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Milk Yield, Milk Composition and Reproductive Performance of Baggara Caws as Effected by Parity Under The Traditional System, Sudan

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Abstract

This study was conducted to evaluate the effect of parity on milk yield and milk chemical composition and calving interval of Baggara cattle as effected by parity. Forty eight cows were selected from the herd of Baggara cattle. The cows were weighed and divided into four groups, each group comprised of (12) cows according to parity order, first, second, third and fourth parities. All cows were raised on natural grazing.The results revealed that parity order significantly (P≤0.05) affected daily, monthly and total milk yields. Milk production increased with advance parity. High (P≤0.05) milk yield, monthly and daily milk scored by 3rd parities as 668.47 kg, 133.73kg and 4.49kg, respectively. The results showed that there were significant differences (P≤0.05) between different parities for the milk composition during the first and third month of lactation period, with high fat percentages in the first month for 2nd parities (6.21) and 3rd parities (6.26) in 3rd month of lactation. The results indicated that calving, days to first estrus and days to conceive were significantly (P≤0.05) affected by parity number. Shorter days to show estrus was obtained by primiparous cows (56.19 ±8.72 days), also Days to conceive exerted significantly (P≤0.05) effected parity order. The results also showed a significant difference (P≤0.05) between different parities order for calving interval, that short day of calving interval scored by primiparous parities (10.04 months) and long days by 4th parities (13.17 month).In conclusion, Baggara cows that is depended on natural grazing reached its peak milk production in third parities with considered that the main purpose of these animals for meat production.

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Sudan'da Geleneksel Koşullarda Baggara İneklerinin Pariteden Etkilenen Süt Verimi, Süt Bileşimi ve Üreme Performansı

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Öz

Bu çalışma, Baggara sığırlarında paritenin süt verimine ve süt kimyasal bileşimine ve pariteden etkilenen buzağılama aralığına etkisini değerlendirmek amacıyla yapılmıştır. Baggara sığırlarının sürüsünden 48 inek seçilmiştir. İnekler tartılarak her grup (12) inek, parite sırasına, birinci, ikinci, üçüncü ve dördüncü paritelere göre dört gruba ayrılmıştır. Tüm inekler doğal olarak otlatılmıştır. Sonuçlar, parite sırasının (P≤0.05) günlük, aylık ve toplam süt verimlerini önemli ölçüde etkilediğini ortaya koymuştur. Süt üretimi avans paritesi ile artmıştır. Yüksek (P≤0.05) süt verimi, aylık ve günlük süt 3. paritede sırasıyla 668,47 kg, 133,73 kg ve 4,49 kg olarak belirlenmiştir. Sonuçlar, laktasyon döneminin birinci ve üçüncü ayında süt kompozisyonu için farklı pariteler arasında önemli farklılıklar olduğunu (P≤0.05), 2. pariteler (6.21) ve 3. pariteler (6.26) için ilk ayda yüksek yağ yüzdeleri olduğunu göstermiştir. laktasyonun 3. ayında. Sonuçlar doğumun, ilk kızgınlığa kadar geçen günlerin ve gebe kalınan günlerin parite sayısından önemli ölçüde (P≤0.05) etkilendiğini göstermiştir. Östrus göstermek için daha kısa günler, primipar ineklerde görülmüştür (56.19 ±8.72 gün), ayrıca gebe kalma günleri, parite düzenini önemli ölçüde etkilemiştir (P≤0.05). Sonuçlar ayrıca buzağılama aralığı için farklı doğum sırası sıralaması, ilk doğumlar (10.04 ay) tarafından puanlanan kısa buzağılama günü ve 4. doğumlar (13.17 ay) için uzun günler arasında anlamlı bir fark (P≤0.05) göstermiştir. Sonuç olarak, doğal otlatmaya bağımlı olan Baggara inekleri, bu hayvanların asıl amacının et için olduğu düşünülerek üçüncü paritede en yüksek süt üretimine ulaşmıştır.

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Introduction

Livestock are an important component of nearly all farming systems and provides draught power, replacement stock, social security, prestige, milk, meat and serve as a capital asset against risk. In addition, livestock are important source of cash income and play a significant role in ensuring food security and mitigating poverty (Ehui et al., 2002). In developing countries, smallholder dairy production allures minimum investment in housing, feed and health-care. The majority of Sudanese cattle breeds are kept by nomadic or semi-nomadic people. Baggara cattle are known for their ability to stay under harsh environmental climate and their effectively utilize poor quality feed resources. They are the cattle-herders, migrating seasonally between grazing lands in the wet season and river areas during the dry season (De Waal and Julie, 2006). Baggara cattle usually pass through a very long and tough migratory way. Baggara cows represent 80% of cattle in the Sudan (Yousif and Fadl El Moula, 2006).

