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BIRTH WEIGHT, BODY MEASUREMENTS AND GESTATION LENGTH OF *Tülü* (BACTRIAN X DROMEDARY F1) CALVES

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ABSTRACT

In this study, gestation length (GL), birth weight (BW) and body measurements (BM) of Bactrian x Dromedary F1 calves called *Tülü* born between 2017 and 2020 in Aydın, Turkey were recorded. Fifteen GL records and 25 heads *Tülü* calves' BW and BM were used. The aim was to establish the relationship between BW and BM in order to predict BW from BM. Farm and sex of calf had statistically significant effects (P<0.05) on GL, but the effect of calving number on GL was insignificant (P>0.05). GL of *Tülü* calves were changed between 366 days and 401 days and the mean was found to be 385.27±3.17 days. GL for males (388.7±3.13 days) was 12.6 days longer than those of the female calves (376.1±4.57 days; P<0.05). BW of *Tülü* calves ranged between 26 and 51 kg with an overall mean of 35.99±1.25 kg.

The effects of farm, sire, birth year, calving number and calf sex on BW were found statistically insignificant (P>0.05). However, farm and calving number effects on some BM traits were found statistically significant (P<0.05). Male calves were 0.84 kg heavier than their female counterparts (P>0.05).

It was concluded that male *Tülü* calves have longer gestation length and like other livestock animal, in this study it was found that hearth girth (HG) could be used to estimate BW of *Tülü* calves (R^2=61.16). The higher correlation coefficient found between BW and HG (r=0.782) also supports this idea.

Key words: Birth weight, gestation length, heart girth, stepwise-regression, *Tülü* camel

Turkish camel population had a dramatic decrease by 97% between 1960 and 2000 (Faye, 2020), thereafter increased for the last twenty years, mainly due to the growing popularity of camel wrestling. The people in communities where the racing and wrestling is taking place, aspire to have a camel because it brings a social recognition (Koç and Atasever, 2016). It is believed in the country that a good wrestling camel should be an F1 male offspring produced by crossing Bactrian sire and dromedary dam, named *Tülü* in Turkish (Dioli, 2020).

In recent years a lot of male *Tülü* have been brought to Turkey for wrestling purposes, especially from Iran. Wrestling camel breeders tend to keep the young male *Tülü* camels together (as a cohort) to give them opportunity for playing each other and thus, stimulating and improving their wrestling styles and games. The wrestling activity is started in these camels when these are 7 years old (Manav *et al*, 2018).

The cameleers in Turkey expect to foresee the quality of the wrestler *Tülü* adult based on the birth weight (BW) and/or body measurements (BM). Front leg length is an important criterion for a good wrestling camel because the front legs play a determinant role during wrestling. A long-term study is required to determine BM and BW for *Tülü* camel to be used as wrestlers.

In the present study, BW and BMs of *Tülü* calves as well as their relationships were recorded. In addition, the effect of gestation length was also assessed. Moreover, the correlations between the traits were determined in addition to the establishment of equation to estimate BW from BMs.

Materials and Methods

Animals and Body Measurements

In present study, 25 heads *Tülü* calves born between 2017 and 2020 in four different farms in Aydın, Turkey were used to record BW and BM, 24 hours after birth. BW was taken with a scale weighs up to 2000 kg with an accuracy of 0.5 kg and BMs were taken with a measuring meter with a spirit level and with a 30 cm ruler. The gestation length (GL) was also estimated from the natural mating of 15 heads camels.

BM taken from the calves are described below (Fig 1):

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A-B is wither height (WH): Height of the highest point of the spine (*Processus spinalis*) from the ground,

C-D is rump height (RH): The height of the highest point of the sacrum (the line joining Tuber coxae) from the ground,

E-F is abdominal height (AH): Height of the last back vertebrae from the ground,

K is abdominal girth (AG): The circumference of the last dorsal spine protrusion from under the abdomen,

G-H is body length (BL): The distance between the tip of the shoulder (Tuberculum majus humeri) and the rump of the seat (Tuber ischci),

O-G is neck length (NL): The distance between the lower part of the head and the chest,

J is heart girth (HG): The circumference of the chest bone measured from the back of the forelimbs and under the back and abdomen,

G-L is arm length (AL): The height of the point where the humerus bone meets the scapula,

M-N is tail length (TL): The distance between the point where the tail connects to the body and the tip,

PR is shoulder width (SW): Distance between two shoulder ends,

S-T is rump width (RW): Distance between the tuber ischi's.

