



FACTOR ANALYSIS OF BIOMETRIC TRAITS OF MARECHA CAMEL IN PAKISTAN

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ABSTRACT

Camel is a vital food and draft source for nomads and pastoralists. The present research was conducted to measure different biometric traits and find the relationship among these traits in the Marecha camel breed in Punjab, Pakistan. A total of twenty-five (25) biometric traits were measured and recorded on animals maintained at Camel breeding & Research Station, Rakh mahni, District Bhakkar, in Punjab province, Pakistan. All the measurements were statistically analyzed for mean, coefficient of variation, and correlation coefficient. The correlation matrix was extracted from PCA with this information. It was explained that Height at wither was found as the chief gauge for breed type, primarily used in EAAP and suggested procedure of FAO. Body conformation of the Marecha camel breed was expressed by seven and five extracted factors (respectively for female and male) which shared their part in variability. These factors symbolize the body of a camel. The estimated communalities showed that testicular length and diameter, size of the teat, length of head, length and width of the ear, and Height of hump are not having a significant role in the conformation of the Marecha camel breed body. While the other traits mentioned are responsible for the expression of body conformation and inset positive effect in terms of body size and dimensions. Body structure explanation can be assessed by biometry. Morphometric qualities can describe the rate of increase in various animals. The body size had been used to describe a specific breed and its origin.

1. INTRODUCTION

Historically and traditionally, camels are considered a significant part of Livestock. Camel is primarily a source of meat and milk products. The arid environment favors camels' growth and breeding (Fadlelmoula et al., 2020). A large number of camels (1.1 million) are present in Pakistan, with annual milk production of 944000 tonnes and 115000 hides, whereas the government focuses on breed improvement and productivity enhancement in livestock animals (GOP, 2022).

Camels in Pakistan are very well adapted to their native environment and can sustain life in hot and harsh deserts (Faraz et al., 2019). The Marecha (*Camelus dromedaries*) is a dromedary camel with one hump. At the same time, the body is typical fawn color with the availability of white and black specimens (Faraz, 2020a). Marecha (*Camelus dromedaries*) is famous for meat and milk and is raised for esthetic purposes (Faraz, 2020b). Knowing the body weight of camels is essential for several routine farm tasks like feeding, breeding, and health care. In field conditions, weighing camels could be complicated;

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therefore, biometric traits are beneficial in estimating body weight (Boujenane 2019). Morphological characteristics employed in body weight prediction are inevitable in the identification and discrimination of breeds (Mungai et al., 2010). Researchers from all around the globe have used biometric traits for their correlation and estimating live body weight (Boujenani et al., 2019; Fatih et al., 2021, Meghelli et al., 2020).

Various researchers reported a significant (P<0.05) result for the regression and coefficients of yearling weight and biometric traits in camels with values ranging from 0.65 to 0.96 and stated that biometric traits could be used in camels to predict their live body weight (Rahimi et al., 2020). In another study, Pakistani camel ecotypes were found to be higher (P<0.05) compared to other ecotypes (Ehsaninia, 2020). Biometric traits may be used in camels to predict the live body weight due to a high positive correlation of live body weight with biometric traits and maximum correlation coefficients, e.g., thoracic girth (r=0.96; Ehsaninia, 2022).

People are unaware of the importance of its milk quality and benefits, which is why they neglect its proper usage. There is a dire need to understand the importance of the camel's role in the future as a food source for the public. The study was planned to understand the biometric traits and relationship among these traits for different gender and age groups of Marecha camel along with the principal component analysis for these traits, which represent body conformation of Marecha camel for population characteristics. It would help select elite animals with the least labor cost in minimum time.

2. MATERIALS AND METHODS

Site and animal selection

This study was carried out at Camel Breeding & Research Station, Rakh Mahni, Tehsil Mankera, District Bhakkar, and surrounding villages in Punjab province, Pakistan. A total of 108 animals were randomly selected to record biometric traits. The number of female calves and adult were 12 and 47, respectively. The number of male calves and adult were 13 and 36, respectively.

Phenotypic traits

A total of twenty-four (24) biometric traits were measured and recorded in Marecha camels as per FAO standards for phenotypic characterization. The traits were withers height (WH), length of body (BL), heart girth (HG), length of the head (HdL), the width of head (HdW), length of ear (ErL), ear width (ErW), neck length (NkL), neck width (NkW), a circumference of neck (NkC), foreleg length (FLL), hind leg length (HLL), thigh girth (TG), abdominal circumference (AbC), hump length (HmL), hump height (HmH), rump length (RmL), rump width (RmW), Height at rump (RmH), tail length (TL), tail width (TW), left front teat length (LFTL), left front teat

diameter (LFTD) and body weight (BW). A graduated iron scale was used to measure all the heights. The measurements of lengths and circumferences were done by using flexible tape. All the dimensions were noted by the same person to avoid individual differences. All the measurements were taken in centimeters (cm). The animals were randomly selected for measurements.

Statistical analysis

Body measurements were statistically analyzed for mean, coefficient of correlation, standard deviation, coefficient of variation, and correlation coefficients between various morphometric traits and statistics to analyze the principal component from the correlation matrix. The following mathematical model was used.

$$f_{j} = \sum_{r=1}^m f_{r} r$$

Where f_{j} indicates the dependent variable on the jth common factors ($j = 1, 2, 3, \dots, 24$), f_{r} are the i^{th} values for r^{th} factor loadings and r Represent coefficients.

3. RESULTS AND DISCUSSION

Descriptive analysis of morphological traits of Marecha Camel

The descriptive statistics for all morphological traits of Marecha male and female calves and female and male adults are presented in tables 1 and 2, respectively.

Phenotypic Correlation

Marecha camel calves

A total of 276 correlation combinations were estimated in Marecha male camel calves, out of which 108 correlations were found negatively associated while the remaining 168 were found as positively associated with each other (Table 3). The phenotypic correlation in Marecha male camel calves ranged from -0.928 (Tail width and body length) to +1.000 (Ear length and Ear width). A total of 276 correlation combinations were estimated in Marecha female camel calves, out of which 76 correlations were found negatively associated while the remaining 200 were found as positively associated with each other (table-4). The phenotypic correlations indicate that correlations value in Marecha female camel calves ranged from -0.789 (tail width and foreleg length) to +0.939 (rump height and withers height).

Marecha camel adults

A total of 276 correlation combinations were estimated in Marecha adult female camel, out of which 62 correlations

were found negatively associated while the remaining 214 were found as positively associated with each other (table-

5). The correlation coefficient in Marecha adult female camel ranged from -0.431 (hind leg length with tail width) to 0.881 (left front teat length with left front teat width). The coefficients of correlation among various morphological traits for Marecha adult male camel are given in table-6. The correlation coefficients in Marecha adult male camel were valued from -0.319 (ear length and head width) to 0.881 (body weight and abdominal circumference).

