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Effect of Parity Order on Body Weight and Body Condition Score of Baggara Cattle under Traditional System in West Kordofan State, Sudan

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ABSTRACT

This study was conducted to evaluate parity order on body weight and body condition score change pre and post- calving of Baggara cattle in West Kordofan State, Sudan. Forty eight cows were selected from the herd of Baggara cattle. The cows were raised on natural grazing, weighed and divided into four groups A, B, C and D, comprising of (12) cows per group according to parity order, first, second, third and fourth parity in complete randomized design. Data were analyzed by using F test for analysis of variance procedures and Duncan's multiple range test (DMRT) for mean separation. The results revealed that parity order significantly ($p<0.05$) affected body weight at pre- calving, calving and weaning, where group D had maintained significantly ($p<0.05$) a heavier body weight as (295.33, 291.17 and 324.80 kg) compared with group A (277.17, 281.00 and 309 kg), B (288.83, 285.83 and 313.70 kg) and C (294.08, 289.33 and 322.30 kg. Also parity order affected ($p<0.05$) significantly body condition score at pre- calving, calving and weaning. However, group D had scored higher scale of body condition compared with other groups. In conclusion, Baggara cows that depended on natural grazing showed high body weight lost during lactation and minimizing the negative energy balance effects by mobilization of body fat during early lactation.

Keywords: *Baggara cattle, body weight, body condition score, parity order, Sudan.*

INTRODUCTION

Livestock plays a significant role in providing food security as well as income resource for less poor people in Sudan. The Sudanese cattle breeds belong to Boss indicus species referred to as Zebu type or indigenous cattle, They were, Kenana and Butana cattle, reputed for their milk production, while Western Baggara cattle provide the bulk of meat consumed locally and contribute considerably to the export trade of beef and cattle (1). Cattle population estimated as 40 million heads (2), about 90% of the cattle population is owned by pastoralists (3). The systems of production for cattle in Sudan are not well characterized, the traditional range grazing system that includes the pastoral and semi-pastoral types is considered to be the most common as under which more than 80% of livestock is raised (3).Western Sudan Baggara cattle are owned by transhumant tribes, who raised their cattle under traditional farming condition, which fluctuates from season to season(rainy to summer) according to rain fall pattern during the years which reflect negatively on animal productivity. Those cattle herds should have an important role in the socio-economic life of their owners.

Body weights are traditionally used to monitor nutritional status and growth of animals (4). However, body weights do not accurately reflect the nutritional status of the animal, as a large framed animal might have low body reserves than a small body framed animal. Changes in body weight are more informative than body weights themselves. Body condition score is an animal characteristic that reflects feeding and management; in addition before calving it influenced dry matter intake. Body condition is an important variable indicating the nutritional status and expected performance of dairy cows. Cows having optimum body condition imply that they have been maintained under good feeding and are expected to produce and reproduce efficiently when compared to those

with lesser body condition (5). Body condition score (BCS) is a function of mainly nutrition; therefore concentrates feeding will raise body condition score. The animal move long distances researching for good pasture and lose more energy which declines its production during the year. Beside that owners, did not give any supplementation diet to their animals and if so, the supplements are not in specific forms. Nutritional deficiencies at the beginning of the lactation can include mobilization of fat deposits affecting, in the long term, the productive life of the cow. Therefore, it is of vital importance to assess the productivity of Baggara cattle that are raised under natural pasture without any supplemented or additional feed stuff. The aim of this study was therefore to evaluate the effects of parity (lactation number) order on the body weight and body condition score changes in pre and post- calving of Baggara cattle kept under traditional farming system in the tropical conditions of West Kordofan state, Sudan.

MATERIALS AND METHODS

Study Area

The experiments were conducted in Elfula area, West Kordofan state (9-12o and 12-30o N, 15-27o and 30o E). The studies included three district seasons (rainy, cool dry and hot dry) the rainy season (May-October), cool dry (December-February) and hot dry season (March-May). The mean monthly temperature ranged from 25.8 C° in July to 31.3 C° in April. The mean maximum is about 39 C° in the three months prior the rainy season with peak temperature in May. The mean minimum temperature varied between 17 C° in January to more than 20 C° at the onset of the rains in May (SKDP, 2000). Annual rainfall of a range 450-650 mm, with peak rain in August and the relative humidity of 35% rise to 75% during the rainy season of year 2016. Soil types varied from sandy (goz) in the north to heavy clays (vertisoil) and the lighter clay (gardoud) in the south.

