

THE RELATIONSHIP BETWEEN BODY CONDITION SCORES AND SOME OVARIAN ACTIVITIES IN SHE-CAMEL

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SUMMARY

The present study was conducted to investigate the relationship between body condition scores and some ovarian activities in she-camel. For this purpose, one 199 ovaries were collected from 102 dromedary female camels at random from El-Bassatein and El-Warraq slaughter houses in Cairo and Giza, Egypt. Ovaries were collected after slaughtering in thermos in saline solution (0.9% NaCl) supplemented with antibiotics at 28-30 °C. Body Condition Score (BCS) of animals was estimated according to size of the hump ranging from 1-5 and ranked before slaughter according to PISC (2004). Results showed that the oocyte yield was affected by BCS. The oocyte yield was observed highest (12.53) with BCS 4-5 and was decreased to 6.45 and 7.98 with lower levels of BCS (1-2 and 3, respectively). Moreover, the total number of follicles was the highest (21.56) in females with BCS 4-5 but females having lower score of 3 and 1-2 had lower number of oocyte (15.2 and 16, respectively). A significant increase in oocyte quality was observed with the increase of BCS and a significant increase in the degenerated oocyte with females having a lower score. It was concluded that the best reproductive traits studied of she-camel was found for those who had the highest BCS.

Keywords: Body Condition Score, ovarian activities, She-Camel

INTRODUCTION

Camels are important animals in the desert because of their ability to provide milk, meat and transport in harsh and dry conditions. The reproductive efficiency of camels under their natural pastoral conditions is very low due to short breeding season, late puberty, long calving interval (Novoa, 1970; Evans and Powys, 1979; and Leonard, 1994) and lack of application of assisted reproductive technologies such as artificial insemination (AI) and *in-vitro* embryo production (EP) (Arthur, 1992). *In-vitro* fertilization (IVF) technology provides an opportunity to produce embryos for genetic manipulation and embryo transfer (Nandi *et al.*, 2002).

Various measurements of the ovary give indication to the physiological activity, quality of the vesicular follicles and yield of oocytes for IVM and IVF processes. Reproductive status is very important to know the extent of ovarian activity and its ability to give high-quality oocyte. Outside the breeding season, the mating activity ceases and the ovaries are inactive or show a limited number of follicles (Shalash, 1980; and Khatir *et al.*, 2007).

Body condition scoring is a technique for reflecting the condition of livestock at regular intervals. The purpose of condition scoring is to achieve a balance between economic feeding, good production and good welfare (DEFRA, 2000). Unfortunately, there is no available literature about the effects of body condition score on the ovarian activities in she-camel.

Hence, the aim of the current study was to visualize the interrelationship between body condition score and the ovarian activities.

MATERIALS AND METHODS

Animals and Body Condition Score:

The current study was conducted on 102 she-camels of unknown breeding history in Cairo Abattoir over the period from October 2011 to August, 2013. These animals were anti-mortem examined for general health condition and body condition score (BCS). Body condition score of the studied animals was assessed according to PISC (2004). The condition of a camel is estimated by looking at the stored of body fat (i.e. the hump). According to size of the hump, BCS was assessed from 1 to five scores:

Score 1: little or no fat in the hump sac; hump hairy and may be leaning to one side.

Score 2 : hump with moderate development rising five percent higher than chest depth, but may also be leaning to one side.

Score 3: hump with good development and rising to ten percent higher than chest depth. Hump is still sculptured inwards on both sides and still fits over the chest and abdominal area.

Score 4 : hump fully developed and rising to fifteen percent higher than chest depth. Hump rounded outwards on

both sides and runs from the shoulder to the rump.

Score 5: hump overextended and rising more than fifteen percent higher than chest, or so full that it is rounded on the sides like a semicircle.

Collection of ovaries:

One hundred and ninety nine ovaries were collected from 102 dromedary camels from El-Bassatein and El-Warraaq slaughterhouses of Cairo and Giza governorates, located at distance approximately 125 km from the laboratory. Five ovaries were found atrophied, hence excluded.