Analysis of Factor

Marecha Adult Female Camel

Analysis of data showed the value of KMO (Kaiser-Meyer-Olkin) as 0.622. The overall consequence of the correlation checked by Bartlett's test of Sphericity for the morphostructural characters (Chi-square appeared 695.868, $p < 0.001$) expressed important and proved correct application of factor analysis. The complete results after data analysis showed clear evidence that factor analysis was a reliable approach for such studies. The table-7 showed eigenvalues and variation by each factor through a complete analysis of each factor for Marecha adult female camel. In this study, 75.219 % share was expressed by seven factors having eigenvalues > 1 .

Marecha Adult Male Camel

The value for sampling sufficiency in KMO (Kaiser-Meyer-Olkin) was obtained as 0.687. The overall significance of the correlation checked by Bartlett's test of Sphericity for the morphometric characters through Chi-square expressed as 931.154, $P < 0.001$, resulting in that factor analysis came as a reliable data analysis technique. Table 8 describes each factor's eigenvalues and total variation by analyzing the factor for Marecha adult male camel. In this study, the total share was described as 80.278 % by five extracted factors as these factors were counted with eigenvalues > 1 .

Coefficient of component matrix

Seven estimated factors from Marecha adult female camels and five estimated factors from Marecha adult camels had different values of coefficient of factor analysis expressed in table-7 and 8, respectively. Various values and positive signs were observed for all characters in the first factor, while other factors gave some negative values to some components mentioned below. All the traits received different values and positive signs in the first factor for Marecha adult female and male camel in table-9

Morphological Traits of Marecha Camel

The values of body measurements for camels may be different due to breed differences. The Marecha camel belongs to the Camelidae family. The comparison of body measurements among different breeds of the Camelidae family makes some sense. However, comparing the

Marecha camel with any cattle, buffaloes, or breeds from a small ruminant group is unjustified. But because most of the literature is available on ovine, caprine, and bovine families, references from these breeds are included in the discussion.

Body weight in this study for Marecha adult male and female camel was recorded as 548.67 ± 110.82 and 453.43 ± 141.87 kg, respectively. Body weight for Marecha male and female camel calves from 4 months to 24 months age group was found as 244.00 ± 22.24 and 164.58 ± 29.42 kilograms. The difference in body weight in both calves groups might be due to genetic growth factors. Hence male Marecha camels have heavier body weights than female Marecha camels.

Height at withers in this study was estimated as (182.91 ± 8.53 , 187.92 ± 9.59 cm) for female and male camels, very close to the results of (Ishag et al., 2011) in breeds Kenani, Rashaidi, Lahwee, Anafi, Bishari, Kabbashi, Maganeen, Maalia, and Butana as 195 ± 8.0 , 176 ± 7.0 , 184 ± 7.0 , 184 ± 8.0 , 184 ± 7.0 , 191 ± 9.0 , 192 ± 9.0 , 191 ± 8.0 , 188 ± 0.08 and 188 ± 10.0 cm, respectively. At the same time, (Grund, 2004) results are lesser than adult Marecha camel results for hind leg length as 170.0 ± 9.0 cm for camel breeds of Kenya. The results of (Abdallah & Faye, 2012) also resemble these values as camel breeds of Honor, Majaheem, Shaele, and Wadda were found as 186.7, 192.2, 187.0, and 186.7 cm, respectively. (Chniter et al., 2013) reported the same results for hind leg length for the Geoudi breed (182.0 ± 7.0 cm) and smaller values for Guiloufi, Merzougui, and Ourdhaoui breeds of Maghrebi camels as 176.0 ± 7.0 , 170.0 ± 13.0 and 175.0 ± 7.0 cm, respectively. The differences in values might be due to the difference in breed type. The results of (Mehta et al., 2007) for Jaisalmeri (199cm) and Mewari (193cm) camel breeds are much larger than the values of Height at withers for Marecha camel breed. It showed that these breeds are taller than the Marecha camel breed. Height at wither was reported by (Raziq et al. 2011) for Raigi camel breeds as 164.34 cm, which is smaller than the values for wither Height of the Marecha camel breed. It showed that the Marecha camel breed is taller than the Raigi camel breed, which might be due to the difference in climatic conditions.

The average body length of Marecha adult female and adult male (169.64 ± 14.70 cm, 168.62 ± 16.22 cm) reported in this study are more significant than the estimates of (Chniter et al. 2013) for Geoudi, Guiloufi, Merzougui and Ourdhaoui breeds of Maghrebi camels were recorded as 147.0 ± 6.0 , 145.0 ± 7.0 , 142.0 ± 6.0 , 136.0 ± 13.0 and 138.0 ± 9.0 cm, respectively. The values of body length measured by (Mehta et al., 2007) for Jaisalmeri and Mewari camel breeds were 156 and 158 cm, respectively, which are slightly less than the values of the Marecha camel breed. This difference might be due to the difference of breed type.

The measurements of heart girth in Marecha adult female (201.60 ± 13.58 cm) and adult male (201.07 ± 24.28 cm) in this study are more significant than the results of (Abdallah & Faye, 2012) for camel breeds of Adhana, Aouadi, Saheli, Shageh, (180.5, 191.3, 195.9, 180.7,) while in close agreement with Awrc and Asali breeds (201.0 and 199.3 cm) and significantly lower than the values for breeds of Zargah, Homor, Majaheem, Shaele, Sofor and Wadda (222.0, 217.3, 219.2, 213.5, 220.9 and 221.8 cm). These variations might be due to differences in climatic differences between these areas. These results are in close agreement with (Chniter et al., 2013) for Maghrebi camels breeds of southern Tunisia (Geoudi, Guiloufi, Merzougui, and Ourdhaoui) were recorded as 200.0 ± 11.0 , 200.0 ± 9.0 , 199.0 ± 9.0 , 193.0 ± 12.0 and 201.0 ± 13.0 cm, respectively. The results of (Ishag et al., 2011) for 10 breeds of camel from Sudani and their mean value of heart girth for Kenani, Rashaidi, Lahwee, Anafi, Bishari, Kabbashi, Maganeen, Shanbali, Maalia, and Butana breeds as 207 ± 10.0 , 194 ± 8.0 , 198 ± 8.0 , 195 ± 8.0 , 194 ± 10.0 , 208 ± 12.0 , 208 ± 19.0 , 206 ± 13.0 , 212 ± 14.0 , $.94 \pm 11.0$ and 199 ± 12.0 cm respectively, are very close to this study. The value for heart girth of the Marecha camel breed is less than the values for the Jaisalmeri camel breed (211 cm) and more significant than the Mewari camel breed (194 cm) reported by (Mehta et al., 2007). (Raziq et al., 2011) reported a heart girth value of 175.92 cm for Raigi camel breed, which is much less than the Marecha camel breed values. These show that the Marecha camel breed is more significant than the Raigi breed.

