A COMPARATIVE STUDY ON GROWTH, CARCASS TRAITS AND BODY COMPOSITION OF AWASSI AND KARADI LAMBS RAISED UNDER TWO LEVELS OF FEEDING AND SLAUGHTERED AT DIFFERENT WEIGHTS: 1- GROWTH PERFORMANCE AND CARCASS TRAITS

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ABSTRACT

Sixteen weaned (3.5-4 months) entire male lambs from each of Awassi and Karadi were weighed and randomly divided equally into two groups to receive concentrate (16% crude protein and 2769 kcal energy) either ad libitum or 3% of their body weights, and to be slaughtered at 36 or 44 kg. Results revealed that overall means of daily gain in weight, dressing percentage based on slaughter and empty body weight, rib eye area and fat thickness were 0.258±0.01 kg, 46.54± 0.49%, 54.35 ± 0.40%, 14.98 ±0.44 cm² and 2.86 ± 0.12 mm, respectively. It seems that Awassi lambs significantly surpass Karadi lambs in dressing percentage based on slaughter weight and had thicker subcutaneous fat, only. Also, lambs fed ad lib excell significantly those lambs fed 3% in daily gain in weight, dressing percentage based on slaughter weight, and fat thickness. Lambs slaughtered at 44 kg had significantly higher dressing percentage, rib eye area and fat thickness.

Keywords: growth, carcass traits, awassi, karadi.
INTRODUCTION
It is well known that small ruminant constitute the majority of the ruminant population in developing countries (37), and are considered the key resource within the frame of future international agriculture species (18), and contribute significantly to household economy (34). In Iraq, sheep including Awassi and Karadi which comprise almost 60 and 20%, respectively of the population are considered the most important farm animals, and the greatest portion of income comes from the sale of lambs (3). Evaluation of the carcass is essential to determine the relative production efficiency of the animals in converting feed to animal tissue (16). Lamb carcass traits and meat quality are affected by several factors, such as breed, sex, age, feeding system, slaughter weight and carcass weight (28, 36, 38). Moreover, it was generally agreed that daily live weight gain in lambs slaughtered at different weights decreases with increasing slaughter weights (2, 8, 14, 22, 31). Moreover, there is a great variation in lamb’s carcass quality due to the number and diversity of breeds and crosses in lamb production. Also, lamb breed influences the pattern of development of important carcasses traits (21). Therefore characterization of carcass composition of different breeds is essential in identifying the genetic resources for lean lamb production, as well as increasing the understanding of management alternations for different genotype (35). The effect of nutrition on animal growth and development are well documented. It was found that lambs fed high energy diet had higher daily body weight, feed conversion ratio, body weight, and carcass weight and dressing percentage than lambs fed medium and low energy diets (4, 20). Thus knowledge of the effect of breed, nutrition and stage of maturity on growth performance of lambs must be applied to obtain efficient conversion of feed by the growing lambs into production of muscle with optimum amount of fat and minimum bone (25). For this reason, the aim of the current study is to evaluate Awassi and Karadi for growth performance and carcass traits raised under two level of feeding and slaughtered at two different weights. Body composition and carcass tissue distribution will be presented in the second part of this series.

MATERIALS AND METHODS
Animals and experimental design
Sixteen weaned (3.5-4 months) entire male lambs from each of Awassi and Karadi with an average initial weight of 25.625±0.576 and 25.563±0.736 kg, respectively raised at Ghrarasha field, College of Agricultural Engineering Sciences, Salahaddin University were used in the present work. After an adaptation period for 10 days, lambs from each breed was weighed and randomly divided equally into two sub groups (8 Lambs) to receive either ad lib concentrate or 3% concentrate of their body weights and to be slaughtered either at 36 or 44kg (4 lambs each group). Each group of lambs was kept in a separate pen and fed on a group bases. The concentrate (16% crude protein and 2769 Kcal energy) in the form of pellet was offered at 8.30 am and 8.30 pm after quantifying and discarding the residue of the previous day. Clean water, multi vitamin and mineral blocks were available constantly. All lambs were weighed at weekly intervals before feed was offered in the morning, and accordingly the offered feed was adjusted.

