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Body condition score in dromedary camel : A tool for management of reproduction

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Abstract: The ability of camels to cope with food shortage is the result of a long evolutionary process in natural conditions where food ability seasonally fluctuates. In arid conditions, all the adaptive mechanisms and especially body fat mobilisation strategies are of considerable importance in determining reproductive performance. In the camel, the hump is the most important fat storage place accessible to external observation.. In a study performed in Morocco on 655 she-camels from different areas, data on body size (circumference and height of the hump, thigh circumference) and on perceptible fat status of different anatomical places (spinous and transverse process of vertebra perceptible or not, hollow of flank present or not, ischial tuberosity and coxal tuberosity proeminent or not, ribs visible or not,…) were collected. Data are treated with cluster analysis in order to identify the types of body conditions. The classes of body conditions can be associated to a specific score. The relationships between this score and fattening ability of the camel have to be deepened with adipocyte measurement. The body scoring appears as a better tool than the hump measuring. Finally, it seems that the body condition score in camel is not mainly linked to the size of the hump.

Key words: Body score, management, reproduction, camel.

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Introduction

The ability of camels to cope with food shortage is the result of a long evolutionary process in natural conditions where food availability seasonally fluctuates. Lipid deposition and mobilisation is a part of the physiological strategy to anticipate the needs for pregnancy, lactation or food shortage. In arid conditions, all the adaptive mechanisms and especially body fat mobilisation strategies are of considerable importance in determining reproductive performance. Tibary and Anouassi (1997) have observed a lack of ovarian activity in she-camel with very low body score. Usually, the female in all ruminants species losses a part of her fat storage after calving to assure the milk production, its intake ability being not sufficient for the needs. The fat deposition occurs generally after 2 or 3 months beyond lactation peak. The fat storage must be enough at the next calving to allow a new reproductive cycle. However this cycle can be disturbed by seasonal food shortage or diseases, leading to reproductive failure.

So, the management of fat storage, appreciated by a body score, is an important tool for the farmer and the veterinarian to assume the best opportunity for reproduction. In the present paper, we propose a body condition scoring scale for camel, after the observations of animals in the field and in abattoir in order to get a convenient and efficient tool for breeding management.

Materials and Methods

This study has been performed in Morocco. It included two parts:

A field study involving 573 she-camels (130 in peri-urban areas and 443 in pastoral

zones). A questionnaire was performed with the camel owners at the animal level (breed, age, physiological status, live weight, drinking status. For each camel, the perceptible fat status of different anatomical places (spinous and transverse process of vertebra, hollow of flank, ischial tuberosity and coxal tuberosity, rib, recto-genital area) were collected. The hump was measured (circumference and height) and the circumference of the thigh as well.

Measurement and notation on 82 camels in the Dakhla and Laâyoune abattoir. Similar data were collected (measurements of the hump and thigh, notation of anatomical points) before slaughtering. After slaughtering, the weight of the carcass and of the hump were reported.

The qualitative notations were the followings:

The ribs are (1) individually visible, (2) slightly visible, (3) not very visible (4) not visible.
The ischial and coxal tuberosities, the shoulder, the scapula, the spinous and transverse process of vertebra are (1) very proeminent, (2) proeminent, (3) slightly proeminent, (4) not visible.
The hollow of the flank is (1) visible, (2) not visible.
The recto-genital zone is (1) very deep, (2) deep, (3) slightly deep, (4) full of fat.

The notations were performed by visual observation, then confirmed by manual palpation when abundant hair masked the anatomical feature.Quantitative data were analysed by measuring the correlations between variables and by Principal Components Analysis (PCA). Qualitative data were analysed by multivariate analysis (Factorial Correspondances Analysis and cluster analysis).

Results

Correlations between quantitative variables at the abattoir

All the quantitative variables
HH = height of the hump,
CH = circumference of the hump,
CT = circumference of the thigh,
CW= carcass weight,
HW= hump weight, are correlated at $p<0.05$. (Tab.1).

