

RELATIONSHIP BETWEEN BODY CONFORMATION AND MILK YIELD AND COMPOSITION IN ZARAIBI AND DAMASCUS GOATS

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ABSTRACT

This experimental work was carried out to investigate the relationship among age, body weight, body length, body circumference, body height or body condition score and reproductive performance, (represented in mating period, gestation period, litter size, weaning weight and growth rate till weaning), milk yield and composition for Damascus and Zaraibi goats.

Damascus does showed that mating period decreased significantly ($P<0.05$), while birth weight increased significantly ($P<0.05$) with aging. Litter size was significantly ($P<0.05$) lower, while weaning weight was significantly ($P<0.05$) higher for does aged 3-6 years. However, growth rate till weaning decreased significantly ($P<0.05$) with increasing does age above 6 years. Average daily milk yield and protein content increased significantly ($P<0.05$) with increasing age. Mating period was significantly ($P<0.05$) higher with body weight of 41-50 kg. Litter size decreased significantly ($P<0.05$), while both birth and weaning weight increased significantly ($P<0.05$) with increasing body weight more than 40 kg. Average daily milk yield did not significantly affected by body weight and body circumference. The contents of lactose and solids not fat in milk decreased significantly ($P<0.05$) with increasing body weight over 40 kg. Milk yield increased significantly ($P<0.05$) with increasing body length. The content of fat, protein, solids not fat and total solids were significantly ($P<0.05$) higher with body circumference over 100 cm. Mating period decreased significantly ($P<0.05$), however, birth and weaning weight and growth rate till weaning increased significantly ($P<0.05$) with increasing body height more than 65 cm. Mating period decreased significantly ($P<0.05$) with increasing body condition score. Litter size, birth and weaning weight and growth rate till weaning increased significantly ($P<0.05$) with increasing body condition score up to 4. Milk yield and fat content increased significantly ($P<0.05$) with increasing body condition score up to 4 and the contents of protein, solids not fat and total solids increased significantly ($P<0.05$) with increasing body condition score up to 3. While, lactose content was significantly ($P<0.05$) lower with body condition score 1.

With regard to Zaraibi does, mating period, birth and weaning weight and growth rate till weaning were higher significantly ($P<0.05$) with age 3-6 years. Average daily milk yield and protein content increased significantly ($P<0.05$) with increasing age, however, lactose content decreased significantly ($P<0.05$) after 6 years of age. Mating period decreased significantly ($P<0.05$), while litter size, birth and weaning weight and growth rate till weaning increased significantly ($P<0.05$) with increasing body weight more than 30 kg. Average daily milk yield and the contents of fat, protein, solids not fat and total solids in milk were significantly ($P<0.05$) higher in does with body weighed 41-50 kg. Milk yield increased significantly ($P<0.05$) with increasing body length. Mating period was significantly ($P<0.05$) lower, while litter size, birth and weaning weight and growth rate till weaning were significantly ($P<0.05$) higher with body circumference more than 80 cm. While, milk yield and composition were not significantly affected by body circumference. Mating period decreased significantly ($P<0.05$), however, birth and weaning weight and growth rate till weaning increased significantly ($P<0.05$) with increasing body height more than 55 cm. Milk yield increased significantly ($P<0.05$) with increasing body height more than 60 cm. However, the contents of fat, lactose, solids not fat and total solids in milk decreased significantly ($P<0.05$) with increasing body height more than 55 cm. Mating period decreased significantly ($P<0.05$) with increasing body condition score. Litter size, birth and weaning weight and growth rate till weaning, milk yield and the contents of protein, lactose, solids not fat and total solids in milk increased significantly ($P<0.05$)

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with increasing body condition score up to 4. While, fat content increased significantly ($P < 0.05$) with increasing body condition score up to 3.

Keywords: Damascus and Zaraibi goats, body conformation, reproductive performance, milk yield and composition.

INTRODUCTION

Body condition score and its utilization are important in terms of attaining the desired performance for certain physiological periods within sheep breeding where extensive conditions are dominant. It is indicated that there might be differences among score values for various physiological periods of different genotypes bred in our country and that basic studies for determining these values should be carried out (**Bicer, 1991**).

During mating time, sheep in better condition comparable to others demonstrate a higher value in terms of reproductive performance. Accordingly, determination of body condition of sheep in the flock and improving it to optimal level during mating time could result in quantitative improvement of lamb efficiency (**Sezenler et al., 2007**).

Body condition score (BCS) at breeding, age of ewes, and genotypes have been observed to be affecting fertility and litter size (**Sezenler et al., 2011**).

The BCS had a significant effect on birth weight of lambs, lambs weaning weight and colostrum production ($P < 0.05$) where the score of 3 at mating time could optimize profitability of Sanjabi ewes (**Jalilianand Moieni, 2012**).

Cabiddu et al. (1999) expressed that from day 120 of lactation there was a tendency towards a higher average milk yield in the herd with the highest BCS as shown by **Branca and Casu (1989)** and **Attiet et al. (2001)** in sheep. However, there was slight negative correlation between mean BCS and milk yield (**Morand-Fehr et al., 1989**). This correlation indeed much influenced by the inverse relationship during lactation between milk yield and BCS.

Many studies reported high correlation between BCS and milk production and composition (**Zahraddeen et al., 2009; Ahmed et al., 2010 and Pambu et al., 2011**) and that BCS affects the reproduction performance of dairy animals (**Suharto et al., 2008 and Serin et al., 2010**).

