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Reproductive and Productive Performance of Local Aardi Goat Breed under Intensive Production System

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## **ABSTRACT**

**Background.** Goats are an integral component of small ruminant production system in Kuwait. Baseline data of the performance of the only local goat breed in Kuwait is scarce. The main objectives were to evaluate the performance of only local goat breed under Kuwait's environmental conditions and to generate baseline data on birth weight, growth rate, and carcass characteristics of two strains of local Aardi (white color, WA, and black color, BA) were used. **Materials and Methods.** The study was conducted at the Kuwait Institute for Scientific Research's Agriculture Research Station in Kabd about 40 km southwest of Kuwait City. All goats were housed throughout the year in partially enclosed sheds having open back yards with a space allocation of 2 m<sup>2</sup>/kid. Comprehensive comparative studies were carried out on the doe's reproductive traits (conceptions, kidding rate, etc.), birth weight, and growth rate of young kids, and milk yield and milk composition of does. Weaning weight and finishing live weights of kids were compared. The finished kids were slaughtered and the carcasses were dissected. **Results.** The conception rates were 98.9% for WA and 90.9% for BA. The litter sizes were 1.20 and 1.05 for WA and BA respectively. Mean birth and weaning weights of W A were highest with 4.50 and 15.50 kg respectively. The mean daily yields during the entire lactation period were 1300.0 and 890.0 ml in BA and WA does respectively. Significant differences (P<0.05) in fat content of milk were observed between the strains. White Aardi had significantly higher hot carcass. **Conclusions.** Local Aardi goat appeared to have rearing potential under the intensive system of production. Baseline data obtained have formed the basis for recommending the future Research and Development studies for the improvement of selected goat breed in Kuwait for meat and milk production.

**Key words::** Aardi goat, growth, milk, carcass

## **INTRODUCTION**

There are several constraints hindering the development of a viable and profitable livestock production in Kuwait. These

constraints include extreme aridity associated with poor rangeland condition and unavailability of year-round forages, livestock breeds with limited production potentials, constraints on feed and inadequate nutrition, and management of livestock and livestock health problems. As a result, the efficiency of livestock production is low, and locally produced livestock products quality and quantity cannot compete with the imported products (Sidahmed, 1995).

Goat farming is complementary to dairy cow, mutton and beef meat production, but goats provide products with unique properties in human nutrition, as healthy and medical valuable food. Goat farmers contribute to diversification, risk distribution and stabilization within a country's agricultural and economy. Goats are thus an important strategies component in economic, political, and climate risk management. Under improved management and genetic selection of goats, higher profits from fewer animals can be easily achieved.

Kuwait's Aardi goat (*Capra hircus*) form an integral part of the livestock production subsector. The local goat populations were 141,000, (MOP, 2008). Therefore, goats were reported to contribute significantly (37.85%) to the lamb and mutton production in the country.

Aardi goat originated from Aardi Mountain in Najid, Saudi Arabia, and spread to Kuwait, Bahrain, Qatar and the United Arab Emirates. Aardi goats have medium body size with long hair. The goat coat's color is usually shiny black, whereas the ears, muzzles, and parts around the eyes are white or brighter in color (PAAFR, unpublished report). They have drooping ears. The head usually is big with straight face. Both sexes have horns in does with the horns turned down and frontward like half circle, whereas buck's horns are in spiral form (Salah et al., 1991).

The live weight of adult Aardi does was reported to be ranging from 26 to 40 kg (Salah et al., 1989 and Bhattacharya, 1989). He also reported that an average live weight of Aardi bucks is 51 kg, and the growth rate was reported to be 200 g/day.

The mean birth weight of Aardi kids was reported by to be 3.57±0.13 kg for single male, 3.17±0.16 kg for single females, 3.2±0.16 kg for twin males, and 2.6±0.16 kg for twin females (Salah et al., 1989). The average weaning weight of kids was

fixed to be 12.9±0.4 kg and could reach weight of 21.17 and 27.8 kg for female and male kids, respectively, at 9 mo age and grows up to 24.23 and 32.14 kg in one year for female and male kids respectively.