The dominant vegetation varies with soil and rainfall patterns, with mixture of grasses and herbs along with scattered shrubs and browsing trees, common grasses are Loudetia togoensis (GAW), Zornia glochidiata (Luseig), Echinocholoa colonum (Differa), Tuibulus pentanclvus, Daetgiloctenium aegyptiaca and Cenchrus biflorus. Common leguminous trees are Albizia amara (Arad), Adansonia digitata (tabaldi), Ziziphus spingchrista (Sidr), Balanites aegyptiaca (Hegleed), Tamavindus indica (Aradeb), Acacia seyal (Taleh), Acacia mellifra (keter) and Acacia Senegal (Hashab) (6). The natural grazing was subjected to chemical analysis according to AOAC (7). The grasses also were subject to approximate analysis twice, in wet and dry season (Table 2).

Experimental Animals and Management

Forty eight Baggara cows were selected from the herd (1- 4 parity orders) from nomadic flock for the purpose of this study. The cows were settling around Elfula area. The cows were monitored from last trimester of pregnancy to calving through conception to parturition. The target cows were divided into four groups each comprises of (12) cow according to number of parity as first (A), second(B), third(C) and fourth(D) parity in a complete randomize design (Table 1). All groups were eared tagged and treated against internal and external parasites (AGVET, USA 1.0 ml/50 kg body weight subcutaneously Ivomec super drench). The animals were vaccinated against foot and mouth disease, Anthrax and Hemorrhagic Septicemia. The animals were housed in partially shaded pens, constructed from traditional local material and allowed daily free grazing on an early pasture period from 8.00 am to 6.00 pm.

Table1. *Experimental animals*

Animal Group	No. of animal	Mean body weight(kg)
1st parity (Group A)	12	274.42
2nd parity(Group B)	12	278.12
3rd parity(Group C)	12	279.75
4th parity(Group D)	12	287.08

Data Recording

Dam's body weight was closely monitored. The dam live body weight was determined by measuring the girth width using a weight band and was recorded after two weeks. Interval before calving and during lactation season up to weaning period.

Body condition score was assessed using the one - to - nine scale (1 emaciated- 9 obese) as described by Nicholson and Butterworth (8). According to this scale, severely emaciated cows were given score1, emaciated cows score 2, very thin cows score 3, very thin cows score 4(borderline), moderate cows score 5, good cows score 6, fat cows score 7, very fat cows score 8 and obese cows score 9 the animals were visually assessed by palpation of the lumbar.

Table2. *Chemical analysis of some grasses in wet and dry season during study period*

Sample	DM%	Fat%	CP%	CF%	Ash%	Ca%	P%
Wet Season							
Tribulus terrestris	93.16	1.68	28.44	34.23	6.27	0.2252	2.35
Zornia glochidiata	93.69	1.3	28.88	31.85	7.58	0.1098	0.70
Dactyloctenuim aegyptium	94.05	0.68	13.48	35.01	7.46	0.1320	0.65
Eragrostis tremula	94.69	1.20	13.77	30.44	6.69	0.138	0.85
Cenchrus biflorus	94.67	0.89	18.03	35.29	8.84	0.1332	0.7
Dry Season							
Tribulus terrestris	90.92	1.41	16.5	22.91	7.30	0.80	0.15
Zornia glochidiata	92.48	1.1	22.53	19.69	7.04	0.55	0.09
Dactyloctenuim aegyptium	93.22	2.18	10.54	16.58	9.48	0.65	0.09
Eragrostis tremula	94.22	2.27	9.38	5.44	6.03	0.45	0.12
Cenchrus biflorus	93.16	1.39	14.20	14.10	9.57	0.45	0.12
Where DM, CP, CF, Ca and P were dry matter, crude protein, crude fiber, calcium and phosphorus respectively.							