Body condition score in dromedary camel from 0 to 5, according to Faye (2001):

The previous reproductive history of the slaughtered animals was unknown. In this concern, left and right ovaries were collected separately per donor in punctured plastic bags immediately after slaughtering and placed in thermos in saline solution (0.9% NaCl) supplemented with antibiotics (100 IU penicillin and 100 µg streptomycin/ml) at 28-30°C. All collected ovaries were transported to the laboratory within 2-3 h of collection.

Recording of ovarian measurements:

In the laboratory, the excess tissue was cut from the ovarian stalk of each ovary (right or left). Ovaries were washed with warmed phosphate buffer saline (PBS) at 28-30°C supplemented with antibiotics (100 IU penicillin and 100 µg streptomycin/ml) to remove adhering clotted blood. Then all ovaries were quickly washed with ethanol (70 %) to remove any contamination on the surface of the ovaries.

Ovarian measurements included the following:

- **Length and width:** The ovarian length and width were measured using a plastic tape.
- **Volume:** Size of the ovary was estimated by water displacement technique to the nearest cubic centimeter.
- **Ovarian weight:** The ovarian weight was determined by electronic balance to the nearest milligram.

Preparation of harvesting medium:

Phosphate buffered saline (PBS) medium was prepared by dissolving one PBS tablet (8g of NaCl, 0.2g of KCl, 1.44g of Na₂HPO₄, 0.24g of KH₂PO₄ (Sigma-Aldrich Chemie GmbH, P4417) in 200 ml sterile distilled water supplemented with antibiotics (100 IU penicillin and 100 µg streptomycin/ml). About 2 mg/ml of bovine serum albumin (BSA) was added to

PBS. The pH value of the solution was adjusted to 7.2-7.4 using pH-meter and osmolarity at 280-300 mOsmol/kg. The solution was filtered by 0.22 µm millipore filter (Milieux GV, Millipore, Cooperation Bedford, MOA).

Morphological investigation of ovarian follicles and oocytes:

The total number of surficial visible follicles (2-8 mm) on each ovary was counted and recorded. The respective follicles were classified at counting into three categories depending on their surface diameter and number of each category. The three categories of follicles were as follows: small follicles (1-<2 mm), medium follicles (2-8 mm) and large follicles (> 8 mm).

Oocyte collection:

Oocytes were collected using aspiration technique (Fry *et al.*, 1997). They were aspirated only from visible follicles having 2-8 mm in diameter through the ovarian stroma using a 20-gauge hypodermic needle attached with a sterile disposable 10 ml syringe containing 2 ml harvesting medium. Contents of each syringe were slowly dispelled into Petri dish for searching of oocytes under a stereomicroscope.

Oocytes evaluation:

The collected oocytes were washed three times in harvesting medium, thereafter counted and evaluated under a stereomicroscope in respect to both investment and ooplasm granulation.

The oocytes were classified into four categories based on their cumulus investment as follows:

- 1- **Complete:** oocyte with three or more layers of complete cumulus cells (Plate 1).
- 2- **Partial denuded:** oocyte with cumulus cells present either incompletely surrounding the oocyte or being less than three layers thick (Plate 2).
- 3- **Expanded:** Cumulus cells are present and appear as scattered clumps in the matrix (Plate 3).
- 4- **Denuded:** oocyte without cumulus cells and covered by only zonapellucida (Plate 4).
- 5- **Parthenogenic oocyte:** fragmented oocytes with 2 cells or 8-16 cells (Plate 5 and 6).
- 6- **Degenerated:** Ooplasm shrunken away from the zonapellucida or not evenly filled the zona (Plate 7).



Plate 1. Complete oocyte.

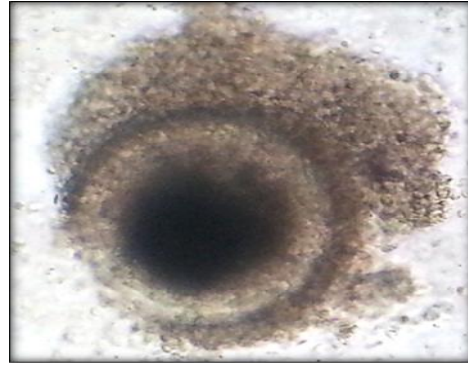


Plate 2. Partial denuded oocyte.