Slaughtering of the animals
All Lambs were slaughtered when each lamb has reached its target slaughter weight (36 or 44 kg) following fasting for 12 hours, with free access to water. The lambs were slaughtered according to Islamic method at abattoir, by severing the throat and major blood vessels in the neck. Immediately after skinning was completed, evisceration was carried out and the carcass and non-carcass components were weighted. Hot carcass includes kidney and kidney fat, edible offal’s comprised of tests, spleen, liver, heart, lung and trachea, and inedible offal’s constitute head, feet and skin were weighed. Omental, mesenteric, cardiac and scrotal fat were separated and weighed. The gastro-intestinal tract was weighed, then emptied of their content, washed and re-weighed to facilitate calculation of empty body weight by subtracting the weight of the gut content from the slaughter weight.
Carcass traits
Following chilling the carcass at 4°C for 24 h, cold carcass was weighed, then kidney and pelvic fat were removed and weighed separately. The carcass was split along the vertebral column into two halves by electric saw. The left side of the carcass was cut into nine wholesale cuts and weighed. The carcass was split along the vertebral column into two halves by electric saw. The left side of the carcass was cut into nine whole sale cuts and weighed. The area of longissimus dorsi muscle at the 12th rib was measured by a placom digital planimeter. Fat thickness over the midpoint of L-dorsi muscle perpendicularly was recorded using Digital Caliper device.

Statistical analysis
The statistical analysis of data was conducted using the GLM (general linear model) within SAS (29) to study the effect of breed, level of feeding and slaughter weight on studied traits. Duncan multiple range tests (12) were used to test the differences between the sub classes of each factor. Since the interaction of studied traits was not significant, the interaction was excluded from the results.

RESULTS AND DISCUSSION

Growth performance
Results related to growth performance including initial and final weights. Fattening period and average daily gain in weight of Awassi and Karadi lambs maintained under two different feeding level and slaughtered at two different weights are given in Table (1).

Daily gain in weight averaged 0.267±0.016 and 0.250±0.014 kg, for Karadi and Awassi, respectively and the difference between them was not significant (P<0.05). The average daily gain recorded in the current work for Awassi and Karadi lambs is almost comparable with those obtained earlier for the same breeds by Alkass and Kak (5), Sefdeen & Alkass (31), Alkass and Hassan (4) and Oramari et al. (22). However, the average daily gain obtained herein for Awassi is higher than those recorded earlier for the same breed by Alkass et al. (6), Alkass et al. (7), Rashid et al. (26) and Al-Jaryan et al. (2), as well as for Karadi lambs (7). Such findings could be attributed to variation in genetic makeup as well as environmental factors and feeding practices in particular. Similarly, several authors found genetic variation among breeds for growth (10, 11, 13). In the current investigation, the effect of level of feeding on daily gain in weight shows that lambs fed ad lib was significantly (P<0.01) higher in daily gain (0.292 ±0.013 kg) than did lambs maintained on 3% of their body weights (0.224±0.012 kg) (Table 1). Similarly, it has been indicated that lambs received a high level of feeding gained higher weight than lambs fed a restricted ration (16, 17, 21). Daily gain in weight averaged 0.246±0.020 and 0.271±0.008 kg, for lambs slaughtered at 36 and 44 kg, respectively, and the difference between them lacked significance. It is generally agreed that daily live weight gain in lambs slaughtered at different weight decrease with increasing slaughter weight (1, 26, 31), mainly due to fat deposition. However, this result agree with the finding of Balci and Karakas, (8) who showed that there were no significant differences among the lambs slaughtered at different weights. Fattening period for Karadi and Awassi lambs was almost similar (P<0.05) being 56.06 and 58.18 days, respectively (Table 1). Also, the result revealed that lambs fed ad lib attained their prescribed slaughter weight in a significantly (P<0.05) shorter period (51.12±5.11 days) than lambs fed 3% (63.12±5.00 days) (Table 1). This result was in accordance with the finding of Alkass and Hassan (4). It is obviously that lambs required shorter time (41.68 days) to attain their target slaughter weight of 36 kg as compared with those slaughtered at 44 kg (72.56 days) (Table 1).
Table 1. Effect of breed, level of feeding and slaughter weight on growth performance of Karadi and Awassi lambs

