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The Production and Reproduction Performance of North Kordofan Sub-type Sudan Desert Sheep under Irrigated Agriculture Land use, Gezira, Sudan

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Abstract

A flock of North Kordofan (NK) Sub-type Sudan Desert Sheep was studied in the previously Animal Production Station at El Huda. Overall average of: 3.6±0.04, 17.2±0.44, 21.7±0.59, and 31.55±1.36 Kg, were obtained, respectively, for live weight at: birth, weaning (16 weeks), six and twelve months of age. Males had heavier weights at birth, 12 months and daily gain to 12 month compared to females. Daily gain to weaning was 122±5.0 vs 119±4.0 gm but non-significantly different for sex effect. Service/conception ratio, gestation length, lambing rate, were 1.00 vs 1.63, 153.1±0.71 vs 151.3±0.45 days, and 48.6 vs 67%, respectively, in the ewe lambs and mature ewes. Litter size differed in the two ewe groups, being bigger in the mature ewes due to the occurrence of multiple births and the increased number of ewes having lambs. The mature ewes had a lambing interval of 339.8±32.08 days. At breeding the young ewes were 313.76±12.56 days old and 48.1±2.82 Kg liveweight and they had their first offsprings when they were 473.12±15.08 days old.

Keywords: *Desert sheep, Reproductive performance, El Huda Station*

المستخلص

رصدت الدراسة المتوسطات الشاملة للأوزان الحية (كيلو جرام) التالية : الميلاد 3.6 ±0.04 ، الفطام 17.2 ± 0.44 (في عمر 16 اسبوع)، الشهر السادس 21.7±0.59 ، والشهرالثاني عشر 31.55±1.36 من العمر . كانت الفروقات معنوية بين الذكور والاناث للوزن الحي عند الميلاد وفي عمر 12 شهراً من العمر وكذلك لمعدل النمو للوزن الحي اليومى من الميلاد الى عمر 12 شهراً بينما تماثل معدل نمو الوزن الحي اليومى لما قبل الفطام (122.0 ±5/ 119.0 ±4 جرام) بينما تراوحت نسبة الوثبات المؤدية للحمل ،فترة الحمل (باليوم) معدت الولادات ما بين: 1.0مقابل 1.63، 153.1±0.71 مقابل 151.3±0.45 و 48.6% مقابل 67% في الاناث الصغيرة والناضجة ،على التوالى . اختلف حجم الولد ة من محصول الحملان بتدنيه عند صغار الاناث عنه عند الناضج ة منها , وذلك بسبب غياب حالات ولادات الت وائم وقلة عدد الاناث الصغيره الوالد ة. كانت هذه الاناث في عمر 313.76 ±12.56 يوما وفي 48.1 ±2.82 كيلو جرام من الوزن الحي عند تزاوجها لأول مرة و أعطت انتاجها من المواليد لاول مرة في عمر 473.12 ±15.08 يوما.

كلما ت مفتاحية: *الضأن الصحراوى، الأداء التناسلى، محطة الهدى*

Introduction

The Sudan Desert Sheep ecotype comprises numerous sub-types which are widely spread over the country largely under nomadic but to a lesser extent as small sized sedentary flocks. They are the most promising marketable sheep commodity the country can benefit from their production potentials. The North Kordofan sheep, mainly the Hamari and Kabashi sub-types, are of especial concern in this respect since the latter sub-type is recognized (Mufarrih, 1991) as the model Desert Sheep. The habitat of these sheep in the North Kordofan region is described by various authors, for instance, El-Hag *et al.*(2007), Tibin*et al.*(2010), Dahab *et al.* (2014) and Mohamed Ali *et al.*(2014). Their husbandry, in the region, is largely governed by communal grazing on open grassland, agricultural products leftover, drinking water limitations and small scale (20%) supplementary feeding practice during the dry season as was investigated by Dahab *et al.*(2014). Its domain lies (Mohamed Ali *et al.*(2014) within longitudes 27^o – 29^o 5` East and latitudes $11^o$5` – 17^o 75` North with sandy soil where low rain fall Savannah belt prevails. Therefore, the nomadic system is traditionally the most dominant feature of sheep production in practice. To promote sheep production in the country at large, it is realized that a kind of descriptive functional stratification is becoming more pressing at the present and fat lamb production industry is an already genuine option.

