PRE-WEANING GROWTH PERFORMANCE OF SYRIA DAMASCUS GOATS

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SUMMARY

Data of 554 Damascus kids were used during 2007 to investigate the effects of some environmental factorson birth weight (BW), weaning weight at 60 days of age (WW) and average daily gain (ADG). These factors were parity of doe, month of kidding, type of birth and sex of kid. This study was carried out at Karhta station belonging to the General Commission for Scientific Agriculture Research, Syria.
Analysis of variance showed that parity had significant effect (P< 0. 01) only on weaning weight. The effects of month of kidding and sex of kid were significant on weaning weight and average daily gain.Whereas, type of birth had significant (P< 0. 01) effect on all the studied traits (BW, WW and ADG).
It was concluded that the birth weight, weaning weight and average daily gain for Damascus kids in Syria are comparable to those in other countries. Therefore, convenient environmental and management conditions could play a major role in improving these traits. Additionally, it is probable that crossbreeding Damascus goats with other local breeds in Syria may improve these traits for local breeds.

Keywords: Birth weight, Weaning weight, Average daily gain, Damascus goats, Syria

INTRODUCTION

Goats (*Capra hircus*) were the earliest ruminants domesticated around 7000 to 9000 B.C. Goats are also known as (poor man's cow). Furthermore, they positively contribute to the rural poor's livelihood in developing countries (Patel *et al.,* 2019).

The number of goats has increased in the world by 67%, therefore their milk yield increased by 79% between 1991 and 2012. This reflects the goats importance in the future (FAO, 2013). There are many factors affecting milk yield in goats such as breed, environmental conditions, lactation length, parity, number of born kids and management policy (Lobo *et al.*, 2017).

Damascus goats breed is considered as the most important livestock in Syria, because they have distinct production and reproduction traits. There were about 41087 heads of goats in Syria (Annual agriculture statistical group, 2018).

Growth traits are one of the fundamental economic traits of goats in different production systems and useful in formulating management and selection decisions. Moreover, weight at birth is one of the first parameters that could be easily measured and critical single parameter of subsequent growth traits. This is due to the heavier kids could grow quicker and healthier than the lighter kids (Sofienaz, *et al.,* 2014 ; Susilorini *et al.,* 2017). Moreover, the differences in birth weight, type of birth and survival rate before weaning play critical role of genetic improvement of goats (Kostaman and danSutam, 2006).

Weaning weight and average daily gain are the most crucial economic traits for meat, because they affect significantly income of farms. In goats enterprises, weaning time of kids has a critical importance for kid growth and marketable milk productivity (Rojo-Rubio *et al.*, 2016).

Many studies indicated that weaning stress might be decreased by efficient management policies. The convenient management conditions would lead to get the greatest marketable milk without causing issues both in health and growth of the kids. Long suckling period negatively affects rumen development of kids, in addition leads to losses in marketable milk production from does (Singh-Knights and Knights, 2005).

Type of birth strongly affects reproductive efficiency and birth weight. Kids delivered from single kidding will be heavier and healthier than that delivered from twins or triplets kidding. In addition, the birth weight decreases with increasing number of kids born (Hagan *et al.*, 2014).

There might be a few studies about these traits. Therefore, the aim of this study was to investigate the effects of some environmental factors such as parity of doe, month of kidding, type of birth and sex of kid on birth weight, weaning weight and average daily gain of Damascus goats under intensive production system in Syria.

MATERIALS AND METHODS

Data:
The data of kidding date, birth and weaning weight were collected from records of 554 kids born during the 2007 at Karahta station belongs to the General Commission for Scientific Agriculture Research in Damascus province in Syria.