The average milk yield in Aardi does was reported to be 125.8 kg in 16.4 wk (Salah et al., 1991). In a study in Saudi Arabia, milk production rates of Aardi does were 454.70±16.31 ml in 3 wk, 505.05±14.65 in 6 wk, and 558.76±13.16 in 10 wk (Al-Shaikh and Mogawer, 2001). The fat % of the Aardi milk ranged from 2.29±0.31 to 3.91±0.31 depending on feeding and nutritional status (Al-Busadah, 2008). In another study, fat % in Aardi doe milk was reported to be 4.84±0.36 (Al-Shaikh et al., 2002).

The afore mentioned descriptions of Aardi goat were presented based on published findings and results. The goats were earlier managed primarily in the extensive or semi-intensive systems. However, the objectives of the studies were to examine the live weight, body measurements, and performance of Aardi goats when exposed to intensive feedlot system of management (zero grazing).

## METHODOLOGY

The study was conducted at the Kuwait Institute for Scientific Research's (KISR's) Agriculture Research Station (ARS) in Kabd about 40 km southwest of Kuwait City. All goats were housed throughout the year in partially enclosed sheds having open back yards with a space allocation of 2 m<sup>2</sup>/kid. The design of the study involved a comparison of the performance of 20 Aardi goats raised in feedlot system. The ration was formulated considering the

nutrient requirements according to National Research Council standards (NRC, 1989). Feed ingredients used for ration formulation for both adult goats and kids were roughages (alfalfa hay and straw) and concentrates (barley, wheat bran, corn, soybean meal, vitamin and mineral premix, ground limestone, and common salt). The adults were fed ration containing 70% concentrate and 30% alfalfa, and straw hay having 11.9 crude protein. The kids after weaning at 8 wk old were fed ad libitum ration containing 60% concentrate and 40% alfalfa hay having 16.7% crude protein. Individual live weight, body condition score (BCS), was taken once every two weeks, early in the morning, before the animals were fed. The level of feeding was increased at the last trimester of pregnancy.

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The does were bred naturally using a mature two-year-old buck. Does were scanned for pregnancy by the ultrasound scanner 40 day after first mating. Each doe was milked starting from the 4<sup>th</sup> day after kidding. Does were milked at 6 am and 6 pm. The milk samples were immediately taken to the laboratory, and were stored in freezer chamber at -70°C until the analysis. A portable milk analyzer was used to determine fat, non-fat (SNF), protein, lactose, casein, and density value in the milk sample.

Kids were fasted for 18 h before slaughtered and the carcasses were presented according to Colomer-Rocher et al. (1987). The lean color, carcass fat color, and carcass subcutaneous fat were evaluated.

## RESULTS AND DISCUSSIONS

White Aardi does were significantly heavier ( $P \leq 0.01$ ) by 16% than BA (Table 1). The average live weight of BA and WA at kidding was 39.68±2.95 and 47.00±3.08 respectively. The BL, WH, and CG were also significantly ( $P \leq 0.01$ ) higher of WA than BA. The BA does were young and mated for the first time in this study, and their conception rate was 90.91%. Only one doe was reported aborted. The kidding rate percentage was 109.10%. The average number of kids produced per doe litter was 1.2. The WA does were also of similar age during the first breeding time, and their conception rate was 88.89%. Two does were aborted or still birth. The total number of kids produced by does joined was 8. The number of kids produced per doe per litter was 1.0. The results of this study are comparable with a study by El Hag et al. (1995), who reported conception rate of does ranging between 90 and 100%, and average litter size ranging between 1.4 and 1.7, depending upon the age of the animal joined. Shetaewi et al. (2001) reported kidding percentage ranging between 90.0 and 63%, and the litter size being 1.38 to 1.57. However, in a study in North Cyprus, the kidding percentage reported for Damascus goats was higher and ranged between 114.3 and 125.9%, and litter size being 1.56 to 1.62.