Cattle in the tropical Africa are used for a few purposes, and in many cases cannot be separated into classes of dairy, beef or work animals. However, milk production is one of main issue for the production system. Milk production in a small holder dairy system is very low and below the genetic potential of the indigenous dairy cattle. The milk production of the Sudanese indigenous cattle breeds, Kenana and Butana *(Bos.indicus)* was found to be lessen than that of *B. taurus* cattle (Ageeb and Hayes, 2000). Among the numerous constraints for milk production, inadequate feed supplies remain a major constraint for sustainable cattle production in milk production and milk components (Olafadehan and Adewumi, 2008). Better reproductive performance and milk production increased with increasing age of the dam, parity was observed to be one of the major sources of variation in milk yield and effect return to ovarian function of post-partum period (Tomomi et al., 2008).The increased demand for milk and milk products because of burgeoning population growth, rapid urbanization, needed to study factors that affect breed production in different systems. The aim of this research was to evaluate the effects of parity order on body weight and milk yield and milk components and calving interval of Baggara cattle kept under traditional in tropic conditions in West Kordofan state, Sudan.

Materials and Methods

Study area

The experiments were carried out in Elfula area, West Kordofan state (9-12^{o} and 12-30^{o} N, 15-27^{o} and 30^{o} E). The study included three district seasons (rainy, cool dry and hot dry) the rainy season (May-October), cool dry (December-February) and a 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 temperature 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). The annual rainfall of a range 450-650 mm, with a peak rain in August. The relative humidity of 35% rise to 75% during the rainy seasons. Soil types varied from sandy in north to heavy clays and the lighter clay in the South. The dominant vegetation varies with soil and rainfall patterns, with a mixture of grasses and herbs with scattered shrubs and browsing trees (Vogt, 1995).

Experimental animals and management

Forty eight Baggara cows were selected from the herd (1-4 parity orders) from the nomadic flock for the purpose of this study. The cows were settling around Elfula area. The cows were monitored from the last trimester of pregnancy to calving through conception to parturition. The target cows were divided into four groups, each group comprise of (12) cow according to number of parity as first, second, third and fourth parities (Table 1). All groups were eared tagged and treated against endo-and ecto-parasites. The animals were vaccinated against foot and mouth disease, Anthrax and Hemorrhagic Septicemia. All animals depended on pasture to maintain their roughage, were allowed for free grazing on an early pasture from 8.00 am to 6.00 pm. The four groups were housed in partially shaded pens, constructed from traditional local material.

Table 1. Experimental animals

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

Milk yield

The newly born calves were left to suckle their dams freely up to their first 7 days after birth. The cows were milked twice a day, in the morning and also in the evening for 150 consecutive days. Daily milk yield by each cow was measured. The average daily, monthly and total milk yield per lactation (kg) was calculated for each cow.

Milk composition

Fresh milk samples were taken every month for the chemical analysis. The milk samples were collected in sterile containers (25 ml) and kept in a fridge at 4°C until analysis at the laboratory of the Department of Dairy Production, Faculty of Animal Production Khartoum University. Chemical analysis of the milk samples were determined by using milk analyzer Lacto scan 90 according to the manufacture instructions to determine fat, lactose, protein, SNF and density of the milk samples.

Statistical analysis

The data were analyzed statistically according to the analysis of variance procedures using the General Linear Model (GLM) applicable to the complete randomized design. Duncan's multiple range test (DMRT) for mean separation was used to identify significant differences. All statistical analysis were conducted using Statistical Package for the Social Sciences, software package (SPSS, V, 11.5, 2000).

Results

Effect of parity order on milk yield

The data highlighting the effect of parity order on milk production displayed in Table (2).The results suggested that parities order had significant (P≤0.05) effect on milk production during five months of lactation period.

