heavier than the Saanen female. The existence of morphological variations within and between goat population might be due to the variation of ecological zones accompanying unique climate and vegetation which leads to management and environmental influences (Hagan *et al.*, 2012).

Significant ( $P \leq 0.05$ ) variations were recorded in the average linear measurements; chest girth, body length, height at withers, height at rump, ear, facial, horn and tail length, head width and hooves length among male and female Pateri goat at different habitats. The heart girth, length, withers height, and development of rump are the symbols of body size and maturity in goats. Among these major linear body measurements, heart

girth is widely used to categorize the corporeal traits of goat (Solomon, 2009). In current study chest girth, body length, height at withers, height at rump, ear, facial, horn and tail lengths, head width and hooves length in male and female Pateri goat noticed reasonably ( $P \leq 0.05$ ) higher at Shaheed Benazirabad in male as compared to female followed by Matiari, Tando Muhammad Khan, Hyderabad, Tando Allahyar and Sanghar vicinity of Sindh. In accordance with present findings Gebreyowhens and Kumar (2017) reported higher heart girth in male compared to female Maefur goat; Alubel *et al.*, (2015) recorded 68.67 and 64.44cm girth in male and female, while Afar goat had 67.4cm heart girth, categorized as little native goat in Ethiopia (Solomon, 2009). Significant ( $P \leq 0.05$ ) variations were reported by researchers in body length, height at wither, height at rump, ear, facial, horn and tail length, head width and hooves length between male and female goat at different regions of world. (Gebreyowhens and Kumar, 2017; Getahun *et al.*, 2020; Bekalu, 2014). In current investigation chest girth of both male and female Pateri goat was the most excellent indicating variable, which varied significantly among the regions than any other linear body traits, in agreement with current results different researchers have confirmed that chest girth is first and vital tool for calculation of weight of live animals, and second by body length of the goat (Hassen *et al.*, 2012; Mahilet, 2012; Ahmed, 2013; Biruh, 2013; Hulunim, 2014).

Udder and teat lengths of female and scrotum circumference of male Pateri goat were recorded statistically ( $P \leq 0.05$ ) higher at Matiari and Shaheed Benazirabad than Tando Allahyar, Mirpurkhas, Tando Muhammad Khan, Hyderabad and Sanghar districts of Sindh. Udder conformation and size of teats significantly different among goat breeds and influenced on total milk yield as reported by Gebreyowhens and Kumar (2017). The differences for these traits could be attributable to the differences in availability of feed, natural grazing field, and the management conditions in which the goats were reared (Cam *et al.*, 2010).

**Table-1. Phenotypic characteristics of Pateri goats in various regions of Sindh, Pakistan.**

Phenotypic characteristics			Regions of Sindh Province						
			Hyd. N (%)	TMK N (%)	Matiari N (%)	MPK N (%)	TAYR N (%)	Sanghar N (%)	Sh.BA N (%)
Skin color Pattern	Female	Spotted	18(20)	12(13)	19(21)	15(17)	11(12)	9(10)	13 (15)
		Non spotted	72(80)	78(87)	71(79)	75(83)	79(88)	81(90)	77(85)
	Male	Spotted	2(20)	2(20)	1(10)	3(30)	2(20)	1(10)	2 (20)
		Non spotted	8(80)	8(80)	8(90)	7(70)	8(80)	9(90)	8 (80)
$\chi^2$ value = 15.54 <sup>NS</sup>			<b>P value (0.05) = 0.9039</b>						
Skin color type	Female	Light brown	12(13)	8(9)	15(17)	7(8)	13(15)	21(23)	9(10)
		White dark	78(87)	82(81)	75(83)	83(82)	77(85)	69(77)	81(90)
		brown							