Statistical Analysis

The data were analyzed statistically according to the analysis of variance procedures using the General Linear Model (GLM). Duncan's multiple range test (DMRT) for mean separation was used to identify significant differences. All techniques of the statistical analysis were conducted using Statistical Package for the Social Sciences, software package (SPSS) (9).

RESULTS

Effect of Parity Order on Body Weight Pre-Calving

The results pertaining to the effect of parity order on body weight pre- calving was presented in (Table3). The data revealed significant ($P < 0.05$) effect of parity order on body weight. Higher body weight before 3 month of calving was obtained by 4th parity 287.08±10.07 Kg then 2nd parity with 285.00±11.42 Kg, 3rd parity scored 279.75±6.86 Kg and lastly 1st parity with 276.42±6.45 Kg.

During the last month pre- calving 4th parity and 2nd parity showed highest ($P<0.05$) body weight pre-calving as 295.33±9.86 and 296.08±14.67 Kg respectively.

First and third parities recorded the lowest body weight pre-calving as 287.17±6.29 and 288.83 ± 6.44 Kg respectively.

Table3. *Effect of parity order on body weight pre-calving (mean± SE)/kg*

Animal Group	No. of animal	Three month pre-calving	Two month pre-calving	One month pre-calving
1st parity	12	276.42± 6.45 ^{B}	281.50± 6.59 ^{B}	287.17 ± 6.29 ^{B}
2nd parity	12	279.75± 6.86 ^{AB}	285.00± 6.99 ^{AB}	288.83± 6.44 ^{B}
3rd parity	12	285.00±11.42 ^{A}	290.75±11.10 ^{A}	294.08±14.67 ^{A}
4th parity	12	287.08±10.07 ^{A}	291.08± 10.57 ^{A}	295.33± 9.86 ^{A}
^{ABC} Values in same column with different superscripts differ at $P<0.05$				

Effect of Parity Order on Body Weight and Body Weight Changes

The analysis of variance for the effect of dam parity on body weight at calving and post-calving was shown in (Figure 1). Parity order showed significant ($P < 0.05$) effect on weight at calving time. Fourth parity had higher body weight at calving 291.17±6.95 Kg than 2nd parity as 289.33±8.64 Kg. The lowest weight was recorded by third and first parities as 285.83±4.75 and 281.00±5.08Kg respectively. The results revealed significant ($P < 0.05$) effect of parity order on weight post- calving. Where 2nd parity showed significant weight changes from calving till 7 month post calving. All cows showed significant change in their body weight during first two months, with high lost in weight was observed by 1st parity as 17 Kg then 3rd parity as 12 Kg and lower lost in weight in 4th parity as 7 Kg.

At third month post- calving, dams of all groups started significantly ($P < 0.05$) to build up their weight until 7 month post- calving, the high weight in three month post calving was recorded

by 4th parity, 2nd parity respectively (292.7±7.8 vs. 287.6±6.84 Kg), and lower weight has been reported for 1st parity 277.5±5.59Kg. Also the results revealed that during the fourth and seven months post- calving, 2nd parity showed best weight as 299.3±8.68, 310.8±7.81, 321.6±8.06 and 329.3±7.77 Kg for 4th, 5th, 6th and 7th month post- calving, where 1st parity recorded lower weight during same period as 287.8±6.24, 298.8±6.82, 302.2±29.18 and 309.3±31.01Kg.