Herd management:
Animals were raised under free housing system in semi-closed sheds with concrete floors. After

kidding, birth weight was recorded, then kids were weekly weighed with a scale (±0.2 kg), and taken into individual pens. Colostrum was supplied to kids in the first five days of age. Beside milk, green fodder, alfalfa hay and concentrates (barley, corn, bran and soya meal) were gradually given during the suckling period. The age at weaning was 60 days. Water was available all the time. Goats were machine milked twice a day at 06.00 a.m. and 6.00 p.m.

Studied traits:
1. Birth weight (BW, kg).
2. Weaning weight (WW, kg).
3. Average daily gain (ADG, g/day) = (Weaning weight - Birth weight) /60.

Statistical analysis:
    Data were subjected to statistical analysis of variance, using the General Linear Model of XLSTAT 2020.3.1.27 program. The statistical model was:

$Y_{ijklm} = \mu + P_i + M_j + T_k + S_l + e_{ijklm}$

Where:
Y_{ijklmn} = observation on m^{th} animal for the studied traits,
μ = the overall mean,
P_i = the fixed effect of ith parity of doe, and i= 1, 2, 3and ≥4 where 1= first kidding, 2 = second kidding, 3= third kidding and ≥4 = fourth kidding and more,
M_j = the fixed effect of jth month of kid ding and j= 1, 2 and 3, where 1= January, 2= February, and 3= March,
T_k = the fixed effect of kth type of born, and k = 1 and 2, where 1= single kidding, 2= twins kidding,
S_l = the fixed effect of lth sex of kid, and l=1, 2 where 1 = male and 2= female, and
e_{ijklmn}= the random error assumed normally and independently distributed (NID) with mean 0 and variance δ_2^2.

RESULTS AND DISCUSSION

    It is apparent from data in Table 1 that the overall mean of birth weight (BW) of Damascus kids was4.18±0.014 kg.This estimate was higher than those reported on Etawah Crossbred goats (3.84 kg) by Susilorini *et al.* (2017)in Indonesia, Atou *et al.* (2017) on Tunisian local goats(2.34 kg), Patel *et al.* (2019) on Mehsana goats(2.55 kg)in India, Ofori and Hagan (2020) on West African Dwarf goats(1.48 kg) in Ghana, Anggraeni *et al.* (2020) on Saperagoats (2.98 kg)in Indonesia, Usha and Kumaravelu (2020, 1.60 kg) on Karunkanni goats in India, Tesema *et al.* (2021, 2.52 kg) on (Boer x Central Highland) crossbred goats in Ethiopia, and Selvam *et al.* (2021, 2.35 kg) on Indian goats.
Whereas, the overall mean of weaning weight (WW) ofDamascus goats was 13.63±0.13 kg. This value was greater than those reported by Anggraeni *et al.*

(2020) on Sapera goats(7.08 kg) in Indonesia ,Ofori and Hagan (2020) on West African Dwarf goats(5.35 kg) in Ghana, and Selvam *et al.* (2021) on Indian goats(8.06 kg). But this estimate of WW was lower than that reported by Mnati *et al.* (2015, 15.53 kg).
The overall mean of ADG was 167±0.002 g/day (Table 1). This estimate was higher than the values reported by Ofori and Hagan (2020) on West African Dwarf goats (32.26 g/d) in Ghana, Usha and Kumaravelu (2020) on Karunkanni Kids(74.73 g/d) in India, Tesema *et al.* (2021) on (Boer x Central Highland) crossbred goats(48 g/d) in Ethiopia, and Selvam *et al.* (2021) on Indian goats(60 g/d).
These differences in WW might be due to the variations in breed type, BW, ADG, weaning age, feeding, hygiene, management and/or climatic conditions.