	<b>Male</b>	Light brown	3(30)	1(10)	2(20)	1(10)	3(30)	4(40)	1(10)	
		White dark brown	7(70)	9(90)	8(80)	9(90)	7(70)	6(60)	9(90)	
		$\chi^2$ value =	<b>25.24<sup>NS</sup></b>						<b>P value (0.05) =</b>	
	<b>0.3928</b>									
<b>Body shape</b>	<b>Female</b>	Compact	78(87)	83(92)	79(88)	87(97)	84(93)	77(85)	85(95)	
		Lanky /Leggy	12(13)	7(8)	11(12)	3(3)	6(7)	13(15)	5(5)	
	<b>Male</b>	Compact	8(80)	9(90)	6(60)	9(90)	7(70)	8(80)	7(70)	
		Lanky /Leggy	2(20)	1(10)	4(40)	1(10)	3(30)	2(20)	3(30)	
		$\chi^2$ value =	<b>22.94<sup>NS</sup></b>						<b>P value (0.05) = 0.5233</b>	
<b>Hair type</b>	<b>Female</b>	Straight/Smooth	88(98)	89(99)	90(100)	87(97)	86(96)	84(83)	87(97)	
		Curly/Coarse	2(2)	1(1)	0(0)	3(3)	4(4)	6(7)	3(3)	
	<b>Male</b>	Straight/Smooth	9(90)	10(100)	10(100)	8(80)	9(90)	7(70)	10(100)	
		Curly/Coarse	1(10)	0(0)	0(0)	2(20)	1(10)	3(30)	0(0)	
		$\chi^2$ value =	<b>24.41<sup>NS</sup></b>						<b>P value (0.05) = 0.4382</b>	
<b>Hair length</b>	<b>Female</b>	Small	3(3)	2(2)	0(0)	0(0)	1(1)	0(0)	3(3)	
		Medium	10(11)	6(7)	3(3)	1(1)	11(12)	0(0)	4(4)	
		Large	77(86)	82(91)	87(97)	89(99)	78(87)	90(100)	83(93)	
	<b>Male</b>	Small	1(10)	0(0)	1(10)	0(0)	0(0)	1(10)	0(0)	
		Medium	2(20)	2(20)	1(10)	1(10)	0(0)	1(10)	2(20)	
		Large	7(70)	8(80)	8(80)	9(90)	10(100)	9(80)	8(80)	
		$\chi^2$ value =	<b>46.45<sup>NS</sup></b>						<b>P value (0.05) = 0.1138</b>	
<b>Horn shape</b>	<b>Female</b>	Spiral	68(76)	85(85)	78(87)	88(98)	50(56)	78(87)	69(77)	
		Curved	6(7)	4(4)	7(8)	0(0)	10(11)	7(8)	11(12)	
		Pooled	3(3)	0(0)	2(2)	0(0)	5(6)	2(2)	3(3)	
		Spiral pooled	13(14)	1(1)	3(3)	2(2)	25(28)	3(3)	7(8)	
	<b>Male</b>	Spiral	6(60)	8(80)	10(100)	10(100)	6(60)	7(70)	5(50)	
		Curved	0(0)	2(20)	0(0)	0(0)	3(30)	3(30)	2(20)	
		Pooled	1(10)	0(0)	0(0)	0(0)	0(0)	0(0)	1(10)	
		Spiral pooled	3(30)	0(0)	0(0)	0(0)	1(10)	0(0)	2(20)	
		$\chi^2$ value =	<b>134.76*</b>						<b>P value (0.05) = 0.0000</b>	
<b>Horn orientation</b>	<b>Female</b>	Female Upward	88(98)	89(99)	90(100)	87(97)	90(100)	89(99)	87(97)	
		Female Backward	2(2)	1(1)	0(0)	3(3)	0(0)	1(1)	3(3)	
	<b>Male</b>	Male Upward	9(90)	10(100)	8(80)	10(100)	9(90)	10(100)	9(90)	
		Male Backward	1(10)	0(0)	2(20)	0(0)	1(10)	0(0)	1(10)	
		$\chi^2$ value =	<b>18.80<sup>NS</sup></b>						<b>P value (0.05) = 0.7628</b>	
		<b>Phenotypic characteristics</b>	<b>Regions of Sindh Province</b>							
			<b>Hyd.</b>	<b>TMK</b>	<b>Matiari</b>	<b>MPK</b>	<b>TAYR</b>	<b>Sanghar</b>	<b>Sh.BA</b>	
			<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	<b>N (%)</b>	
<b>Head/facial profile</b>	<b>Female</b>	Straight	87(97)	89(99)	90(100)	88(98)	86(96)	85(95)	89(99)	
		Concave	3(3)	1(1)	0(0)	2(2)	4(4)	5(5)	1(1)	
	<b>Male</b>	Straight	9(90)	10(100)	10(100)	10(100)	10(100)	8(80)	10(100)	
		Concave	1(10)	0(0)	0(0)	0(0)	0(0)	2(20)	0(0)	
		$\chi^2$ value =	<b>24.37<sup>NS</sup></b>						<b>P value (0.05) = 0.4408</b>	
<b>Ear orientation</b>	<b>Female</b>	Erect	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	
		Pendulous	90(100)	90(100)	90(100)	90(100)	90(100)	90(100)	90(100)	
	<b>Male</b>	Erect	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)		
		Pendulous	10(100)	10(100)	10(100)	10(100)	10(100)	10(100)	10(100)	
		$\chi^2$ value =	<b>6.74<sup>NS</sup></b>						<b>P value (0.05) = 0.8746</b>	
<b>Rump profile</b>	<b>Female</b>	Flat	3(3)	4(4)	1(1)	0(0)	2(2)	0(0)	0(0)	
		Sloping	87(97)	86(96)	89(99)	90(100)	88(98)	90(100)	90(100)	
	<b>Male</b>	Flat	1(10)	2(20)	0(0)	0(0)	0(0)	1(10)	0(0)	
		Sloping	9(90)	8(80)	10(100)	10(100)	10(100)	9(90)	10(100)	
		$\chi^2$ value =	<b>24.94<sup>NS</sup></b>						<b>P value (0.05) = 0.4089</b>	
<b>Wattles</b>	<b>Female</b>	with wattles	90(100)	90(100)	90(100)	90(100)	90(100)	90(100)	90(100)	