More feasible environment prevails under irrigated agriculture land use, where, in addition to agricultural crops production, fodder production can be successfully integrated to support this industry with due precautions actively in mind. The objective behind this study is to investigate on this line to activate and establish systematic fat lamb production on economic grounds for the benefit of this sector.

Materials and Methods

Animals and Management

A group of breeding female and male North Kordofan, (NK), sub-type Desert Sheep (Hamari and Kabashi) was run with a herd of cattle in the previously Animal Production Station at al El Huda (a region lying between longitudes 30° – 32° East and Latitudes 14° – 15° North with an annual rainfall of about 420 mm and levelled clay plains, that become increasingly loamy Northwards. In the Station these sheep were fed by grazing on natural grasses growing on canal banks, fallow lands, agricultural crops by-products and leftover in addition to irrigated fodder crops like Clitoriaternatea, Phillepessara and Sudan grass. The sheep grazed during the day (early morning to late evening) and received straw or green fodder during the night. Drinking water was readily accessible.

Housing and Veterinary Care

Kraals were used for the night keeping as well as rearing and nursing pens. Veterinary health care comprised deworming (internal and external parasitism) and preventative measures (vaccination and public health) and routine daily clinical attendance. Problems associated with parasitic infestation and respiratory and digestive physiology had been of especial concern as was indicated by Sulieman *et al.,* (1983) and Sulieman *et al.,* (1989) for the situation and therefore strict, appropriate and precautionary measures to combat such production hazards were always right in the front line management.

Data and parameters measured

These included records on age, sex and live weights at different phases of growth of different sheep groups. Also records on mating events and frequencies, lambing and other parameters of reproductive performance concern were taken. Service ratio was calculated as number of services per conception in the ewe, whereas lambing rates were obtained as percentage of ewes lambing out of those presented for breeding. Litter size was estimated as the ratio of lambs born to, either the available ewes at breeding time (EA) or ewes actually lambed (EL).

Statistical analysis

The data collected was manipulated statistically according to Snedecor and Cochran (1970) for analysis of variance using Texas Instruments programmable calculator (TI 58 C). Mean values were compared by t-test.

Results

General information

In (Table 1) the mean values for male and female NK lambs birth weight were significantly ($P< 0.01$) heavier in the male (3.7 Kg) than in the female (3.5 Kg) with an overall mean value similar to that reported by EL-Hag *et al.,* (2007) for the traditionally reared control group sub-type in the region of North Kordofan and was also similar to that (3.64 Kg) shown by Sulieman *et al.,* (1990) as an overall mean value for the local flocks (Shugor, Dabasi and Watish), but was heavier than all mean values which were shown by Tibin *et al.,* (2010) for Hamari sub-type non-supplemented. These authors also noted that male Hamari lambs were significantly heavier at birth than females (3.4 vs 2.4 Kg). Comparing the Hamari and Kabashi single born male lambs Mohamed Ali *et al.,* (2014) because of their similarly heavier weight at birth concluded that, these two sub-types were one and the same sample of NK sub-type. From these observations on birth weight it could be noticed that this NK sub-type can serve a good potential for fat lamb production under the conditions of the irrigated agriculture land use since they exhibited good response in birth weight when they were subjected to improved nutritional conditions at home as was shown by EL-Hag *et al.,* (2007) and Tibin *et al.,* (2010), bearing in mind, and in addition, for the better management which is apt to be provided to maximize their performance response.