Effect of parity of doe:
    Table 1 presents the effect of parity of doe on BW of kid which was non-significant. This result is in accordance with that of Usha and Kumaravelu (2020) on Karunkanni Kids in India and Kasap *et al.* (2020) on Saanen kids in Croatia. Contrary to our finding, Khandoker *et al.* (2018) found that BW was increased by progressing parity on Saanen goats in Malaysia. Tesema *et al.* (2021) found that BW of kids born from the first and fifth parities were lighter than those from other mid parities (2-4) in (Boerx Central Highland) crossbred goats in Ethiopia. The authors explained that earlier-paritygoats continue to grow till reaching adult weight and compete with their foetuses for available nutrients during pregnancy.
    Nevertheless, Table 1 showed that the effect of parity of doe on WW was significant (P<0.01). The kids delivered from first parity had lighter WW (12.84 kg) compared to other parities. This might due to development of the physiological processes with increasing parity of the dam including udder functions that leads to better maternal environment in terms of milk for the suckling kids. The obtained result agree with Al-Azawi (2011) who found that the WW was the highest for kids delivered from Shami goats at 2-3 years in Iraq. Barazandeh *et al.* (2012) indicated that the WW increased by increasing parity till sixth parity and return to decrease in Raini Cashmere goats in Iran. This finding conflicts with Usha and Kumaravelu (2020) and Tesema *et al.* (2021) who did not find any obvious effect for parity on WW of Karunkanni kids in India and (Boer x Central Highland) crossbred goats in Ethiopia.
Whereas, the result in this study revealed that parity of doe was non-significantly affected the ADG (Table 1). This result agreed with Usha and Kumaravelu (2020) on Karunkanni Kids in India. Conversely, Barazandeh *et al.* (2012) found that ADG was the lightest in the first parity compared to other parities of Raini Cashmere goats in Iran.

Table 1. Least Squares Means (LSM) and standard errors (±SE) of the studied traits of Damascus kids as affected by parity of doe

Classification[1]	Studied traits (LSM±SE)		
	Birth weight (BW, kg)	Weaning weight (WW, kg)	Average daily gain (ADG, g)
Overall mean	4.18±0.014	13.63±0.13	167±0.002
Parity of doe	**NS**	**	**NS**
1	4.12±0.035	12.84[a] ±0.34	163±0.006
2	4.19±0.038	13.19[ba]±0.36	167±0.006
3	4.21±0.037	14.55[b]±0.36	174±0.006
≥ 4	4.18±0.037	13.93[ba] ±0.35	165±0.006

1: Means followed by different superscripts within each column within each trait are significantly different (P<0.05), **(P<0.01), NS: not significant.

Effect of month of kidding:

Result in Table 2 show that month of kidding had no significant effect on BW. It ranged between 4.12 kg during March and 4.25 kg during January. This result agreed with those of Birteeb and Lomo (2015) on West African Dwarf kids in Ghana, Atoui *et al.* (2017) on Tunisian local kids, Patel *et al.* (2019) on Mehsana kids in India, Anggraeni *et al.* (2020) on Sapera goat kids in Indonesia. On the contrary, Barazandeh *et al.* (2012) reported that the value of BW was greater significantly during February compared to other months on Raini Cashmere kids in Iran. Furthermore, Tesema *et al.* (2021) found significant effect for season of kidding on BW of (Boer x Central Highland crossbred) goats in Ethiopia, it was heavier (2.6 kg) in short rain compared to other seasons.

However, the results in this study showed that month of kidding had a significant effect on WW and ADG traits. The highest values of WW and ADG (16.71 kg and 196 g/d, respectively) were observed in January and the lightest values (10.58 kg and 147g/d,

respectively) were observed in March, (Table 2). This is due to differences in available feedstuffs and environmental conditions among months. This result is in accordance with Mnati *et al.* (2015) on goat kids in Iraq. Barazandeh *et al.* (2012) found that the WW and ADG were greatest (11.04 kg and 94.78 g/d, respectively) during January and lightest during February, (8.89 kg and 69.44 g/d, respectively), on Raini Cashmere kids in Iran. Also, Sarma *et al.* (2019) reported that season of kidding had a significant effect on early growth traits of mountain goat in India. Inversely, Birteeb and Lomo (2015) found that the kidding season had no significant effect on weaning weight and average daily gain on West African Dwarf goats in Ghana. Also, Anggraeni *et al.* (2020) did not find any significant effect formonth of kidding on WW of Sapera goat kids in Indonesia. They attributed to that the two months of kidding were still in one kidding season (end of the rainy season).

