

## Distribution of Lean, Fat and Bone in the Carcasses of Najdi and Naeimi Ram Lambs

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**ABSTRACT.** Thirty ram lambs representing equal numbers of Najdi and Naeimi sheep were slaughtered at 50 kg-body weight to determine the effect of breed on tissue distribution of the carcasses. At similar slaughter weights, there were no significant differences between Najdi and Naeimi ram lambs for either hot or cold carcass weight, dressing percentage or fat thickness at the 12th rib. On the other hand, Najdi carcasses had significantly ( $P<0.01$ ) thicker body wall measurements, higher percentage internal fat, less percentage tail fat and smaller rib eye size than did the Naeimi carcasses. Results from carcass physical separation revealed that, there were negligible differences between Najdi and Naeimi carcasses in separable lean distribution within the various wholesale cuts, but this was not the case for separable fat and bone. In general, Najdi carcasses had a higher ( $P<0.01$ ) percentage total separable fat than Naeimi carcasses. The study also indicated that Najdi ram lambs possessed wider and longer backs in comparison with Naeimi sheep of similar weight.

The emphasis of lamb breeding in recent years has been on increased cutability which is synonymous with more edible meat and less fat and bone. One of the most comprehensive ways to define leanness is dissection of the carcass into standardized wholesale cuts and then dissect each cut into lean, fat and bone (Lirette *et al.* 1984 and Dahmen *et al.* 1985). Wholesale cuts of a sheep carcass among the various breeds, differ in value because they differ in composition (Sents *et al.* 1982 and Lirette *et al.* 1984). Therefore, the identification of breeds of sheep capable of producing desirable carcasses will be necessary to satisfy consumer demands. A previous report showed that meat from Najdi and Naeimi sheep were the most preferred of those breeds prevailing in Saudi Arabia (Abouheif *et al.* 1985). Both are fat-tailed sheep and typical of those found in the range areas of the Middle East. Information relating to Najdi and Naeimi differences and changes in

wholesale cut composition is needed to guide local producers and consumers in the choice of breeds of sheep.

The objective of this study was to compare carcass characteristics of Najdi and Naeimi ram lambs at about 50 kg-live weight.

### Materials and Methods

Thirty ram lambs representing equal numbers of Najdi and Naeimi sheep were purchased in February, 1986, from a commercial breeding farm near the El-Kharj area of Saudi Arabia. The animals were purchased as yearlings, weighing between 46.2 and 51.8 kg body weights. The Najdi and Naeimi lambs were raised together under similar environmental, nutritional and management conditions. All lambs had access to a high-energy creep feed until they were naturally weaned at approximately 3- to 4-month of age. After weaning, the lambs were fed a daily diet consisting of 0.5 kg commercially formulated concentrates (12% protein) / head, plus alfalfa hay offered *ad libitum*.

The Najdi and Naeimi rams were slaughtered in a commercial slaughterhouse after a 24h fast; however, water was available at all times. Live body weights were determined immediately before slaughter, while hot carcass weights were obtained at slaughter. Carcasses were allowed to chill for 24h at 5°C before carcass traits were measured. After chilling, the cold carcass weights were recorded and the total kidney, pelvic and heart fats (internal fat) were removed and weighed. Dressing percentage was calculated as (cold carcass weight/live body weight) × 100. Carcasses were then split down the midline and the right side of each carcass was ribbed between the 12th and the 13th ribs. After ribbing, an acetate tracing was made of the longissimus dorsi muscle (rib eye area), and a planimeter was used to determine the area. Fat thickness over the center of the longissimus dorsi muscle, and body wall thickness (11 cm lateral to the midline between the 12th and the 13th ribs) were also measured.

