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Reproductive traits and lactation performance of *Kenana* cows at *Umbenein* Livestock Research Station, Sinnar State, Sudan

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ABSTRACT

Sudanese *Kenana* breed is one of the largest east African *Zebu* cattle. Its performance is close to the best dairy breeds in Africa. This study aimed to estimate selected reproduction and lactation traits and effects of sire, lactation number and year of calving on those traits in *Kenana* cows at *Umbenein* Livestock Research Station, Sinnar State, Sudan. The official records of the station during the years 2000 -2017 were used. Overall mean of age at first calving, calving interval, open, dry and lactation periods (day) and lactation, daily and standard yields (kg) were 1673, 468, 184, 151, 315, 2260, 7 and 2042, respectively. The daughters of the sire of *Umbenein* Research Station showed earlier age at first calving and shorter calving interval, open and dry periods, while those of the sire of *Umbenein* village were higher in lactation, daily and standard yields. Lactation number had significant effects ($P \leq 0.05$) on lactation yield, calving interval and open period and were least in the fourth lactation. Daily and standard yields were higher in the third lactation, with a clear drop in the fourth one. Year of calving had significant effects ($P \leq 0.05$) on calving interval, open period, daily and standard yields. All traits studied, except lactation period, were higher in 2009-2011 years of calving and decreased in 2012-2014 and 2015-2017 calvings.

INTRODUCTION

Animal production is an important sector in the Sudan due to high population, wide distribution and socio-economic impacts. Livestock population is estimated at 107 million heads. Cattle formed about 28% of livestock population in the country. However, the contribution of cows in milk production is about 64% and more than 80% of milk production in cities and towns is provided by the traditional sector (MARF, 2016).

Kenana and *Butana* cattle are the main promising indigenous dairy breeds in the Sudan. However, their productive performance is generally low compared to exotic breeds (Ageeb and Hillers, 1991). *Kenana* cattle are a subtype of the northern Sudan short horned *Zebu* with typical dairy characteristics and are considered among the best milkers in Africa (Luo, *et al*., 1997). The *Kenana* population is estimated at 3 million heads, forming about 12% of the cattle population in the Sudan.

Kenana average milk yield is 1860 kg in 222 days lactation (Osman, 1981). Peak milk yield is during the fourth lactation. The average productive herd life of cows is 5.4 lactations. Age at first calving with good management is 45.2 months. About 61 % of heifers first calving is 37-48 months. With good management, considerable improvement could be achieved in the reproductive performance of the breed.

Morphological traits are used to rank animal populations according to their levels of phylogenetic distinction (Gatesy and Arctander, 2000). Modern breeding programs for dairy cattle improvement require basic information to determine the genetic and environmental influences on milk yield and other related traits (Sharaby *et al*., 1987). This helps in the distinction between breeds and types, identifying the promising productive and reproductive characteristics and those need to be improved through selection or crossbreeding.

Due to the lack of recent information on this breed in its natural habitat, this study was conducted to estimate selected lactation and reproduction traits of *Kenana* cows and to test the effects of sire, lactation number and year of calving on their reproductive and lactation performance in Sinnar State.

MATERIALS AND METHODS

Study area

Data used in this study were collected from the official records of *Umbenein* Research Station. It is located in Sinnar State on the western bank of the Blue Nile river at latitude 13^{o} 04□ N, longitude 33^{o} 57□ E and altitude of 435 masl.

The highest daily maximum temperature is 45.5^{o}C in April, while the minimum is 26.0^{o}C in January. As in tropical areas, the rainfall regime is the most important climatic factor influencing agriculture and vegetation. In *Umbenein* area, there is a clearly defined rainy season from July to October with some showers in May and June. There are three distinct seasons in the year based on rainfall and temperature which are winter (November – February), dry summer (March – June) and wet summer (July – October). The annual rainfall ranges between 400 and 600 mm (Saeed *et al*., 1987).