BCS was an important indicator to predict the traits of milk produced of *Peranakanetawah* goats, thus BCS can be used as a marker for milk production and milk quality (**Susilorini et al., 2014**).

The objective of this study was to investigate the relationship among age, body weight, body length, body circumference, body height and body condition score with reproductive performance, milk yield and its compositions in Damascus and Zaraibi does.

MATERIALS AND METHODS

The current work was carried out at Sakha Animal Production Research Station, belonging to Animal Production Research Institute (APRI), Agricultural Research Center (ARC), Egypt.

Thirty two Damascus goats aging 2.5-7.5 years and weighing 33-59 kg and forty one Zaraibi goats aging 2.2-8.5 years and weighing 21-46 kg were used in the study. The body measurements of the goats were estimated at the start of mating season (autumn season). Body length (BL), circumference (BC) and height (BH) were measured with a measuring tape in centimeter. The body condition score (BCS) were manually evaluated by palpating the fullness of muscling and fat cover over and around the vertebrae in the loin area. The points scale between 1 and 5 as described by **Spahr, (2004)** was used (1 = extremely thin, 2 = thin, 3 = good, 4 = fat, 5 = obese). Reproductive performance (mating period, gestation period, litter size, birth weight, weaning weight and growth rate till weaning) were recorded. Mating (MP) was recorded from the beginning of mating season in 1st September until gestation period (GP) which described from mating until kidding.

Litter size (LS), birth weight (BW), weaning weight (WW) (45 days for Damascus kids and 90 days for Zaraibi kids) and average daily gain (ADG) were recorded.

Average daily milk yield was recorded biweekly from kidding till the end of lactation seasons. Milk samples were taken monthly for

chemical analysis for fat, protein, lactose, solids not fat (SNF) and total solids (TS) by Milko Scan device.

Data were subjected to statistical analysis by one-way ANOVA, using General Linear Models procedure adapted by IBM SPSS Statistics (2013). Differences among means were tested according to Duncan's New Multiple Range Test (Duncan, 1955) whenever the differences were significant.

RESULTS AND DISCUSSION

A descriptive statistics of body conformation of Damascus and Zaraibi goats are shown in Table (1). The results of Damascus goats indicate means of 4.99±0.10 years for age; 46.07±0.34Kg for body weight; 54.12±0.16 cm for body length; 95.70±0.42cm for body circumference; 66.14±0.15 cm for body height and 3.64±0.07 for body condition score. The corresponding values of coefficient of variance (CV) were 32.26; 11.67; 4.79; 7.00; 3.66 and 29.04%, respectively. Estimates of Zaraibi goats were; age 4.35±0.11 years; body weight 33.17±0.34Kg; body length 46.94±0.16 cm; body circumference 84.56±0.45 cm; body height 58.26±0.17 cm and body condition score 3.03±0.07. The corresponding values of CV were 40.80; 16.00; 5.09; 8.22; 4.62 and 33.89%,

respectively. Spahr (2004) and Villaquiran *et al.* (2004) recommended that BCS of 3.0 to 3.5 as optimal for goats within breeding season. The coefficient of variation of a trait gives an idea of size of discrepancy of the tested data (El Khidir, 2009).

The relationship of age with reproductive performance, milk yield and composition of Damascus and Zaraibi goats are shown in Table (2). Mating period decreased significantly (P<0.05) with older age more than 3 years for Damascus and Zaraibi does, which had high negative (P<0.05) correlation between them (r=-0.236** and -0.185**). Gestation period did not affect by age of Damascus or Zaraibi does. Litter size was significantly (P<0.05) lower when Damascus does aged 3-6 years, while it was higher (P<0.05) when Zaraibi does aged 3-6 years. Damascus goats have heavier birth weight at ages over 3 years (P<0.05) (r= 0.214**). Weaning weight was significantly (P<0.05) heavier when does aged 3-6 years. Daily gain maintained the same rate until 6 years old then start to decrease in Damascus goats (P<0.05) (r=-0.169**), while in Zaraibi does the daily gain increased by increasing age till 6 years then start to decrease (P<0.05) when age older than 6 years.

Table 1: Body measurement and conformation at meeting season of Damascus and Zaraibi goats.

Item	Body conformation				
	Minimum	Maximum	Mean	SE	CV%
Damascus					
Age (year)	2.53	7.47	4.99	0.10	32.26
Body weight (kg)	33.00	59.00	46.07	0.34	11.67
Body length (cm)	48.00	60.00	54.12	0.16	4.79
Body circumference(cm)	82.00	114.00	95.70	0.42	7.00
Body height(cm)	60.00	70.00	66.14	0.15	3.66
Body condition score	1.00	5.00	3.64	0.07	29.04
Zaraibi					
Age (year)	2.16	8.48	4.35	0.11	40.80
Body weight (kg)	21.00	46.00	33.17	0.34	16.00
Body length (cm)	40.00	53.00	46.94	0.16	5.09
Body circumference(cm)	64.00	107.00	84.56	0.45	8.22
Body height(cm)	52.00	64.00	58.26	0.17	4.62
Body condition score	1.00	5.00	3.03	0.07	33.89

Average daily milk yield increased significantly (P<0.05) with advance of age with Zaraibi does (r= 0.194*), while Damascus does showed increased daily milk yield till 6 years old

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($P < 0.05$) then maintain the level ($r = 0.152^*$). Milk composition not significantly affected by age for Damascus does. While, Zaraibi does had the same similarity in contents of fat, solid not fat, total solid and ash over the ages studied, while protein content increased significantly ($P < 0.05$) with increasing age above 3 years and lactose decreased by aging especially after 6 years old ($P < 0.05$) ($r = -0.249^{**}$). These results are in agreement with those obtained by **Sezenler *et al.* (2011)** that age was positively correlated with both reproductive performance of fertility rate and litter size displaying an increasing trend with advance of age. **Raats *et al.* (1983)** found that milk production of Boer goats increased with age from 2 to 6 years. **Alsheikh (2013)** stated that milk yield of Zaraibi and Shami goats increased with increasing age.

