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EVALUATION OF DROMEDARY CAMEL'S BODY PARAMETERS AND THE EFFECT OF EPIDIDYMAL REGION ON EXTRA-GONADAL SPERM RESERVE

[1]Hassan, I.T., [2]Abdussamad, A.M., [2]Raji, A.Y., and [2]Bello, B.
[1]Abdullahi Aminchi College of Advanced Studies, Funtua
[2]Department of Animal Science, Bayero University, Kano
Corresponding author email: Isahtambaya05@gmail.com
Phone number: +2348030868637

ABSTRACT

This study was aimed to evaluate the effect of epididymal regions on camelid extra-gonadal sperm reserve and the relationship among the sperm reserve and some body parameters using twenty-one apparently healthy adult male dromedary camels brought to the Kano main abattoir for slaughter. Body parameters such as body length, chest girth, hump base circumference and hump lateral base were measured before slaughter. Body weight was then derived from these parameters. Paired samples of testicles with their associated epididymides were obtained post-slaughter and transported to the laboratory on ice. The testicles were separated from the epididymides. One epididymis was processed, its weight and volume recorded and epididymal sperm reserve was determined by haemocytometry. Results of the study showed that there was no correlations between the camel's body weight and epididymal parameters. However, there was positive correlation between camel's body weight and all body parameters. The cauda epididymis accounted for the highest portion (73.72%) of extra-gonadal sperm reserve as compared to the corpus (20.95%) and caput (5.33%), but statistically no significant difference was observed in sperm reserve between corpus and caput epididymis. It can be concluded that camel's body weight should not be considered as an indicator of higher epididymal sperm reserve. Also, cauda epididymis is the most suitable site for post-mortem harvest of camel's spermatozoa. Therefore, spermatozoa from the cauda epididymis could be harvested, preserved and subsequently be used for artificial insemination in camels.

Key words: Camel; Body; Parameter; Epididymis; Sperm reserve

INTRODUCTION

Viable and functional spermatozoa is required for assisted reproductive technologies, this necessitates the need for its optimal harvesting, processing and storage to maintain its quality and fertilizing ability for longer periods (El-Badry, *et al*., 2005). Collection and cryopreservation of epididymal sperm cells in dog (Hewitt *et al*., 2001), horse (Morris *et al*., 2002), ram (Kaabi *et al*., 2003), and boar (Suzuki and Nagai, 2003) have been reported and recently scientist showed interest in developing assisted reproductive technologies and cryobanking for the conservation of camel genetic resources (Turri *et al*., 2013). Thus, epididymal sperm recovered post-mortem has increased the opportunities for creation of semen storages (El-Badry *et al*., 2005). However, semen collection in camels is encountering some hitches including the nature of camels' mating behaviour, lengthy ejaculation and the thick viscousity of the semen itself (Skidmore *et al*., 2013). As such, epididymal sperm collection can serve as an alternative when natural mating or the use of ejaculated semen persist due to difficulty of handling intractable animal or sudden death of an animal (Foote 2002; Kaabi *et al*, 2003; Edeneil *et al*, 2015). Therefore, recovery of camelid epididymal spermatozoa helps a lot in creating semen reservours for preserving the genetic traits of high vigour animals.

Body condition score, body weight and heart girth are good parameters for evaluation of body development due to their ease of application and high degree of accuracy (Bandeira *et al*., 2016). Also, biometric parameters, such as scrotal circumference, testicular weight and testicular length are essential measurements in the andrological evaluation of a breeding animal (Ajani *et al*., 2015). However, information on the relationships among the camelid body weight, epididymal and morphometric parameters of the camel bulls were scarce. Hence, the present study provide baseline information on camel's body parameters in relation to its extra-gonadal sperm reserve which could serve as a guide to camel farmers in selection of bulls for breeding.

MATERIALS AND METHODS

Study Area

The body parameters of camels and camel testicles used for the study were obtained from camels brought for slaughter at Kano main abattoir (GPS Coordinates: Between 12.01330^{o} and 12.01213^{o} N, 08.52147^{o} and 08.52160^{o} E) of Kano State, Nigeria.

Sampling Animals

Sampling was conducted in late dry season from January to February of the year 2016. A total of 21 apparently healthy adult camels of 5 years old and above were selected within the entire study period of 7 weeks. The age of camels was determined by rostral dentition method as described by Bello *et al*. (2013). Three camels were selected per week and in each sampling day, a camel was selected by convenience sampling method.

Study Design

A cross-sectional design was used in the study which was divided into two phases, the abattoir and laboratory phase.