Housing and Feeding

All the animals were kept in the barn in single or group paddocks in whole year. After the birth, *Tülü* calves were allowed to suckle their mothers, and the weaning age was very late, about 12 months or more. In two farms the camel milk was sold and calves were allowed to stay and suckle its mother for about 1-1.5 months after birth and the dams were not milked in this period.

When the calves were about 2-3 months old, farmers gave clover hay and concentrate (calf starter used for cattle calf) to them. The calves had also opportunity to drink fresh water *ad libs*. The lactating camels were also fed with roughage, like clover hay and wheat or barley straw and concentrate produced for dairy cattle. While some farms were harvesting alfalfa and withering in the sun before giving it to animals, in some cases in the spring, the grass on the edges of the fields was cut and distributed to the animals.

Statistical Analysis

The differences between the means of the fixed factor levels were taken into account to be statistically significant at $P<0.05$ (2-tailed) based on Tukey's adjustment type I error rate.

Statistical model used for the analysis of GL data is given in Equation I as follow:

$$y_{ijkl}=\mu+a_i+b_j+c_k+e_{ijkl}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(I)$$

where μ is the overall mean, y_{ijkl} of the gestation length, a_i the farm group effects (i=1 and 2), b_j the calving order effects (j=1 and ≥2), c_k the effect of sex (k=Male and Female), and e_{ijkl} the residual random errors.

Statistical model used for the analysis of BW and BMs data is given in Equation II as follow:

$$y_{ijklmn}=\mu+a_i+b_j+c_k+d_l+f_m+e_{ijklmn}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(II)$$

where μ is the overall mean, y_{ijklmn} of the BW or BMs, a_i the farm group effects, (i=1 and 2), b_j the sire effects (j=Cafer Buhur and Deli Buhur), c_k the birth year