Changes in body weight as affected by reproductive performance, milk yield and compositions for Damascus and Zaraibi goats are shown in Table (3). Mating period of Damascus does was significantly ($P < 0.05$)

longer with medium body weight ranged 41-50 kg, while shorter at weights less or over. In Zaraibi does mating period was more extend with smaller weights ($P < 0.05$) (21-30kg) then shorten by increasing body weight ($r = -0.264^{**}$). Gestation period of Damascus and Zaraibi does don't vary by changes in body weights. Litter size, in Damascus goats, was greater at smaller weights (31-40kg) ($P < 0.05$) compared to heavier body weight more than 40 kg ($r = -0.236^{**}$). Litter size, in Zaraibi goats, oppositely was the least at smaller weight (21-30 kg) ($P < 0.05$) compared to heavier weights (31-50 kg) ($r = 0.254^{**}$).

Both birth and weaning weight of kids increased significantly ($P < 0.05$) with heaviest body weight in both Damascus ($r = 0.286^{**}$ and 0.145^* , respectively) and Zaraibi does (0.289^{**} and 0.290^{**} , respectively). Growth rate till weaning in Damascus goats did not affected by body weight of does, while increased significantly ($P < 0.05$) with increasing body weight of Zaraibi does ($r = 0.278^{**}$).

Table 2: Effect of age (year) on reproductive performance, milk production and composition of Damascus (Dam) and Zaraibi (Zar) goats.

Item	Age (year)						SEM	
	<3		3 - 6		>6		Dam	Zar
	Dam	Zar	Dam	Zar	Dam	Zar		
Mating period (day)	17.13 ^a	6.30 ^a	8.38 ^b	2.36 ^b	8.42 ^b	2.75 ^b	0.88	0.33
Gestation period (day)	153.5 ^a	153.2 ^a	155.46 ^a	152.27 ^a	154.33 ^a	153.25 ^a	0.18	0.26
Litter size	1.12 ^a	1.30 ^b	1.00 ^b	1.68 ^a	1.17 ^a	1.38 ^b	0.02	0.04
Birth weight (kg)	3.81 ^b	3.05 ^b	4.20 ^a	3.86 ^a	4.16 ^a	3.06 ^b	0.04	0.08
Weaning weight (kg)	15.25 ^b	15.90 ^b	15.70 ^a	20.36 ^a	15.05 ^b	15.00 ^b	0.09	0.38
Daily gain (g/day)	254.17 ^a	142.78 ^b	255.56 ^a	183.33 ^a	241.92 ^b	132.64 ^b	1.66	3.44
Milk yield (kg/day)	1.62 ^b	1.68 ^b	2.00 ^a	1.83 ^{ab}	1.99 ^a	2.09 ^a	0.06	0.05
Fat %	4.35 ^a	4.4 ^a	4.46 ^a	4.42 ^a	4.29 ^a	4.39 ^a	0.05	0.08
Protein %	2.61 ^a	2.38 ^b	2.62 ^a	2.68 ^a	2.53 ^a	2.72 ^a	0.05	0.07
Lactose %	4.26 ^a	4.35 ^a	4.14 ^a	4.23 ^a	4.11 ^a	4.00 ^b	0.03	0.04
Solids not fat %	7.51 ^a	7.40 ^a	7.41 ^a	7.58 ^a	7.32 ^a	7.39 ^a	0.06	0.08
Total solids %	11.86 ^a	11.8 ^a	11.87 ^a	12 ^a	11.61 ^a	11.77 ^a	0.1	0.14
Ash %	0.65 ^a	0.67 ^a	0.65 ^a	0.67 ^a	0.68 ^a	0.67 ^a	0.01	0.01

Values in percentages or means. Values with different letters (a, b) in the same row differ significantly ($p < 0.05$)

Average daily milk yield did not affected by differences in body weight of Damascus does, while in Zaraibi does slight increase in milk yield was noticed until increasing weight till 40 kg

then increase became significant ($P < 0.05$) ($r = 0.474^{**}$). The contents of lactose and solids not fat in milk of Damascus does decreased significantly ($P < 0.05$) with increasing body

weight over 40 kg ($r = -0.152^*$ and -0.095 , respectively). While, milk percentages of fat, protein, total solids and ash were negligibly changed with different body weights. Zaraibi does differently showed that contents of fat, protein, solids not fat and total solids had increasing trend by increasing weight, but increase was more pronounced at weight 41-50 kg ($P < 0.05$) ($r = 0.183^*$, 0.217^* , 0.271^{**} and 0.247^{**} , respectively). The percentage of ash was insignificantly affected by changes in body weights of the two breeds. These results agree

with **Serin *et al.* (2010)** who found that body weight had a significant effect on fertility of Saanen goats during breeding season. **Snyman (2010)** reported that body weight at mating had significant positive relationship with reproduction of Angora goats. Number of kids scanned, born and weaned per Maiden doe increased with the increase of body weight at first mating. **Alsheikh (2013)** stated that milk yield of Zaraibi and Shami goats increased with increasing live body weight.