Type of conformation in field study

Some incomplete data being discarded, as the whole 469 she-camels from field were retained. The quantitative data (HH,CH,CT) were analysed with a PCA followed by a cluster analysis. Four types of conformation were identified (Fig. 1).

Table 1. Correlation matrix of quantitative data measuring the hump size and the global conformation of the camel (n= 82).

Variables	HH	CH	CT	CW	HW
HH	1.00				
CH	0.96	1.00			
CT	0.69	0.65	1.00		
CW	0.74	0.67	0.90	1.00	
HW	0.80	0.70	0.64	0.79	1.00

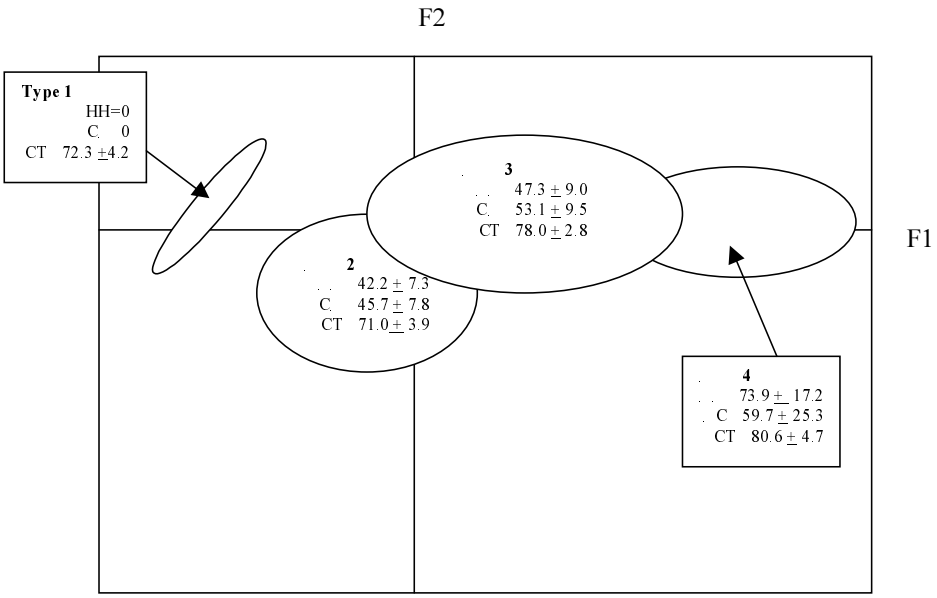

Figure 1. Projection on the first factorial plan (F1,F2) of the classes according to the quantitative data (measures of the hump and of the thigh).

A part of the animals are characterised by the absence of the hump in spite of medium TC (type 1). The 3 other types have an increase of hump size correlated to increasing TC.

Assessment of the hump weight

On the basis of the full data involving the 655 measures in field and in abattoir, the current equation can be used for Moroccan camel for assessing the hump weight:

$sqrtHW = 0.083\ HH + 0.000096\ CH + 1.587 \quad \varepsilon = 0.331 \quad p<0.0001$

However, the prediction by adding CH value is not improved. So the following predictive equation can be suggested:

$SqrtHW = 1.59 + 0.0836\ CH \quad \varepsilon = 0.571 \quad p<0.0001$

The examination of the residues showed a better adjustment with big humps.

Class of body condition score in field study

The multivariate analysis was applied on the 469 she-camels retained in the previous analysis. After classification, 4 classes of body condition score were identified on the factorial plan (F1,F3) which was the most discriminating plan (Fig. 2). This four classes could be interpreted as 4 notes of the body condition score which can be appreciated by palpation/ observation of the anatomical features (visibility of the coxal, ischial and shoulder tuberosity, visibility of ribs and vertebra, hollow of the flank, depth of the recto-genital zone under the tail). The four classes of animals can be interpreted as four body condition scores of (1) very thin, (2) thin, (3) good, (4) fat camels.