Plate 3. Expanded oocyte.

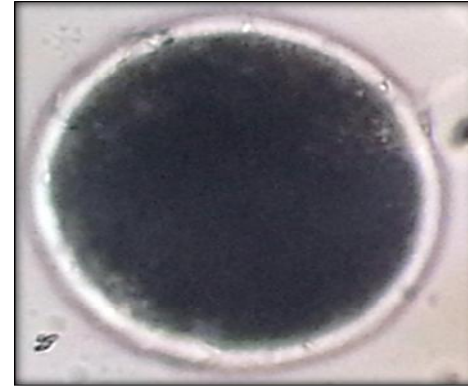


Plate 4. Denuded oocyte.

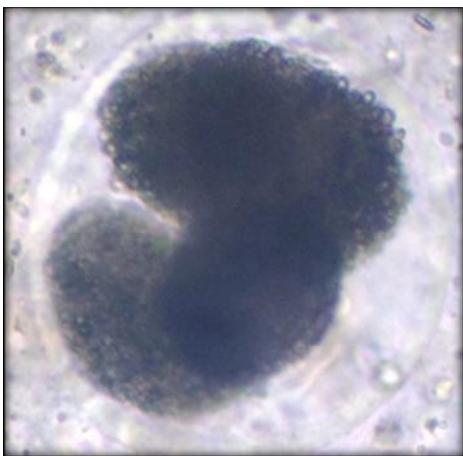


Plate 5. Cleaved oocyte (2 cells).

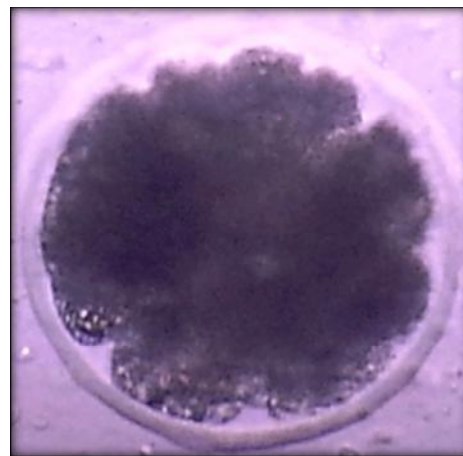


Plate 6. Cleaved oocyte (>2 cells).

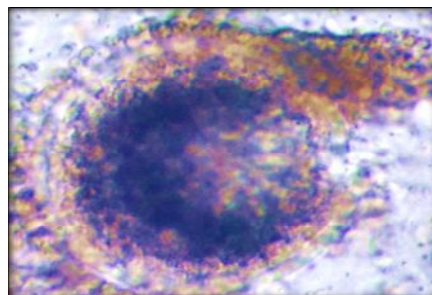


Plate 7. Degenerated oocyte

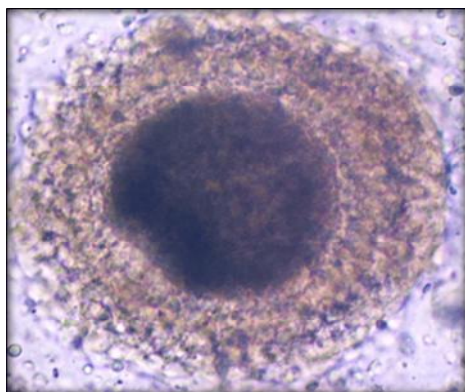


Plate 8. Even oocyte

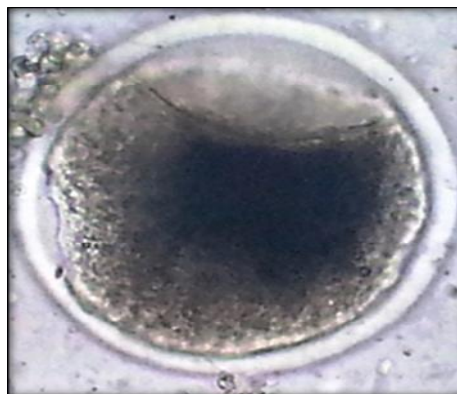


Plate 9. Uneven oocyte

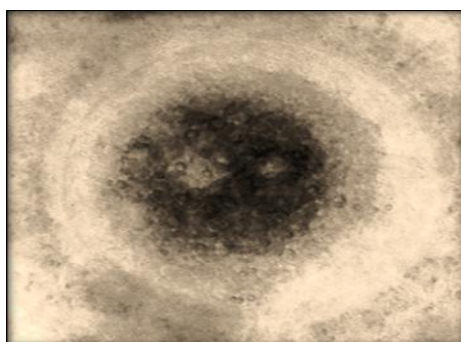


Plate 10. Shrunken oocyte.

