

Body Weight of Aardi Goat Kids in Saudi Arabia at Different Ages and Affecting Factors

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Abstract. Thirty-one males and 19 females of Aardi goat kids were used to investigate the weights at birth and 3, 6, 9 and 12 months of age. The effects of dam weight after kidding, sex, litter size and season of kidding on these weights were also studied. Birth weight averaged 3.6 ± 0.1 , 3.2 ± 0.2 , 3.2 ± 0.2 and 2.6 ± 0.2 Kg. for single males and females, twin males and females, respectively. Heavy dam produced heavy kid ($r = 0.26$), but later weights had no relation with dam weight. Males were always superior for their body weights over females. Although the weight at birth was higher for single kids than twins, the twin females compensated for this lack of weight very early than twin males. Season of kidding had no influence on body weights of the kids throughout their first year of life. The increased correlations between weights of different chronological age suggested the use of early weight as a tool of selection for high body weight of Aardi goats of older ages to increase the total productivity of these animals.

Introduction

The goats have been raised in various areas of the world for their production of meat, milk, skin and fibers as well. This species is well known for its high ability to adaptation in the tropical and sub-tropical regions and especially in the arids. In Saudi Arabia, where the climate is suitable for goats, the number of these animals is believed to exceed 2.5 millions [1] mainly of the Masri (Egyptian) and Aardi (Baladi) breeds. The Aardi goats are more adapted to the arid region than the Masri. Although the latter produces more milk [2] the first produces milk steadily and therefore is greatly appreciated by desert dwellers, where it is widely spread. The contribution of goat as a source of meat to total meat income of Saudi Arabia is about 30%. Although, the large population and substantial contribution of goats to total

meat income of Saudi Arabia, this species remains neglected and its rearing is exclusively in the hands of the nomadic people. Therefore, the productive performance of this animal has a great lack of information.

Birth weight is an important parameter in meat producing animals because it is strongly correlated with growth rate and adult size, and also the viability of the new-born kids. The present study was conducted to investigate the birth weight and weights at different ages (3 month intervals) up to one year old for Aardi goat kids and to evaluate the effects of mother weight after kidding, sex, litter size and kidding season on these weights.

Materials and Methods

The data included 31 male and 19 female Aardi goat kids from 30 does, maintained at the Animal Production Experimental Farm of King Saud University at Riyadh during the period 1985–1986. After kidding, the new-born kids were marked and weighed. The birth weight was recorded and the kids were left with their dams for sucking till weaning age at three months. They received *ad libitum* fresh alfalfa and hay beginning the third week.

About the fifth week of age, variable amounts of concentrate mixture were given to the kids to ensure that the requirements for growth were met. Water and mineral salts were also provided *ad lib*. On the morning of the second day after kidding, and before feeding, dams were weighed. The kids weighed every week during the weaning period and every two weeks thereafter. Birth weights and body weights at ages of 3, 6, 9 and 12 months were used in this study as the dependent observations.

Kids were kept indoor most of the time during the first four months and permitted to outdoor environment when it was suitable. Then they stayed outdoor all day time with shade against direct solar radiation, and indoor during night period. To study the weight effect of mother on kid weights at different ages, kids were divided into 3 groups according to the dam weight after kidding. Groups of the dams weight were as follows: light (less than 30 kg.), medium (30–37 kg.), and heavy (over 37 kg.)

According to average temperature and relative humidity the months of kidding were grouped into 3 seasons: Winter (December-February), Spring (March-April), and Fall (September-October). No kiddings occurred during hot summer months (May-August).

The effects of dam weight, sex, litter size and kidding season on kids weights at different ages were analyzed using the following model:

$$Y_{ijklm} = \mu + M_i + S_j + L_k + (SL)_{jk} + K_l + e_{ijklm}$$

where, Y_{ijklm} is the recorded weight of the m th kid of certain age, of the j th sex born within the k th litter size during the l th season from dam of i th weight, μ is the overall mean; M_i is the effect of the i th mother weight ($i = 1, 2$ and 3); S_j is the effect of the j th sex of the kid ($j = 1$ and 2); $(SL)_{jk}$ is the effect of the j th sex within the k th litter size, K_l is the effect of the l th season of kidding ($l = 1, 2$ and 3) and e_{ijklm} is the error term. All effects were considered fixed except for the error term. The data were analyzed by computer program using the Statistical Analysis System (SAS), release 5.16 [3]. The procedures used for analysis were GLM, LSMEANS and CORR.

Results and Discussion

Birth weight and live-body weight

The birth weight of various breeds of goats in the tropics was summarized by Devendra and Burns [4-5]. Its range was 1.8 to 4.9 kg. for single males and 1.6 to 4.2 kg. for single females. Those of twins were 1.8–4.4 and 1.7–3.9 kg., respectively. In Aardi goat kids the birth weight averaged 3.6 ± 0.1 kg. for single males, 3.2 ± 0.2 kg. for single females, 3.2 ± 0.1 kg. for twin males and 2.6 ± 0.2 kg. for twin females (Table 1). These weights are considerably higher than those for many other tropical breeds. This should encourage the attempts of selection for high birth weight within that local breed of Saudi Arabia. Datta *et al.* [6] reported high correlation between birth weight and live body weight increase and therefore birth weight affects the time taken to reach slaughter weight.