Table 2. Effect of parity order on milk yield (mean ± SE kg)

Animal Group	No.	1st month	2nd month	3rd month	4th month	5th month
1st parity	12	105.38 ± 17.05 ^{B}	132.99± 17.65 ^{A}	132.81 ± 5.44 ^{C}	122.07 ± 11.78 ^{C}	107.92 ± 28.24 ^{B}
2nd parity	12	100.00 ± 9.58 ^{C}	121.30±14.95 ^{B}	145.95 ± 17.15 ^{AB}	141.29± 26.46 ^{B}	111.82± 12.86 ^{B}
3rd parity	12	133.27± 16.94 ^{A}	129.50 ± 20.18 ^{A}	146.85± 26.65 ^{A}	147.39±29.79 ^{B}	131.95± 15.77 ^{A}
4th parity	12	88.85 ±11.28 ^{D}	116.91± 21.06 ^{B}	161.05 ±28.36 ^{B}	138.64 ±10.88 ^{A}	129.18± 18.47 ^{A}
		total yield	**monthly yield**	**daily yield**		
1st parity	12	599.68 ± 34.60 ^{C}	119.93 ± 6.92 ^{C}	3.99 ± 0.23 ^{C}		
2nd parity	12	613.24± 47.99 ^{C}	122.63± 9.65 ^{BC}	4.08 ± 0.32 ^{BC}		
3rd parity	12	668.47± 62.21 ^{A}	133.73± 12.44 ^{A}	4.49± 0.42 ^{A}		
4th parity	12	636.49± 31.27 ^{B}	124.96± 16.26 ^{B}	4.14 ± 0.56 ^{B}		

^{ABC} Values in the same column with different superscripts differ at P≤0.05

Dams in 3rd parity recorded higher milk production during the first month of lactation (133.27±16.94 kg) then primiparous (105.37±17.05 kg) and the lower milk production was obtained by dams in 4th parity. During the second month of lactation dams in all parities started to increase their milk production with the advance of the lactation period except dams in 1st parity, where high amounts of milk yielding were recorded in the third month by dams in 3rd parity (147.39±29.79 kg) and lower by dams in primiparous (132.81±5.44 kg). But in fourth months of lactation cows in parity four produced the highest amount of milk 138.64±10.88 kg followed by cows in 3rd parity (146.85±26.65 kg) and lower observed in 1st parity animals (122.07±11.78 kg). The lactation curve of all dams began to go down and the milk production decreased significantly (P≤0.05). The amount of milk yielding was (107.92±28.24, 111.82±12.86, 131.95±15.77 and 129.18±18.47 kg) for primiparous, 2nd, 3rd and 4th parities respectively. Dams in 3rd parity significantly (P≤0.05) had higher total and daily milk production as (668.47±62.21kg and 4.49±0.42 kg) respectively, compared with dams in primiparous parity (599.67±34.60 and 3.99±0.23), 2nd parity (613.24±47.99 and 4.08±0.32 kg) and 4th parity (636.49±31.27 and 4.14±0.56 kg) for total and daily production respectively.

Effect of parity order on milk composition

The effect of the parity orderon milk composition of experimental cows is illustrated in Table (3). The data indicated that parity order had exerted a significant (P≤0.05) effect on fat, lactose, crude protein and SNF during first and third month of the lactation period. Lactose, fat and protein were not different during the second month. The fat content during the first 30 days of lactation was highest in the primiparous parity group (6.15±0.44) and lower in 4th parity group (5.12±0.16). The lactose content was significantly (P≤0.01) higher in the 2nd parity (5.12 ± 0.04) and lower in 4th parity animals (4.53±0.49). Crude protein and SNF content were higher in 2nd parities animals (3.80 ±0.03 vs. 9.65 ± 0.08) and lower in 4th parity (3.53 ±0.26 vs. 8.98 ± 0.44). The data also indicated no significant effects of parity number of fat, protein and SNF content during the second month of lactation. During the third month of lactation, high fat content was secured by primiparous parity (6.26). High lactose, protein and SNF were recorded cows in 2nd parity, the respective values were (5.43±0.02, 4.01± 0.05 and 10.22±0.04) for lactose, protein and SNF respectively. Lowered fat and protein content was observed in 3rd parity animals (Table 3).

Table 3. Effect of parity order on milk composition (mean ± SE %)