<table>
<thead>
<tr>
<th>Effects</th>
<th>No.</th>
<th>Initial Wt. (kg)</th>
<th>Final Wt. (kg)</th>
<th>Period (day)</th>
<th>ADG (kg)</th>
<th>Feed Conversion Ratio (kg)</th>
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</thead>
<tbody>
<tr>
<td>Overall mean</td>
<td>32</td>
<td>25.594 ± 0.460</td>
<td>39.988 ± 0.726</td>
<td>57.125 ± 3.682</td>
<td>0.258 ± 0.011</td>
<td>4.212</td>
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<td>Breed</td>
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<tr>
<td>Karadi</td>
<td>16</td>
<td>25.563 ± 0.736 a</td>
<td>39.988 ± 1.046 a</td>
<td>56.063 ± 5.398 a</td>
<td>0.267 ± 0.0166 a</td>
<td>4.194</td>
</tr>
<tr>
<td>Awasi</td>
<td>16</td>
<td>25.625 ± 0.576 a</td>
<td>39.988 ± 1.040 a</td>
<td>58.188 ± 5.172 a</td>
<td>0.250 ± 0.0146 a</td>
<td>4.230</td>
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<td>L. of Feeding</td>
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<tr>
<td>3%</td>
<td>16</td>
<td>25.563 ± 0.753 a</td>
<td>40.00 ± 1.037 a</td>
<td>63.125 ± 5.004 a</td>
<td>0.224 ± 0.0123 b</td>
<td>3.979</td>
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<tr>
<td>ad lib</td>
<td>16</td>
<td>25.625 ± 0.554 a</td>
<td>39.975 ± 1.0495 a</td>
<td>51.125 ± 5.119 b</td>
<td>0.292 ± 0.0139 a</td>
<td>4.447</td>
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<tr>
<td>Slaughter Wt.</td>
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<tr>
<td>36kg</td>
<td>16</td>
<td>26.563 ± 0.532 a</td>
<td>35.950 ± 0.0447 b</td>
<td>41.688 ± 3.695 a</td>
<td>0.246 ± 0.0203 a</td>
<td>4.329</td>
</tr>
<tr>
<td>44kg</td>
<td>16</td>
<td>24.625 ± 0.682 b</td>
<td>44.025 ± 0.0323 a</td>
<td>72.563 ± 3.257 b</td>
<td>0.271 ± 0.008 a</td>
<td>4.156</td>
</tr>
</tbody>
</table>

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

**Feed conversion ratio**

Total feed intake required to produce one kilogram live weight gain by Karadi and Awassi lambs was almost the same being 4.19 and 4.23 kg/kg, respectively. Also, feed conversion ratio of lambs fed 3% concentrate is slightly lower (3.97 kg/kg) than lambs fed ad lib (4.44 kg/kg). Feed to gain ratio increased from 4.15 kg to 4.32 kg/kg in lambs slaughtered at 36 and 44 kg, respectively which may be is due to the deposition of fat. Similar findings have been reported earlier (22, 31, 32). It is of interest to note that no statistical analysis was carried out for this trait because of lambs are fed on a group basis. Moreover, the feed conversion ratio obtained in the current work is lower than those reported earlier for Karadi and Awassi lambs by Alkass and Kak, (5) and Alkass and Hassan (4).

**Carcass traits**

The overall means of dressing percentage based on the slaughter weight and empty body weight were 46.54±0.49 and 54.35±0.40%, respectively (Table 2). Examination of the effect of breed on dressing percentage based on slaughter weight reveals that Awassi lambs yielded significantly (P<0.05) higher value (47.31±0.51%) than Karadi lambs (45.77±0.81%) (Table 2). However, differences in dressing percentage based on empty body weight between the two studied breeds lacked significance (53.87 vs. 54.84%) (Table 2). The reason for such difference could be attributed to the lower gut content of the Awassi (13.71±0.77) as compared with Karadi (15.09±0.62%). Similarly, Alkass and Hassan (4) found that Awassi lambs had numerically higher (50.29%) dressing percentage based on slaughter weight, than Karadi lambs (49.62%). Similar results have been reported earlier by other investigators (15, 24, 27). It can be observed from Table (2) that lambs fed 3% concentrate had significantly (P<0.01) lower dressing percentage based on slaughter weight (45.66±0.58%) than did lambs fed ad lib (47.43±0.75%), but the difference in dressing percentage based on empty body weight lacked significance possibly due to higher gut content of lambs fed ad lib (15.85%) as compared to lambs fed 3% (12.94%). It has been reported generally that lambs fed a high level of feeding tends to have a higher dressing percentage compared to those fed low level of feeding (9, 16, 30). The dressing percentage of lambs slaughtered at 36 kg had significantly (P<0.01) lower dressing percentage than those slaughtered at 44 kg based either on slaughter weight (44.72 vs. 48.36%) or empty body weight (53.24 vs. 55.47%) (Table 2). Also, previously it was indicated that dressing percentage usually tend to increase as slaughter weight increases (1, 14, 33). Shrinkage averaged 2.85±0.06% (Table 2), and neither breed nor level of feeding had a significant effect on this traits. However, lambs slaughtered at 36 kg had significantly (P<0.01) higher shrinkage (3.04±0.06%) as compared with lambs slaughtered at 44 kg (2.65±0.08%) (Table 2). This is possibly due to the thicker subcutaneous fat in lambs slaughtered at 44 kg (3.05±0.16mm) as compared with lambs slaughtered lighter (2.67±0.17mm) (Table 2). In the current
investigation, rib eye area averaged 14.98±0.44 cm² (Table 2). This value is slightly higher than the value obtained earlier for Awassi lambs (4, 5, 7, 22) as well as for Karadi lambs (4, 5). Results reveal that neither breed nor level of feeding had a significant effect on this trait. Such result is in agreement with those reported on the effect of breed (4, 21, 24, 35), and on the effect of level of feeding (4, 16, 21). Rib eye area of lambs slaughtered at 44 kg (13.20±0.37 cm²) was thicker fat than did lambs slaughtered at 36 kg (13.20±0.37 cm²) (Table 2). Similarly, Rashid et al (26), Macit (19), Balci and Karakas (8), Sefdeen and Alkass (31) indicated that when slaughter weight increased, fat was found to be thicker. In this study, fat thickness averaged 2.86±0.12 mm, and Awassi lambs laid significantly (P<0.01) higher subcutaneous fat over L-dorsi muscle than laid Karadi lambs (3.13±0.13 vs. 2.41±0.12 mm) (Table 2). This result is in accordance with those of other workers (4, 22, 35).