Live-body weights of the kids increased markedly with age ($r = 0.88$), to reach an average weight of more than eight times of birth weight. Correlations between weights increased significantly with chronological ages. Irrespective of sex and litter size, the relationships between birth weight and weights at 3, 6, 9 and 12 months of age were moderate and significant ($r = 0.42, 0.51, 0.48$ and 0.47 , respectively). Lower correlations were reported between birth weight and body weights of different ages of Mubende goats [7]. In South Indian meat goats introduced into Sri Lanka, Wijeratne [8] reported a 0.57 correlation coefficient between birth weight and one year old liver weight.

The average weaning weight of Aardi goat kids was 12.9 ± 0.4 kg. Its correlation with one-year weight was highly significant ($P < 0.01$, and $r = 0.76$), suggesting the use of weaning weight as an early criteria for selection. The correlation between 6 months weight and weight at 12 months was similar to that reported by Wijeratne [8].

Table 1. Least square means of live-body weight for Aardi goat kids at different ages

Effect	Birth	3 Months	6 Months	9 Months	12 Months
<i>Doe weight:</i>					
Light	2.92 ± 0.20^a	11.98 ± 1.09^a	19.18 ± 1.55	22.93 ± 2.20	26.09 ± 3.07
Medium	3.16 ± 0.11^{ab}	13.24 ± 0.62^b	20.56 ± 0.79	25.05 ± 1.18	28.74 ± 1.68
Heavy	3.41 ± 0.15^b	13.87 ± 0.86^b	20.61 ± 1.21	25.54 ± 1.73	30.13 ± 2.57
<i>Sex:</i>					
Male	3.39 ± 0.11^a	14.15 ± 0.65^a	22.42 ± 0.89^a	27.84 ± 1.28^a	32.41 ± 1.83^a
Female	2.95 ± 0.15^b	11.91 ± 0.82^b	17.81 ± 1.11^b	21.17 ± 1.61^b	24.23 ± 2.24^b
<i>Litter size:</i>					
Single	3.42 ± 0.13^A	13.99 ± 0.73^A	21.48 ± 0.98^A	26.43 ± 1.39^A	30.42 ± 1.98^A
Male	3.57 ± 0.13^a	15.74 ± 0.72^a	24.46 ± 0.94^a	30.10 ± 1.35^a	35.50 ± 2.03^a
Female	3.17 ± 0.16^b	12.26 ± 1.14^b	18.49 ± 1.52^{bc}	22.76 ± 2.17^{bc}	25.43 ± 3.05^b
Twin	2.92 ± 0.13^B	12.07 ± 0.77^B	18.75 ± 1.08^B	22.58 ± 1.55^B	26.21 ± 2.28^A
Male	3.20 ± 0.16^b	12.57 ± 0.90^b	20.38 ± 1.28^b	25.57 ± 1.86^b	29.31 ± 2.66^b
Female	2.64 ± 0.16^c	12.57 ± 0.97^b	17.13 ± 1.33^c	19.59 ± 1.93^c	23.42 ± 2.82^b
<i>Kidding season:</i>					
Winter	3.23 ± 0.08	12.29 ± 0.49	18.87 ± 0.76	22.93 ± 0.95	25.81 ± 1.35
Spring	3.28 ± 0.25	13.29 ± 1.41	21.81 ± 1.78	21.56 ± 2.31	31.52 ± 3.63
Fall	2.99 ± 0.15	13.52 ± 0.82	20.27 ± 1.20	24.12 ± 1.91	26.62 ± 2.57

Within each effective variable of each column, the same letter indicates no significant differences ($P < 0.05$) between means.

Factors affecting body weight of kids

Least square means of weights at different ages of Aardi goat kids and the effects of dam weight after kidding, sex, litter size and kidding season on these weights are presented in Table 1.

1) Effect of dam weight

Average weight for dams of light, medium and heavy groups were 26.5 ± 0.5 , 34.9 ± 0.2 and 41.7 ± 0.4 kg., respectively. These weights influenced kid early weights (at birth and 3 months old), but not at later ages. Heavier does produced heavier kids ($r = 0.26$). This significant relationship was applied only for the single-

born kids ($r = 0.54$), but not for twins and agreed well with the results of Payne and Miles [9]. Devendra and Burns [4] and Mittal [10] reported considerable influence of weight of the dam on the weight of the kids at birth. For Barbari and Jamnapari goats in India, the significant correlations between these two variables were 0.69 – 0.99 [10].