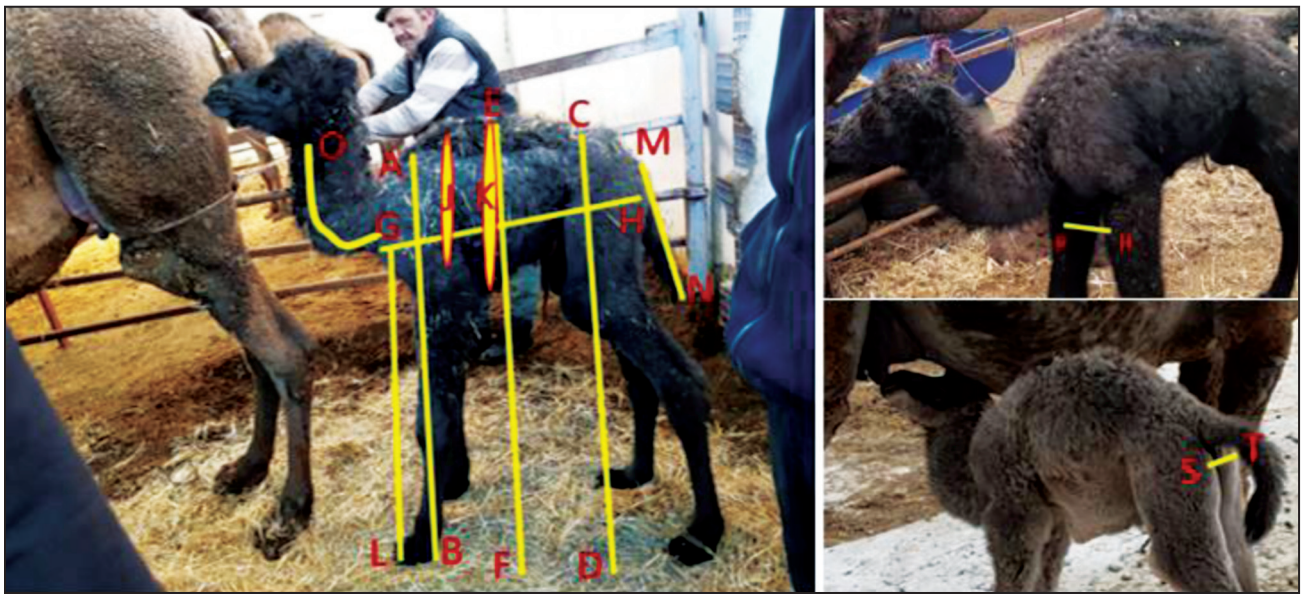

Fig 1. Body measures of *Tülü* calf.

effects (k=2017, 2018, 2019 and 2020), d_l the calving order effects (l=1 and ≥2), f_m the effect of sex (m=Male and Female), and e_{ijklmn} the residual random errors.

The Pearson correlation was used to assess the relationships between BW and the body measurements. The software used for statistical analyses was SAS (1999). In addition, equations were developed by using stepwise-regression procedure in MINITAB 13.0 for the estimation of BW from BMs.

Results

Gestation Length (GL)

The GL varied from 366 to 401 days with a mean value of 385.27±3.17 days. Farm group (P<0.05) and sex of calf (P<0.05) had significant effect on GL, contrary to calving number which was non-significant (Table 1). GL means for first and second farm

Table 1. Gestation length (day) of camel cows

Factor	N	Mean	Min	Max
Farm group		*		
1	8	390.7±3.87	383	399
2	7	374.2±4.68	366	401
Calving Order		NS		
1	7	379.4±4.68	377	399
≥2	8	385.4±3.87	366	401
Sex of calf		*		
Male	10	388.7±3.13	372	401
Female	5	376.1±4.57	366	392
Overall	**15**	**385.27±3.17**	**366**	**401**

NS: not significant, *: Significant for P<0.05

Table 2. Birth weight and body measurements of *Tülü* (Bactrian x Dromedary F1) calves

Factor	n	BW, kg	WH, cm	RH, cm	AH, cm	AG, cm	BL, cm
Farm		NS	NS	*	*	NS	NS
1	15	36.34±1.68	105.87±1.30	103.20±1.11	108.13±1.29	78.33±1.86	59.67±0.96
2	10	35.22±1.93	101.20±2.34	97.45±2.48	102.20±2.54	79.70±2.02	60.40±1.43
Sire		NS	NS	NS	NS	NS	NS
Cafer Buhur	6	32.85±1.10	101.67±1.15	99.17±2.07	102.17±1.45	73.33±2.74	57.50±1.28
Deli Buhur	19	36.85±1.55	104.74±1.62	101.45±1.58	106.89±1.69	80.63±1.36	60.74±0.91
Birth year		NS	NS	NS	NS	NS	NS
2017	8	36.33±2.61	102.38±2.21	99.06±2.56	103.13±2.14	77.00±2.01	59.38±1.22
2018	5	34.14±1.78	103.80±1.66	101.60±2.11	105.20±1.96	78.40±2.77	59.40±2.38
2019	5	36.60±2.87	107.80±2.69	102.80±2.35	107.80±2.96	77.60±0.93	60.80±1.89
2020	7	36.14±2.69	103.29±3.11	101.14±3.08	107.71±3.54	82.29±2.70	60.43±1.81
Calving order		NS	NS	NS	NS	*	*
1≥	10	33.64±1.59	100.70±2.31	97.45±2.52	101.90±2.58	74.90±2.07	57.60±1.09
2	15	37.39±1.72	106.20±1.23	103.20±1.07	108.33±1.18	81.53±1.47	61.67±0.89
Sex		NS	NS	NS	NS	NS	NS
M	15	36.23±1.82	102.93±1.95	99.43±2.00	104.33±2.01	77.80±1.93	59.67±1.11
F	10	35.39±1.60	105.60±1.25	103.10±1.02	107.90±1.56	80.50±1.75	60.40±1.17
Overall	25	35.99±1.25	104.00±1.28	100.90±1.30	105.76±1.38	78.88±1.36	59.96±0.80

