Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.4, No.10, 2014

Studies on Growth, Carcass Traits and Body Composition of Goats Raised either in Intensive or Pasture Conditions (1-Growth Performance and Carcass Traits).

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Abstract

Thirty two weaned (90 days) males (16) and females (16) native kids with an average live weight of 16.22±0.80 for males and 17.00 ±0.7 kg for females were used in this experiment. Each sex was divided randomly into two groups, the first (8 males and 8 females) was penned individually and fed on concentrate, and the second group (8 males and 8 females) was raised on pasture to be fattened and slaughtered at 20 kg or 30 kg.

Result revealed that daily gain in weight averaged 75.65±5.54 g/day. No significant differences were observed due to the effect of sex, feeding system and slaughter weight on this trait. Male kids and those slaughtered at 30 kg were more efficient in converting feed than females and kids slaughtered at 20kg. Dressing percentage based on live weight and on empty body weight averaged 46.54 ±0.50 and 56.76 ± 0.44 %, respectively. Kids received concentrate and those slaughtered at 30 kg had significantly ($p<0.05$) higher dressing percentage than kids raised on pasture or slaughtered at 20kg. Kids slaughtered at 30kg had significantly ($p<0.05$) larger rib eye area and thicker fat than kids slaughtered at 20kg. Kids raised on pasture had significantly higher proportion of leg (31.8 vs. 29.98%) and lower proportion of shoulder (17.72vs. 19.92%) than kids received concentrate.

Key words: growth, carcass, feeding regimens, goat.

1- Introduction

Goats are important animals for the provision of animal protein and as a source of income to small holders in the less developed parts of the world (Mahgoub and Lodge, 1996) . Furthermore, goats have an adaptive capacity to survive and produce in harsh environmental condition particularly in dry area (Lebbie, 2004). The number of goat has increased globally to reach around 867,968,573 million heads and providing about 5 million metric tons of meat annually (FAO, 2011). Additionally, today's health conscious consumers demand a more healthy diet; therefore, opportunities exist for goat meat because of its dieteric and health qualities. Goat meat is leaner than other red meats and has less saturated fat and lower saturated to unsaturated fatty acids ratios than lambs (Sheridan *et al*., 2003).

In Iraq, goats are produced using traditional practices where the main feed resources are natural pastures consisting of grasses, browse tree species or any available by product, which is not sufficient to support optimal growth due to low levels of protein and energy. However, it is generally known that raising young animals on high concentrate diets result in a higher daily gain, dressing percentage, carcass quality, reduce age

to slaughter and increases meat output thereby improving access to households in the traditional sector than on a forage system (Mtenga and Kitaly, 1990; Johnson and McGowan., 1998, Kosum *et al*., 2003; Johnson et al., 2005). Since information related to the potential of native Iraqi black goat for meat production is very limited, therefore, the objectives of the present study were to investigate growth and some carcass traits in native goats raised under two feeding regimens. Body composition and carcass tissue distribution will be presented in the second part of this series.

2- Materials and Methods

2.1 Animals and Management

Thirty- two weaned (90 days) entire male and female kids (16 animals for each sex) with an average live weight of 16.22±0.80 kg for male and 17.00 ±0.7 kg for females raised in the animal farm of the Faculty of Agriculture and Forestry, University of Duhok were used. Eight animals in each sex group were randomly allocated to be fed either on concentrate or raised on pasture. Each main group was then subdivided into two equal sub groups to be slaughtered at 20 or 30 kg. These slaughter weights was chosen to represent a range within which local animals are traditionally slaughtered. Male and female kids assigned to the feedlot treatment were individually penned and fed a concentrate pellets (Table 1) ad libitum. The refusal was collected and weighed on the next day before morning feeding. Clean water and mineral blocks were available constantly. Range kids was turned out on rangeland consisting of multiple species of native grasses (Lactuca, Hardeum, Avenna, Lolium, Onobrige Christa-gali, and Bramus) and shrubs (Querous aegilops, Querous infectoria, Querous libani, Daphne aculeata, Astragulus, and Anagyris foetida).

Table 1 Chemical composition of experimental diet, grasses and shrubs in the pasture.