The measured length of the head (HdL) of 42.96 ± 4.67 cm, and 47.34 ± 5.24 cm of Marecha adult female and adult male reported in this study meet the results of (Abdallah & Faye, 2012) for camel breeds of Adhana, Aouadi, Saheli, Shageh, Awrc, Zargah, Asali Homor, Majaheem, Shaele, Sofor and Wadda (42.1, 42.4, 42.8, 39.3, 41.5, 40.5, 42.3, 46.5, 46.9, 46.9, 48.1 and 47.4 cm) respectively. Similar results were reported by (Raziq et al., 2011) for Raigi camel breeds as they found head length as 39.25 cm. These values are slightly less than the values of the Jaisalmeri camel breed (53 cm) recorded by (Mehta et al., 2007) while equal to the values for Mewari camel breed (45 cm). Jaisalmeri breed might be included in the giant breed of camel than the Marecha camel breed. Measurement of neck length (NkL) in this study for male and female Marecha camel breed was found as 113.88 ± 9.37 and 109.88 ± 11.39 cm, respectively, which are in close agreement with the results of Mehta et al. (Mehta et al., 2007) for Mewari (107 cm) and Jaisalmeri (109 cm) Indian breeds of camels. These results are more significant than the values for the neck length measured by (Raziq et al. 2011) for the Raigi camel breed as 81.85 ± 0.49 cm. This significant difference in neck length might be due to the difference in climatic and feeding opportunities for these different breeds. (Abdallah & Faye, 2012) also shared similar results for different

Sauida camel breeds, as the Marecha camel breed ranges from 104 cm to 110 cm. This slight value difference might be due to the difference in eco-zoological zones. Marecha camels are more significant in neck length than the breeds studied by (Chniter et al., 2013) as their values ranged from 99.0 ± 8.0 cm to 103.0 ± 8.0 cm. This is a relatively slightly larger difference and might be due to different adoptive behavior and breed type.

Circumference of the neck in this study for males and females was found as 76.46 ± 9.59 and 74.64 ± 8.08 cm, which is close in agreement for some breeds measured by (Abdallah & Faye, 2012) and slightly less than some breeds given by Adhana, Aouadi, Saheli, Shageh, Awrc, Zargah, Asail, Homor, Majaheem, Shaele, Sofor, and Wadda was found as 74.8, 79.3, 84.6, 92.0, 88.8, 91.0, 86.3, 83.90, 89.90, 83.0, 81.0 and 79.0 cm, respectively.

The measurements of foreleg length in Marecha male and female camels in this study are found as (126.31 ± 6.49 and 124.45 ± 7.92) cm, which is near to the results of (Chniter et al., 2013) for Geoudi, Guiloufi, Merzougui and Ourdhaoui breeds of Maghrebi camels recorded as 126.0 ± 4.0 , 126.0 ± 7.0 , 122.0 ± 5.0 , 123.0 ± 8.0 and 118.0 ± 8.0 cm, respectively. The values for the foreleg reported by (Mehta et al., 2007) for Jaisalmeri (146 cm) and Mewari (144 cm) camel are much larger than the values of the Marecha camel. These differences might be due to differences in breed type.

The values of hind leg legs for the Marecha camel were 145.06 ± 10.43 and 149.17 ± 9.48 cm, respectively, for female and male camels, which are lesser than the values found by (Mehta et al., 2007) for Mewari and Jaisalmeri camel 154 cm. These variations might be due to differences in breed type. Thigh girth measurements in this study for male and female Marecha camel were found as 86.83 ± 11.33 and 82.72 ± 8.27 cm, which is in the close range and a little bit greater than the results from (Abdallah & Faye, 2012) as reported in camel breeds of Homor, Majaheem, Shaele and Wadda 93.1, 94.9, 86.9 and 93.0 cm, respectively. Some values might be due to differences in breed type and eco-zoological area.

Measurement of abdominal circumference in this study was found as 264.82 ± 34.67 , and 256.17 ± 23.70 cm for adult male and adult female Marecha camel, respectively, and these values are more significant than the values for abdominal circumference (243.87 cm) reported by (Raziq et al., 2011) for Raigi camel breeds. (Ishag et al., 2011) also reported similar results for different camel breeds of Sudan. The hump length for adult Marecha females and males were recorded in this study as 70.36 ± 13.08 and 74.54 ± 14.02 cm, respectively, which is very small than the values for Jaisalmeri (100 cm) and Mewari (103 cm) camel breeds reported by (Mehta et al., 2007). This difference might be due to the difference in the size of the breed. Hump height in this study was found as 37.48 ± 7.48 and 36.73 ± 8.46 cm, respectively, for adult female and male Marecha camels, and these values are lesser than the

values for Jaisalmeri (45 cm) and Mewari (51cm) recorded by (Mehta et al., 2007). The variation in values might be due to the difference in the climate of the desert. Rump length measured in this study for adult female and male Marecha camels are found as 38.53 ± 5.72 , and 36.69 ± 6.25 cm, equal to results (Grund, 2004) of camels from Kenya found 31.0 ± 10.0 cm. Measurement of neck length from the middle in males and females in this study were found as 107.42 ± 11.70 and 105.75 ± 17.49 cm is in close agreement with the result of (Abdallah & Faye, 2012) and (Chniter et al., 2013) for Homor, Majaheem, Shale, and Wadda was found as 107.1, 110.7, 104.5, 108.6 cm and 100.0 ± 5.0 , 103.0 ± 8.0 , 100.0 ± 6.0 , 101.0 ± 8.0 , 99.0 ± 8.0 respectively and camel breeds of Maghrebi camels from southern Tunisia. These values are also in equal agreement with the Jaisalmeri and Mewari camel breeds recorded by (Mehta et al., 2007).