NS: not significant, *: Significant for P<0.05; BW: Birth weight, WH: Wither height, RH. Rump height, AH. Abdominal height, AG: Abdominal girth, BL: Body length

Table 2. Continued

Factor	n	NL, cm	HG, cm	SW, cm	AL, cm	RW, cm	TL, cm
Farm group		NS	NS	NS	NS	NS	NS
1	15	40.07±1.45	80.40±1.56	13.33±0.72	88.10±1.38	9.80±0.30	31.53±0.79
2	10	37.50±1.49	76.70±1.80	11.40±0.45	84.20±2.71	8.90±0.53	31.50±1.16
Sire		NS	NS	NS	NS	NS	NS
Cafer Buhur	6	35.50±1.38	77.67±1.58	12.00±1.06	82.25±1.30	9.50±0.43	30.17±1.19
Deli Buhur	19	39.63±1.30	80.11±1.56	12.74±0.58	87.89±1.67	9.42±0.35	31.95±0.76
Birth year		NS	NS	NS	NS	NS	NS
2017	8	35.63±1.34	78.38±2.15	11.63±0.93	83.44±2.61	8.62±0.46	30.63±0.93
2018	5	35.40±1.44	78.40±1.50	12.20±0.80	86.20±1.83	9.20±0.49	30.20±1.44
2019	5	38.40±2.23	79.40±2.77	15.40±1.20	88.40±2.04	9.80±0.80	30.60±0.93
2020	7	44.57±1.57	81.71±3.18	11.86±0.46	89.00±3.38	10.29±0.42	34.14±1.18
Calving order		NS	NS	NS	*	*	NS
1	10	37.50±1.54	77.10±1.86	11.90±0.51	82.15±2.51	10.00±0.52	30.40±1.06
≥2	15	39.40±1.51	81.13±1.58	13.00±0.76	89.47±1.12	9.07±0.30	32.27±0.79
Sex		NS	NS	NS	NS	NS	NS
M	15	38.53±1.52	79.40±1.87	12.13±0.61	85.43±2.07	9.20±0.38	31.20±0.82
F	10	38.80±1.60	79.70±1.48	13.20±0.85	88.20±1.50	9.80±0.42	32.00±1.09
Overall	**25**	**38.64±1.09**	**79.52±1.25**	**12.56±0.50**	**86.54±1.39**	**9.44±0.28**	**31.52±0.65**

NS: not significant, *: Significant for P<0.05, NL: Neck length, HG: Hearth girth, SW: Shoulder width, AL: Arm length, RW: Rump width, TL: Tail length

groups were 390.7±3.87 days and 374.2±4.68 days, respectively. A difference occurred also according to the sex of the camel calf: GL for *Tülü* calves were 388.7±3.13 and 376.1±4.57 days, respectively for male and female (P< 0.05).

A correlation coefficient was also calculated between GL and BW of *Tülü* calves. A moderate and statistically insignificant correlation (r=0.407; P=0.244) was observed.

Birth Weight (BW) and Body Measurements (BM)

The mean BW in our sample was 35.99±1.25 kg. Except the significant effects of sire on RH and AH (P<0.05) and calving order effects on AG, BL, AL and RW, farm, sire, birth year and sex of calf did not show significant effects on BW and BMs (Table 2). The overall means of WH, RH, AH, AG, BL, NL, HG, SW, AL, RW and TL were, 104.00±1.28 cm, 100.90±1.30 cm, 105.76±1.38 cm, 78.88±1.36 cm, 59.96±0.80 cm, 38.64±1.09 cm, 79.52±1.25 cm, 12.56±0.50 cm, 86.54±1.39 cm, 9.44±0.28 cm and 31.52±0.65 cm, respectively.

Estimating Birth Weight (BW) from Body Measurements (BMs)

BW can be estimated from BMs. The equations were reported in Table 3. The stepwise-regression analysis gave two equations with high R^2 values. In the first equation, BW of *Tülü* calves was estimated by using only HG (R^2=61.16). It means that by using only HG, the BW of *Tülü* calves can be estimated with 61.16% accuracy. In the second equation, in addition to HG, SW was also used and R^2 increased slightly for reaching 66.89%. It means that by using HG and SW measures, the BW of *Tülü* calves can be estimated with the accuracy rate over 60%. The addition of other measurements did not improve the prediction.