Table 3: Effect of body weight (kg) on reproductive performance, milk yield and composition of Damascus and Zaraibi goats.

Item	Body weight (kg)				SEM
	21-30	31-40	41-50	51-60	
Damascus					
Mating period (day)		8.17 ^b	12.56 ^a	7.65 ^b	0.90
Gestation period (day)		154.55 ^a	154.50 ^a	155.18 ^a	0.18
Litter size		1.23 ^a	1.04 ^b	1.03 ^b	0.02
Birth weight (kg)		3.71 ^b	4.14 ^a	4.28 ^a	0.04
Weaning weight (kg)		14.80 ^b	15.46 ^a	15.56 ^a	0.09
Daily gain (g/day)		246.43 ^a	251.58 ^a	250.62 ^a	1.66
Milk yield (kg/day)		1.82 ^a	1.93 ^a	1.88 ^a	0.06
Fat %		4.48 ^a	4.35 ^a	4.36 ^a	0.05
Protein %		2.75 ^a	2.54 ^a	2.57 ^a	0.05
Lactose %		4.32 ^a	4.13 ^b	4.11 ^b	0.03
Solids not fat %		7.72 ^a	7.33 ^b	7.33 ^b	0.06
Total solids %		12.20 ^a	11.68 ^a	11.70 ^a	0.10
Ash %		0.64 ^a	0.67 ^a	0.65 ^a	0.01
Zaraibi					
Mating period (day)	5.29 ^a	2.28 ^b	1.92 ^b		0.34
Gestation period (day)	152.60 ^a	152.83 ^a	153.04 ^a		0.26
Litter size	1.39 ^b	1.62 ^a	1.72 ^a		0.04
Birth weight (kg)	3.08 ^b	3.81 ^a	4.02 ^a		0.08
Weaning weight (kg)	16.24 ^b	19.52 ^a	20.48 ^a		0.38
Daily gain (g/day)	146.23 ^b	174.56 ^a	182.89 ^a		3.44
Milk yield (kg/day)	1.61 ^b	1.88 ^b	2.54 ^a		0.05
Fat %	4.31 ^b	4.40 ^{ab}	4.85 ^a		0.08
Protein %	2.51 ^b	2.58 ^b	3.16 ^a		0.07
Lactose %	4.14 ^a	4.26 ^a	4.27 ^a		0.04
Solids not fat %	7.34 ^b	7.50 ^b	8.09 ^a		0.08
Total solids %	11.65 ^b	11.90 ^b	12.94 ^a		0.14
Ash %	0.68^a	0.66^a	0.66^a		0.01

Values in percentages or means. Values with different letters (a, b) in the same row differ significantly ($p < 0.05$)

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Table 4: Effect of body length (cm) on reproductive performance, milk yield and composition of Damascus and Zaraibi goats

Item	Body length (cm)		SEM
	40-50	51-60	
Damascus			
Mating period (day)	9.54 ^a	11.09 ^a	0.90
Gestation period (day)	155.75 ^a	154.27 ^a	0.18
Litter size	1.10 ^a	1.06 ^a	0.02
Birth weight (kg)	3.99 ^a	4.13 ^a	0.04
Weaning weight (kg)	15.17 ^a	15.41 ^a	0.09
Daily gain (g/day)	250.62 ^a	250.10 ^a	0.84
Milk yield (kg/day)	1.70 ^b	1.98 ^a	0.06
Fat %	4.38 ^a	4.37 ^a	0.05
Protein %	2.73 ^a	2.53 ^a	0.05
Lactose %	4.18 ^a	4.15 ^a	0.03
Solids not fat %	7.56 ^a	7.34 ^a	0.06
Total solids %	11.94 ^a	11.71 ^a	0.10
Ash %	0.65 ^a	0.67 ^a	0.01
Zaraibi			
Mating period (day)	3.91 ^a	2.14 ^a	0.34
Gestation period (day)	152.84 ^a	152.61	0.26
Litter size	1.54 ^a	1.56 ^a	0.04
Birth weight (kg)	3.49 ^a	3.72 ^a	0.08
Weaning weight (kg)	18.21 ^a	18.86 ^a	0.38
Daily gain (g/day)	163.54 ^a	168.17 ^a	3.44
Milk yield (kg/day)	1.79 ^b	1.98 ^a	0.05
Fat %	4.48 ^a	4.29 ^a	0.08
Protein %	2.63 ^a	2.61 ^a	0.07
Lactose %	4.25 ^a	4.17 ^a	0.04
Solids not fat %	7.55 ^a	7.44 ^a	0.08
Total solids %	12.03 ^a	11.73 ^a	0.14
Ash %	0.67 ^a	0.67 ^a	0.01

Values in percentages or means. Values with different letters (a, b) in the same row differ significantly ($p < 0.05$)

Reproductive performance, milk production and composition of Damascus and Zaraibi goats as affected by body length are presented in Table (4). Milk yield of both Damascus and Zaraibi goats increased significantly ($P < 0.05$) (by 13.5 and 10.6%, respectively) with increasing body length ($r = 0.300^{**}$ and 0.272^{**} , respectively). However, other traits studied did not show significant changes with different body lengths.

Data presented in Table (5) reveal the relationship among body circumference (cm) and reproductive performance, milk production and composition of Damascus and Zaraibi goats. Reproductive traits and milk yield of Damascus does were not affected, in general, by changes in body circumference, unless the content of fat,

protein, solids not fat and total solids which were significantly ($P < 0.05$) higher with bigger circumference ($r = 0.180^{**}$, 0.316^{**} , 0.280^{**} and 0.277^{**} , respectively).