		without wattles	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
	<b>Male</b>	with wattles	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
		without wattles	10(100)	10(100)	10(100)	10(100)	10(100)	10(100)	10(100)
<b>Hooves</b>	$\chi^2$ value =	<b>6.74<sup>NS</sup></b>							<b>P value (0.05) = 0.8746</b>
	<b>Female</b>	Dark Brown	90(100)	90(100)	90(100)	90(100)	90(100)	90(100)	90(100)
	<b>Male</b>	Dark Brown	10(100)	10(100)	10(100)	10(100)	10(100)	10(100)	10(100)
<b>Tail</b>	$\chi^2$ value =	<b>6.74<sup>NS</sup></b>							<b>P value (0.05) = 0.8746</b>
	<b>Female</b>	Straight	78(87)	81(90)	76(85)	87(97)	79(88)	88(98)	90(100)
		Curved	12(13)	9(10)	14(15)	3(3)	11(12)	2(2)	0(0)
	<b>Male</b>	Straight	7(70)	8(80)	9(90)	8(80)	7(70)	8(80)	9(90)
		Curved	3(30)	2(20)	1(10)	2(20)	3(30)	2(20)	1(10)
<b>Udder</b>	$\chi^2$ value =	<b>39.26*</b>							<b>P value (0.05) = 0.0256</b>
	<b>Female</b>	Compact	87(97)	84(93)	88(98)	82(91)	85(95)	83(92)	89(99)
		Loose	3(3)	6(7)	2(2)	8(9)	5(5)	7(8)	1(1)
	$\chi^2$ value =	<b>16.25<sup>NS</sup></b>							<b>P value (0.05) = 0.1802</b>

N = Number of goats exhibiting a particular qualitative character; % = Percent,  $\chi^2$  = Pearson chi-square; \*significant difference (P < 0.05); NS = Non-significant difference. Hyd. = Hyderabad, TMK = Tando Muhammad Khan, MPK = Mirpurkhas, TAYR = Tando Allahyar, Sh.BA = Shaheed Benazirabad