Right sides of the carcasses were then fabricated into standard wholesale leg, loin, rack, shoulder, breast and flank cuts by the procedure described by Romans and Ziegler (1974). In addition, the neck was removed from the shoulder by a cut made parallel to the line of the scapula, and the fat tail was also separated between the croup and the first caudal vertebrae. Each wholesale cut was closely trimmed of all external fat, boned out and most intermuscular fat was removed. Intermuscular fat included all fat lying between muscles and between muscles and bones. The total of fat trim and intermuscular fat in each wholesale cut was used as the estimate of separable fat. Lean from each cut was used as the estimate of separable lean, and the bone from each cut boned out as the estimate of bone. The three components were weighed separately to determine relative proportions within

cuts. Also, percentages of separable lean, fat and bone were calculated by dividing the weight of any component in the right side of the carcass by the combined weight of separable lean, fat and bone in the right side of the carcass  $\times 100$ . It should be mentioned that internal fat, tail fat and neck were not included as side weight or with dissected tissue components. However, while these estimates of separable lean, fat and bone do not represent the actual carcass composition, they should identify the trend for differences in composition among Najdi and Naeimi ram lambs.

Means and standard errors were calculated, and Duncan's new multiple range test was used to detect differences among individual means according to Steel and Torrie (1960). All statistical computations were accomplished by the use of computer program entitled Statistical Analysis System (SAS 1982).

### Results and Discussion

As shown in Table 1, there were no significant differences between Najdi and Naeimi ram lambs for hot or cold carcass weight, dressing percentage or fat thickness over the 12th rib; however, some important differences were observed concerning other carcass fat depots. Naeimi rams had significantly ( $P < 0.01$ ) less body wall thickness and less weight and percent kidney, pelvic and heart fat than Najdi rams. On the other hand, Najdi rams had significantly ( $P < 0.01$ ) less tail fat and smaller rib eye areas than Naeimi rams. The heavier tail in Naeimi carcasses is not readily explainable, other than by an assumption of either; (a) it is genetically determined; (b) it is more developed at that age; or (c) the deposition of tail fat was accumulated at the expense of other fat depots. The authors were unable to find any reports in the literature in which Najdi and Naeimi were compared. Further studies are, however, needed to explore the relationships between the rate of deposition of internal, body fat and tail fat at various stages of maturity in fat-tailed sheep. In general, these results agree with previous findings (McClelland and Russell 1972, Boylan *et al.* 1976 and Lirette *et al.* 1984) who noted that the influence of breed results in various subcutaneous and internal fat deposits within the carcasses of Suffolk and Finnish-Landrace breeds.

Wholesale cuts differ in economic value because of differences in the amount of lean in each cut and differences in composition. The leg, loin, rack and shoulder are considered to be the primal cuts which command the highest prices per kilogram, followed by the breast and flank. Breeds of animals with more lean in the primal cuts could have an economic advantage. However, as illustrated in Table 2, there were no significant differences in the percentage of separable lean components for each wholesale cut between the Najdi and Naeimi carcasses, except for the flank cut, where the percentage of separable lean in the wholesale cut from Naeimi rams was significantly ( $P < 0.01$ ) higher than that from the Najdi

**Table 1.** Carcass trait means and standard errors (SE) for Najdi and Naeimi ram lambs.

Trait	Najdi $\pm$ SE	Naeimi $\pm$ SE
No. Lambs	15	15
Slaughter weight, kg	50.40 $\pm$ 0.81	49.60 $\pm$ 1.33
Hot carcass weight, kg	25.00 $\pm$ 0.60	25.40 $\pm$ 0.83
Cold carcass weight, kg	24.30 $\pm$ 0.52	24.60 $\pm$ 0.89
Dressing % <sup>a</sup>	48.20 $\pm$ 1.09	49.60 $\pm$ 1.27
Fat thickness, cm	0.36 $\pm$ 0.06	0.28 $\pm$ 0.03
Body wall thickness, cm	1.75 $\pm$ 0.15 <sup>b</sup>	1.64 $\pm$ 0.19 <sup>c</sup>
Rib eye area, cm <sup>2</sup>	11.67 $\pm$ 0.56 <sup>c</sup>	13.12 $\pm$ 0.51 <sup>b</sup>
KPH fat, kg <sup>d</sup>	0.66 $\pm$ 0.11 <sup>b</sup>	0.23 $\pm$ 0.04 <sup>c</sup>
, % <sup>a</sup>	2.72 $\pm$ 0.03 <sup>b</sup>	0.93 $\pm$ 0.01 <sup>c</sup>
Tail fat, kg	2.24 $\pm$ 0.20 <sup>c</sup>	2.83 $\pm$ 0.32 <sup>b</sup>
, % <sup>a</sup>	9.22 $\pm$ 0.45 <sup>c</sup>	11.50 $\pm$ 0.53 <sup>b</sup>

<sup>a</sup> Expressed as % of cold carcass weight.