Animal Groups	No.	F	L	CP	SNF
			First month of lactation period		
1st parity	12	6.15±0.44 ^{A}	4.68±0.44 ^{BC}	3.59±0.06 ^{B}	9.18±0.19 ^{BC}
2nd parity	12	6.21±0.04 ^{A}	5.12±0.04 ^{A}	3.80 ±0.03 ^{A}	9.65±0.08 ^{A}
3rd parity	12	5.55±0.49 ^{B}	4.94±0.09 ^{AB}	3.64±0.05 ^{B}	9.25±0.14 ^{B}
4th parity	12	5.12±0.16 ^{C}	4.53±0.49 ^{C}	3.53 ±0.26 ^{B}	8.98±0.44 ^{C}
			Second month of lactation period		
1st parity	12	5.29±0.69	5.03±0.45	3.70± 0.35	9.35±0.60 ^{A}
2nd parity	12	4.95±0.54	4.79±0.33	3.53 ±0.18	8.98±0.47 ^{AB}
3rd parity	12	5.19±0.43	4.98±0.32	3.69 ±0.13	9.43±0.37 ^{A}
4th parity	12	4.78±0.41	4.74±0.26	3.59±0.16	8.78±0.45 ^{B}
			Third month of lactation period		
1st parity	12	6.26±0.77^{A}	4.78±0.58 ^{B}	3.58±0.45 ^{B}	9.05±1.12 ^{B}
2nd parity	12	5.58±0.06^{B}	5.43±0.02 ^{A}	4.01±0.05 ^{A}	10.22±0.04 ^{A}
3rd parity	12	4.38±0.23^{C}	4.83±0.23 ^{B}	3.53±0.18 ^{B}	9.05±0.45 ^{B}
4th parity	12	6.02±0.13^{A}	5.023±0.03 ^{B}	3.74±0.02 ^{B}	9.49±0.05 ^{B}

^{ABC} Values in same column with different superscripts differ at P≤0.05 *Where F, L, CP and SNF were Fat, Lactose, crude protein and solid not fat respectively*.

Effect of parity order on open period and calving interval

The data pertinent the effect of parity order of appearance of days open (first estrus and service period) is presented in Table (4). The results indicated that calving days to first estrus and days to conceive were significantly (P≤0.05) effected by parity number. Shorter days to show estrus was obtained by cows in their 1st parity (56.19 ±8.72 days) than that of the second, third and fourth parity animals with a value of 61.44 ± 11.62, 90.90 ±5.26 and 113.58 ±10.18 days respectively. Days to conceive exerted significant (P≤0.05) effect parity order. Cows that had first calvers have shorter days to service interval compared with other cows in 1st and 4th parties (92.92± 26.59 vs 129.60 ±38.68 days) respectively. Animals in 4th parity had scored longer days to service interval (129.60±38.68 days). The effect of the parity orderon calving interval is illustrated in Table (4). The parity order exerted significant (P≤0.05) effect on calving interval, whereby that 4th parity cows had the highest calving interval compared with other parties' calvers. The longest open period was scored by parity four as 243.18 days and shorter one to 1st parity cow 149.11 days.

Table. 4 Effect of parity order on open period and calving interval

Animal Group	No.	Open period/day		calving interval/month
		first estrous	service interval	
1st parity	12	56.19 ± 8.72 ^{A}	92.92± 26.59 ^{A}	10.04 ±0.99 ^{A}
2nd parity	12	61.44 ±11.26 ^{B}	119.92± 34.21^{C}	11.34±1.35 ^{A}
3rd parity	12	90.90 ±5.26^{C}	125.00±28.80 ^{AB}	12.03±1.01 ^{B}
4th parity	12	113.58 ±10.18 ^{D}	129.60±38.68 ^{D}	13.17 ±1.23 ^{C}

^{ABDC} Values in the same column with different superscripts differ at P≤0.05

Discussion

Effect of parity order on milk production

Parity order had a significant effect on milk production during lactation period. Where increasing milk production found in the present study as parity increased, as dams in 3rd and 4th parities recorded higher milk production during lactation and the lower milk production was obtained by dams in 1st and 2nd parity. This result was consisted with Mohamed (2004) and Meikle et al. (2004) who showed that primiparous cows produced less milk than multiparous cows. Also confirms the results of Mech et al. (2008) whom concluded that milk yield increased up to 90 days and remain high for a while and then declines in late stage of lactation. Generally the present study revealed that milk yield increased with advanced lactation and then gradually decreased. In this study Baggara cows at different stages of lactation and in all parities obtained lower milk production (total milk and daily milk yield). Higher milk yield in third parities during early and mid-lactations was observed, while during the late lactation, fourth parity showed a significantly higher milk yield compared to first, second and third parties. This is partially agree with Shuiep *et al*. (2016) who reported that higher daily milk yield in third and fourth parity during early and mid-lactations was observed. The different of milk production reported here by other authors may be due to genetic factors and management practice as supplementation during pre-partum and post-partum period since Baggara cow depend on natural grazing and were not selected genetically for milk production. Generally the stage of lactation is one of the major factors influencing milk yield and composition in cattle.