Animals management

Cows were housed in pens fenced by iron bars and corrugated iron sheet for shading. The houses were partially shaded to protect lactating cows from excessive sun and rain. Animals were kept in pens according to the purpose of production. The feeding of the herd was based on irrigated forages. Milking cows and growing stock were given special attention and fed in the yards in addition to daily grazing. Concentrates were fed to milking cows. These concentrates consisted of sorghum grains, oil seed cakes, wheat bran and molasses. All animals in the herd had free access to fresh clean water in the yards. Vaccination against infectious diseases was freely and routinely practiced.

Data collection

Data used in this study covered the period be years 2000 and 2017. A total number of 76 records from 24 dairy cows with 2-4 lactation seasons were used**.** The reproductive data consisted of age at first calving, calving interval and open period. Lactation traits consisted of dry period, lactation period, lactation yield, daily milk yield and standard lactation yield.

Standard lactation yield refers to the amount of milk produced by the cow as calculated for 305 days, which is considered the standard lactation length (Makawey and Ahmed, 2005):

$$\text{Standard lactation yield} = \frac{\text{Total lactation yield} \times 305.}{\text{Lactation length}}$$

Statistical analysis

Data were analysed using SPSS software (version 20). Descriptive statistics was used to explain the mean and standard error for all traits. Linear model procedure was used to test the effect of fixed factors on the traits studied, as follows:

$Y_{ijk} = \mu + S_i + T_j + G_k + e_{ijk}$, where:

Y_{ijk} = observation on reproductive and lactation traits.

μ = the overall mean.
S_i = the effect of i^{th} sire (i = 1-2).
T_j = the effect of j^{th} lactation number (j= 1-4).
G_k = the effect of k^{th} year-group of calving (k=1-6).
e_{ijk} = residual effect.

Using the year of calving as a criterion, the data were classified into six periods of calving, three years each. Namely 2000-2002, 2003-2005, 2006-2008, 2009-2011, 2012-2014 and 2015-2017. Duncan's Multiple Range Test was used for means separation.

RESULTS AND DISCUSSION

Reproductive and lactation traits

Overall mean, standard error and coefficient of variation for reproductive and lactation traits of *Kenana* cows at *Umbenein* Livestock Research Station are shown in Table 1. Age at first calving is one of the most important economic traits; it signifies the commencement of the productive life and can be attributed to the level of feeding, management practices and health standards (Makawey and Ahmed, 2005). The overall mean age at first calving was higher than that reported by Mohamed *et al*. (1985), Ageeb and Hillers (1991) and Elnagi (2014) for the breed.

Calving interval is one of the most important traits in relation to the breeding efficiency of dairy cattle. Standard calving interval is between 356-380 days (Makawey and Ahmed, 2005). Overall mean calving interval was longer than that obtained by Elnagi (2014). However, it was shorter than the 528 and 489 days reported by Ageeb and Hillers (1991) for *Kenana* and *Butana* crossbred cattle, respectively, in Elnisheishiba farm of the University of Gezira.

Standard open period is between 85-100 days (Makawey and Ahmed, 2005). The estimated overall mean was longer than that found by Gasmalla (2018) for *Kenana* and *Butana* crossbred cows in Gezira State. The causes for the high values in this study might be due to management, failure to detect heat, which is a frequent problem, resumption of normal ovarian cycle, or efficiency of the bull.

The overall mean dry period was longer than the 60 days optimum dry period (Makawey and Ahmed, 2005) and longer than 95.1 days found by Elnagi (2014) for *Kenana* cattle in Umbenein.

Mean lactation length was higher than that for the breed (Elnagi, 2014) and for *Butana* cattle at Atbra Research Station (Abdalla *et al*., 1990)

Overall mean milk yield per lactation was less than that reported by Abdalla *et al*. (1990). However, it was higher than that reported by Ageeb

and Hillers (1991) for *Kenana* and *Butana* breeds at Elnisheishiba farm. It was also higher than the findings of Elnagi (2014).

The estimated mean of daily milk yield was higher than that reported by Makawey and Ahmed (2005) for both *Kenana* and *Butana* cows and that reported by Elnagi (2014) for *Kenana* breed.