Table 3. Equations developed to estimate birth weight from body measurements in *Tülü* (Bactrian x Dromedary F1) calves

	Equations	R^2
1	= -26.33+0.78*HG	61.16
2	= -25.53+0.87*HG-0.64*SW	66.89

HG: Heart girth, SW: Shoulder width

Correlations (Table 5)

The phenotypic correlations of BW with BMs were moderate to high, positive and statistically significant, except small positive correlations with SW and RW. The highest positive correlation of BW was with HG (r=0.782; P<0.01). BW was also highly correlated with AG (r=0.607; P<0.01) and NL (r=0.513; P<0.01). None of the negative correlations (SW with AG and TL, then RW with WH and BL) were significant. Other correlations among the BW and BM were positive and generally high.

Unlike other livestock animal, camel has a long neck and it has also high correlations with WH (r=0.488; P<0.01), RH (r=0.554; P<0.01), AH (r=0.663; P<0.01), HG (r=0.667; P<0.01), AL (r=0.562; P<0.01), RW (r=0.474; P<0.05) and TL (r=0.602; P<0.01).

Discussion

Gestation length

Like other livestock species, GL for male *Tülü* calves appeared longer than those of females. Such difference was already observed for long time in dromedary (Agarwal and Khanna, 1993; Al Mutairi *et al,* 2010; Nagy and Juhasz, 2019) and in Bactrian camel (Chen and Yuen, 1984). However, such observations are not constant (Tibary and Anouassi, 1997). For example, unlike this study, Al Mutairi *et al* (2010) reported higher GL for female calves than male in Saudi camels.

Similar to Nagy and Juhasz (2019), the multiparous camels had higher GL than primiparous camels in our study. However, the difference observed in our study (6.0 days) was higher than the difference reported in UAE camel (Nagy and Juhasz, 2019).

With a mean GL of 384.5 ±0.17 days in UAE dromedary camels, Nagy and Juhasz (2019) have assessed the decisive effect of environmental conditions (i.e. photoperiod) on reproductive parameters. With an average of 377.5 days in Saudi camels, Al Mutairi *et al* (2010) reported that season and year of calving had also significant effects on GL, but the effect of parity and sex of calf was not affecting GL significantly. The correlation between GL and BW found for *Tülü* calves in our study was higher than the correlation found for UAE dromedary camels by Bene *et al* (2020) which appeared very weak (r=0.14; P<0.01).

Birth weight

The weight and BMs of livestock animals at birth varies in relation to the breed and the average dam body weight. Since BW of the offspring affect the ease of birth and consequently the survival of the calf, it is therefore considered vital as a management tool.

There are many other factors affecting BW and BM at birth in camel, like genetic factors, age, weight, parity, health and nutrition status of the dam, calf sex, season and geographical region (Koç *et al,* 2018;

Harmas *et al,* 1990; Al Mutairi, 1999). Burger *et al* (2019) reported that season and mother camel (not the breed) play an important role in the variation of gestation length and Birth Weight of the calf.

A higher influence of environment, management, feeding and intrauterine raring capacity of dam on BW than the hereditary growth potential was reported by Bene *et al* (2020).

BW mean found for *Tülü* calves in our study was close to that reported for dromedary camels in some previous studies (Harmas *et al,* 1990; Bakheit *et al,* 2009). However, with a mean value of 35.99 kg, *Tülü* camel calves BW in our sample was slightly higher than those of dromedary calves raised in UAE, the mean BW being 34.5±0.09 kg (Nagy and Juhasz, 2019) and 34.75 ± 5.67 kg (Bene *et al,* 2020). Al Mutairi (2000) reported globally lower BW in African breeds compared to Middle East ecotypes, especially in Saudi Arabia. Indeed, lower BW were reported for the newborn camels in African countries: the mean BW of the newborn dromedary camels were 25.8 in Tunisia and 30.9 kg in Kenya (Burgemeister, 1975; Hertrampf, 2004), or 27 kg in Somalia (Ouda, 1995) and Tunisia according to other reference (Hammadi *et al,* 2001). At reverse, higher BW (39 kg on average) was reported for Indian camel (Bissa, 1996). The same author (Bissa, 2002) reported that BW ranged between 26 and 51 kg in Indian dromedary camel ecotypes. Like values reported by this last author, BW of *Tülü* calves in Turkey was also varied between 26 and 51 kg. However, Bene *et al* (2020) reported surprisingly wider range (10-64 kg) for UAE dromedary camels. Indeed, it is generally admitted that below 25 kg, the probability of survival is very low (Tibary and Anouassi, 1997).