Tail length in the present study in both gender (male and female) was found as 56.77 ± 5.19 and 49.38 ± 4.50 cm, which is significantly larger than the results from (Chniter et al., 2013) from southern Tunisia for some breeds and equal to other breeds i.e., Geoudi, Guiloufi, Merzougui and Ourdhaoui breeds of Maghrebi camels were recorded as 38.0 ± 3.0 , 41.0 ± 6.0 , 39.0 ± 5.0 , 50.0 ± 6.0 , 49.0 ± 5.0 and 47.0 ± 7.0 cm, respectively. The values for tail length reported by (Mehta et al., 2007) for Jaisalmeri and Mewari breeds are in close agreement with (55 and 58 cm, respectively) the values for adult Marecha camels.

Analysis of Factors

In the statistical procedure used for adult female Marecha camel, Kaisee-Meyer-Olicn value is 0.622. Along with this, Bartlett's test of Sphericity expressed that morphostructural characters were significant (Chi-square shown as 695.868, $P < 0.001$), and this value proves that factor analysis has gained significant support in its validity. Each factor was explained by its eigenvalues and variation as described in table-5 for Marecha adult female camel. There were seven factors extracted. Their share in total variability was shown as 75.219 % in this study. The share of first, second, third, fourth, fifth, sixth, and seventh factors from total variability was expressed as 25.512 %, 18.892 %, 7.957%, 7.185 %, 5.999 %, and 5.231 % and 4.443%, respectively. These values are different because camel belongs to different breed and family than other animals. While (Pundir et al., 2011) reported three factors extracted through eigenvalues > 1 , their share was 66.02% in the variance. Two factors were described by (Yakubu et al., 2009), and their share was 85.37% in complete variance. (Salako, 2006) reported two factors and counted for 75% of the total variation. These variations might be due to differences in the breeds of animals.

In Arabian mare and stallion separately, three factors had their share as 66% of the total variation. Two factors were found by (Yakubu et al., 2009) and (Khurram, 2013) in

the biometric traits, which accounts for 85.37% and 71 % of complete variance by studying the different biometric characteristics of cattle breeds white Fulani and Dhanni. Two factors were found by (Salako, 2006) by using 10 different morphostructural characters from the Sheep breed of Uda, which had a share of 75 % in wide variation. Three factors were analyzed by (Sadek et al., 2006), and their share was 66 % and 67 % separately for Arabian female and male equines for various 14 characters. Because of the difference in breed types, camels' values differ from the studies mentioned above. (Khurram, 2013) separated two different variances, 51 and 43 % of observed traits in Dhanni cattle. In this learning, the share of the first factor was 47.670% for a male and 25.512 % for a female camel of the total variation out of 24 original measurements. It was expressed that the first factor behaves for the body size of camel, i.e., universal animal size. It is worth mentioning that for white Fulani cattle, (Yakubu et al., 2009) reported 78.99% and 67.05% as a share of the first factor from total variance in traits. Similar to the present study, it was already explained previously the initial factor expresses maximum variation by (Pundir et al., 2007; Pundir et al., 2007), (Karacaören & Kadarmideen, 2008), (Yakubu et al., 2009), and (Khurram, 2013).

The second factor's value was 18.892 % for a female camel and 14.604 % for a male camel of the total variability. Previously it was described by (Yakubu et al., 2009) and (Khurram, 2013) that the second factor had a share of 6.38% of the whole variance, but it was found to be 11.03% by (Salako, 2006) for Uda sheep. The value of the second factor was 15 % and 17 % for Arabian mares and stallions, respectively, by (Sadek et al., 2006). In the current study, values might differ due to the difference in the family of the animal under study. The third factor's share was 7.957 % for a female camel and 7.305 % for a male camel of the total variation. It was described as 12% of the total variance by (Sadek et al., 2006) for Arabian horses.

In the present study, neck circumference from the middle, rump height, head length, thigh girth, hump length, tail length, and hump height for Marecha female camel while hump length, heart girth, head length, the circumference of neck and body length are correlated and these traits are significant to express the conformation of body. The other measured characters proved as minimum contributory players and could not be utilized to show the body conformation. The results show that PCA may be applied in selecting elite camel individuals like other dairy animals by reducing a set of measuring characters in the future.

4. CONCLUSION

The results show that PCA may be appropriately applied in selecting elite camel individuals like other dairy

animals for different purposes by limiting the traits used in measurement previously.

5. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interests regarding the publication of this article.

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Table-1: Descriptive statistics for the body measurements of Marecha Camel calves

Parameters	Female Mareecha Calves (n=12)			Male Mareecha Calves (n=12)		
	Mean	Range	C.V	Mean	Range	C.V
BW (Kg)	164.58±29.42	125-205	0.18	244.00±22.24	215-290	0.09
WH (cm)	167.75±9.28	157-183	0.06	162.31±3.35	159-169	0.02
BL (cm)	146.91±8.39	129.54-57	0.06	142.30±8.24	116.8-149	0.06
HG (cm)	167.11±6.89	158-182	0.04	154.02±7.43	147-169	0.05
HdL (cm)	36.25±5.01	31-44	0.14	34.77±1.64	32-37	0.05
HdW (cm)	17.25±2.70	15-23	0.16	15.00±1.58	13-18	0.11
ErL (cm)	6.17±0.72	5-8	0.12	5.69±0.75	5-7	0.13
ErW (cm)	5.42±0.67	5-7	0.12	5.69±0.75	5-7	0.13
NkL (cm)	97.13±5.54	89-107	0.06	83.23±14.88	66-112	0.18
NkW (cm)	14.79±0.98	13-16	0.07	13.26±1.49	11-16	0.11
NkC (cm)	61.71±7.66	52-79	0.12	55.52±7.32	45-68	0.13
FLL (cm)	118.00±7.40	107-126	0.06	118.82±8.11	102-131	0.07
HLL (cm)	138.67±4.42	129-145	0.03	134.15±4.26	128-142	0.03
TG (cm)	79.52±4.96	72-86.36	0.06	70.86±4.98	63-80	0.07
AbC (cm)	184.60±18.24	168-229	0.10	181.62±8.20	172-199	0.05
HmL (cm)	57.17±3.93	50-63	0.07	59.23±4.32	52-65	0.07
HmH (cm)	31.75±3.31	26-36	0.10	30.92±2.84	26-37	0.09
RmL (cm)	30.25±4.09	24-39	0.14	29.11±2.35	24-32	0.08
RmW (cm)	17.17±3.16	14-23	0.18	17.30±2.66	15-22.86	0.15
RmH (cm)	154.83±8.35	143-170	0.05	146.62±3.84	142-154	0.03
TL (cm)	40.08±4.21	36-48	0.11	38.52±3.80	32-45.72	0.10
TW (cm)	5.67±0.78	5-7	0.14	5.10±0.37	5-6.35	0.07
LFTL (cm)	1.25±0.45	1-2	0.36	-	-	-
LFTD(cm)	1.17±0.39	1-2	0.33	-	-	-
TsL (cm)	-	-	-	3.46±0.52	3-4	0.15
TsD(cm)	-	-	-	2.92±0.28	2-3	0.09