Lamb weaning weight varies with dam milk yield, age, management as well as with genetic background in addition to other effects. In the present study male and female lambs (Table 1) had similar weaning weight (about 17.0 Kg) at 16 weeks of age and Similar live weight at 6 month of age (22.3±0.90 Kg) for males vs 21.2±0.78 Kg for females), but live weights at 12 month of age were strikingly elevated in the males (32.6±1.31 vs 23.44±4.30 Kg) due to the higher growth rate, especially to 12 month in those males (85±4 vs 58±13 gm). The small number available at this age of females could have had an adverse effect on their subsequently observed performance. Tibin *et al.,* (2010) obtained heavier average weaning weight (25.6 vs 23.9 Kg) at 120 days of age with no significant difference between males and females, but these lambs, demonstrated an improved weaning weight performance, resulting from feed supplementation, from 19.5±1.17 Kg in the traditional system to 28.0±0.79 Kg in their corresponding supplemented group, at120 days of age. Mohamed Ali *et al.,* (2014) working in that region NK depicted very similar weights (24.33±0.74 vs 24.25±0.61 Kg) and weight gain (0.165 vs 0.165 Kg) for Hamari and Kabashi single born male lambs at weaning and to weaning at 120 days of age. Our results compared least to these two latter studies; however, this does not rule the idea of incorporating these sub-types in an active sheep industry, out of this worthwhile concern. It is realized that early genetic improvement in sheep production can be successfully induced by practicing selection at weaning or thereafter, for example, to yearling age. In The Station and for comparison, El Amin and Sulieman (1979) described more heavier live weights of 25.5±4.4, 19.8±3.5, 22.8±6.8 and 22.6±4.7 Kg for lambs born and weaned at 120 days old, as single males, twin males, single females and twin females, respectively. However, the data analyzed by Sulieman *et al.,* (1990), from, a relatively large body of records, revealed an overall average 120 - day weaning weight of 16.7 Kg, with the Shugor and Dabasi flocks having similar values (16.9 and 16.7 Kg) which were significantly heavier than that (15.2 Kg) shown for the Watish flock. On the other hand, Tibin *et al.,* (2010) obtained a value of 25.7±1.07 Kg as a 180 - day live weight for the Hamari sub-type under traditional husbandry, whereas our present results showed 21.7±0.59 Kg for the NK flock, in The Station, at six months of age, with no significant difference between males and females. Liveweights at 6 and 12 month of age in this study were comparable to those reported by Wilson (1976) for Southern Darfur sheep. The present performance could be improved by the prevailing conditions and management under irrigated agriculture land use to a greater extent than that which might have been cropped at the traditional environment under supplementary feeding, which may prove to be rather more expensive.

Daily live weight gain to 12 months of age (Table 1) was significantly greater (85 vs 58 gm) for male than female lambs, even though larger data may be required to further verify this trend. However, Charles (1985) inferred that in Africa, growth rates in lambs ranged from 75 – 140 gm/day from birth to three months of age, but this dropped to 30 – 75 gm/day at 3 – 12 months of age. The growth rate of 85 gm/day for males from birth to 12months of age in this study falls above the upper limit indicated by Charles (1985), who explained this attitude as a main exception, because Sudan Desert Sheep exhibited higher growth rates suggesting either an element of compensatory growth or slower rate of maturing. The overall average growth (82 gm/day) to 12 months of age, in the present study, compares to that shown by Wilson (1976) for Southern Darfur sub-type Desert Sheep, although the data presented by Osman *et al.*, (1968) depicted a greatly slower growth rate (23 gm/day) for some sub-type Desert Sheep under riverine conditions.

Table 1: Live weight Performance of a Flock of North Kordofan sub- type Desert sheep under irrigated agriculture land use

Sex	Male			Female		
Traits	**N**	**$\bar{X}$±Se**	**CV%**	**N**	**$\bar{X}$±Se**	**CV%**
Birth weight, Kg	99	3.70** ± 0.07	20.96	124	3.50 ± 0.05	15.75
Weaning weight, Kg	39	17.50 ± 0.68	24.21	36	17.00± 0.56	19.89
ADG to weaning, gm	39	122.00 ± 5.0	27.87	36	119 ± 4.00	18.49
Six month weight, Kg	31	22.30± 0.90	22.38	32	21.2 ± 0.78	20.77
Twelve month weight, Kg	23	32.60** ± 1.31	19.31	3	23.44 ± 4.30	31.83
ADG to twelve month, gm	23	85.00*± 4.00	21.76	3	58.00 ± 13	37.66