Composition	concentrate	Grasses	Shrubs
Dry matter %*	92	30	50
Crude protein %*	15	21.49	24.04
Neutral detergent fiber %**	-	33.93	34.62
Acid detergent fiber % **	-	21.41	18.63
Ash %*	8.42	10.27	10.19
Ether extract %	3.07	-	-
Energy (Kcal)/kg***	2533	-	-

*Calculated according to (AOAC, 1984) **Calculated by using NIR brukir (Germany), ***Al- Khawaja et al (1971)

Animals were slaughtered when each individual kid reached its designated body weight. Feed was withdrawal over night and animal was slaughtered according to Muslim (Halal) way by severing the throat and major blood vessels in the neck. Carcass component such as head, skin, feet, omental, mesenteric, full and empty alimentary tract, liver, spleen, heart, lung and trachea and genital were weighed. Full and empty reticul- rumen and intestines was weighed and the weight of gut contents was calculated as the difference between full and empty weight. Empty body weight (EBW) was computed by subtracting the weight of gut contents from slaughter weight. Dressed carcass was weighed within 1 h (hot carcass weight).

2.2 Carcass Measurements:

After chilling the carcass at 4°C for 24 h, cold carcass was weighed and kidney and pelvic fat was weighed separately. The carcass was split along the vertebral column into two halves, using an electrical saw. The right half was separated into eight whole sale cuts. The weight of each cut was recorded and expressed as a percent of chilled carcass weight. The cross-sectional surface of the *Longissimus dorsi* muscle between rib 12 and 13 was traced immediately after cutting, and the area was subsequently measured by a digital planimeter. Fat thickness over the midpoint of *L.dorsi* muscle was recorded by using calliper device.

2.3 Statistical Analysis:

General Linear Model (SAS, 2002) was used to study the effect of sex, feeding system, slaughter and their interaction on studied traits. Significant differences between means were assessed using Duncan Multiple range test (Duncan, 1955).

3. Results and Discussion

3.1 Kid Performance

The overall mean of daily gain in weight was 75.65±5.54 g/day (Table 2). This value is within the range (49.0-110 g/ day) reported earlier for Iraqi native goat (Ayied,1996 and Mayi and Alkass,2010) Morever, as McGregor (1985) had stated that growth rate of goat can vary from 30g/day for small tropical breeds to over 200g/ day for large European breeds and South African Boer breed.

In the present study, males grew marginally faster than females (83.26 vs. 67.52 g/day) (Table 2). This superiority of male kids over females is may be due to a higher birth weight, and the function of androgens (Kiango, 1989; Nkungu et al., 1995). Similar results were also reported earlier by various et al.,2001; Dzakuma et al.,2004;Thiruvenkadan et al.,2009 and Wang et al., 2010).

Table (2) The effect of sex, feeding system and slaughter weight on average daily gain and number of days to investigators (Ahmed slaughter.

Means with different letters within each column differ significantly (P<0.05) according to Duncan's test

Traits		No	Initial weight kg	Final weight kg	Average daily gain (g/day)	Days to slaughter
Overall mean		31	16.60± 0.53	24.94± 0.93	75.65±5.54	112.19±11.55
Sex	Male	16	16.22± 0.80 a	25.19± 1.35 a	83.26±9.29 a	112.06±16.11 a
	Female	15	17.00± 0.70 a	24.67 ±1.34 b	67.52±5.33 a	112.33±17.17 a
Feed	Concentrate	16	16.68± 0.77 a	25.11± 1.28 a	76.67±9.6 a	118.81±18.55 a
	Pasture	15	16.52± 2.91 a	24.75± 5.48 b	74.55±5.54 a	105.13±13.83 a
Slaughter kg	20	16	16.70± 0.45a	19.98± 0.07 b	68.00± 9.52 a	65.31± 8.24 b
	30	15	17.17± 0.98 a	30.23± 0.15 a	83.80± 4.83 a	162.20± 12.95 a