Relationships between conformation and body condition score

The cross-table (Tab.2) confirms some relationships between the 4 types of conformation and the four notes of body condition score. However, in the type 1 (without hump), a third of the animals has been classed in note 3 (i.e with a good body condition score). A majority of type 2 corresponds to thin animals (Fig. 3.2). For the type 3, the repartition between very thin, good and fat animals is unclear, even if a majority of the camels (65.4%) are classified in good or fat animals. The type 4 is clearly representative of fat animals.

Table 2. Repartition (%) of the camels in each type of conformation according to their type of body condition score

	Note 1	Note 2	Note 3	Note 4
Type 1	**35.5**	3.2	**38.7**	22.6
Type 2	5.6	**52.8**	13.9	27.8
Type 3	**29.7**	5.0	**26.9**	**38.5**
Type 4	16.3	10.0	24.0	**49.5**

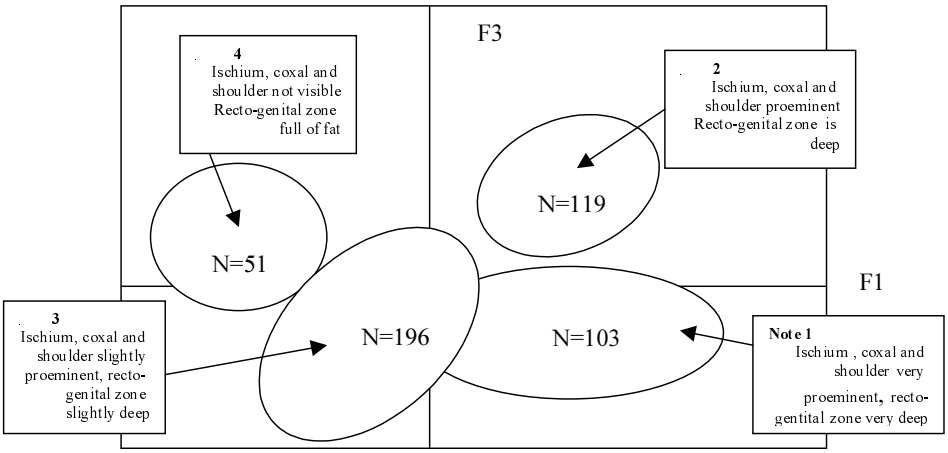

Figure 2. Projection on the factorial plan (F1,F3) of the classes of qualitative data (anatomical features) corresponding to the body condition score.

In the present study, the variability seems high and the different types of score occur in the population. However, it is possible that extreme values were not present in the studied population. It could be expected that very thin animal (notably those affected by trypanosoma) and very fat animals (feed-lot animals) may exist in a more wide population. So, the final proposed scoring scale includes 2 other notes (0 and 5) in order to be comparable to score used for cattle (fig.3).

Discussion

The most important part of the adipose tissue in camel is in the hump (on average 44% of the whole fat according to unpublished results from Tunisia) and around the kidney and viscera, but fat storage can occur on other parts of the carcass (shoulder, sternum, flank, ribs, thigh and neck.). On fat animal, fat storage is abundant also in recto-genital zone (Prat, 1993). The general repartition of fat storage in camel is quite different from that in other ruminants as cattle (Robelin, 1986), sheep (Atti and Khaldi, 1987) and goat (Morand-Fehr and Branca, 1987). In cattle, the fat part represents around 20% of the carcass (mainly subcutaneous). In camel, the fat percentage is on average 8% of the carcass (unpublished results from Tunisia).

The variability of the hump weight is very high in all the class of body condition score and some animals with a good conformation can be characterised by the absence of hump (type 1). Its indicates that the hump could not be the best indicator of the fat status of camel as it has been already suggested from the measurement of the adipocyte patterns (Faye *et al.,* 2001).