The Abattoir Phase

The body parameters (chest girth, body length, hump base circumference, hump lateral base) of the camels were measured by using a measuring tape. The body weight was derived from the weight estimation method (Higgins and Kock, 1984).

Upon slaughter and evisceration, the scrotum containing the testicles and epididymides was detached from the inguinal region by severing its neck at the level of the spermatic cord using a scalpel blade. The testicles with epididymides were wrapped in soft tissue paper, placed in a container with ice pack and transported to the laboratory for measurements, processing and sperm reserve determination.

Laboratory Phase

Immediately after arrival to the laboratory, the scrotum containing the testicle and epididymis was dissected out of the tunica vaginalis using sharp scissors. The epididymis was separated from the testicle then weighed and its volume was taken from the beaker readings using the Archimedes' principle of water displacement.

One epididymis was divided into caput, corpus and cauda segments and weighed separately. The cauda epididymis was minced in 20 ml of saline with sharp scissors. Volume from minced cauda epididymis (10 µl) was transferred onto a glass slide and a cover slip was placed over the drop which was allowed to settle for 5 minutes and observed under light microscope at ×40 stage magnification. The total motility and intensity of motility of spermatozoa were determined by modification of the method described by Abdussamad *et al*, (2015). The intensity of motility was scored from 0 to 5.

To determine extra-gonadal sperm reserve, the remaining minced cauda epididymis was kept in a refrigerator at 5°C and stored overnight. In the morning, it was filtered through gauze and the filtrate volume was measured. One ml of cauda epididymal filtrate was diluted in 2ml distilled water and the cauda epididymal sperm reserve was determined by haemocytometric method. With the exception of the determination of motility and its intensity as carried out for the cauda, all other procedures (as mentioned above) were applied on corresponding caput and corpus epididymis.

Statistical Analysis

Statistical Package for Social Sciences (SPSS, Version 23) was used to analyse the data. Data on camelid extra-gonadal sperm reserve were subjected to one way analysis of variance (ANOVA), significantly different means were separated using Tukey procedure. The relationships among camel's body weight, epididymal and body parameters were determined by Pearson correlation.

RESULTS

Table 1 - Camelid Body Weight and Somatometric Parameters

Parameter	N	Max.	Min.	Mean	SEM
Body weight (kg)	21	587.00	433.00	537.19	8.39
Body length (cm)	21	195.00	134.00	178.24	3.27
Chest girth (cm)	21	238.00	179.00	214.76	3.83
Hump base circumference (cm)	21	73.00	40.00	54.76	1.73
Hump lateral base (cm)	21	140.00	93.00	120.38	3.23

N= Number of Samples, SEM= Standard Error of Means.

Table 2 - Camelid Epididymal Parameters

Parameter	N	Max.	Min.	Mean	SEM
Epididymal Weight (g)	21	32.00	10.00	18.14	1.14
Epididymal volume (cm^3)	21	67.00	53.00	57.05	0.77
Cauda epididymal sperm motility (%)	21	69.00	49.00	62.48	0.95
Cauda epididymal sperm intensity of motility	21	3.00	1.00	1.57	0.18

N= Number of Samples, SEM= Standard Error of Means.

Table 3 - Camelid Sperm Reserve among the Caput, Corpus and Cauda Epididymis

Parameter	N	Max.	Min.	Mean	SEM
Caput epididymal sperm reserve (X 10^6/ml)	21	1165.80	25.10	193.11[b]	55.17
Corpus epididymal sperm reserve (X 10^6/ml)	21	2914.50	75.40	759.08[b]	157.49
Cauda epididymal sperm reserve (X 10^6/ml)	21	19587.50	35.20	2670.93[a]	923.90

[ab] means in the same column with different superscripts are significantly different (P<0.05), N= Number of Samples, SEM= Standard Error of Means.

Table 4 - Pearson Correlations between Camelid Body Weight and Epididymal Parameters

Parameter	Correlation Coefficient (r)	Level of Significance
Cauda epididymal sperm motility	-0.364	Ns
Cauda epididymal sperm intensity of motility	-0.196	Ns
Epididymal Weight	0.429	Ns
Epididymal volume	0.312	Ns
Caput epididymal sperm reserve	0.077	Ns
Corpus epididymal sperm reserve	0.241	Ns
Cauda epididymal sperm reserve	0.043	Ns

Ns = Not Significant

Table 5 - Pearson Correlations between Camelid Body Weight and Body Parameters

Parameter	Correlation Coefficient (r)	Level of Significance
Chest girth	0.750	*
Body length	0.851	**
Hump base circumference	0.532	*
Hump lateral base	0.671	**