The average daily gain of kids fed concentrate or raised on pasture is almost comparable (76.67 vs. 74.55g /day) (Table 2). This result could be attributed to the availability of forage quantatively and qualitatively in the pasture. The present results is contrary to the finding of Dosky (2010) who indicated that native black kids raised intensively had significantly higher daily gain than those raised on pasture Also, Alexandre et al (2009) and Johnson et al (2010) concluded that kids fed grain had significantly higher daily gain compared to kids fed only forage. A non- significant difference in average daily gain was noticed between kids slaughtered at 20 kg or 30 kg (68.00 vs. 83.80g/day) (Table 2). Hence no significant difference in growth rate of males and females exist as well as between kids raised on concentrate or on pasture, therefore the number of days required to reach their target weights at slaughter is almost similar (Table 2).

3.2 Feed Intake and Feed Efficiency:

In the present work, the overall mean of feed conversion ratio for kids fed concentrate was 9.00±0.86 kg/kg (Table 3). Male kids marginally had consumed less feed and had better feed conversion (8.08kg/kg) than female (9.92kg/kg) kids. The primary reason for this result is that males are growing relatively faster, especially in protein mass, and had higher mature weight than females. This results is in accordance with the findings of Dzakuma et al.(2004); Cameron et al.(1998); Al-Shorepy and Al-Hadrami (2008) and Idiong and Udom (2011) who reported that male kids were more efficient in converting feed to body mass compared to female kids.

Table (3) The effect of sex and slaughter weight on feed intake and feed conversion ratio.

Traits		No	Feed intake (kg)	Feed conversion(kg/kg)
Overall mean		16	74.62 ± 13.31	9.00 ± 0.86
Sex	Male	8	67.44 ± 17.92 a	8.08 ± 1.35 a
	Female	8	81.79 ± 20.59 a	9.92 ± 1.06 a
Slaughter weight	20kg	8	37.16 ± 10.19 b	9.33 ± 1.48 a
	30kg	8	112.07 ± 15.97 a	8.66 ± 0.99 a

Means with different letters within each column differ significantly (P<0.05) according to Duncan's test

3.3 Carcass Traits

The overall mean of the dressing percentage based on the slaughter weight and empty body weight of the black goat kids were 46.54±0.50 and 56.76± 0.44%, respectively (Table 4). Such values are within the range noticed by Sulaiman and Alkass (2009) and Mayi and Alkass (2010) on Iraqi native kids. It was found that the difference in dressing percentage between male and female kids lacked significance. Similar results have been reported earlier by Wildeus et al.(2007); Memisi et al.(2009); Rodrigues et al. (2009); Bonvillani et al., (2010);

Prpic et al,(2010); Simela et al.,(2011) and Teixeira et al.,(2011). However, since the males and females are slaughtered at a constant weight, therefore, such results is expected.

Kids fed concentrate had significantly ($p<0.05$) higher dressing percentage based on slaughter weight or empty body weight than kids raised on pasture (Table 4).The reason for this difference may be due to a higher gut content of kids raised on pasture compared to those fed concentrate (28.41 vs.23.79%) as well as the significant differences in carcass weight (11.19 vs.12.06 kg) (Table 4). This result is in accordance to those noticed by Hopkins- Shoemaker (2006); Wildeus et al.(2007); Rodrigues et al.(2009); Dosky (2010) and Miller et al.(2011) who found that dressing percentage for intensively fed kids was significantly higher than kids raised extensively. Dressing percentages 1 and 2 of kids slaughtered at 30 kg was significantly ($p<0.05$) higher by 1.4% and 1.73%, respectively than kids slaughtered at 20 kg (Table 4) .Similarly, Al-Doori et al.(2002); Bonvillani et al.(2010) reported that as slaughter weight increase , there is an increase is dressing percentage..

Chilling losses was significantly ($P<0.05$) lower in kids fed concentrate than kids raised on pasture (2.77 vs. 3.26%) (Table 4). Such variation is possibly due to the thicker fat over the *L.dorsi* muscle for kids raised on concentrate (0.17mm) as compared to those raised on pasture (0.07mm) which prevents losses of moisture from carcass. Similarly, Dosky (2010) indicated that kids received concentrate had significantly lower shrinkage percent than kids raised on pasture. Also, results revealed that neither sex nor slaughter weight had a significant effect on this trait (Table 4).