Body length (BL), Head length (HdL), Head width (HdW), Heart Girth (HG), Abdominal Circumference (AbC), Hump Height (HmH), Hump Length (HmL), Foreleg Length (FLL), Hind leg Length (HLL), Height at rump (RmH), Rump Width (RmW), Rump Length (RmL), Neck Width (NkW), Neck Length (NkL), Neck Circumference (NkC), Height at wither (WH), Tail Length (TL), Tail Width (TW), Left Front Teat Length (LFTL), Left Front Teat Diameter (LFTD), Testis length (TsL), Testis Diameter (TsD), body weight (BW)

Factor analysis of biometric traits of Marecha camel breed

Table-2: Descriptive statistics for body measurements of adult Marecha Camel

Parameters	Adult Mareecha Female (n=47)			Adult Mareecha Male (n=36)		
	Mean	Range	C.V	Mean	Range	C.V
BW (Kg)	453.43±141.87	215-710	0.31	548.67±110.82	300-750	0.20
WH (cm)	182.91±8.53	146-195	0.05	187.92±9.59	164-206	0.05
BL (cm)	169.64±14.70	116.8-189	0.09	168.62±16.22	130-189	0.10
HG (cm)	201.60±13.58	162.5-231	0.07	201.07±24.28	149-238.76	0.12
HdL (cm)	42.96±4.67	33-53.34	0.11	47.34±5.24	36-55	0.11
HdW (cm)	20.80±2.85	14-29	0.14	24.90±6.51	13-32	0.26
ErL (cm)	7.10±0.85	6-9	0.12	7.41±0.91	7-10.16	0.12
ErW (cm)	6.19±0.75	5-7.62	0.12	6.16±0.66	5.08-8	0.11
NkL (cm)	109.88±11.39	75-132	0.10	113.88±9.37	88.9-125	0.08
NkW (cm)	16.74±1.59	14-20.32	0.09	18.72±2.85	11.43- 23.5	0.15
NkC (cm)	74.64±8.08	53.34-89	0.11	76.46±9.59	58.42-96.52	0.13
FLL (cm)	124.45±7.92	106-139	0.06	126.31±6.49	109-141	0.05
HLL (cm)	145.06±10.43	127-168	0.07	149.17±9.48	138-176	0.06
TG (cm)	82.72±8.27	63.5-94	0.10	86.83±11.33	60.96-121.9	0.13
AbC (cm)	256.71±23.70	168-296	0.09	264.82±34.67	172-302.26	0.13
HmL (cm)	70.36±13.08	39-99	0.19	74.53±14.02	41-96.52	0.19
HmH (cm)	37.48±7.48	25-56	0.20	36.73±8.46	19-55	0.23
RmL (cm)	40.52±3.87	30-47	0.10	39.43±4.77	30.48-48	0.12
RmW (cm)	21.41±2.69	16-28	0.13	20.82±6.18	12.7-33	0.30
RmH (cm)	173.09±11.54	141-190	0.07	177.69±10.19	156-197	0.06
TL (cm)	49.38±4.50	42-60	0.09	56.77±5.19	48-65	0.09
TW (cm)	6.23±1.21	5-10.16	0.19	6.95±1.44	5-11.54	0.21
LFTL (cm)	2.99±1.66	1-8	0.55	-	-	-
LFTD(cm)	1.88±1.11	1-5	0.59	-	-	-
TsL (cm)	-	-	-	18.17±4.05	7.62-22	0.22
TsD(cm)	-	-	-	10.39±3.05	4-15	0.29

Body length (**BL**), Head length (**HdL**), Head width (**HdW**), Heart Girth (**HG**), Abdominal Circumference (**AbC**), Hump Height (**HmH**), Hump Length (**HmL**), Foreleg Length (**FLL**), Hind leg Length (**HLL**), Height at rump (**RmH**), Rump Width (**RmW**), Rump Length (**RmL**), Neck Width (**NkW**), Neck Length (**NkL**), Neck Circumference (**NkC**), Height at wither (**WH**), Tail Length (**TL**), Tail Width (**TW**), Left Front Teat Length (**LFTL**), Left Front Teat Diameter (**LFTD**), Testis length (**TsL**), Testis Diameter (**TsD**), body weight (**BW**)

Table-3: Correlation among different traits in Marecha male camel calves

	WH	BL	HG	HL	HW	EL	EW	NL	NW	NC	FL	HLL	TG	AbC	HuL	HuH	RL	RW	RH	TL	TW	TsL	TsD
BW	0.401	0.152	0.744	-0.196	-0.024	-0.090	-0.090	0.758*	0.304	0.797*	0.446	0.248	0.607*	0.667*	0.584	0.150	0.526	-0.295	0.538	-0.050	-0.014	-0.455	0.068
WH		0.116	0.333	-0.153	0.252	0.438	0.438	0.065	-0.053	0.182	-0.343	-0.284	0.569	0.105	0.426	-0.172	0.143	0.322	0.431	0.376	0.152	0.295	-0.600
BL			0.414	-0.168	-0.419	-0.323	-0.323	0.300	0.268	0.314	0.326	0.252	-0.198	-0.408	-0.017	-0.054	-0.098	-0.606	-0.118	-0.368	-0.928	-0.174	-0.172
HG				0.126	-0.249	0.021	0.021	0.657	0.441	0.713*	0.297	0.220	0.278	0.079	0.181	-0.033	0.584	-0.321	0.040	-0.253	-0.271	-0.277	0.001
HL					0.193	0.343	0.343	-0.325	0.110	0.127	-0.118	-0.340	0.008	-0.422	-0.462	0.157	0.104	0.319	-0.266	-0.077	0.225	0.331	0.141
HW						0.281	0.281	-0.592	-0.450	0.053	-0.520	-0.161	0.355	0.194	0.486	-0.055	-0.080	0.506	0.110	0.557	0.570	0.203	-0.380
EL							1.000	-0.254	-0.262	-0.199	-0.438	-0.844	0.081	-0.074	-0.055	-0.597	0.423	0.252	-0.247	0.607*	0.523	0.395	-0.123
EW								-0.254	-0.262	-0.199	-0.438	-0.844	0.081	-0.074	-0.055	-0.597	0.423	0.252	-0.247	0.607*	0.523	0.395	-0.123
NL									0.583	0.584	0.755*	0.269	0.254	0.457	0.253	0.201	0.433	-0.567	0.282	-0.330	-0.348	-0.695	0.308
NW										0.549	0.400	0.083	0.352	-0.041	0.157	0.292	0.126	-0.341	0.061	-0.515	-0.370	-0.448	0.053
NC											0.414	0.321	0.482	0.302	0.533	0.207	0.248	-0.336	0.250	-0.171	-0.194	-0.534	0.021
FL												0.246	0.040	0.337	-0.032	0.506	0.123	-0.611	0.215	-0.297	-0.450	-0.738	0.623*
HLL													-0.187	0.078	0.135	0.358	-0.306	-0.131	0.116	-0.482	-0.364	-0.374	0.011
TG														0.567	0.622	0.334	0.270	0.195	0.717*	0.168	0.322	-0.063	-0.189
AbC															0.595	0.160	0.394	-0.129	0.620	0.240	0.419	-0.405	0.279
HuL																-0.059	0.136	-0.104	0.402	0.252	0.120	-0.424	-0.401
HuH																	-0.354	0.226	0.555	-0.356	-0.096	-0.256	0.204
RL																		-0.290	-0.051	-0.041	0.175	-0.082	0.143