At the same time, oocytes were classified into three categories based on their cumulus evenly granulated dark ooplasm as follows:

- 1- **Even:** oocyte had evenly granulated dark ooplasm and granulation of the ooplasm giving the oocyte a dusty appearance (Plate 8).
- 2- **Uneven:** granules clumped or uneven distributed in ooplasm, Ooplasm (Plate 9).
- 3- **Shrunken:** Ooplasm looks degenerated with fragment empty zonapellucida (Plate 10).

Oocyte yield and recovery rate:

The oocyte yield after aspiration of medium follicles was recorded and the recovery rate was calculated as the percentage of oocytes in proportional to the total of medium follicles presented on the ovarian surface of each ovary using the following formula:

Recovery rate%=(number of recovered oocytes/ number of medium sized follicles) x 100

Statistical analysis:

Statistical analysis of the obtained data was performed by general liner model (GLM), using SPSS program (2014), while differences among

the treatment mean was performed using Duncan's Multiple Range Test (Duncan, 1955).

The percentage values were adjusted to arcsine transformed before performing the analysis of variance. Means were presented after being recalculated from transformed values to percentages.

RESULTS AND DISCUSSION

Ovarian morphometry

Table (1) showed that there was no significant difference ($P<0.01$) between three categories of BCS for ovarian weight and volume, but females with the BCS (4-5) have a bigger ovaries 6.2 gram. On the other hand, a significant increase ($P<0.01$) occurs in ovarian width for score 4-5 than other scores 3 and 1-2 (3.03, 2.5 and 2.6, respectively). All studied ovarian measurements in the present study were affected significantly by breeding season, reproductive status and ovarian site. Zia-ur-Rahman, 2004 reported that length and width of left camels ovarian were 3 ± 0.59 , and 2.08 ± 0.19 cm and for right ovary were 2.87 ± 0.58 and 2.07 ± 0.36 , respectively.

Table 1. Effect of body condition score (BCS) on ovarian weight (g), volume (cm³), length and width (cm) in she-camel

BCS	No. of ovaries	Weight (g)	volume (cm ³)	length (cm)	width (cm)
1 – 2	80	5.8±0.28	5.02±0.26	3.6±0.08 ^{ab}	2.6±0.07 ^b
3	55	5.3±0.31	4.9±0.29	3.4±0.09 ^b	2.5±0.08 ^b
4 – 5	64	6.2±0.29	5.8±0.27	3.8±0.08 ^a	3.03±0.07 ^a

Morphological investigation of ovarian structure:

Effect of body condition score on distribution of the visible follicles population in she-camels is presented in Tables (2). In this concern, data indicated that the total count of visible follicles yielded from 199 camel ovaries examined in this study was 3496 follicles. Small follicles (SF) represented the largest number and percentage (2451 and 70.1%, respectively). However, medium follicles (MF) represented moderate values (979 and 28.0%) and the large follicles (LF) recorded the lowest number and percentage (66 and 1.99 %, respectively).

Score of 4-5 had a highly significant ($P<0.01$) value of the total number of follicles (TVF) per ovary in she-camels. Also, Score 4-5 showed a progress, in total of small and medium follicles. The average number of the total of follicles per ovary in the females had (1-2, 3 and 4-5 scores, respectively) were (16.0, 15.2 and 21.6). The average number of the small follicles per ovary in the females had 1-2, 3

and 4-5 were (11.08, 10.15 and 15.73). Also, the averages of numbers of the medium follicles were 4.34, 5.02 and 5.56 respectively. In contrast, the averages of numbers of the large follicles per ovary were in the females had 0.59, 0.04 and 0.27 score 1-2, 3 and 4-5, respectively.