Table 2. Least Squares Means (LSM) and standard errors (±SE) of the studied traits of Damascus kids as affected by month of kidding

Classification[1]	Studied traits (LSM±SE)		
	Birth weight (BW, kg)	Weaning eight (WW, kg)	Average daily gain (ADG, g)
Month of kidding	NS	**	**
January	4.25±0.017	16.71[c] ±0.17	196[c] ±0.003
February	4.16±0.045	13.59[b] ±0.43	159[b] ±0.007
March	4.12±0.069	10.58[a] ±0.66	147[a] ±0.011

1: Means followed by different superscripts within each column within each trait are significantly different (P<0.05), **(P<0.01), NS: not significant.

Effect of type of birth:

Table 3 shows that the BW, WW and ADG of kids from single kidding (4.52, 14.74 kg, 176 g/d, respectively) were significantly (P<0.01) higher than those from twins kidding (3.84, 12.51 kg, 158 g/d, respectively). Higher birth weight of single born kids was due to more nutrition available and more space in the uterus from the mother during prenatal period compared to multiple kids. Additionally, there is no competition between kids during suckling period on single kidding. The same trend was found by Mohammed *et al.* (2018) on Saudi Aradi kids, Patel

et al. (2019) on Mehsana kids in India and Tesema *et al.* (2021) on (Boer x Central Highland) crossbred kids in Ethiopia. Meanwhile, Ofori and Hagan (2020) found that the BW and WW were the highest in single kidding compared to twins and triplets kidding, but the ADG was the greatest in triplets kidding compared to single and twins kidding on West African Dwarf kids in Ghana. Conversely, Anggraeni *et al.* (2020) indicatedthat the BW decreased by increasing number of kids born. But,they did not find any significant effect for type of birth on weaning weight of Sapera kids in Indonesia.

However, Kasap *et al.* (2020) did not find any significant effect of type of birth on BW on Saanen kids in Croatia. In the meantime, Usha and Kumaravelu (2020) did not find any significant effect for type of birth on BW, WW and ADG on Karunkanni kids in India.

Table 3. Least Squares Means (LSM) and standard errors (±SE) of the studied traits of Damascus kids as affected by type of birth

Classification[1]	Studied traits (LSM±SE)		
	Birth weight (BW, kg)	Weaning weight (WW, kg)	Average daily gain (ADG, g)
Type of birth	**	**	**
Single	4.52[b]±0.035	14.74[b]±0.34	176[b]±0.006
Twins	3.84[a]±0.030	12.51[a]±0.28	158[a]±0.005

Means followed by different superscripts within each column within each trait are significantly different (P<0.05), **(P<0.01).

Effect of sex of kid:

In Table 4, the BW mean of male and female kids were 4.21±0.031 kg and 4.15±0.032 kg, respectively. The effect of sex of kid on BW was non-significant. Present finding corroborated to reports of Anggraeni *et al.*(2020)Indonesian goat kids, Kasap *et al.* (2020) on Saanen kids in Croatia,Ofori and Hagan (2020) on West African Dwarf kids in Ghana and Selvam *et al.*(2021) on Indian goat kids. Conversely, previous studies reported higher birth weights of male kids than females (Khandoker*et al.*, 2018; Patel *et al.,* 2019 and Tesema *et al.,* 2021). The authors attributed that to longer gestation periods and to the effect of male sex hormone, which influences grow faster during pre-natal development for male kids compared to females.

In this context, Table 4 shows that sex of kid exerted a highly significant influence on WW and ADG of Damascus kids. The mean of WW and ADG of male kids (14.21 kg and 174 g/d, respectively) were significantly (P<0.05) higher than those of female kids (13.05 kg and 161g/d), respectively.