Table 1. Body Characteristics after Kidding and Reproductive Performance of Black and White Aardi Reared under Kuwaiti Intensive Production System

Traits	Black Aardi	White Aardi
<b>Body Characteristic after kidding:</b>		
Weight (kg)	39.68 ± 2.95 <sup>a</sup>	47.00 ± 3.08 <sup>b</sup>
BCS (1-5)	4.27 ± 0.26 <sup>a</sup>	4.30 ± 0.27 <sup>a</sup>
BL (cm)	81.75 ± 4.62 <sup>a</sup>	85.33 ± 5.98 <sup>b</sup>
WH (cm)	73.21 ± 4.11 <sup>a</sup>	78.50 ± 4.53 <sup>b</sup>
CG (cm)	77.61 ± 3.66 <sup>a</sup>	86.25 ± 3.98 <sup>b</sup>
<b>Reproductive Performance:</b>		
No. of Does Mated	11	9
No. of Conceived	10	8
Abortion and Still birth	1	2
No. of Kids Born Alive	11	6
No. of Kids Aborted	1	2
Total No. of Kids Produced	12	8
Conception Rate %	90.9	88.89
Kidding Rate %	109.10	88.89
Litter Weight At Birth/Ewe Joined	3	4.515
Litter Weight At Weaning/Ewe Joined	11.7	14.89

BCS: body condition score; BL: Body Length; WH: Wither Height; CG: Chest Girth

The half day milk yield was significant higher ( $P \leq 0.05$ ) in BA (1300.0 ml) in the first week of lactation than that in WA (725 ml). However, the lactation yield for both strains was not significant at the last lactation (Table 2). The fat content was significantly higher in WA's milk at the beginning (7.6%) and the end (3.72%) of lactation than that in BA's milk (4.49 and 2.15% respectively). Iloeje et al. (1981) reported that fat percentage and milk yield of goat correlated negatively both phenotypically and genetically. No variation between SNF, protein, lactose, and casein were recorded for both strains.

Table 2. Milk Yield and Composition of First and last Week of Lactation of Black and White Aardi

Trait	First Week		Last Week	
	BA	WA	BA	WA
Milk Yield ml/12 h	1300.0±1.9 <sup>a</sup>	890.0±2.3 <sup>b</sup>	725.0±1.5 <sup>a</sup>	850.0±5.9 <sup>a</sup>
Composition %				
Fat	4.49±2.04 <sup>a</sup>	7.60±6.34 <sup>b</sup>	2.15±1.18 <sup>b</sup>	3.72±0.3 <sup>a</sup>
SNF	10.51±1.5 <sup>a</sup>	9.88±1.14 <sup>a</sup>	9.11±0.26 <sup>a</sup>	8.85±0.2 <sup>a</sup>
Protein	5.91±0.84 <sup>a</sup>	5.61±0.71 <sup>a</sup>	5.09±0.14 <sup>a</sup>	4.98±0.1 <sup>a</sup>
Lactose	4.90±0.87 <sup>a</sup>	4.47±0.48 <sup>a</sup>	4.21±0.13 <sup>a</sup>	4.03±0.06 <sup>a</sup>
Casein	5.60±1.10 <sup>a</sup>	5.62±0.22 <sup>a</sup>	35.87±1.54 <sup>a</sup>	33.44±0.5 <sup>a</sup>

BA: black Aardi; WA: white Aardi, SNF: solid non fat

All growth parameters (except BCS) of WA were significantly ( $P \leq 0.05$ ) higher than those of BA (Table 3). Results of BA kid's growth were consistent with those obtained earlier by Salah et al. (1989) and Devendra and Burns (1983).