Mean standard lactation yield was less than the finding of Gasmalla (2018) who studied *Kenana* and *Butana* crossbreed cows in Gezira State. However, it was higher than the 1405 kg reported by Ageeb and Hillers (1991) for *Kenana* and *Butana* breeds in Elnisheishiba farm. The higher value of CV% in some traits may be due to the variation in nutrition, management or other environmental factors.

Table 1. Overall means, standard errors (SE±) and coefficients of variation (C.V. %) for selected reproductive and lactation traits in *Kenana* cows.

Trait	No. of records	Mean	S.E	C.V. %
Age at first calving (days)	24	1672.58	71.50	20.9
Calving interval (days)	76	468.41	9.18	17.1
Open period (days)	76	183.84	9.14	43.4
Dry period (day)	76	151.08	7.75	44.7
Lactation period (day)	76	314.54	8.07	22.4
Lactation yield (kg)	76	2260.16	125.23	48.3
Daily yield (kg)	76	6.69	0.23	30.4
Standard yield (kg)	76	2041.73	70.93	30.3

Effect of sire on reproductive and lactation traits

Daughters from the sire of Umbenein Research Station showed earlier age at first calving and shorter calving interval and open and dry periods. The sire of Umbenein village had higher total lactation, daily and standard milk yields. However, the effect of sire was not significant for all the traits studied (Table 2). The overall mean milk yield per lactation was higher than that reported by Musa *et al*. (2005) for *Butana* cattle with significant ($P \leq 0.05$) effect for sire and parity number.

Table 2. Effect of sire on selected reproductive and lactation traits in *Kenana* cows.

Sire*	AC (days)	CI (days)	OP (kg)	DP (days)	LP (days)	LY (kg)	DY (kg)	SY (kg)
1	1612.02	464.83	180.50	150.24	314.62	2230.39	6.34	1936.28
2	1733.15	472.82	187.97	152.12	314.44	2296.94	7.12	2171.99

*1= Sire of Umbenein station, 2= Sire of Umbenein village, AC= Age at 1st calving, CI= Calving interval, OP= Open period, DP= Dry period, LP=Lactation period, LY= Lactation yield, DY= Daily yield, SY= Standard yield.

Effect of lactation number on reproductive and lactation traits

Lactation number had no significant effect on all traits, except lactation yield (Table 3). However, dry period increased and open period decreased with lactation number. A clear drop in lactation yield occurred in the fourth lactation, this could be attributed to nutrition, management or other environmental factors.

In agreement with this study, Gasmalla (2018) found that lactation milk yield was significantly ($p \leq 0.05$) affected by lactation number and dam parity in *Kenana* and *Butana* crossbred cows. Lactation number had no significant effect on calving interval. The variation in calving interval among parities could be attributed to the physiological status, breeding systems, or failure of cows to conceive after one service or inadequate nutrition (Musa *et al*., 2005).

Table 3. Effect of lactation number on selected reproductive and lactation traits in *Kenana* cows.

Lactation number	CI (days)	OP (kg)	DP (days)	LP (days)	LY (kg)	DY (kg)	SY (kg)
1	461.75	177.38	137.92	318.33	2609.02	6.84	2086.81
2	483.50	198.83	158.29	321.88	2152.46	6.63	2024.11
3	473.18	188.47	153.76	319.41	2249.00	7.00	2137.87
4	442.64	158.09	159.91	282.73	1751.27	6.01	1833.24

CI= Calving interval, OP= Open period, DP= Dry period, LP=Lactation period, LY= Lactation yield, DY= Daily yield, SY= Standard yield.

Effect of year of calving on reproductive and lactation traits

Year of calving had significant ($P \leq 0.05$) effect on calving interval, open period, daily, and standard lactation yields. Calving interval, open and dry periods were longer, and daily and standard lactation yields were higher in the 2009-2011 period of calving as shown in Table 4.

Year of calving had significant ($P \leq 0.05$) effects on calving interval, open period, daily and standard lactation yields. However, it had no significant effect on lactation yield. These findings agree with those of (Gasmalla, 2018) for *Kenana* and *Butana* crossbred cows in Gezira.