Hussein *et al.* (2008) showed that the percentages of inactive ovaries <3mm, were much higher in each of the BCS 1-2, 4-5, being 32.3 and 31.32 %, respectively than that of the 3 BCS (11.62%). The growing follicle of sub ovulatory size (3-9 mm), showing a higher incidence in the BCS (3) group in comparison with those of the BCS 1-2, 4-5 groups. Mature ovulatory follicles (10-19 mm) were higher in the BCS (3) group (51.74%) than those of the BCS (1-2) group (38.46%) which was slightly higher than those of the BCS (3) group (32.53%). Over mature and aged follicles size (20-30 mm), were higher in the BCS (3) group (28.90%) than those of the BCS (1-2) group (24.61%) which higher than those of the BCS (3) group (16.88%).

Table 2. The overall average of proportional distribution of vesicular follicles in she-camels as affected by body condition score

BCS	No. of ovary	TVF		S.F		M.F		L.F	
		No. of follicle	per ovary	N	per ovary	N	per ovary	N	per ovary
1 - 2	80	1280	16.0±1.12 ^b	886 (66.2%)	11.08±1.11 ^b	347 (29.6%)	4.34±0.38 ^b	47 (4.1%)	0.59±0.10 ^a
3	55	836	15.2±1.24 ^b	558 (57.1%)	10.15±1.2 ^b	276 (42.5%)	5.02±0.42 ^b	2 (0.3%)	0.04±0.11 ^b
4 - 5	64	1380	21.6±1.17 ^a	1007 (70.0%)	15.73±1.2 ^a	356 (28.4%)	5.56±0.39 ^a	17 (1.5%)	0.27±0.10 ^b

Oocyte yield and recovery rate:

As shown in Table (3) the average of the oocyte yield/ovary only harvesting from MF in the present study was 8.8 with 55.5% as average of recovery rate. The average number of oocyte yield / ovary (OY) was affected significantly by the BCS ($P<0.01$). The tabulated data show that

the average of oocyte yield per ovary was significantly higher in score 4-5 (12.5) than OY in the other scores. At the same time, results in Table (3) indicate that the recovery rate of oocyte (ORR) did not differ among different scores.

Table 3. Effect of body condition score (BCS) on oocyte yield and recovery rate in she-camel

BCS	No. of ovary	No. of follicle	Oocyte yield		%Oocyte recovery rate
			Oocyte yield (OY)	OY per ovary	
1 - 2	80	1280	516	6.45±6.2 ^b	48.9
3	55	836	439	7.98±7.5 ^b	58.9
4 - 5	64	1380	802	12.53±11.8 ^a	58.8

Morphological oocyte evaluation:**Oocyte investments:**

The effect of body condition score on the proportional grades of oocyte investments is shown in (Tables 4). In general, the proportion of complete cumulus oocytes grade recorded the highest percentage among the different oocytes investment grades irrespective of BCS 4-5 group.

Results indicated that the number of oocyte of good acceptable investment grade (with complete cumulus) was significantly higher for oocytes aspirated from female with score 4-5 (510) than that those aspirated from female with score 1-2 (336) and 3 (269), respectively.

Table 4. Effect of body condition score (BCS) on proportional investment grades of oocyte

BCS	No. oocyte	Oocyte investment N (%)					
		Complete	Partial	Denuded	Expanded	Parth.	Deg.
1 - 2	516	336 ^a (65.1%)	36 ^b (7.0%)	70 ^b (13.6%)	12 (2.3%)	25 ^b (4.8%)	37 ^a (7.2%)
3	439	269 ^b (61.3%)	65 ^a (14.8%)	70 ^{ab} (15.9%)	2 (0.5%)	27 ^b (6.2%)	6 ^b (1.4%)
4 - 5	802	510 ^{ab} (63.6%)	96 ^a (12.0%)	112 ^a (14.0%)	14 (1.7%)	59 ^a (7.4%)	11 ^b (1.4%)

Oocyte ooplasm granulation

The body condition score significantly affected the proportional distribution of even grades oocyte ooplasm granulation (Table 5). In general, the oocytes aspirated from female had highest scores the even granulated ooplasm

grade was 88.1% as compared with oocytes of the grade of uneven granulated ooplasm (8.9%) or oocytes the grade of shrunken granulated ooplasm (3.0%), as shown in Table (5).