**Table 2. Effect of breed, level of feeding and slaughter weight on some carcass characteristics of Karadi and Awassi lambs**

<table>
<thead>
<tr>
<th>Effects</th>
<th>No.</th>
<th>Slaughter Wt. (kg)</th>
<th>Hot carcass wt. (kg)</th>
<th>Chilled carcass wt. (kg)</th>
<th>Shrinkage %</th>
<th>Dressing %/ live wt.</th>
<th>Dressing %/ empty body wt.</th>
<th>Rib eye area Cm²</th>
<th>Fat thickness mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall mean</td>
<td>32</td>
<td>39.988 ± 0.726</td>
<td>18.687 ± 0.493</td>
<td>18.160 ± 0.486</td>
<td>2.850 ± 0.064</td>
<td>46.546 ± 0.495</td>
<td>54.357 ± 0.404</td>
<td>14.988 ± 0.448</td>
<td>2.863 ± 0.121</td>
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<tr>
<td>Breed</td>
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<tr>
<td>Karadi</td>
<td>16</td>
<td>39.988 ± 1.046 a</td>
<td>18.391 ± 0.744 b</td>
<td>17.871 ± 0.730 b</td>
<td>2.851 ± 0.088 a</td>
<td>45.773 ± 0.815 b</td>
<td>53.870 ± 0.701 a</td>
<td>15.181 ± 0.094 a</td>
<td>2.413 ± 0.122</td>
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<tr>
<td>Awassi</td>
<td>16</td>
<td>39.988 ± 1.040 a</td>
<td>18.982 ± 0.663 a</td>
<td>18.448 ± 0.658 a</td>
<td>2.850 ± 0.094 a</td>
<td>47.319 ± 0.518 a</td>
<td>54.844 ± 0.701 a</td>
<td>14.794 ± 0.136 a</td>
<td>3.314 ± 0.126</td>
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<td>L. of Feeding</td>
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<tr>
<td>3%</td>
<td>16</td>
<td>40.00 ± 1.037 a</td>
<td>18.314 ± 0.631 b</td>
<td>17.784 ± 0.616 b</td>
<td>2.904 ± 0.076 a</td>
<td>45.661 ± 0.589 b</td>
<td>54.258 ± 0.582 a</td>
<td>15.031 ± 0.136 a</td>
<td>2.644 ± 0.264</td>
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<tr>
<td>ad lib</td>
<td>16</td>
<td>39.975 ± 1.0495 a</td>
<td>19.059 ± 0.767 a</td>
<td>18.536 ± 0.761 a</td>
<td>2.797 ± 0.102 a</td>
<td>47.431 ± 0.750 a</td>
<td>54.456 ± 0.578 a</td>
<td>14.944 ± 0.095 a</td>
<td>3.083 ± 0.149</td>
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<td>Slaughterer Wt.</td>
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<tr>
<td>36kg</td>
<td>16</td>
<td>35.950 ± 0.0447 b</td>
<td>16.081 ± 0.183 b</td>
<td>15.591 ± 0.176 b</td>
<td>3.045 ± 0.065 a</td>
<td>44.729 ± 0.498 b</td>
<td>53.242 ± 0.460 b</td>
<td>13.206 ± 0.372 b</td>
<td>2.671 ± 0.276</td>
</tr>
<tr>
<td>44kg</td>
<td>16</td>
<td>44.025 ± 0.0332 a</td>
<td>21.293 ± 0.257 a</td>
<td>20.729 ± 0.258 a</td>
<td>2.656 ± 0.086 b</td>
<td>48.363 ± 0.570 a</td>
<td>55.473 ± 0.544 a</td>
<td>16.769 ± 0.172 a</td>
<td>3.056 ± 0.161</td>
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</table>