Effect of parity order on milk composition

In this study, parity order had a significant effect on milk composition. The mean of milk fat during the present study was higher than those obtained by Ibrahim (1989), Ibrahim and Samaha (1986) and Hamid (1994). This might be attributed to genetic variations, plane of nutrition and yield of cows. High milk fat is a typical characteristic of Zebu cattle as they produce more milk fat compared to the temperate cows (Barbosa et al., 2008). This indicates that the milk fat as quantitative trait is genetically affected by some set of genetic factors. Milk fat

in dairy cattle is influenced by the amount of roughage and the ratio of forage to concentrate in addition to meal frequency. Moreover, the reduction in the dietary forage-to-concentrate ratio decreases milk fat (Sutton, 1989). Wang et al. (2004) reported that supplementation of fat ration effectively increased milk fat. The fat content during the first month of lactation was highest in the 1st parity and lower in 4th parity. This result is in agreement with Shuiep et al. (2016). Reduction in milk fat content of cows in the later parity may be related to age factor as local cows gave first calves at age of 5-7 years (Abdel-Aziz et al., 2005). The result obtained from Baggara cows is supporting Nyamushamba et al. (2014) who reported that there was a linear relationship between age at calving and milk fat. On the other hand, the data also indicated no significant effects of parity number of fat content during the second month of lactation.

In this study, parity order had exerted a significant effect on milk solid not fat content (SNF). The overall mean of milk solid not fat content (SNF) obtained in the present study was similar to that reported by Bashir (2011). Variation of SNF content between 2nd parities 4th parity is agreement with Shuiep et al. (2016).These results could be attributed to age factor as the elder cow; has lower efficiency of feed utilization. Smith et al. (1961) reported that utilization of feed was a linear function of body weight. On the other hand, non-significant variations were obtained in SNF in the second month of lactation in different parities. This result is in partial agreement with Sudhakar et al. (2013). However, it disagreed with Singh and Pratap (2014) who reported different SNF profile. Protein content in this study was affected by parity order. The overall mean of milk protein obtained in the present study was similar to that reported by Bashir (2011). However, it disagrees with the findings of Klungel et al. (2000). These differences may be due to stage of lactation and genetics variations (Mustafa and Serdar, 2009). In this study it was observed that protein content was higher in early parities and lower in later parities, these results were in agreement with Shuiep et al. (2016), this observation could be attributed to the age of cows. On the other hand, the non-significant differences of milk protein content during second month of lactation were in accordance with the results of Ahmed and El Zubeir (2007).

Parity order had effected on lactose during first and third month of the lactation period. The overall mean of lactose of milk from Baggara cows was in agreement with those reported by Ibrahim (1989) and Bashir (2011). Also, this result was conflicting with that reported by Mech et al. (2008) and Shuiep *et al.* (2016) who reported parity order has no influence on the lactose content of milk. Lactose synthesis is highly correlated to the amount of water drawn into the milk. Secretion rates of lactose and water are nearly constant throughout lactation (Pollott, 2004). Therefore, compared to other milk constituents, lactose is the most stable component. This could explain the less influence of lactation stages on this constituent.

Effect of parity order on some reproductive traits

The resumption of bovine ovarian cyclicity after parturition is an important physiological process for cattle breeding, and attaining pregnancy of dairy cows in the post-partum period**.** It has obvious economic importance of reproductive parameters because a longer service period increases the calving interval, resulting in a reduced life time production. The interval to first post-partum (PP) ovulation is related to the period of NEB, as metabolites and metabolic hormones convey information about the cow's metabolic status of her central nervous system (Butler, 2003).

Re-initiation of post-partum ovarian activity is closely related to the feeding and management during the transition period and the physiological and metabolic changes (Bell, 1995). The mean of service period obtained in the present study was similar to Brahmstaedt and Schonmuth, (1983) who suggested that service period in cattle should not be less than 40 days, Basak and Das (2018) who found overall mean service period and calving interval were estimated at (158.78 ± 3.5 and 445.97 ± 3.67 days), respectively of Deoni cattle. Bushara (2016) reported first progesterone rise (79.9 ±48.86 days) and days to conception (133.12±59.46 d 133.12±59.46 days). Mackey *et al*. (2000) the first estrus occurs between 41 and 70 days post-partum, and lower than that reported by Singh *et al*. (2002), Poncheki et al. (2015) and Reist et al. (2003) observed that the average number of days to conception for dairy cows with a satisfactory milk yield was 100.4 days. De Vries and Veerkamp (2000) investigated the return of luteal activity in dairy cows and found that animals returned to ovarian activity on average