Table 5. Effect of body condition score (BCS) on ooplasm granulation of camel oocyte

BCS	No. oocyte	Oocyte ooplasm granulation N (%)		
		Even	Uneven	Shrunken
1 - 2	454	371 ^b (81.7%)	62 (13.7%)	21 (4.6%)
3	406	340 ^b (83.7%)	51 (12.6%)	15 (3.7%)
4 - 5	732	645 ^a (88.1%)	65 (8.9%)	22 (3.0%)

CONCLUSION

The study led to the conclusion that females with the highest BCS had the best ovarian activities.

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العلاقة بين حالة الجسم وبعض أنشطة المبيض في إناث الجمال

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أجريت هذه الدراسة لمعرفة العلاقة بين درجة حالة الجسم وللنوق وبعض أنشطة المبيض، حيث تم جمع ١٩٩ مبيض عشوائيا من ١٠٢ ناقه من مسلخى البساتين و الوراق في القاهرة والجيزة، مصر وتم جمع المبايض بعد الذبح مباشرة في ترمس يحتوى على محلول ملحي (كلوريد الصوديوم ٠.٩%) اضيفت اليه المضادات الحيوية في درجة حرارة من ٢٨-٣٠ م. تم تصنيف درجة حالة الجسم (BCS) للحيوانات قبل ذبحها وفقا لـ PISC (٢٠٠٤) وتبعاً لحجم السنم، حيث صنفت ٥ درجات لحالة الجسم (BCS) على النحو التالي: الدرجة ١: وهى النوق الضئيلة أو معدومة الدهون في منطقة السنم ويوجد بالسنم شعر ويمكن أن يميل السنم فيها إلى أحد الجوانب. الدرجة ٢: ويكون وضع السنم فيها معتدل مع ارتفاع لأعلى بمقدار ٥% عن عمق الصدر، ويمكن أن يميل أيضا إلى أحد الجوانب. الدرجة ٣: تكون السنم فيها جيدة التطور ومنحوتة من على الجانبين وترتفع لأعلى بمقدار ١٠% عن عمق الصدر الا انها مازالت متناسبة مع منطقة الصدر والبطن. الدرجة ٤: حيث ترتفع فيها السنم إلى أعلى بمقدار ١٥% عن عمق الصدر. وتخرج السنم تقريبا على كلا الجانبين إلى الخارج ممتدة من الأكتاف إلى الأرداف. الدرجة ٥: حيث تكون السنم مفرطة وترتفع لأعلى بمقدار يفوق ١٥% عن عمق الصدر، حيث تبدو من على الجوانب مثل شكل نصف دائرة. أظهرت النتائج أن محصول البويضات قد تأثر بحالة الجسم حيث كان أعلى محصول للبويضات (١٢.٥٣) للحيوانات ذات الفئة ٤-٥ في درجة شكل الجسم، بينما انخفض محصول البويضات للحيوانات ذات المستويات الأقل في درجة شكل الجسم حيث كانت ٦.٤٥ للحيوانات ذات الفئة من ١-٢ و ٧.٩٨ للحيوانات ذات الفئة ٣. وعلاوة على ذلك، كان العدد الإجمالي للحويصلات المبيضية (٢١.٥٦) أعلى في الإناث ذات الفئات ٤-٥ في درجة شكل الجسم وانخفض عدد الحويصلات المبيضة للإناث الأقل في درجة شكل الجسم حيث كانت ١٥.٢ لمبايض حيوانات الفئة ٣ و ١٦ لمبايض حيوانات الفئات ١-٢. وقد لوحظت زيادة معنوية في جودة البويضات مع زيادة درجة شكل الجسم BCS كما لوحظت زيادة معنوية في البويضات المتدهورة للإناث ذات الفئات الأقل في درجة شكل الجسم. وقد خلصت الدراسة لأن أفضل قدرة تناسلية للنوق تكون لتلك التي كانت لها أعلى الدرجات في حالة الجسم.