In Zaraibi does, as circumference increased mating period was significantly ($P < 0.05$) shorter with bodies more than 80 cm ($r = -0.300^{**}$). Litter size, birth and weaning weight and growth rate till weaning of kids were significantly ($P < 0.05$) higher with body circumference more than 80 cm ($r = 0.264^{**}$, 0.306^{**} , 0.245^{**} and 0.219^{**} , respectively), while, milk yield and composition were not significantly affected by body circumference.

Table 5: Effect of body circumference (cm) on reproductive performance, milk yield and composition of Damascus and Zaraibi goats.

Item	Body circumference (cm)			SEM
	61-80	81-100	101-120	
Damascus				
Mating period (day)		10.66 ^a	10.65 ^a	0.90
Gestation period (day)		154.69 ^a	154.58 ^a	0.18
Litter size		1.08 ^a	1.04 ^a	0.02
Birth weight (kg)		4.05 ^a	4.23 ^a	0.04
Weaning weight (kg)		15.32 ^a	15.46 ^a	0.09
Daily gain (g/day)		250.28 ^a	249.54	1.66
Milk yield (kg/day)		1.92 ^a	1.83 ^a	0.06
Fat %		4.32 ^b	4.57 ^a	0.05
Protein %		2.46 ^b	3.05 ^a	0.05
Lactose %		4.14 ^a	4.22 ^a	0.03
Solids not fat %		7.27 ^b	7.91 ^a	0.06
Total solids %		11.59 ^b	12.48 ^a	0.10
Ash %		0.67 ^a	0.64 ^a	0.01
Zaraibi				
Mating period (day)	5.56 ^a		2.59 ^b	0.34
Gestation period (day)	152.03 ^a		153.04 ^a	0.26
Litter size	1.42 ^b		1.59 ^a	0.04
Birth weight (kg)	3.14 ^b		3.71 ^a	0.08
Weaning weight (kg)	17.11 ^b		18.88 ^a	0.38
Daily gain (g/day)	155.21 ^b		168.50 ^a	3.44
Milk yield (kg/day)	1.78 ^a		1.88 ^a	0.05
Fat %	4.44 ^a		4.41 ^a	0.08
Protein %	2.66 ^a		2.61 ^a	0.07
Lactose %	4.29 ^a		4.19 ^a	0.04
Solids not fat %	7.62 ^a		7.47 ^a	0.08
Total solids %	12.06 ^a		11.87 ^a	0.14
Ash %	0.67 ^a		0.67 ^a	0.01

Values in percentages or means. Values with different letters (a, b) in the same row differ significantly ($p < 0.05$)

The relationship of body height with reproductive performance, milk production and composition of Damascus and Zaraibi goats are shown in Table (6). Mating period of Damascus does decreased significantly ($P < 0.05$) with increasing body height more than 65 cm ($r = -0.236^{**}$). However, birth and weaning weights and growth rate till weaning increased significantly ($P < 0.05$) with increasing of body height more than 65 cm ($r = 0.271^{**}$, 0.260^{**} and 0.171^* , respectively). Milk yield and composition were not affected by body height.

With regard to Zaraibi does, mating period decreased significantly ($P < 0.05$) as body height increased, 56-60 height compared to 51-55 height, ($r = -0.284^{**}$) then minor shorten

happened with goats higher than 60cm. Gestation period and litter size did not change significantly with different heights. Birth and weaning weight and growth rate till weaning increased ($P < 0.05$) by 15, 9 and 8.2% with increasing height till 60 cm, then slight changes occurred ($r = 0.133$). Milk yield increased significantly ($P < 0.05$) with increasing body height especially over 60 cm ($r = 0.273^{**}$). While, the percentages of fat, lactose, solids not fat and total solids in milk of Zaraibi does decreased significantly ($P < 0.05$) with increasing body height over 55 cm ($r = -0.244^{**}$, -0.239^{**} and 0.261^{**} , respectively). Protein and ash didn't show significant changes with changes in body height.

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Data presented in Table (7) show the relationship between body condition score and reproductive performance, milk production and compositions of Damascus and Zaraibi goats. Generally Damascus goats having BCS 4 show the best performance while those had score 5 indicate over weight and accompanied with reduction in performance. Zaraibi goat also showed that score 4 was the best.

In Damascus and Zaraibi does, mating period for was negatively correlated ($P < 0.05$)

with increasing body condition score ($r = -0.151^*$ and -0.251^{**} , respectively). Damascus goats with poor score (1) had clear extend in mating period (20.8 d) compared to higher scores (2-5, 12.3 – 7.79 d), while the range in Zaraibi was more narrow among body scores 1 to 5 (3.0 – 8.5 d). This highlight better adaptation of Zaraibi to hard conditions than Damascus, which conform with that the first is a native breed while the second is imported.

Table 6: Effect of body height (cm) on reproductive performance, milk yield and composition of Damascus and Zaraibi goats.