N = number of animals
$\bar{X}$±Se = mean± standard error
CV% = coefficient of variation, percentage
ADG =average daily gain.
gm. = gram
*****= $p < 0.05$, ** = $p < 0.01$

Table 2 displays some of the production traits pertaining to live weight, age and others, measured for the ewe lambs of NK sub-type Desert Sheep born in the Station, under irrigated agriculture land use. The birth weight in these ewe lambs (3.81 Kg) is comparable to the 3.6±0.04 Kg of the overall average birth weight of the lambs (Table 1), but is of greater variability stemming out, probably, in part, from the critical number of animals studied. In contrast, this birth weight performance is far greater than that (2.4 Kg) shown by EL- Hag *et al.*, (2007) for the farmers' practice, and even better than that obtained for the supplemented group (2.7 Kg) in NK. The results obtained by Sulieman *et al.*, (1985) for the progeny of the first-time lambing ewe lambs from the resident flocks, show but greatly reduced birth weights for these local flocks (2.9±0.19, 2.7±0.18 and 2.2±0.2 Kg, in the Shugor , Dubasi and Watish, respectively).

These ewe lambs, from NK sheep, were weaned at about a similar live weight (17.2 Kg) to that (17.5 Kg) shown in table 1, but when they were about more than two weeks younger than those in table 1 (95 vs 112 days) and that was reflected in their higher growth to weaning (142 vs 121 gm/day). A relatively slower growth rate (124 gm/day) was reported by EL Amin and Rizgalla (1976) for a flock of Watish sheep, while more higher rates were shown by Wilson (1976) and Sulieman (1976) for other sub-type Desert Sheep, but according to Mohamed Ali *et al.*, (2014) single born male Hamari and Kabashi lambs, in the NK, weaned when 120 days old at heavier live weights (about 24 Kg) and grew more faster (0.165 Kg/day) than our present lambs (142/121 gm/day) in the Station. In the former study of Sulieman *et al.*, (1985) the overall average live weight at weaning and average growth rate to weaning was 15.73 Kg and 108 gm/day, respectively.

Sulieman (1983) reported that ewe lambs from the resident flocks were found to have attained puberty at an overall average age of 206 days when they were 20.6 Kg, on average, heavy. Some variations, in live weight existed between flocks and whether individual ewe lambs produced offsprings or they did not experience that. For the present study breeding live weight, first time breeding and lambing ages and lambing interval, are shown in Table 2.Similarly Sulieman *et al.,* (1985) in former study demonstrated that first lambing age was attained by 433 days of age which is shorter than the 473.12 days of the present study on NK ewe lambs. But EL-Hag *et al.*, (2007), studying these sheep in their ecological domain found that ewe lambs under the farmer's practice lagged behind their contemporary ewe lambs which exhibited behavioural oestrus when 8 months old and 29.5 Kg heavy, served and conceived in response to nutritional supplementation, unlike those few which were traditionally reared.

On the other hand, Dahab *et al.*, (2014) illustrated, from a questionnaire, that Hamari ewes in North Darfur and NK had their first lambs when they were 11.68±1.94 and 12.30±3.92 months old, respectively, a finding which is still shorter than our present results. Though these two sub-types at the two locations were shown to have very similar lambing interval (11.6±2.17 and 11.9±2.63 months) which closely relates to the lambing interval shown in (Table 2) obtained for the NK flock in this Station. But under these conditions of irrigated agriculture more frequent lambing events (as described by a number of authors e.g. Tempest (1983), Mukasa-Mugerwa and Lahlu Kassi (1995), Atta and EL Khidir (2003), Hassan and Talukder (2011) and Lakew *et al.,* (2014) would rather be more compatible and reasonably more feasible.