Table (4) The effect of sex, feeding system and slaughter weight on carcass traits.

Traits	Overal mean	Sex		Feeding system		Slaughter weight kg		Sig		
		Male	Female	Conc.	Pasture	20	30	S	F	STW
No	31	16	15	16	15	16	15			
EBW kg	20.45± 0.87	20.7± 1.16	20.17± 1.07	20.96 ±1.05	19.90 ± 1.18	16.38± 0.20	24.79± 0.26	n.s.	*	*
Hot carcass kg	11.64± 0.48	11.81± 0.71	11.46± 0.66	12.06 ± 0.62	11.19± 0.75	9.17 ± 0.81	14.29 ± 0.18	n.s.	*	*
Chilled carcass kg	11.29± 0.47	11.45± 0.69	11.12± 0.64	11.7± 0.60	10.82± 0.72	8.89± 0.18	13.86± 0.18	n.s.	*	*
Dressing % 1	46.54 ± 0.50	46.64 ± 0.53	46.42± 0.90	48.08± 0.57	44.89± 0.63	45.86± 0.82	47.26± 0.53	n.s.	*	*
Dressing % 2	56.76± 0.44	56.88 ± 2.35	56.62± 0.70	57.54± 0.51	55.92± 0.70	55.92± 0.66	57.65 ± 0.53	n.s.	n.s.	*
Shrink %	3.00 ± 0.10	3.07 ± 0.15	2.94 ± 0.13	2.77 ± 0.11	3.26 ± 0.14	3.01 ± 0.15	3.00 ± 0.13	n.s.	*	n.s.
Rib eye area ($cm^{2)}$	8.41± 0.39	8.37 ± 0.63	8.46 ± 0.47	8.71 ± 0.41	8.09 ± 0.68	6.81 ± 0.37	10.13 ± 0.34	n.s.	n.s.	*
Fat thickness (mm)	0.12± 0.03	0.15± 0.06	0.09± 0.01	0.17 ± 0.06	0.07 ± 0.01	0.05 ± 0.01	0.20 ± 0.06	n.s.	n.s.	*

n.s. = non-significant

* = P< 0.05, EB W= Empty body weight,S=sex, F=feeding system, STW= slaughter weight

Dressing 1(based on live body weight), Dressing 2 (based on empty body weight)

Result of the present study showed that no significant difference between male and female kids exist for the rib eye area (8.37 vs.8.46 cm^2) (Table 4). This result was in agreement with those reported by Wildeus et al.(2007); Bonvillani et al .(2010); Simela, (2005); Simela et al. (2011) and Teixeira et al.,(2011). Also, no significant

difference was observed between the two feeding systems in this trait. Similarly, Wildeus et al. (2007) found that rib eye area was not significantly affected by feeding system. While, Oman et al.(1999); Daskiran et al.(2006); Hopkins-Shoemaker,(2006); Rodrigues et al.(2009) and Dosky (2010) demonstrated that rib eye area of intensively raised kids was significantly larger than that of pasture group. Kid slaughtered at 30kg weight had significantly ($P<0.05$) higher rib eye area ($10.13\pm 0.34cm^{2)}$ than kids slaughtered at 20kg ($6.81\pm0.37cm^2$). This result support the finding of AL-Doori et al., (2002); and Bonvillani et al., (2010) who indicated that as slaughter weight increased rib eye area was significantly increased.

The overall mean of fat thickness of black goat was 0.12 ± 0.03 mm (Table 4). Gender of kids had no significant effect on fat thickness which confirm the results obtained by Wildeus et al. (2007) and Teixeira et al.,(2011). Fat thickness of kids received concentrate was marginally thicker than in kids raised on pasture (0.17 ± 0.06 vs. 0.07 ± 0.01mm). This result was in agreement to those reported by Oman et al.(1999) and Dosky (2010). It appears that kids slaughtered at 30kg had significantly ($p<0.05$) thicker fat (0.20mm) than those slaughtered at 20kg.This variation is obvious since as kids increase in weight deposit more subcutaneous fat. Such result agrees with those of AL-Doori et al. (2002).