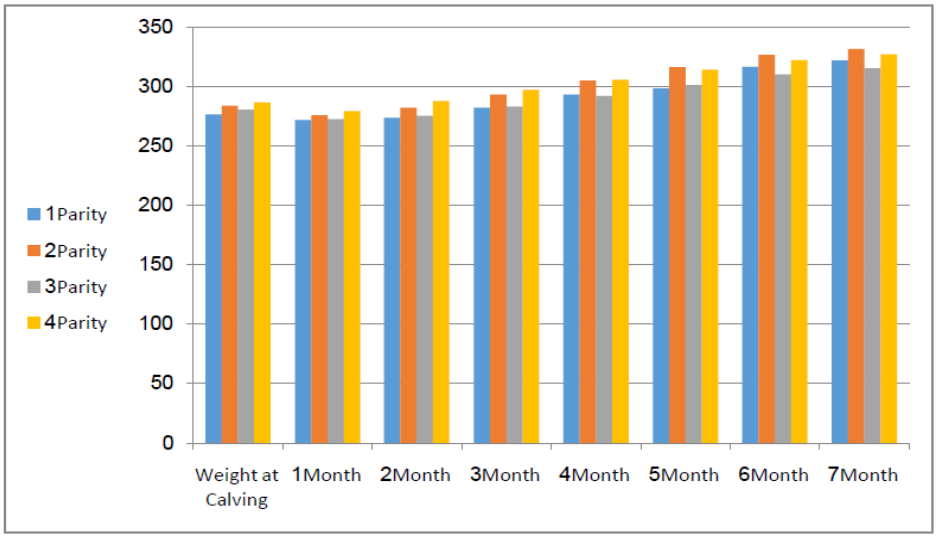

Figure1. *Effect of parity order on body weight change post- calving*

Effect of Parity Order on Body Weight Change

The data in (Table 4) indicated the effect of parity order on body weight pre- calving, at calving, weaning weight and body weight change. The results indicated that parity order had significantly ($P < 0.05$) affected the body weight pre- calving, where cows at 4th parity had highest weight 295.33±9.8Kg and 1st parity cows had the lowest weight 287.17±6.29Kg.

Table4. *Effect of parity order on body weight and body changes at calving and weaning*

Variables	No.	body wt pre-calving	body wt at calving	body wt at weaning	body wt change	change%
Animal Group						
1st parity	12	287.17± 6.29 ^{C}	281.00 ± 5.08 ^{B}	309.3±31.01^{C}	28.3± 9.12 ^{A}	10.07
2nd parity	12	288.83 ± 6.4^{BC}	285.83 ± 4.7 ^{A}	313.7±4.86 ^{BC}	27.87± 8.16 ^{B}	9.75
3rd parity	12	294.08±14.6 ^{AB}	289.33 ± 8.64 ^{A}	322.3±7.77^{A}	39.97± 5.37 ^{A}	15.41
4th parity	12	295.33 ± 9.8 ^{A}	291.17 ± 6.95 ^{A}	324.8±9.00 ^{AB}	33.63± 3.17 ^{A}	11.55

The results also revealed that weight at calving was significantly ($P < 0.05$) higher, 4th parity cows scored higher weight at calving compared with 1st, 2nd and 3rd parities cow, the figures were 291.17±6.95, 281.00±5.08, 285.83±4.7 kg and 289.33±8.64Kg for 4th , 1st , 2nd and 3rd parities cows respectively. The weaning weight for the 3rd parity cows was significantly ($P < 0.05$) higher (322.3±7.77 Kg) than 4th parity (324.8±9.00Kg), 2nd parity (313.7±4.86 Kg) and 1st parity (309.3±31.01Kg).

The results also indicated that the dams cow experienced variable body weight change during lactation period, where highest gain was obtained by 3rd parity dams (39.97± 5.37 as15.41%) and lowest gain was recorded by dams in 2nd parity (27.87± 8.16 Kg as 9.75%).

Effect of Parity Order on Body Condition Score Pre- Calving

The data describing the body condition score pre- calving was presented in (Table 5). The data revealed that parity order studied had revealed a significant ($P < 0.05$) effect on the body condition score at pre- calving. During the last three months pre- calving 1st parity cows revealed highest body condition score (7.08±0.99) then 4th parity animal recorded 6.25±1.06. 2nd parity cow had the lowest body condition score (5.67±2.09). In the last month pre- calving 1st parity had significant ($P < 0.05$) superior of body condition score of 8.00±0.96 compared to 4nd parity (6.42±1.34), 3rd parity (6.75±1.49) and the lowest was noticed by 2nd parity (6.33±2.02).