Factor analysis of biometric traits of Marecha camel breed

RW	0.181	0.233	0.627	0.547	-0.418
RH		0.000	0.187	0.013	-0.030
TL			0.570	0.111	0.041
TW				0.312	0.083
TsL					-0.312

Body length (**BL**), Head length (**HdL**), Head width (**HdW**), Heart Girth (**HG**), Abdominal Circumference (**AbC**), Hump Height (**HmH**), Hump Length (**HmL**), Foreleg Length (**FLL**), Hind leg Length (**HLL**), Height at rump (**RmH**), Rump Width (**RmW**), Rump Length (**RmL**), Neck Width (**NkW**), Neck Length (**NkL**), Neck Circumference (**NkC**), Height at wither (**WH**), Tail Length (**TL**), Tail Width (**TW**), Testis length (**TsL**), Testis Diameter (**TsD**), body weight (**BW**)

Values containing star (*) as superscript are significant and positively correlated.

Table-4: Correlation among different traits in Marecha Female Camel Calves

	WH	BL	HG	HL	HW	EL	EW	NL	NW	NC	FL	HLL	TG	AbC	HuL	HuH	RL	RW	RH	TL	TW	LFTL	LFTD
BW	0.863*	0.041	0.480	0.824*	0.642*	0.520	0.356	-0.003	0.373	0.240	-0.395	-0.005	0.067	0.721*	0.111	0.303	0.745*	0.749*	0.917*	0.628*	0.251	0.658*	0.562
WH		-0.106	0.594	0.937*	0.768*	0.471	0.472	-0.037	0.633*	0.337	-0.520	-0.315	0.089	0.694*	0.482	0.110	0.748*	0.839*	0.939*	0.733*	0.428	0.752*	0.641*
BL			0.221	-0.261	-0.244	-0.458	-0.666	0.489	-0.255	0.213	0.125	-0.095	0.113	0.103	0.190	0.538	-0.066	-0.122	0.054	-0.099	-0.326	-0.484	-0.079
HG				0.471	0.522	-0.007	-0.211	0.377	0.250	0.497	-0.140	-0.428	-0.372	0.425	0.365	0.092	0.665	0.632	0.595	0.448	0.148	0.357	0.569
HL					0.821*	0.493	0.509	-0.116	0.777*	0.194	-0.513	-0.287	-0.055	0.654	0.372	0.229	0.817*	0.870*	0.885*	0.676*	0.373	0.852*	0.722*
HW						0.164	0.390	-0.072	0.587	0.344	-0.469	-0.396	-0.117	0.608	0.296	0.221	0.849*	0.869*	0.763*	0.414	0.130	0.837*	0.908*
EL							0.789*	-0.053	0.276	-0.048	-0.599	0.162	0.220	0.341	0.086	-0.326	0.356	0.348	0.369	0.657*	0.759*	0.420	-0.108
EW								-0.311	0.384	-0.089	-0.643	0.082	0.430	0.256	0.214	-0.401	0.257	0.352	0.339	0.439	0.640*	0.526	0.058
NL									0.075	0.183	-0.362	-0.313	0.101	0.409	0.269	0.025	0.159	0.122	0.049	0.136	0.316	-0.143	0.074
NW										-0.116	-0.521	-0.421	0.025	0.397	0.528	0.188	0.534	0.693	0.526	0.475	0.433	0.588	0.576
NC											-0.176	-0.564	-0.116	0.482	0.404	-0.079	0.365	0.264	0.329	0.349	0.050	0.391	0.323
FL												0.465	-0.353	-0.652	-0.457	0.138	-0.522	-0.568	-0.412	-0.706	-0.789	-0.408	-0.221
HLL													0.153	-0.447	-0.500	0.062	-0.352	-0.439	-0.145	-0.526	-0.326	-0.273	-0.388
TG														0.062	0.328	-0.315	-0.344	-0.017	0.047	0.048	0.364	-0.133	-0.238
AbC															0.240	0.198	0.691*	0.622	0.740*	0.627*	0.388	0.654*	0.586
HuL																-0.067	0.235	0.357	0.389	0.357	0.406	0.230	0.218
HuH																	0.368	0.152	0.331	-0.155	-0.565	0.046	0.389

Factor analysis of biometric traits of Marecha camel breed

RL	0.855*	0.786*	0.584	0.228	0.749*	0.770*
RW		0.773*	0.676*	0.394	0.732*	0.789*
RH			0.546	0.214	0.734*	0.708*
TL				0.758*	0.466	0.213
TW					0.258	-0.100
LFTL						0.775*

Body length (**BL**), Head length (**HdL**), Head width (**HdW**), Heart Girth (**HG**), Abdominal Circumference (**AbC**), Hump Height (**HmH**), Hump Length (**HmL**), Foreleg Length (**FLL**), Hind leg Length (**HLL**), Height at rump (**RmH**), Rump Width (**RmW**), Rump Length (**RmL**), Neck Width (**NkW**), Neck Length (**NkL**), Neck Circumference (**NkC**), Height at wither (**WH**), Tail Length (**TL**), Tail Width (**TW**), Left Front Teat Length (**LFTL**), Left Front Teat Diameter (**LFTD**), Body Weight (**BW**)

Values containing stars (*) as superscript are significant and positively correlated.