**Table-2-A: Quantitative traits of Pateri goat at different regions of Sindh, Pakistan.**

Regions	Sex	Quantitative traits of Pateri goat						
		Body weight (Kg)	Chest girth (Cm)	Body Length (Cm)	Height at withers (Cm)	Height at rump (Cm)	Ear length (Cm)	Facial length (Cm)
Hyderabad	Female	29.50 <sup>j</sup>	72.50 <sup>i</sup>	61.50 <sup>h</sup>	47.67 <sup>fg</sup>	55.83 <sup>g</sup>	17.83 <sup>g</sup>	9.00 <sup>fg</sup>
	Male	38.83 <sup>d</sup>	79.83 <sup>c</sup>	72.66 <sup>c</sup>	52.83 <sup>bc</sup>	63.16 <sup>d</sup>	22.33 <sup>bc</sup>	11.83 <sup>c</sup>
Tando Muhammad Khan	Female	31.50 <sup>hi</sup>	74.50 <sup>gh</sup>	63.50 <sup>fg</sup>	48.00 <sup>ef</sup>	56.50 <sup>g</sup>	18.33 <sup>g</sup>	10.33 <sup>de</sup>
	Male	40.50 <sup>c</sup>	81.50 <sup>b</sup>	74.16 <sup>b</sup>	53.66 <sup>b</sup>	65.83 <sup>b</sup>	22.33 <sup>bc</sup>	13.50 <sup>b</sup>
Matiari	Female	33.50 <sup>g</sup>	76.50 <sup>ef</sup>	65.50 <sup>c</sup>	48.83 <sup>c</sup>	59.16 <sup>f</sup>	21.50 <sup>cd</sup>	11.50 <sup>c</sup>
	Male	42.67 <sup>b</sup>	83.83 <sup>a</sup>	76.50 <sup>a</sup>	55.50 <sup>a</sup>	68.83 <sup>a</sup>	24.83 <sup>a</sup>	15.83 <sup>a</sup>
Mirpurkhas	Female	30.83 <sup>i</sup>	73.83 <sup>h</sup>	62.83 <sup>g</sup>	46.83 <sup>g</sup>	52.33 <sup>h</sup>	18.66 <sup>fg</sup>	9.50 <sup>ef</sup>
	Male	37.83 <sup>de</sup>	78.83 <sup>cd</sup>	72.16 <sup>c</sup>	52.50 <sup>c</sup>	63.16 <sup>d</sup>	23.00 <sup>b</sup>	13.66 <sup>b</sup>
Tando Allahyar	Female	32.50 <sup>gh</sup>	75.50 <sup>fg</sup>	64.50 <sup>ef</sup>	48.83 <sup>c</sup>	49.66 <sup>i</sup>	49.66 <sup>g</sup>	10.50 <sup>d</sup>
	Male	38.66 <sup>d</sup>	79.66 <sup>c</sup>	72.50 <sup>c</sup>	51.83 <sup>cd</sup>	64.50 <sup>d</sup>	23.00 <sup>b</sup>	14.16 <sup>b</sup>
Sanghar	Female	31.66 <sup>hi</sup>	74.66 <sup>gh</sup>	63.66 <sup>fg</sup>	48.33 <sup>ef</sup>	49.16 <sup>i</sup>	16.16 <sup>h</sup>	8.50 <sup>g</sup>
	Male	37.16 <sup>c</sup>	78.16 <sup>d</sup>	72.17 <sup>c</sup>	52.16 <sup>cd</sup>	62.00 <sup>e</sup>	19.66 <sup>ef</sup>	11.16 <sup>cd</sup>
Shaheed Benazirabad	Female	35.83 <sup>f</sup>	76.83 <sup>c</sup>	70.83 <sup>d</sup>	51.33 <sup>d</sup>	53.16 <sup>h</sup>	20.50 <sup>de</sup>	11.66 <sup>c</sup>
	Male	44.00 <sup>a</sup>	85.00 <sup>a</sup>	76.00 <sup>a</sup>	56.50 <sup>a</sup>	65.66 <sup>b</sup>	24.16 <sup>a</sup>	13.83 <sup>b</sup>
<b>P value (&lt;0.05) =</b>		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>LSD (0.05) =</b>		1.1322	1.1815	1.1132	1.1421	1.1421	1.0132	0.9120
<b>SE± =</b>		0.5669	0.5916	0.5574	0.5719	0.5719	0.5073	0.4567

Superscripts with different letters in same column varied significantly from one another.