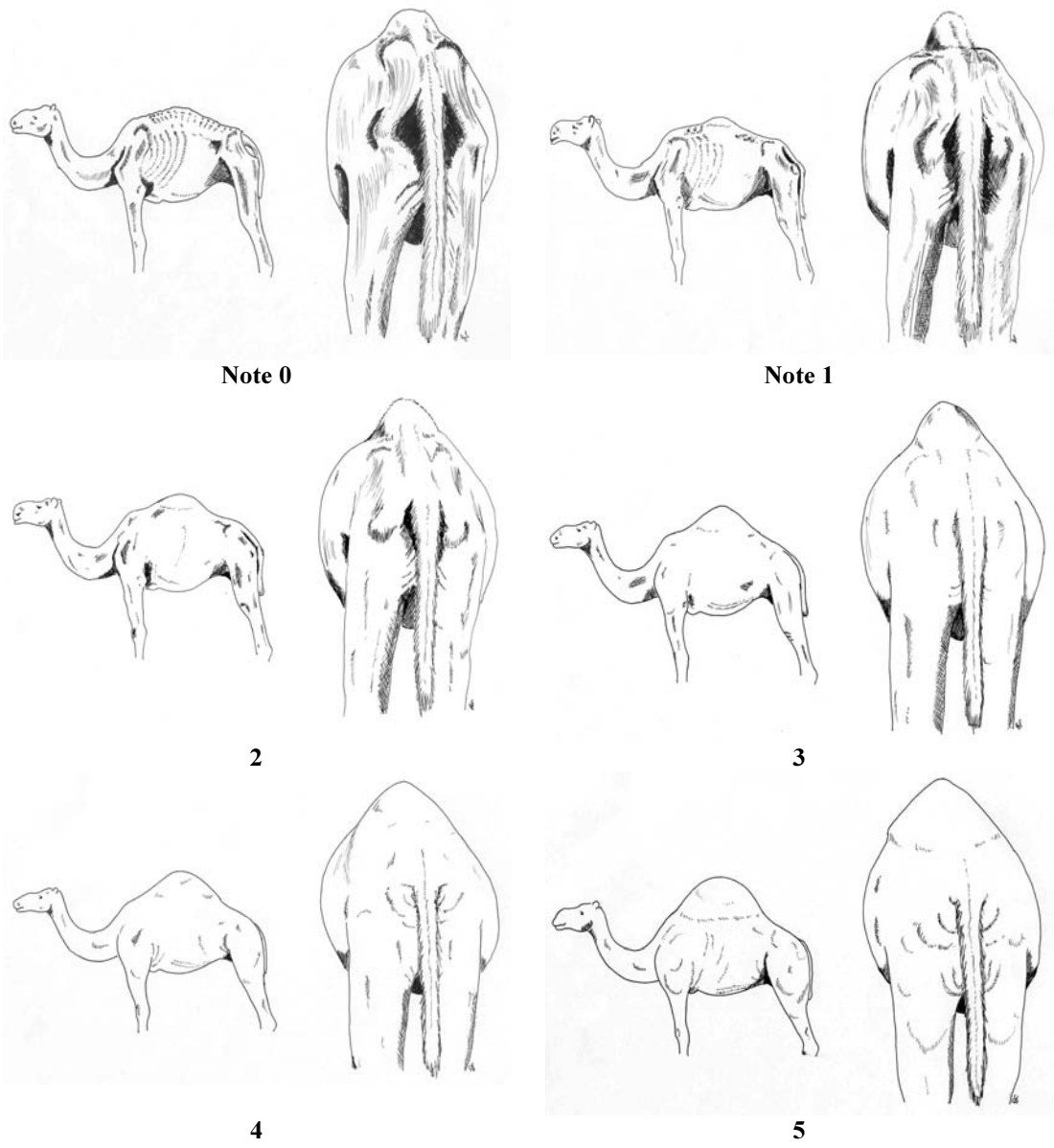

Figure 3. Body condition score (0 to 5) of the dromedary camel

The fatness of camel is not necessarily linked to the hump size. Probably genetic factors must play an important role for the hump size. The thigh conference seems to be an interesting indicator which is commonly used by the butchers.

The present body condition scoring scale on camel includes 6 figures from 0 to 5 similar to the dairy cattle scale proposed by Bazin (1984). Further investigations are currently performed to assess the threshold score for good reproductive performance and confirm if low score (below 2/2.5) is linked to reproduction failure as for sheep (Abrecia *et al.*, 1991) or cattle (Dohoo et al., 2001).

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