It seems from Table (5) that no significant difference was obtained between male and female kids in commercial cuts. Similarly, Bovillani et al.(2010) and Rodrigues et al.,(2009) found that leg, shoulder, ribs, neck and flank cuts was not differ significantly between male and female kids. However, Wildeous et al., (2007) reported that the bucks had significantly a lower percentage of shoulder, loin and leg retail cuts than does.

In the current study, kids raised on pasture had significantly ($p<0.05$) higher proportion of leg (31.80%) and lower proportion of shoulder cut (17.72%) than did kids fed concentrate (29.98 and 19.92%, respectively). Other cuts of the carcass were not differ significantly between the two feeding regimens. Also, Daskiran et al. (2006) Alexander et al. (2009) and Dosky et al. (2009) noticed no significant differences between kids raised intensively or extensively in commercial cuts in different breeds of goats. Kids slaughtered at 20kg body weight had significantly ($p<0.05$) a higher proportion of leg cut (32.00%), a lower proportion of each of rack (8.56%) and flank cut (5.84%) only in comparison with those slaughtered at 30kg body weight (Table 5). This result is in accordance with the findings of Marichal et al. (2003) Pieniak-Lendzion et al. (2009) Bonvillani et al.(2010) Mayi and Alkass, (2010). Leg, loin and rack cuts are considered the most valuable by industry standards (Cameron et al., 2001). These cuts make up nearly 60% of lambs carcass (Hale and Griffin, 1992). However, goat deposit relatively more tissue in the fore quarters compared with cattle and sheep. In the present study, leg, loin and rack cuts made up 48.17%. This is close to the values obtained by other workers in different breeds of goats (Hale and Griffin, 1992; Hogg et al., 1992; Cameron et al., 2001;Mayi and AlKass 2010).

Table (5) The effect of sex, feeding system, and slaughter weight on commercial cuts of black goat carcass.

Traits	Overal mean	Sex		Feeding system		Slaughter weight kg		Sig		
		Male	Female	Conc.	Pasture	20	30	S	F	STW
No	31	16	15	16	15	16	15			
Leg %	30.86±0.36	30.51±0.46	31.2±40.55	29.98±0.43	31.80±0.48	32.00±0.45	29.65±0.37	n.s.	*	*
Loin 5	8.13± 0.17	8.009±0.25	8.26±0.22	8.34± 0.26	7.91± 0.21	7.99± 0.18	8.28±0.29	n.s.	n.s.	n.s.
Rack %	9.11± 0.19	9.15± 0.31	9.06± 0.23	9.08± 0.29	9.15± 0.27	8.56± 0.20	9.70± 0.27	n.s.	n.s.	*
Shoulder %	18.85±0.45	18.82±0.66	18.89±0.65	19.92±0.67	17.72±0.49	19.35±0.50	18.32±0.77	n.s.	*	n.s.
Neck %	6.54± 0.16	6.77± 0.18	6.31± 0.26	6.53± 0.25	6.56± 0.20	6.47± 0.21	6.63± 0.24	n.s.	n.s.	n.s.
Fore shank %	10.05±0.29	10.64±0.42	9.41± 0.35	9.81± 0.37	10.30±0.46	9.89± 0.29	10.22±0.53	n.s.	n.s.	n.s.
Breast %	9.48± 0.24	9.48± 0.32	9.48± 0.38	9.92± 0.28	9.01± 0.38	9.38± 0.39	9.59± 0.29	n.s.	n.s.	n.s.
Flank %	6.58± 0.23	6.48± 0.25	6.69± 0.41	6.38± 0.23	6.80± 0.42	5.84± 0.21	7.37± 0.32	n.s.	n.s.	*

* = P< 0.05, S= sex, F= feeding system, STW= slaughter weight, n.s. = non-significant

4. Conclusion:

Results of our experiment suggest that raising kids on pasture is almost comparable to those fed concentrate in term of growth, number of days required to reach the target weight and carcass traits. However, gender is not a significant source of variation in studied traits excepts males are more efficient in converting feed.

Acknowledgments

We would like to express our appreciation to the president of duhok University for their financial supports and their encouragement

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