Table 2: Some performance characteristics of North Kordofan, ewe lambs under irrigated agriculture land use

Traits	N	$\bar{X}$±Se	CV%
Birth weight, Kg	17	3.81 ± 0.13	14.07
Weaning weight, Kg	17	17.35 ± 0.91	21.56
Weaning age, days	16	95.44 ± 5.29	22.18
ADG to weaning, Kg	17	0.142 ± 0.008	24.65
Breeding age, days	17	313.76 ± 12.56	16.50
Breeding live weight, Kg	17	48.06 ± 2.82	24.22
Lambing age, days	17	473.12 ± 15.08	13.14
Lambing interval, days	11	339.8 ± 32.08	37.78

N= number of animals.
$\bar{X}$±Se = mean ± stander error.
ADG = average daily gain.
CV% = coefficient of variation, percentage.

The service ratio values shown in(Table 3) were bigger for the adult ewes (1.63) than in the ewe lambs (1.00) but the resulting conception lasted non-significantly longer in the ewe lambs (153.1±0.07 vs 151.3±0.45 days). On the other hand lambing rates, litter size (per ewes available or ewes actually lambed), (Table 3) had higher mean values in the adult ewes than in the ewes that lambed for the first time.

Weight/age and/or parity effects were realized factors affecting these reproductive parameters (Sulieman *et al.*, 1990). However these gestation length values fall within the range of 145 – 154 days reported by a number of authors for different flocks of different breeds and ages, for instance, Sulieman and Essawi (1984), Sulieman *et al.*, (1990), Mukasa-Mugerwa and Lahlu Kassi (1995), Atta and EL Khidir (2003), Idris *et al.*, (2010), Hassan and Talukder (2011) and Zohara*et et al.*, (2014). But the latter authors referred to a lower range of gestation length of 141 – 145 days in indigenous ewes in Bangladesh.

The variation in lambing rate and litter size in the adult and young ewes was mainly due to the lower fertility in the latter ewes which had lesser lambing and lacked multiple birth events. Information on these sheep was shown in their region, in some studies including those by El Mobark (2001), El Hag *et al.*, (2007) and Tibin *et al.*, (2010) with different results depending on the practice provided and their values ranged from 66.96 – 85%. However, the overall lambing performance was observed to be improved by nutritional supplementation in both the mature and young ewes.

But the present lambing rate for these ewe lambs compared favourably with those in their equivalent groups of the resident Shugor, Dubasi and Watish (Sulieman et al., 1985).

As for litter size some of the available studies, for example, Wilson (1976), Sulieman *et al.*, (1978) and Sulieman and Essawi (1984) showed a range of 119 – 146% in some of the subtypes Sudan Desert Sheep. Of the factors affecting these parameter are management and nutrition and age and parity. In the present study (Table 3) it varied clearly between the two age groups of NK sheep reflecting the presence or absence of multiple births. For supportive evidence El Hag *et al.*, (2007) and Tibin *et al.*, (2010) reported that litter size in the Hamari sheep was promoted by feed supplementation in both ewe age groups, from 100 – 113% for ewe lambs as indicated by El Hag *et al.*, (2007) and from 100 - 145% in the Hamari mature ewes as indicated by Tibin *et al.*, (2010).

These observations together with the previous one on birth weight indicate a possible positive potential for reasonable productivity of NK sheep under well managed irrigated agriculture land use.

Table (3): Reproductive performance of the North Kordofan sub-type of Sudan Desert Sheep under irrigated agriculture land use

Ewe group	**Mature ewes**		**Ewe lambs**	
Traits	N	**$\bar{X}$±Se**	N	**$\bar{X}$±Se**
Ewes present (EP)	94	-	35	-
Ewes lambed (EL)	63	-	17	-
Service ratio	63	1.63	17	1.00
Gestation length, days	60	151.3±0.45	14	153.1±0.71
Lambing rate, %	-	67		48.6
Litter size :-				
Lamb /EP,%	-	71.28	-	48.6
Lamb /EL ,%	-	106.35	-	100.0
Twinning rate %	-	6.35	-	0.00

N = number of sheep

$\bar{X}$±Se = mean value ± standard error

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