Item	Body height (cm)				SEM
	51-55	56-60	60-65	66-70	
Damascus					
Mating period (day)			14.96 ^a	7.93 ^b	0.90
Gestation period (day)			154.27 ^a	154.98 ^a	0.18
Litter size			1.07 ^a	1.06 ^a	0.02
Birth weight (kg)			3.94 ^b	4.20 ^a	0.04
Weaning weight (kg)			15.01 ^b	15.60 ^a	0.09
Daily gain (g/day)			246.09 ^b	253.43 ^a	1.66
Milk yield (kg/day)			1.87 ^a	1.92 ^a	0.06
Fat %			4.44 ^a	4.33 ^a	0.05
Protein %			2.59 ^a	2.57 ^a	0.05
Lactose %			4.15 ^a	4.17 ^a	0.03
Solids not fat %			7.40 ^a	7.40 ^a	0.06
Total solids %			11.84 ^a	11.73 ^a	0.10
Ash %			0.66 ^a	0.66 ^a	0.01
Zaraibi					
Mating period (day)	6.74 ^a	2.70 ^b	2.17 ^b		0.34
Gestation period (day)	151.51 ^a	153.01 ^a	153.46 ^a		0.26
Litter size	1.49 ^a	1.56 ^a	1.56 ^a		0.04
Birth weight (kg)	3.16 ^b	3.65 ^a	3.66 ^a		0.08
Weaning weight (kg)	17.09 ^b	18.62 ^a	18.67 ^a		0.38
Daily gain (g/day)	154.78 ^b	167.51 ^a	166.78 ^a		3.44
Milk yield (kg/day)	1.68 ^b	1.78 ^b	2.11 ^a		0.05
Fat %	4.86 ^a	4.28 ^b	4.32 ^b		0.08
Protein %	2.83 ^a	2.46 ^a	2.76 ^a		0.07
Lactose %	4.39 ^a	4.23 ^a	4.04 ^b		0.04
Solids not fat %	7.88 ^a	7.36 ^b	7.46 ^b		0.08
Total solids %	12.75 ^a	11.64 ^b	11.78 ^b		0.14
Ash %	0.66 ^a	0.68 ^a	0.66 ^a		0.01

Values in percentages or means. Values with different letters (a, b) in the same row differ significantly ($p < 0.05$)

Both breeds showed that gestation period did not affected by body condition score. Up to score 4, litter size was increased significantly ($P < 0.05$) with body condition score ($r = 0.287^{**}$ and 0.208^{**} , respectively), birth and weaning weight

were increased significantly ($P < 0.05$) with body condition score ($r = 0.476^{**}$, 0.259^{**} , 0.215^{**} and 0.199^{**} , respectively). Growth rate till weaning showed different responses; as rate of gain not affected by body condition score with

Damascus kids, while significantly ($P < 0.05$) increase with increasing body condition score up to score 4 in Zaraibi kids ($r = 0.187^{**}$). The bigger mature weight of Damascus compared to Zaraibi might explain this relative persistency of growth rate.

In Damascus does, milk yield and fat content increased significantly ($P < 0.05$) with increasing body condition up to score 4 ($r = 0.214^{**}$ and 0.196^{**} , respectively). The contents of protein, solids not fat and total solids increased significantly ($P < 0.05$) with increasing body condition score up to 3 ($r = 0.165^*$, 0.216^{**} and 0.227^{**} , respectively). While, lactose and fat percentages showed small differences with different BCS ($r = 0.126^*$ and 0.113^* , respectively).

In Zaraibi does, milk yield and contents of protein, lactose, solids not fat and total solids increased significantly ($P < 0.05$) with increasing body condition score up to 4 ($r = 0.225^{**}$, 186^{**} , 145^{**} , 131^* and 178^{**} , respectively), while ash content was not differed significantly. These results agree with those obtained by **Sezenler et al. (2011)** who found that body condition score (BCS) at breeding, age of ewes and breed were observed to affect fertility and litter size. The BCS had a significant effect on kg lambs born per ewes, birth weight of lambs, lambs weaning weight and colostrum production ($P < 0.05$) and the score of 3 at mating time could optimize profitability of Sanjabi ewes (**Jalilian and Moeini, 2012**). The BCS was an important indicator to predict the milk production traits in *Peranakan Etawah* goats and BCS can be used as a marker for milk production and milk quality (**Susilorini et al., 2014**).

Prediction of milk yield from body conformation

The linear prediction equations of milk yield for **Damascus** does from body conformation were:

1- Age (AG): Milk yield = $1.458 + 0.088AG$

2- Body weight (BW): Milk yield = $1.959 - 0.001BW$

3- Body length (BL): Milk yield = $- 0.012 + 0.035BL$

4- Body circumference (BC): Milk yield = $1.935 + 0.000BC$

5- Body height (BH): Milk yield = $- 1.238 + 0.047BH$

6- Body condition score (BCS): Milk yield = $2.356 - 0.124BCS$

The linear prediction equations of milk yield for **Zaraibi** does from body conformation were:

1- Age (AG): Milk yield = $1.550 + 0.064AG$

2- Body weight (BW): Milk yield = $0.098 + 0.053BW$

3- Body length (BL): Milk yield = $- 1.207 + 0.065BL$

4- Body circumference (BC): Milk yield = $0.705 + 0.014BC$

5- Body height (BH): Milk yield = $- 1.346 + 0.055BH$

6- Body condition score (BCS): Milk yield = $1.660 + 0.058BCS$

From the previous results, it could be concluded that age, body weight, body length, body circumference, body height and body condition score of Damascus and Zaraibi does had significant correlations with reproductive performance, milk yield and composition. Therefore, from the practical point of view, it can be recommended for breeding Damascus does that the age ranged between 5-6 years, body weight more than 40 kg, body circumference more than 100 cm, body height more than 65 cm and body condition score 3-4 are the best for better production output. Comparable estimates for Zaraibi goats are; 5-6 years old, 30kg body weight, 55 cm body height, 80 cm body circumference and BCS 3-4. Also, milk yield of Damascus and Zaraibi does can be predicted from the linear regression of body conformation.