Table 3. Growth Parameters of Weaned Black and White Kids Reared under Intensive System of Production

Trait	Black Aardi	White Aardi
Birth Weight (kg)	3.27±0.25 <sup>b</sup>	5.00±0.00 <sup>a</sup>
Weaned Weight (kg)	12.40±2.28 <sup>b</sup>	16.32±2.36 <sup>a</sup>
Finish Weight (kg)	19.51±0.45 <sup>b</sup>	26.59±0.083 <sup>a</sup>
ADG (kg)	0.12±0.004 <sup>a</sup>	0.18±0.007 <sup>a</sup>
BCS (1-5)	2.00±0.00 <sup>a</sup>	2.00±0.00 <sup>a</sup>
BL (cm)	61.67±3.78 <sup>a</sup>	66.50±0.71 <sup>a</sup>
WH (cm)	56.33±4.62 <sup>b</sup>	71.00±5.66 <sup>a</sup>
CG (cm)	61.67±2.89 <sup>b</sup>	67.50±2.12 <sup>a</sup>

ADG: average daily gain; BCS: body condition score; BL: Body Length; WH: Wither Height; CG: Chest Girth

White Aardi had significantly ( $P < 0.01$ ) higher hot carcass than BA goats (Table 4). Dhanda et al. (1999a) reported significant differences between various goat breeds for carcass weight. The subjective meat color was red for heavy weight WA and pink for BA. The color of meat was largely dictated by the concentration and chemical nature of the haemoproteins present as well as

temperature and pH of the muscle of post slaughter (Ledward, 1992; Kadim et al., 2003). The subjective fat color was scored as yellow for WA and cream for BA. Pena et al. (2007) reported white fat color appearing in light slaughter weights and changed to cream for higher slaughter weights. In contrast, Colomer-Rocher et al. (1992) reported lower scores for similar weights. Dhanda et al. (1999b) reported no effect of genotypes on fat color, only on ages. The subjective fat cover score was 2 for BA and 4 for WA. A positive relationship was observed between carcass fat cover and slaughter weight by (Pena et al., 2007). Generally, goat carcasses had a very thin layer of subcutaneous fat (1.6 to 2.2 mm) with little differences between genotypes (Colomer-Rocher et al., 1992). The ultimate meat pH ranged from 5.93 to 6.05, which was on the higher side but is in the acceptable range (Hedrick et al., 1994). A high ultimate pH is generally indicative of stress in animals.

Table 4. Carcass Characteristic of Buck Kids of Different Genotypes Reared Under Intensive System of Production

	Black Aardi	White Aardi
Hot EBW (kg)	9.41±0.51 <sup>b</sup>	14.02±0.82 <sup>a</sup>
Fat cover (1-5)	2.00±1.00 <sup>b</sup>	4.00±0.00 <sup>a</sup>
Meat color (pale, pink, red)	Pink	Red
Fat color (white, cream, yellow)	Cream	Yellow
GR (cm)	0.80±0.26 <sup>a</sup>	0.45±0.07 <sup>a</sup>
Eye muscle (cm) width	4.47±1.28 <sup>a</sup>	4.90±0.56 <sup>a</sup>
Eye muscle (cm) length	5.67±1.75 <sup>a</sup>	5.50±0.70 <sup>a</sup>
Muscle area cm <sup>2</sup>	20.16±8.76 <sup>a</sup>	21.72±5.26 <sup>a</sup>
Ultimate pH	5.93±0.11 <sup>a</sup>	6.05±0.32 <sup>a</sup>

## CONCLUSIONS AND RECOMMENDATIONS

Although WA kids had higher birth, weaning and finishing weights, BCS, body measurements, and milk fat % than BA, both strains of local Aardi goat appeared to have rearing potential under the intensive system of production. Baseline data obtained have formed the basis for recommending the future R&D studies for the improvement of selected goat breed in Kuwait for meat and milk production.

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