However, the birth weight observed in our sample appeared lower than records generally published for hybrid calves. According to Dioli (2020), Hybrids F1 have an average higher birth weight (45.4±0.842.1kg) than both the calves of Asian dromedaries (Nagy and Juhász, 2019) and of Bactrian camels (34.55±7.17kg according to Zhao *et al*, 2000).

Regarding the sex effect, BW of male *Tülü* calves in our study was 0.84 kg higher than those of female and this result agreed with those of the literature (Al Mutairi, 1999; Bakheit *et al,* 2009). Al Mutairi (1999) reported that the mean BW in male and female calves were 37.45 ± 0.55 kg and 37.27 ± 0.41 kg, respectively. Bakheit *et al* (2009) reported that in Sudanese camel, BW of male calves (39 ± 0.31 kg) was higher than that of female calves (36 ± 0.34 kg). Harmas *et al* (1990) stated that the effect of calf sex on BW is significant, indicating that BW of males was 35.0 ± 0.95 kg and that of females was 34.1 ± 0.46 kg.

The higher birth weight of male calves can be attributed to the developmental factors of males and it can also be in relationship with the longer stay in the dam's uterus than females. This idea is supported by the positive correlation coefficient (r=0.407; P>0.05) determined between GL and BW of *Tülü* calves in this study.

It should be emphasised that maternal uterine conditions have also a significant effect on BW of camel (Bene *et al,* 2020). Twining in camel is very rare (Merkt *et al,* 1990) and due to insufficient nutrition and management, death rates in camel calves sometimes increases to 30-50% (Koç *et al,* 2016), especially in camel with very low BW.

In the late stages of pregnancy, maternal malnutrition causes decrease in the weight gain of the foetus, while the death of the foetus and abortions may also occur depending on the severity of malnutrition (Kadim and Mahgoub, 2013). In different farms of Ethiopia, it was stated that the range of mortality rate in camel calves was 14.9-20.3%, due to insufficient management and nutritional factors (Megersa *et al,* 2008).

In contrast to Al Mutairi (1999), mother age did not have a significant effect on BW of *Tülü* calves in our study. However the measures of AG, BL and AL in *Tülü* calves were lower for the first calving order than those of the second and higher calving order. It was stated that there was a positive correlation between the body weight of the mother and BW of the calf and that the geographical region has also an effect on BW besides the genetic factors (Kadim and Mahgoub, 2013). A high correlation coefficient (r=0.87) between maternal age and calf birth weight was calculated for Saudi camels by Al Mutairi (1999).

The heritability of camel BW was high, and its variation was due to mother (20%), foetus (17%), parity (7%), nutrition (6%), sex (2%) and mother age (1%) (Hansard and Berry, 1969).

Prediction of BW with BM

Like other livestock species, HG could be used in camel to estimate the BW (Table 4). In Holstein-Friesian bulls for example, live weight was estimated with 88.02% accuracy rate (Koç and Akman, 2007). In adult camel, HG was used to estimate BW in the equation proposed by Boué (1949) in Algeria, Graber (1966) in Chad, Field (1979) in Kenya or Bucci *et al* (1984) in Egypt. In his recent comparative study

regarding the accuracy of the different equations published on camel, Boujenane (2019) stated that the formula of Field (1979), where estimated weight (kg) = 6.46*10-7*(WH+HG+AG)3.17, appears to be the best choice. Ihuthia *et al* (2010) estimated live weight of camel from the measures of AG, HG and AH, and Kuria *et al* (2007) reported that the combined effects of HG, AG and WH on body weight were higher than the other individual variables and combination of BMs in camel.