RELATIONSHIP BETWEEN BODY CONFORMATION AND MILK YIELD AND COMPOSITION IN ZARAIBI AND DAMASCUS GOATS

Table 7: Effect of body condition score on reproductive, milk yield and composition of Damascus and Zaraibi goats.

Item	Body condition score					SEM
	1	2	3	4	5	
Damascus						
Mating period (day)	20.82 ^a	12.31 ^b	10.17 ^b	10.10 ^b	7.79 ^b	0.90
Gestation period (day)	154.27 ^a	153.79 ^a	155.09 ^a	154.69 ^a	154.44 ^a	0.18
Litter size	1.01 ^c	1.04 ^c	1.09 ^{bc}	1.18 ^b	1.38 ^a	0.02
Birth weight (kg)	3.34 ^c	3.66 ^b	4.28 ^a	4.37 ^a	3.87 ^b	0.04
Weaning weight (kg)	14.18 ^b	15.02 ^a	15.62 ^a	15.71 ^a	15.19 ^a	0.09
Daily gain (g/day)	240.83 ^a	247.87 ^a	254.03 ^a	256.25 ^a	249.90 ^a	1.66
Milk yield (kg/day)	1.68 ^b	1.90 ^{ab}	2.00 ^{ab}	2.27 ^a	1.93 ^{ab}	0.06
Fat %	4.07 ^b	4.35 ^{ab}	4.48 ^{ab}	4.70 ^a	4.38 ^{ab}	0.05
Protein %	2.36 ^b	2.68 ^{ab}	2.78 ^a	2.47 ^{ab}	2.36 ^b	0.05
Lactose %	3.99 ^b	4.21 ^a	4.21 ^a	4.21 ^a	4.14 ^{ab}	0.03
Solids not fat %	7.00 ^b	7.56 ^{ab}	7.65 ^a	7.34 ^{ab}	7.16 ^{ab}	0.06
Total solids %	11.07 ^b	11.91 ^{ab}	12.13 ^a	12.04 ^a	11.54 ^{ab}	0.10
Ash %	0.65 ^a	0.67 ^a	0.66 ^a	0.66 ^a	0.66 ^a	0.01
Zaraibi						
Mating period (day)	8.53 ^a	4.25 ^b	2.64 ^b	2.06 ^b	3.00 ^b	0.34
Gestation period (day)	152.00 ^a	153.20 ^a	153.48 ^a	151.52 ^a	152.41 ^a	0.26
Litter size	1.22 ^b	1.44 ^{ab}	1.59 ^a	1.67 ^a	1.65 ^a	0.04
Birth weight (kg)	2.81 ^c	3.28 ^{bc}	3.77 ^{ab}	4.06 ^a	3.66 ^{ab}	0.08
Weaning weight (kg)	14.89 ^b	17.38 ^{ab}	18.98 ^a	19.69 ^a	19.18 ^a	0.38
Daily gain (g/day)	134.22 ^b	156.67 ^{ab}	169.00 ^a	173.67 ^a	172.44 ^a	3.44
Milk yield (kg/day)	1.78 ^b	1.80 ^b	1.91 ^{ab}	2.19 ^a	1.81 ^b	0.05
Fat %	4.09 ^c	4.39 ^{bc}	5.25 ^a	4.87 ^{ab}	4.00 ^c	0.08
Protein %	2.29 ^b	2.52 ^b	2.89 ^{ab}	3.14 ^a	2.67 ^{ab}	0.07
Lactose %	3.76 ^c	4.20 ^b	4.39 ^{ab}	4.60 ^a	4.21 ^b	0.04
Solids not fat %	6.70 ^b	7.38 ^{ab}	7.94 ^{ab}	8.41 ^a	7.56 ^{ab}	0.08
Total solids %	10.79 ^b	11.77 ^{ab}	13.19 ^a	13.28 ^a	11.56 ^{ab}	0.14
Ash %	0.65 ^a	0.66 ^a	0.66 ^a	0.67 ^a	0.68 ^a	0.01

Values in percentages or means. Values with different letters (a, b,c) in the same row differ significantly (p < 0.05)

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RELATIONSHIP BETWEEN BODY CONFORMATION AND MILK YIELD AND COMPOSITION IN ZARAIBI AND DAMASCUS GOATS

الملخص العربي

العلاقة بين صفات الجسم الظاهرية والأداء التناسلي ونتاج اللبن ومكوناته في الماعز الدمشقي والزرايبي

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استخدم في هذه الدراسة عدد 32 عزة دمشقي يتراوح عمرها بين 2.53- 7.47 سنة ووزنها بين 33-59 كجم وعدد 41 عزة زرايبي يتراوح عمرها بين 2.16-8.48 سنة ووزنها بين 21-46 كجم لدراسة تأثير قياسات الجسم على التناسل ونتاج اللبن وتركيبه 0

أظهرت النتائج المتحصل عليها نقص فترة التلقيح معنوياً مع تقدم العمر 0 انخفاض عدد المواليد معنوياً في الماعز الدمشقي، بينما ارتفع معنوياً في الماعز الزرايبي عند عمر 3-6 سنوات 0 ارتفاع وزن الميلاد للنتاج معنوياً في الماعز الدمشقي مع تقدم عمر الأمهات ولوحظ أعلى وزن للقطام مع الأمهات التي عمرها 3-6 سنوات، بينما ينخفض المعدل حتى القطام مع تقدم عمر الأمهات لأكثر من 6 سنوات 0 فضلاً عن ذلك سجلت الماعز الزرايبي التي يتراوح عمرها 3-6 سنوات أعلى وزن للنتاج عند الميلاد والقطام وأعلى معدل نمو حتى القطام 0 زيادة انتاج اللبن ومحتوى البروتين معنوياً مع تقدم العمر، بينما انخفض محتوى اللاكتوز معنوياً مع تقدم العمر أكثر من 6 سنوات في الماعز الزرايبي 0