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

**Whole sale cuts**

Comparison between the two studied breeds reveal that Karadi lambs had a significantly (P<0.05) higher proportion of leg as compared to Awassi lambs (29.90 vs. 28.76%), conversely, the percentage of rack and fore shank are significantly (P<0.05) higher in Awassi as compared to Karadi (Table 3). On the effect of level of feeding on carcass cuts it appears from Table (3) that lambs fed 3% concentrate had significantly (P<0.05) higher percentage of loin as compared with lambs received ad lib feeding (9.28 vs 8.73%). Also, as slaughter weight increased, percentages of leg, neck, shoulder decreased, and the percentage of loin and fat tail increased (Table 3) reflecting the influence of fat deposition. These changes reflect the different rates of maturity among the whole sale cuts previously reported by Palsson and Verges (23). These changes are similar to those reported by Sents et al (32) and Sefdeen and Alkass (31).
Table 3. Effect of breed, level of feeding and slaughter weight on carcass cuts of Karadi and Awassi lambs

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<tbody>
<tr>
<td>Overall mean</td>
<td>32</td>
<td>29.335 ± 0.037 ± 7.371 ±</td>
<td>18.077 ± 0.271 ± 9.084 ±</td>
<td>6.777 ± 0.196 ± 2.702 ±</td>
<td>12.825 ±</td>
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<tr>
<td>Karadi</td>
<td>16</td>
<td>29.095 ± 0.464 a 8.363 ± 0.268 a 7.357 ± 0.221 a</td>
<td>17.700 ± 0.355 a 4.384 ± 0.105 a 10.095 ± 0.362 a</td>
<td>6.448 ± 0.187 b 2.542 ± 0.112 a 12.732 ± 0.946 a</td>
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<tr>
<td>Awasi</td>
<td>16</td>
<td>28.765 ± 0.429 b 9.187 ± 0.158 a 7.385 ± 0.206 a</td>
<td>18.455 ± 0.397 a 3.811 ± 0.080 b 9.513 ± 0.257 a 7.105 ± 0.330 a 2.862 ± 0.108 a 12.917 ± 0.822 a</td>
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<tr>
<td>L. of Feeding</td>
<td>3%</td>
<td>29.308 ± 0.330 ± 7.515 ±</td>
<td>18.168 ± 0.374 ± 9.813 ±</td>
<td>6.940 ± 0.124 a 2.672 ± 0.334 a 12.125 ± 0.331 a 0.108 a 0.632 a</td>
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<tr>
<td>ad lib</td>
<td>16</td>
<td>29.362 ± 0.578 a 8.735 ± 0.216 b 7.226 ± 0.234 a</td>
<td>17.987 ± 0.402 a 4.025 ± 0.110 a 9.795 ± 0.310 a 6.613 ± 0.213 a 2.733 ± 0.126 a 13.525 ± 1.052 a</td>
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<tr>
<td>Slaughter Wt.</td>
<td></td>
<td>36kg</td>
<td>30.211 ± 0.446 a 8.686 ± 0.197 b 7.767 ± 0.185 a</td>
<td>18.747 ± 0.323 a 4.158 ± 0.099 a 9.625 ± 0.242 a 6.907 ± 0.272 a 2.683 ± 0.141 a 11.215 ± 0.753 b</td>
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<td></td>
<td></td>
<td>44kg</td>
<td>28.459 ± 0.377 b 9.337 ± 0.219 a 6.975 ± 0.190 b</td>
<td>17.407 ± 0.373 b 4.037 ± 0.134 a 9.983 ± 0.381 a 6.647 ± 0.286 a 2.721 ± 0.088 a 14.435 ± 0.812 a</td>
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Means with different letters within each column differ significantly (P<0.05) according to Duncan’s test.

CONCLUSION

From the results presented in the text, it can be conclude that Awassi and Karadi lambs grew at a similar rate, and Awassi excelled Karadi in dressing percentage, had a thicker fat and smaller area of L-dorsi muscle. Also, lamb fed ad lib grew faster than those received 3% concentrate.

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