Table5. *Effect of parity order on body condition score pre- calving*

Animal Group	No.	3 month pre- calving	2 month pre-calving	month pre- calving
1st parity	12	7.08± 0.99 A	7.75± 1.14 A	8.00±0.96 A
2nd parity	12	5.67± 2.09 B	6.33±2.11 B	6.33±2.02 B
3rd parity	12	6.08± 1.73 AB	6.83±1.69 AB	6.75±1.49 B
4th parity	12	6.25± 1.06 AB	6.83± 0.95 AB	6.42±1.34 B
ABC Values in same column with different superscripts differ at P<0.05				

Effect of Parity Order on Body Condition Score Post- Calving

The means of body condition score of Baggara cows as affected by parity order were showed in (Fig2). The results revealed significant ($P < 0.05$) effect of parity number on body condition score during the two months post- calving. Where all animal showed significant decrease in body condition score, high decrease was recorded by 1st parity and the lower in 4th parity. Then during the three month of lactation 1st parity of lactating Baggara cows started to increase their body condition score up to 7.97 at7month of lactation, same results were shown by 3rd and 4th parities, with highest body condition score recorded in 4th parity (8.67), 2nd and 3rd parities with same score (7.25 and 7.45) respectively.

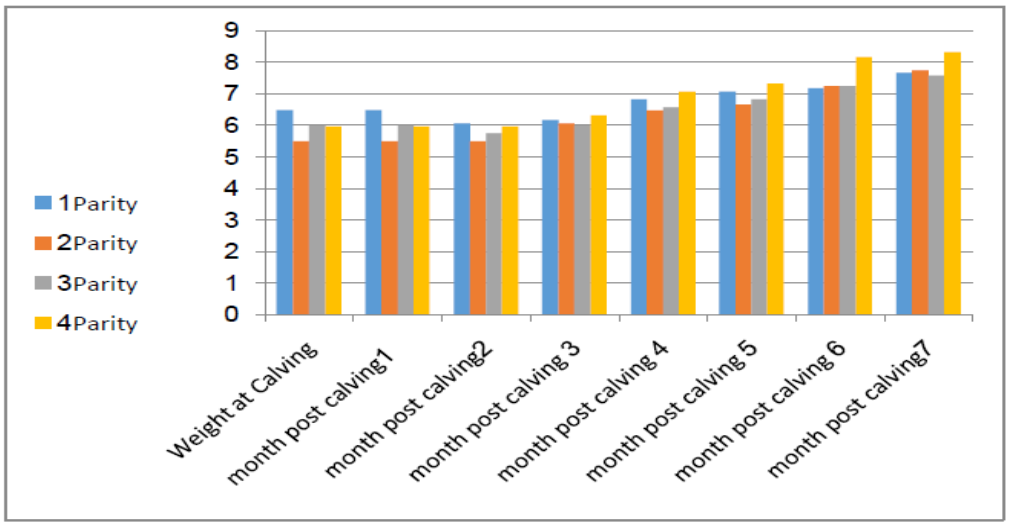

Figure2. *Effect of parity order on body condition score post- calving*

Effect of Parity Order on Body Condition Score Change

The data in (Table 4.4) indicated the effect of parity order on body condition score at pre-calving, calving, weaning weight and body score change. The results indicated that parity order was significantly ($P < 0.05$) affected by body score pre- calving; where cows at 1st parity had highest score 8.00±0.96 and 4th primiparous cows had the lowest weight (6.42±1.34). The results also revealed that body score at calving was significantly ($P < 0.05$) higher, 1st parity recorded higher score at calving compared with 2nd , 3rd and 4th parities, having 6.92±1.09, 5.50±1.89, 6.00±1.21, and 5.92±0.90 respectively. Body score at weaning for the 1st parity was not significant, but it's higher (8.05±0.49) than 4th parity (7.97±0.99) and 2nd parity animals (7.25±1.35). The results also indicated that the cows experienced variable body score change during lactation and weaning period, where highest gain was obtained by 1st primiparous dams (2.12± 0.09 as 36.24 %) and lowest gain was recorded by dams in parity 4th (0.55± 0.94 as 7.33%).