Effect of interaction of month × lactation number on lactation milk yield

Table 5 shows the monthly lactation milk yield within lactation number of *Kenana* cows. The analysis of variance revealed no significant effect of month during the first four lactations. However, the highest milk yield was obtained in April followed by March and May. The least milk yields were reported in November and January. The non significant effect of months on milk yield was similar to the finding of Abdelgadir (2014) for crossbred dairy cows in Sinnar State.

Table 5. Effect of month × lactation number on monthly lactation milk yield (kg).

Lactation / Month	1	2	3	4	Mean	SE±
January	182.92	155.63	193.00	134.36	169.53	13.42
February	153.23	195.58	170.62	158.73	171.29	11.67
March	199.13	190.08	198.71	181.09	193.57	11.43
April	202.38	211.29	211.29	156.27	200.20	11.43
May	191.79	209.46	195.35	144.00	191.25	11.72
June	170.46	191.08	189.88	135.00	176.18	10.88
July	172.71	190.13	180.35	135.27	174.50	10.86
August	213.21	183.21	188.18	154.73	189.67	12.65
September	198.04	199.94	192.53	145.55	189.81	13.95
October	203.77	148.17	176.68	140.27	170.96	16.20
November	232.04	129.08	160.71	117.18	166.95	17.05
December	204.21	144.77	206.00	157.91	179.14	13.55

REFERENCES

Abdalla, E. A, A. M. Nasr, A. M. Khalafalla and S. A. ElShafei. 1990. The influences of age on lactation length and milk yield in *Kenana* and *Butana* cows. Sudan Journal of Animal Production 3(2): 93-101.

Abdelgadir, T.M. 2014. Factors affecting the performance of crossbred dairy cows in West Sennar Sugar Factory, Sennar State, Sudan. M.Sc. Thesis, University of Gezira, Sudan.

Ageeb, A. G. and J. K. Hillers. 1991. Effects of crossing local Sudanese cattle with British Friesian on performance. Bulletin of Animal Health and Production in Africa 39: 69-79.

Elnagi. A. H. 2014. Selected morphological, productive and reproductive characteristics of Kenana cattle breed, Sinnar State, Sudan. M.Sc. Thesis, University of Gezira. Sudan.

Gasmalla, T. E. M. 2018. Reproductive and lactation performance of *Kenana* and *Butana* crossbred cows, Gezira State, Sudan. M.Sc. Thesis, University of Gezira, Sudan.

Gatesy, J. and P. Arctander. 2000. Hidden morphological support for phylogenetic placement of *Peudorxy ngetinhensis* with *bovine bovids*: A combined analysis of gross anatomical evidence and DNA sequences from five genes. Systematic Biology 49 (3): 515-538.

Luo, M.F., G. R. Wiggans and S. M. Hubbard. 1997. Variance component estimation and multitrate genetic evaluation for type traits of dairy goats. Journal of Dairy Science 80: 594 – 600.

Makawey, A, and S. Ahmed. 2005. Basics of Animal Production Science, Second Edition. Khartoum. Sudan.

MARF (Ministry of Animal Resources and Fisheries). 2016. Statistical Bulletin for animal resources, No. 25, Khartoum, Sudan.

Mohamed, O., A. Friend and A. M. Saeed. 1985. The productive performance of the *Kenana* cattle at Umbenein Livestock Research Station. Bull. 15, Umbenein Livestock Research Station, Sudan.

Musa, L. M., M. A. Ahmed, K. J. Peters, B. Zumbach and K. A. E. Gubartalla. 2005. The reproductive and milk performance merit of *Butana* cattle in Sudan. Archives of Animal Breeding 48: 445 – 459.

Osman, A. H. 1981. Genetic types for different environments. Animal Genetic Resources Conservation. Proceedings FAO/UNEP Technical Consultation, Rome, Italy.

Saeed A. M., P. N. Ward, D. Light, J. W. Durkin and R. T. Wilson 1987. Characterization of *Kenana* cattle at Umbenein. Sudan. ILRI Research Report No. 16 Addis Ababa, Ethiopia.

Sharaby, M. A., I. S. El Kimary and M. A. Aziz. 1987. Genetic and environment control of first lactation milk yield in cows and Buffalos. Livestock Production Science 17 (3): 225-233.