Because of using BW and BM of calves at birth, accepting the formulae given in Table 3 to estimate camel live weight at any age would be giving values with high error. One of the main differences regarding the prediction of live weight from body measurements between the camel calf and adult is the hump. In adult camel, the presence of a big hump has a big influence on the live weight. In our study, because of the hump of calf was not developed yet, its influence is low compared to HG.

In our equation to estimate the weight, SW, NL and AG were also important traits. Besides HG, Koç *et al* (2018) reported AL was also important trait to estimate BW from BM in *Tülü*. Due to having a long neck, in live weight estimation of camel, NL should be one measurement in relationship with the live weight estimation.

The equations developed in our study from 25 heads calves are valid for the measurements between the smallest and the maximum values of the BW and BM recorded. In case of values below the minimum specific or above the higher one, the reliability of the estimate would be reduced. Devore and Pack (1993) described such situations as "danger of extrapolation".

Table 4. Estimated birth weight (BW) based on heart girth (HG) measurements in *Tülü* (Bactrian x Dromedary F1) calves

HG, cm	BW, kg		HG, cm	BW, kg		HG, cm	BW, kg
65	24.4		77	33.7		89	43.1
66	25.2		78	34.5		90	43.9
67	25.9		79	35.3		91	44.7
68	26.7		80	36.1		92	45.4
69	27.5		81	36.9		93	46.2
70	28.3		82	37.6		94	47.0
71	29.1		83	38.4		95	47.8
72	29.8		84	39.2		96	48.6
73	30.6		85	40.0		97	49.3
74	31.4		86	40.8		98	50.1
75	32.2		87	41.5		99	50.9
76	33.0		88	42.3		100	51.7

Correlations

Positive correlations were widely observed between the different measurements. That is a common feature due to the allometric development of body in all species including camel as it was observed in many studies aiming to identify different camel phenotypes based on body measurements (Kamili *et al,* 2006; Chniter *et al,* 2009; Abdallah and Faye, 2012; Oulad-Belkhir *et al,* 2013, Legesse *et al,* 2018; Diop *et al,* 2020).

Conclusion

GL and BW in *Tülü* camel were highly variable under the effect of classical factors as sex, or mother parity. It was possible to predict the birth weight

Table 5. Correlation between birth weight and body measurements in *Tülü* (Bactrian x Dromedary F1) camel

	BW	WH	RH	AH	AG	BL	NL	HG	SW	AL	RW
WH	0.576**										
RH	0.538**	0.911**									
AH	0.583**	0.905**	0.939**								
AG	0.607**	0.379	0.315	0.470*							
BL	0.468*	0.588**	0.577**	0.559**	0.451*						
NL	0.513**	0.488*	0.554**	0.663**	0.443*	0.431*					
HG	0.782**	0.717**	0.643**	0.739**	0.536**	0.408*	0.667**				
SW	0.053	0.498**	0.349	0.392*	-0.111	0.136	0.180	0.355			
AL	0.486*	0.773**	0.815**	0.830**	0.517**	0.599**	0.562**	0.541**	0.127		
RW	0.086	-0.009	0.121	0.114	0.010	-0.203	0.474*	0.100	0.057	0.041	
TL	0.357	0.228	0.332	0.249	0.475*	0.375	0.602**	0.415*	-0.181	0.478*	0.257

*: Significant for P<0.05; **: Significant for P<0.01; BW: Birth weight, WH: Wither height, RH: Rump height, AH: Abdominal height, AG: Abdominal girth, BL: Body length, NL: Neck length, HG: Heart girth, SW: Shoulder width, AL: Arm length, RW: Rump width, TL: Tail length

from body measurements, especially HG with a good accuracy. The mean BW of *Tülü* calf, despite the expected heterosis effect, did not appear exceptional even if it was higher than camel calves from African ecotypes. However, it represents a good starting point to reach the expected weight for a wrestling adult camel. For that, the farmers have to pay special attention to the growth during the first few months of the life of their camel calves.

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