**Table-2B: Quantitative traits of Pateri goat at different regions of Sindh, Pakistan.**

Regions	Sex	Quantitative traits of Pateri goat (cm)						
		Horn length	Tail length	Head width	Hooves length	Udder	Teats	Scrotum
Hyderabad	Female	12.58 <sup>i</sup>	11.05 <sup>fg</sup>	8.46 <sup>g</sup>	2.31 <sup>h</sup>	10.51 <sup>c</sup>	4.76 <sup>d</sup>	-
	Male	17.55 <sup>b</sup>	12.65 <sup>b</sup>	8.95 <sup>f</sup>	2.81 <sup>ef</sup>	-	-	6.91 <sup>d</sup>
Tando Muhammad Khan	Female	12.58 <sup>i</sup>	10.68 <sup>gh</sup>	9.03 <sup>f</sup>	2.55 <sup>g</sup>	11.66 <sup>b</sup>	5.80 <sup>b</sup>	-
	Male	17.40 <sup>b</sup>	12.46 <sup>bc</sup>	10.63 <sup>c</sup>	2.98 <sup>d</sup>	-	-	7.66 <sup>bc</sup>

<b>Matitari</b>	Female	14.87 <sup>c</sup>	12.58 <sup>b</sup>	10.33 <sup>d</sup>	2.95 <sup>dc</sup>	14.00 <sup>a</sup>	6.86 <sup>a</sup>	-
	Male	18.68 <sup>a</sup>	13.63 <sup>a</sup>	12.06 <sup>a</sup>	3.72 <sup>a</sup>	-	-	8.73 <sup>a</sup>
<b>Mirpurkhas</b>	Female	14.05 <sup>fg</sup>	10.52 <sup>h</sup>	9.93 <sup>c</sup>	2.77 <sup>f</sup>	12.00 <sup>b</sup>	5.68 <sup>b</sup>	-
	Male	17.56 <sup>b</sup>	12.18 <sup>cd</sup>	11.75 <sup>b</sup>	3.18 <sup>c</sup>	-	-	7.55 <sup>c</sup>
<b>Tando Allahyar</b>	Female	13.83 <sup>g</sup>	10.82 <sup>f-h</sup>	8.88 <sup>f</sup>	2.75 <sup>f</sup>	12.16 <sup>b</sup>	5.03 <sup>c</sup>	-
	Male	17.40 <sup>b</sup>	12.03 <sup>d</sup>	11.60 <sup>f</sup>	3.15 <sup>c</sup>	-	-	7.78 <sup>b</sup>
<b>Sanghar</b>	Female	13.01 <sup>h</sup>	9.93 <sup>i</sup>	8.40 <sup>g</sup>	2.52 <sup>g</sup>	10.50 <sup>c</sup>	4.81 <sup>d</sup>	-
	Male	16.46 <sup>d</sup>	11.13 <sup>f</sup>	10.00 <sup>e</sup>	3.13 <sup>c</sup>	-	-	6.80 <sup>d</sup>
<b>Shaheed Benazirabad</b>	Female	14.20 <sup>f</sup>	11.52 <sup>e</sup>	10.00 <sup>e</sup>	2.85 <sup>d-f</sup>	13.50 <sup>a</sup>	6.81 <sup>a</sup>	-
	Male	17.16 <sup>c</sup>	12.82 <sup>b</sup>	12.13 <sup>a</sup>	3.43 <sup>b</sup>	-	-	8.93 <sup>a</sup>
<b>P value (<math>\leq 0.05</math>) =</b>		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>LSD (0.05) =</b>		0.2249	0.3797	1.1421	0.1777	0.7516	0.1378	0.2164
<b>SE<math>\pm</math> =</b>		0.1126	0.1901	0.5719	0.0890	0.3680	0.0675	0.1060

Superscripts with different letters in same column varied significantly from one another.



**Fig. 1: Pateri female and male goat:**

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