Table-5: Correlation among different traits in Marecha Adult Female Camel

	WH	BL	HG	HdL	HdW	ErL	ErW	NkL	NkW	NkC	FLL	HLL	TG	AbC	HmL	HmH	RmL	RmW	RmH	TL	TW	LFTL	LFTD
BW	0.037	-0.329	0.335	0.149	-0.352	0.147	0.371	-0.142	0.082	-0.136	-0.201	-0.066	0.082	0.542	0.020	0.384	-0.233	-0.067	-0.280	0.044	0.492	0.406	0.269
WH		0.416	0.186	0.327	0.186	-0.159	0.048	0.356	0.008	0.362	0.233	0.011	0.157	0.229	0.253	-0.040	0.279	0.368	0.546	0.435	0.182	-0.082	0.084
BL			0.188	0.297	0.339	-0.319	-0.176	0.512*	0.201	0.546*	0.490	0.117	0.307	0.021	0.341	0.095	0.495	0.216	0.573*	0.290	-0.005	-0.087	-0.023
HG				0.391	-0.065	-0.119	0.057	0.101	0.141	0.153	0.266	0.260	0.450	0.381	0.302	0.238	0.203	0.283	0.304	0.169	0.303	0.290	0.220
HdL					0.174	0.132	0.287	0.337	0.416	0.240	0.138	-0.148	0.490	0.356	0.375	0.389	0.389	0.329	0.386	0.385	0.509*	0.524*	0.522*
HdW						0.026	-0.022	-0.052	0.284	0.205	0.294	0.140	-0.159	-0.192	0.021	-0.050	0.173	0.208	0.281	0.263	-0.137	-0.052	0.031
ErL							0.532*	-0.300	-0.017	-0.312	-0.281	-0.044	0.074	-0.158	-0.061	-0.115	0.001	-0.092	-0.323	0.026	0.069	0.317	0.338
ErW								-0.069	0.147	-0.214	-0.392	-0.281	0.191	0.097	0.074	0.268	-0.103	0.042	-0.218	0.129	0.344	0.481	0.453
NkL									0.080	0.389	0.252	-0.164	0.469	0.220	0.274	0.222	0.362	0.173	0.457	0.204	0.154	-0.046	-0.018
NkW										0.229	0.071	-0.090	0.162	0.190	0.194	0.266	0.087	-0.047	0.155	0.422	0.338	0.301	0.156
NkC											0.283	0.036	0.390	0.035	0.648*	0.299	0.409	0.304	0.737*	0.494	0.129	0.105	0.072
FLL												.684*	0.190	-0.158	0.021	-0.127	0.368	0.366	.509*	-0.074	-0.230	-0.373	-0.348
HLL													0.014	-0.150	-0.077	-0.228	0.198	0.120	0.131	-0.134	-0.431	-0.312	-0.330
TG														0.163	0.541	0.451	0.419	0.419	0.373	0.317	0.094	0.344	0.320
AbC															0.247	0.342	0.032	0.035	-0.149	0.123	0.459	0.351	0.313
HmL																.582*	.525*	0.313	0.479	.533*	0.187	0.397	0.476
HmH																	0.223	0.079	0.188	0.327	0.326	0.491	0.391
RmL																		0.285	0.502*	0.199	0.065	0.173	0.200

Factor analysis of biometric traits of Marecha camel breed

RmW	0.460	0.213	0.032	0.109	0.232
RmH		0.411	0.164	-0.046	0.017
TL			0.220	0.357	0.406
TW				0.575*	0.454
LFTL					0.881*

Body length (**BL**), Head length (**HdL**), Head width (**HdW**), Heart Girth (**HG**), Abdominal Circumference (**AbC**), Hump Height (**HmH**), Hump Length (**HmL**), Foreleg Length (**FLL**), Hind leg Length (**HLL**), Height at rump (**RmH**), Rump Width (**RmW**), Rump Length (**RmL**), Neck Width (**NkW**), Neck Length (**NkL**), Neck Circumference (**NkC**), Height at wither (**WH**), Tail Length (**TL**), Tail Width (**TW**), Left Front Teat Length (**LFTL**), Left Front Teat Diameter (**LFTD**), Body Weight (**BW**)

Values containing star (*) as superscript are significant and positively correlated.

Table.-6: Correlation among different morphological traits in Marecha Adult Male Camel

	WH	BL	HG	HdL	HdW	ErL	ErW	NkL	NkW	NkC	FLL	HLL	TG	AbC	HmL	HmH	RmL	RmW	RmH	TL	TW	TsL	TsD
BW	0.679*	0.749*	0.923*	0.727*	0.573*	0.130	0.480	0.563*	0.632*	0.706*	0.453	0.280	0.686*	0.881*	0.851*	0.782*	0.544*	0.433	0.489	0.331	0.438	0.615*	0.634*
WH		0.726*	0.541*	0.531*	0.318	0.332	0.502*	0.554*	0.568*	0.522*	0.538*	0.422	0.667*	0.452	0.601*	0.465	0.524*	0.378	0.749*	0.215	0.387	0.292	0.242
BL			0.599*	0.858*	0.707*	-0.036	0.323	0.701*	0.460	0.742*	0.610*	0.289	0.537*	0.703*	0.784*	0.654*	0.555*	0.226	0.483	0.218	0.229	0.491	0.366
HG				0.655*	0.525*	0.256	0.482	0.459	0.671*	0.622*	0.385	0.207	0.671*	0.812*	0.776*	0.727*	0.529*	0.375	0.382	0.341	0.455	0.603*	0.610*
HdL					0.822*	-0.079	0.311	0.641*	0.414	0.834*	0.590*	0.179	0.521*	0.777*	0.814*	0.708*	0.526*	0.244	0.284	0.253	0.331	0.539*	0.495
HdW						-0.319	0.033	0.524	0.214	0.656*	0.311	-0.107	0.319	0.757*	0.751*	0.663*	0.397	0.258	-0.038	0.010	0.137	0.590*	0.523
ErL							0.619*	-0.026	0.331	-0.043	0.168	0.340	0.219	-0.059	-0.060	-0.149	0.237	-0.024	0.374	0.333	0.415	-0.194	-0.054
ErW								0.176	0.181	0.400	0.229	0.446	0.563*	0.266	0.355	0.258	0.353	0.243	0.440	0.409	0.594*	-0.120	0.083
NkL									0.424	0.664*	0.746*	0.330	0.561*	0.475	0.657*	0.407	0.420	0.185	0.359	0.176	0.233	0.432	0.290
NkW										0.425	0.533*	0.364	0.533*	0.526*	0.432	0.512*	0.433	0.287	0.555*	0.324	0.287	0.631*	0.536*
NkC											0.633*	0.474	0.614*	0.640*	0.771*	0.706*	0.492	0.375	0.385	0.314	0.521*	0.400	0.418
FLL												0.643*	0.546*	0.318	0.556*	0.444	0.597*	0.170	0.589*	0.280	0.161	0.263	0.179
HLL													0.492	-0.003	0.333	0.292	0.347	0.243	0.675*	0.323	0.316	-0.101	-0.067
TG														0.450	0.671*	0.572*	0.597*	0.550*	0.666*	0.341	0.479	0.384	0.405
AbC															0.789*	0.774*	0.421	0.273	0.226	0.147	0.244	0.744*	0.748*
HmL																0.841*	0.563*	0.483	0.408	0.274	0.293	0.534*	0.508*
HmH																	0.375	0.468	0.387	0.198	0.234	0.638*	0.676*