2) Effect of sex and litter size

Birth weight was also strongly affected by sex [10-16] and litter size [12,15]. The significant difference between sexes observed in birth weight of kids (Table 1) was also evident in later ages, where the males tended to be superior [14]. For Ganjham goats of India, Naik *et al.* [16] found no significant effects of sex on later body weights of the kids, although the male kids tended to be higher in body weight.

Single-born Aardi kids were superior in their weights at birth and later ages to twin-born kids, except at one year old. The twin birth weight was about 0.85 of single-birth weight. This figure was 0.91 for Black Bengal [17] and British Saanen [18] goats, 0.86 for Damascus goat [19] and 0.89 for Barbari goat [15]. Aardi twin-born males and females were 0.89 and 0.81 of the weight of their single-born counterparts. The corresponding values were 0.88 and 0.92 for Nubian [20] and Saanen [18] goats and 0.85 and 0.92 for Black Bengal goat [17]. These different outcomes may be due to breed differences in litter size, dam size and the efficiency of mother to convert the available feed into fetal growth. Single-born male Aardi kids remained heavier than their counterpart twins throughout the first year of age. The single-born females were superior over twin-born females by birth weight, but not by weights of later ages.

Within litter size, the effect of sex on body weight was significant at all ages for singles and only at birth, six and nine months old for twins. For Damascus (Shami) goat, Mavrogenis *et al.* [21] found that single-born kids were heavier at birth, at weaning and at 140 days of age ($P < 0.01$) than twins. Irrespective of litter size, males in general are expected to be heavier than females due to their constitutional and environmental superiority in the form of aggressive feeding behavior both on range and in stalls [22].

Birth weight was significantly correlated with live-body weight of all advanced ages for males ($r = 0.47 - 0.59$) but not for females ($r = 0.05 - 0.23$), regardless of the size of the litter. Also, it was correlated significantly with weight of single born kids at ages of 6, 9 and 12 months. There were non-significant relationships between birth weight and advanced body weights of twin-born kids, regardless of their sex.

The correlations between weaning weight and later weights were higher ($r = 0.76 - 0.81$) than those between birth weight and the same later body weights ($r = 0.47 - 0.51$) for both sexes and for singles and twins with the higher values for single males.

3) Effect of kidding season

Spring-born kids had higher weights at birth and later ages than winter and fall-born ones. The weights of the fall borns at 3, 6, 9 and 12 months were higher than for winter-born ones. All these season differences were not significant. Singh [13] and Moulick and Syrstad [17] found no significant influence of kidding season on weight at birth. Naik *et al.* [16] reported that kids born during November and December had higher body weight at birth and at 6 months of age than those born in other seasons. They found no effect for different seasons of kidding on body weight at 12 months of age. Singh *et al.* [14] reported significant season effect on birth weight and weight at 9 month of age. The different output between workers of season effect on body weight may be due to differences in breed studied and management applied, especially in nutrition and health. The system of feeding for our goats was almost the same all year around.

In conclusion, the Aardi goat as a local breed showed some high performance in respect of live-body weight at birth and at advanced ages. Further studies on growth rate of this animal under better management and later ages should be done in order to raise the total productivity of this animal for better meat production.

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وزن الجسم عند أعمار مختلفة لصغار الماعز العارضي في المملكة العربية السعودية والعوامل المؤثرة

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ملخص البحث. استخدم ٣١ ذكر و ١٩ أنثى من صغار الماعز العارضي لتقويم أوزانها عند الميلاد وعند أعمار ٣، ٦، ٩، ١٢ شهراً. كذلك درست تأثيرات وزن الأم بعد الولادة، جنس المولود، عدد الخلفات وموسم الولادة على تلك الأوزان. بلغ متوسط الوزن عند الميلاد ٣٦ ± ٠١ ، ٣٢ ± ٠٢ ، ٣٢ ± ٠٢ ، ٣٢ ± ٠٢ ، ٢٦ ± ٠٢ كجم للذكور والإناث الفرادي والذكور والإناث التوأم على التوالي. لقد أعطت الأم ذات الوزن الأعلى نتائجاً ذو وزن أعلى (معامل الارتباط ٠٢٦)، ولكن لم تظهر أي علاقة بين وزن الأم ووزن الصغار في الأعمار المتقدمة، كانت الذكور دائماً متفوقة في أوزانها عن الإناث. وبالرغم من أن وزن الصغار التي ولدت فرادي كان أكبر من تلك التي ولدت توأم إلا أن الإناث التوأميه عوضت هذا النقص في الوزن مبكراً جداً عن مثيلاتها الذكور. أما موسم الولادة فلم يكن له أي تأثير على وزن الناتج خلال السنة الأولى من عمره.

ويقترح من العلاقة المتطردة بين أوزان الصغار عند الأعمار المختلفة من إمكانية استخدام الأوزان المبكرة كمعايير انتخاب لصفة الوزن العالي في الماعز العارضي لزيادة الإنتاجية الكلية لتلك الحيوانات.