* = P<0.05, ** = P<0.01

Table 6 - Pearson Correlations among Some Camelid Epididymal Parameters

Parameter Combination	Correlation Coefficient (r)	Level of Significance
EWGT *vs*. ESIM	0.513	*
EVOL *vs*. CPEV	0.525	*
EVOL *vs*. COEV	0.808	**
EVOL *vs*. CAEV	0.558	**
CPEV *vs*. CAEV	0.468	*
EWGT *vs*. COSR	0.781	**
EWGT *vs*. CASR	0.657	**
ESMT *vs*. COSR	0.620	**
ESMT *vs*. CASR	0.648	**
COSR *vs*. CASR	0.724	**

* = P<0.05, ** = P<0.01

EWGT = Epididymal Weight, ESMT = Epididymal Sperm Motility, ESIM = Epididymal Sperm Intensity of Motility, EVOL = Epididymal Volume, CPEV = Caput Epididymal Volume, COEV = Corpus Epididymal Volume, CAEV = Cauda Epididymal Volume, CPSR = Caput Epididymal Sperm Reserve, COSR = Corpus Epididymal Sperm Reserve, and CASR = Cauda Epididymal Sperm Reserve.

DISCUSSION

The findings of this study (Table 3) indicated that means of cauda epididymis accounted for the highest portion of extra-gonadal sperm reserve (73.72%) when compared to corpus (20.95%) and to caput (5.33%) epididymides. According to Ibrahim *et al.* (2012), camelid cauda epididymis accounted for 62.13% of the observed epididymal sperm reserve while caput and corpus epididymides contributed 20.29 and 17.64% of the epididymal sperm reserve, respectively. However, their result contradict the findings of the current study that corpus epididymis had higher sperm reserve than caput epididymis. Earlier studies by Osman and El-Azab (1974) and El-Wishy and Omar (1975) reported that half to two-third of the extra-gonadal sperm reserve in dromedary camel is located in the corpus epididymis, while the caput contributes only 21 to 36%. Conversely, Waheed *et al*. (2011) recorded no statistically significant difference in sperm reserve between the corpus and cauda epididymal regions.

Tingari and Moniem (1979) attributed the discrepancy in sperm reserve between corpus and cauda epididymal regions to dense mass of spermatozoa in tubules of the intermediate part of the corpus epididymis in dromedaries but Zayed *et al*. (2012) opined that the lamina propria of the epididymal duct is surrounded by numerous layers of circularly and obliquely arranged smooth muscle fibres which always increase in thickness toward the terminal segment. Also, Ross *et al*. (1989) mentioned that, the caput and corpus epididymis demonstrate spontaneous rhythmic peristaltic contractions that serve to convey the sperms along the duct. It was reported that only fewer of such contractions were observed in the caudal region which might suggest the possible reason of its highest content of sperm reserve (Zayed *et al*., 2012).

Although positive and significant associations between body weight and several reproductive measurements were reported by researchers (Bello and Adama 2012: Yilmaz *et al*. 2013). The present study revealed that there

was no association between body weight and epididymal parameters (Table 4). However, the results in Table 5 has shown that relationship exist between the camel's body weight and chest girth (r = 0.750, P<0.05) which is in agreement with the report of Mugnai *et al.* (2010) who found a highly significant (P<0.01) correlation coefficient (r =0.957) between the live weights of camel calves and the heart girth **(**chest girth).

The result of present study for the correlation between camel's body weight and body length (r=0.851, P<0.01) is similar to the value (r= 0.954, P<0.001) reported by Rashid *et al*. (2016) for the correlation between live weight of Brahman crossbred cattle and heart girth. Also, result of the present study showed that hump base circumference (r = 0.532, P<0.05) and hump lateral base (r = 0.671, P<0.01) were positively correlated to camel's body weight. This is in agreement with the finding of Faye *et al.* (2001) who reported that camelid carcass weight was positively correlated to hump circumference (r = 0.67, P<0.05) and hump height (r = 0.74, P<0.05). Although the authors concluded that body condition score in camel is not linked to hump size.

Table 6 of the present study reveals that camelid epididymal parameters were significantly and positively correlated to each other which is an indication that using a combination of the parameters can helps to improve prediction accuracy in breeding bull's selection.

CONCLUSION AND RECOMMENDATIONS

It can be concluded that, camelid body weight should not be considered as an indicator of high epididymal sperm reserve. Also, the cauda epididymis is the most suitable site for post-mortem harvest of camelid spermatozoa. Therefore, spermatozoa from the cauda epididymis could be harvested, preserved and subsequently be used for artificial insemination and other assisted reproductive technologies.

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