قصرت فترة التلقيح معنوياً في الماعز الدمشقي التي يتراوح وزنها بين 41-50 كجم عن باقي الأوزان، بينما قصرت معنوياً في الماعز الزرايبي التي يزيد وزنها عن 30 كجم 0 قل عدد المواليد معنوياً في الماعز الدمشقي مع زيادة وزنها عن 40 كجم، بينما زاد عدد المواليد معنوياً في الماعز الزرايبي مع زيادة وزنها عن 30 كجم 0 زيادة وزن الميلاد و وزن القطام للنتاج معنوياً مع زيادة وزن الأمهات عن 40 كجم في الماعز الدمشقي و 30 كجم في الماعز الزرايبي 0 كذلك زيادة معدل النمو حتى القطام كانت معنوية مع زيادة وزن الأمهات في الماعز الزرايبي زنة 30 كجم 0 لم يتأثر انتاج الماعز الدمشقي معنوياً بوزن الجسم، بينما ارتفع انتاج اللبن معنوياً في الماعز الزرايبي التي يتراوح وزنها بين 41-50 كجم 0 انخفاض محتوى اللاكتوز والجوامد الصلبة اللادهنية معنوياً في الماعز الدمشقي التي يزيد وزنها عن 40 كجم، بينما ارتفع محتوى الدهن والبروتين والجوامد الصلبة اللادهنية والجوامد الصلبة الكلية في الماعز الزرايبي التي يتراوح وزنها بين 41-50 كجم 0

زيادة انتاج اللبن معنوياً مع زيادة طول الجسم في الماعز الدمشقي والزرايبي 0 لم تتأثر صفات التناسل ونتاج اللبن معنوياً بمحيط الجسم في الماعز الدمشقي، بينما زاد محتوى الدهن والبروتين والجوامد الصلبة اللادهنية والجوامد الصلبة الكلية معنوياً مع زيادة محيط الجسم عن 100 سم 0 قصرت فترة التلقيح

معنوياً في الماعز الزرايبي مع زيادة محيط الجسم عن 80 سم 0 ارتفاع وزن الميلاد و وزن القطام ومعدل النمو حتى القطام معنوياً في الماعز الزرايبي مع زيادة محيط الجسم عن 80 سم 0 بينما لم يتأثر انتاج اللبن وتركيبه في الماعز الزرايبي معنوياً بمحيط الجسم 0

قصرت فترة التلقيح معنوياً، بينما زاد وزن الميلاد ووزن القطام ومعدل النمو حتى القطام معنوياً مع زيادة ارتفاع الجسم عن 65 سم في الماعز الدمشقي وعن 55 سم في الماعز الزرايبي 0 زيادة انتاج اللبن معنوياً في الماعز الزرايبي مع زيادة ارتفاع الجسم عن 60 سم، بينما يقل محتوى الدهن واللاكتوز والجوامد الصلبة اللادهنية والجوامد الصلبة الكلية معنوياً مع زيادة ارتفاع الماعز الزرايبي عن 55 سم 0

قصر فترة التلقيح معنوياً في الماعز الدمشقي والزرايبي مع زيادة درجة حالة الجسم 0 زيادة عدد المواليد، وزن القطام و معدل النمو حتى القطام معنوياً مع زيادة درجة حالة الجسم حتى 04 زيادة انتاج اللبن و محتوى الدهن معنوياً في الماعز الدمشقي مع زيادة درجة حالة الجسم حتى 4 وزيادة محتوى البروتين والجوامد الصلبة اللادهنية والجوامد الصلبة الكلية مع زيادة درجة حالة الجسم حتى 3، بينما انخفض محتوى اللاكتوز معنوياً مع درجة حالة الجسم الى 1 علاوة على ذلك زيادة انتاج اللبن ومحتوى البروتين واللاكتوز والجوامد الصلبة اللادهنية والجوامد الصلبة الكلية في الماعز الزرايبي مع زيادة درجة حالة الجسم حتى 4، بينما زاد محتوى الدهن معنوياً مع زيادة درجة حالة الجسم حتى 03

نستخلص من هذه الدراسة أن العمر، وزن الجسم، طول الجسم، محيط الجسم، ارتفاع الجسم و درجة حالة الجسم أظهرت تأثيرات معنوية على التناسل ونتاج اللبن وتركيبه في الماعز الدمشقي والزرايبي وأنها كانت أكثر تأثيراً في الماعز الزرايبي عن الدمشقي 0 بالإضافة الى ذلك يوصى في تربية الماعز الدمشقي والزرايبي ألا يزيد عمرها عن 6 سنوات و ألا يقل وزنها عن 40 كجم في الدمشقي و 30 كجم في الزرايبي، كذلك لا يقل طول الجسم عن 50 سم، محيط الجسم لا يقل عن 100 سم في الدمشقي و 80 سم في الزرايبي، ارتفاع الجسم لا يقل عن 65 سم في الدمشقي و 55 سم في الزرايبي ودرجة حالة الجسم 3-4 في كل من الدمشقي والزرايبي 0 كما يمكن التوقع بإنتاج اللبن في الماعز الدمشقي والزرايبي من خلال معادلات الانحدار الخطي لمقاييس الجسم 0