Factor analysis of biometric traits of Marecha camel breed

RmL	0.364	0.447	0.362	0.365	0.246	0.218
RmW		0.305	0.162	0.248	0.278	0.399
RmH			0.261	0.240	0.144	0.189
TL				0.569*	-0.129	-0.045
TW					0.040	0.209
TsL						0.857*

Body length (**BL**), Head length (**HdL**), Head width (**HdW**), Heart Girth (**HG**), Abdominal Circumference (**AbC**), Hump Height (**HmH**), Hump Length (**HmL**), Foreleg Length (**FLL**), Hind leg Length (**HLL**), Height at rump (**RmH**), Rump Width (**RmW**), Rump Length (**RmL**), Neck Width (**NkW**), Neck Length (**NkL**), Neck Circumference (**NkC**), Height at wither (**WH**), Tail Length (**TL**), Tail Width (**TW**), Testis length (**TsL**), Testis Diameter (**TsD**), body weight (**BW**)

Values containing stars (*) as superscript are significant and positively correlated.

Table-7: Total variance explained by different factors of Marecha Adult Female Camel

Component	Total Variance Explained					
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.123	25.512	25.512	6.123	25.512	25.512
2	4.534	18.892	44.404	4.534	18.892	44.404
3	1.910	7.957	52.361	1.910	7.957	52.361
4	1.724	7.185	59.546	1.724	7.185	59.546
5	1.440	5.999	65.545	1.440	5.999	65.545
6	1.256	5.231	70.776	1.256	5.231	70.776
7	1.066	4.443	75.219	1.066	4.443	75.219
8	.839	3.498	78.717			
9	.778	3.241	81.957			
10	.713	2.973	84.930			
11	.631	2.629	87.560			
12	.508	2.116	89.676			
13	.411	1.711	91.387			
14	.390	1.624	93.011			
15	.344	1.434	94.445			
16	.285	1.189	95.634			
17	.265	1.105	96.739			
18	.212	.883	97.622			
19	.179	.746	98.368			
20	.126	.527	98.895			
21	.104	.435	99.330			
22	.068	.284	99.614			
23	.059	.248	99.861			
24	.033	.139	100.000			

Extraction Method: Principal Component Analysis. Seven components extracted

Table-8. Total variance explained by different factors of Marecha Adult Male Camel

Component	Total Variance Explained					
	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.441	47.670	47.670	11.441	47.670	47.670
2	3.505	14.604	62.274	3.505	14.604	62.274
3	1.753	7.305	69.580	1.753	7.305	69.580
4	1.473	6.136	75.716	1.473	6.136	75.716
5	1.095	4.562	80.278	1.095	4.562	80.278
6	.871	3.628	83.905			
7	.709	2.954	86.860			
8	.616	2.568	89.428			
9	.522	2.175	91.603			
10	.415	1.730	93.333			
11	.345	1.439	94.772			
12	.282	1.174	95.946			
13	.203	.846	96.793			
14	.184	.767	97.560			
15	.146	.608	98.168			
16	.121	.502	98.670			
17	.087	.364	99.033			
18	.070	.291	99.325			
19	.046	.193	99.518			
20	.040	.168	99.686			
21	.029	.121	99.807			
22	.028	.117	99.924			
23	.014	.057	99.981			
24	.005	.019	100.000			

Extraction Method: Principal Component Analysis.

Table-9: Component Matrix of different factors of Marecha Adult Male and Female Camel

Component Matrix ^a													
Component (Adult Female Mareecha)							Component (Adult Male Mareecha)						
Parameters	1	2	3	4	5	6	7	Parameters	1	2	3	4	5
HmL	.763				-			BW	.922				
					.367								
HdL	.748						.307	HmL	.901				
TG	.681				-			HG	.853		.358		
					.446								
RmH	.664	-						HdL	.844				
		.568											
NkC	.659	-						NkC	.841				
		.402											
TL	.642		.325				-	BL	.839		-		
							.339				.314		
HmH	.583	.331				-		HmH	.820				
						.384							
RmL	.582	-						AbC	.812	-			
		.331								.420			
NkL	.509			-			.438	TG	.793				
				.363									
HG	.505		-	.428				WH	.745	.308			
			.477										
RmW	.479			.353		.340		NkL	.702		-.452		
FLL		-		.416				NkW	.684			.480	
		.747											
LFTL	.537	.693						FLL	.672		-.540		
ErW		.640						RmL	.664				
BW		.630	-					HdW	.661	-		-	
			.515							.577		.316	
LFTD	.548	.599						TsL	.619	-		.371	
										.578			
BL	.537	-						TsD	.613	-	.426		
		.559								.461			
TW	.480	.525			.334			RmH	.585	.521		.440	
HdW		-	.575		.481			TW	.471	.427	.370	-	
		.338										.424	
AbC	.381	.395	-					ErL		.723	.369		.374
			.563										

Factor analysis of biometric traits of Marecha camel breed

ErL	.474	.486	.468		HLL	.429	.635	-.312
HLL		-	.663		ErW	.480	.588	
	.514							
NkW	.409		.510	-	TL	.361	.482	-
				.472				.386
WH	.493		.303	.579	RmW	.482		-
								.733

Extraction Method: Principal Component Analysis.

a. 7 components extracted

a. 5 components extracted

Body length (**BL**), Head length (**HdL**), Head width (**HdW**), Heart Girth (**HG**), Abdominal Circumference (**AbC**), Hump Height (**HmH**), Hump Length (**HmL**), Foreleg Length (**FLL**), Hind leg Length (**HLL**), Height at rump (**RmH**), Rump Width (**RmW**), Rump Length (**RmL**), Neck Width (**NkW**), Neck Length (**NkL**), Neck Circumference (**NkC**), Height at wither (**WH**), Tail Length (**TL**), Tail Width (**TW**), Left Front Teat Length (**LFTL**), Left Front Teat Diameter (**LFTD**), Testis length (**TsL**), Testis Diameter (**TsD**), body weight