This is might be due to the variations in hormonal status between males and females. Similar results were found by Mioč *et al.*(2011) and Barazandeh *et al.*(2012). The authors reported that male kids grew faster than females .

On the contrary, Ofori and Hagan (2020), Anggraeni *et al.* (2020) and Selvam *et al.* (2021) didn't find any significant differences in WW and ADG for both sexes of kid on West African Dwarf kids in Ghana, Sapera kids in Indonesia, and Indian kids, respectively.

Table 4. Least Squares Means (LSM) and standard errors (±SE) of the studied traits of Damascus kids as affected by sex of kid

Classification[1]	Studied traits (LSM±SE)		
	Birth weight (BW, kg)	Weaning weight (WW, kg)	Average daily gain (ADG, g)
Sex of kid	NS	**	**
Male	4.21±0.031	14.21[b]±0.29	174[b]±0.005
Female	4.15±0.032	13.05[a]±0.30	161[a]±0.005

Means followed by different superscripts within each column within each trait are significantly different (P<0.05), **(P<0.01), NS: not significant.

CONCLUSION

Damascus goat kids are raised successfully under intensive production system in Syria. Some non-genetic factors such as parity of doe, month of kidding, birth type and sex of kid should be considered when kids are evaluated. The birth weight, weaning weight and average daily gain of the same breed in this study were higher than those in the most other studies. It could be deduced that better environmental and management conditions could play a major role in improving these traits.

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DECLARATIONS

CONFLICTS OF INTEREST: The authors declare no competing interest
AVAILABILITY OF DATA AND MATERIAL: Data will be provided by corresponding author on reasonable request.
ETHICS APPROVAL: The study did not involve animal handling.

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أداء النمو في مرحلة ما قبل الفطام لجداء الماعز الدمشقي السوري

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تم إستخدام بيانات ٥٥٤ من جداء الماعز الدمشقى خلال عام ٢٠٠٧ ، وذلك لدراسة تأثير بعض العوامل البيئية على وزن الميلاد (كجم) ووزن الفطام (كجم) عند عمر ٦٠ يوم من الميلاد ومتوسط الزيادة اليومية (جم/يوم). كانت العوامل التي درست هي ترتيب موسم ولادة العنزات، وشهر الميلاد وحالة الولادة وجنس الجدي. أُجريت هذه الدراسة في محطة قرحتا التابعة للهيئة العامة للبحوث العملية الزراعية في سورية.

بلغ المتوسط العام لكلٍ من وزن الميلاد ووزن الفطام ومتوسط الزيادة اليومية ٤.١٨±٠.٠٣٥ كجم، ١٣.٦٣±٠.١٣ كجم، ١٦٧±٠.٠٠٢ جم/يوم، على الترتيب.

أظهرت النتائج وجود تأثير معنوي (P< 0. 01) لترتيب موسم الولادة على وزن الفطام، وتأثير معنوي (P< 0. 01) لكلٍّ من شهر الميلاد وجنس الجدي على وزن الفطام ومتوسط الزيادة اليومية. في حين أثرت حالة الولادة (فردية أو توأميه) معنوياً (P< 0. 01) على جميع الصفات المدروسة.

نستنتج من هذه الدراسة بأن وزن الميلاد ووزن الفطام ومتوسط الزيادة اليومية لجداء الماعز الدمشقي في سورية يضاهي مثيلاته في الدول الأخرى. لذلك، يمكن أن تلعب الظروف البيئية والإدارية المناسبة دورًا رئيسياً في تحسين هذه الصفات. بالإضافة إلى ذلك، من المحتمل أن يؤدي تهجين الماعز الدمشقي مع السلالات المحلية الأخرى في سورية إلى تحسين هذه الصفات للسلالات المحلية.