at 29.7 days, ranging from 10 to 97 days. The milking/suckling system is probably one important cause of the long post-partum anoestrous periods and long intervals between calving exhibited by the cows. The suckling stimulus is one of the main factors affecting the duration of post-partum anoestrus in dual purpose cows (Das et al., 1999). In this study calving parity had a significant effect on days open (days to estrus and days to service interval), same results obtained by Goshu et al. (2007) and Dhaware et al. (2008) which they reported there was a significant effect of parity on service period. On contrast, Gifawosen et al. (2003) and Basak and Das (2018) reported that tehre was non-significant effect parity of the cows in service period. Early parities obtained shorter days to show estrus and shorter days to service interval than cows in their later parities. These results in line with Asseged and Birhanu (2004) and Goshu et al. (2007) who documented those days open decreased as the parity number increased until 3, Cows in their first parity demanded 35 more days than the average for days open. Hammoud *et al*. (2010) stated that the highest days open were in the 1st and 2nd parities (142.6±4.8 and 148.3±4.8 days), then days open declined from the 3rd parity and over ranged between (121.1±9.6 and 127.8±5.9 days). Stahl et al. (1999) ha reported that the first-lactation cows have lower energy balances because they eat less and have energy requirements for growth in addition to the lactation. Lower energy balance in the first lactation cows was related to delayed intervals to first ovulation. Several investigators have reported that negative energy balance causes a delay in interval to first ovulation and a delay in interval to the first estrus (Lucy et al., 1992). The reason for the delay in interval to first ovulation might be explained partially by the greater negative energy balance in modern dairy cows. The days open found in the current study are about twice the limit given to a well-managed herd and may be related to the change in feeding and management.

The effect of low level of nutrition on extended post-partum period because of weight loss was noted by Gebreegziabher et al. (2005). Nutrition and suckling are the major factors effecting the resumption of post-partum ovarian cycles (Motlagh et al., 2013). Beside, Tadesse and Zelalem (2003) announced that increasing the level of protein supplementation from low (2kg.day^{-1}) to high (4 kg.day^{-1}) decreased the post-partum interval from 159 to 100 days. The highest days open required for the first and the second parity cows in current study might be due to the nutritional requirements for the growth and their inability to quickly initiate post-partum ovarian activity due to the low levels of body reserves.

In this study calving interval (CI) were affected by parity number, different authors reported the effect of parity order in calving interval (CI) as Mureda and Mekuriaw (2007), Asimwe and Kifaro (2007) and Abou-Bakr et al. (2006) found that the parity order significantly affected calving interval. The data of the present study revealed that the mean of calving interval reported for Baggara cow's was (11.65±1.15 months). This result is lower of reported of Kamdasamy et al. *(*1993) (12 months) and El-khalil (2001) (13.4±2.3 months). Ali (2011) reported that the longest calving interval was (442.21±14.8) day in the 4th parity, while the shortest calving interval was (411.9±19.2) day in the 5th parity. Other works reported longest calving interval than the present study, Ismail (2002) (432.3±2.23 days), Asimwe and Kifaro (2007) (480.4±2.4 days) in dairy cattle in Tanzania and Haile *et al.* (2009) (439.0 days) for Boran cattle in Central Ethiopia. The difference in the length of the calving interval between the present study and the previous studies may be explained by the different breeds and management systems in the other studies.

The results revealed that calving interval is the longest in the second and fourth parities cows and the shortest in the cows with first and third parity. Similarly results obtained by Mukasa- Mugrewa (1989). This could be related to the improvement in reproductive management and it also indicates that the physiological maturity is attained with the advanced age of the cows. The prolonged CI for first calvers has been suggested to be physiologically necessary to allow animals to replenish their fat reserves, which is depleted during lactation and this allows them to put on weight before the next calving.

From the present study it was observed that calving interval decrease with increasing parity order. This is in partial agreement with Yousif et al. (1998). It is disagrees with Sattar et al. (2005**)** and Ali (2011) who reported that the length of calving interval enhanced with parity in Swiss Brown Cattle. These variations might be attributing to breed, nutrition and environmental conditions. Generally, many previous studies have reported that the higher milk yield was related to the longer time to resumption of ovarian activity and as well as longer post-partum

intervals (Lopez-Villalobos et al., 2005) as a consequence of the lower production of progesterone (Stadnik et al., 2009), or irregular estrous cycles in the cows selected for the high milk yield (Walsh et al., 2011).

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