DISCUSSION

Effect of Parity Order on Body Weight Change

The transition period (from three weeks before to three weeks after calving) has been considered the stage of highest interest in the life of cows (10). Over this period, animals undergo several anatomical, physiological, hormonal, and metabolic changes. Because of these changes, this is the period of most concern in terms of nutrition and occurrence of metabolic and infectious disorders (11). Cattle farmers in this area traditionally kept only the

indigenous Baggara breed for meat production. In this experiment, parity order had significant effected body weight of Baggara cows pre-calving, at calving and post- calving.

Body weight increase with increasing parity order, where dams with later parity achieved the highest body weight pre- calving; at calving and post- calving compared with early parity dams. Similarly, the results of this study agreed with Meikle et al. (12) whom found that multiparous cows had a higher body weight than primiparous cows, also similar with Magaña et al. (13) who observed that first parity cows and cows with 7 or more calving had lower body weight than 3 to 6 parity cows. Other study, Segura-Correa (14) notified that cows between 5.5 to 6.5 years of age had heavier body weight than cows with less than 4 and more than 8.5 years old. Young cows are still growing and old cows have suffered a physiological waste, and in consequence they calve light calves.

In this study, it was observed that the body weight change of primiparous Baggara cows was higher than that of multiparous cows; also this may be due to low nutritive value to range grasses. These findings were conflicting with that reported by Roche et al. (15) and Van Straten et al. (16) who reported that greater-parity cows tended toward higher body weight loss in the first months of lactation, a longer time needed to reach the original body weight, and less excess of the original body weight by the end of the lactation period observed.

The highest BW at calving for cows in third parity and over is in conformity with the Van Straten et al. (16) and NRC (17), whom stated that primiparous cows should calve at 0.82, second-parity at 0.92, and cows in their third parity and over at their mature weight. The severity of the negative energy balance (NEB) is more pronounced in primiparous cows, as they have energy requirements for their own growth in addition to the energy demands for fetal growth, mammary development and their first lactation (18).

Also Banos et al. (19, 20) reported that older cows in early lactation suffered a longer period in negative energy balance (NEB) and lost more body weight. This difference may be attributed to nutrition, management and environmental conditions also to the type of breed. The difference between mean BW at calving and weight loss was expected, due to the typical NEB in early lactation as described by Gross et al. (21), who investigated BW loss and BCS associated with decreased dry matter intake (DMI) leading to mobilization of body reserves. Generally the loss of weight during lactation is probably a combined effect of mobilization of body reserves to maintain milk production and limited feed intake due to low pasture quality (22).

Effect of Parity Order on Body Condition Score Change

In this study parity order had affected body condition score (BCS) of Baggara cows during the transition period. Body condition score decrease with increasing parity order, where dams with early parity scored the highest body condition score compared with later parity dams. This contrasts with Meikle et al. (12) who reported that primiparous cows had lower body condition score than multiparous cows. This variation might be due to level of management and plane of nutrition.

On the other hand, the results revealed that primiparous dams had highest score gain than multiparous dams during lactation and weaning period. Idris et al. (23) reported that cow parity number had no effect on the body condition score, the cows in first and second parity lost more BCS than the cows in third parity. Cows of 7 years aged or older recorded better BCS than the other age groups in the period (30-270 days) post-partum.

Meikle et al. (12) studied loss in body condition score and mentioned that lean cows had a smaller BCS while fat cows tended to lose more BCS. Primiparous cows had a steeper decline in BCS than multiparous cows but they recuperated faster (12). This is probably related to the increasing needs for growth in primiparous cows occurring simultaneously with the demands of lactation and their lower feed intake capacity (24). As expected, cow live body weight decline with decreasing pasture availability but, surprisingly, no effect was seen on body condition.

This may be due to the longer time requirement effect on body condition to be seen than an effect on live body weight. The live weight loss was serious and can have a negative impact on cow fertility, evoking body reserves mobilization to meet the increased nutrient demand for milk yield (25), leading to longer calving intervals and thereby a loss in productivity (26 and 27).

CONCLUSIONS

The results obtained in this study indicated that Baggara cows depend on natural grazing in their natural habitat with different parities, showed large lost in body weight and body scoring during lactation period and minimizing the negative effects of fat mobilization during early lactation.

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