<sup>b,c</sup> Means in the same row bearing different superscripts differ ( $P < 0.01$ ).

<sup>d</sup> Kidney, pelvic and heart fat.

rams. The wholesale cuts from the Najdi carcasses, with the exception of the leg and loin, had significantly ( $P < 0.01$ ) a higher percentage separable fat and a lower percentage bone in rack and shoulder cuts than those from the Naeimi breed. These findings agree with the results of Prud'hon (1976) and Lirette *et al.* (1984) who noted that breed of sheep had an important influence on fat deposition within different regions of the ovine carcasses.

Means for percentages of side weight in wholesale cuts and component tissues are given in Table 3. The Najdi carcasses had a higher ( $P < 0.01$ ) percentage of total separable fat and lower ( $P < 0.01$ ) percentage of total bone, but was not significantly different from the Naeimi carcasses in percentage of total separable lean. The difference in total percentage of separable lean from the primal wholesale cuts was only 1.48% in favour of Naeimi ram lambs. The general absence of important differences between the Najdi and Naeimi breeds for total percentage separable lean agrees partly with the results of Solomon *et al.* (1980) who reported that there were no differences between breeds for retail cuts when expressed as a percentage of carcass weight. In general, the carcasses evaluated in this study contained average values of % total separable lean, % separable fat and % bone which basically agrees with the values obtained from mutton breeds on the variability of the relative composition of ovine carcasses (Sents *et al.* 1982 and Lirette *et al.* 1984). However, according to previous studies (Dahmen *et al.* 1977,

**Table 2.** Percentage means and standard errors (SE) for separable lean, fat and bone in wholesale cuts from Najdi (n=15) and Naeimi (n=15) carcasses.

Wholesale cut	Najdi ± SE				Naeimi ± SE			
	wt, kg <sup>a</sup>	Lean	Fat	Bone	wt, kg <sup>a</sup>	Lean	Fat	Bone
Leg	3.49±0.11	62.4±2.1	16.1±0.8	21.5±0.9	3.69±0.13	61.7±1.8	15.9±0.2	22.4±2.0
Loin	0.92±0.04	48.2±1.9	29.9±0.9	21.9±0.8	1.03±0.82	49.9±1.2	29.0±0.5	21.0±1.5
Rack	0.97±0.03 <sup>b</sup>	53.1±1.7	19.8±1.0 <sup>b</sup>	27.2±0.9 <sup>c</sup>	0.74±0.67 <sup>c</sup>	55.4±1.5	14.2±0.3 <sup>c</sup>	30.4±1.1 <sup>b</sup>
Shoulder	2.54±0.12	59.3±2.3	15.1±1.1 <sup>b</sup>	25.6±1.7 <sup>c</sup>	2.62±0.14	62.0±2.0	8.8±0.1 <sup>c</sup>	29.2±0.8 <sup>b</sup>
Breast	1.80±0.91	55.5±2.0	19.9±1.1 <sup>b</sup>	24.6±1.3	1.82±0.10	56.4±1.9	17.1±0.1 <sup>c</sup>	26.5±1.1
Flank	0.55±0.52 <sup>b</sup>	39.1±2.1 <sup>c</sup>	59.4±2.2 <sup>b</sup>	1.6±0.1	0.42±0.05 <sup>c</sup>	51.9±3.4 <sup>b</sup>	46.3±2.3 <sup>c</sup>	1.8±0.1

<sup>a</sup> Combined weights of separable lean, fat and bone.

<sup>b,c</sup> Means bearing different superscripts within each variable among Najdi and Naeimi rams differ (P<0.01).

**Table 3.** Percentage means and standard errors (SE) for side weight in wholesale cuts and separable components from Najdi (n=15) and Naeimi (n=15) carcasses.

Wholesale cut	Najdi ± SE				Naeimi ± SE			
	Lean %	Fat %	Bone %	Total <sup>a</sup> %	Lean %	Fat %	Bone %	Total <sup>a</sup> %
Leg	21.3±0.10	5.5±0.02	7.3±0.01	34.1±2.1	22.0±0.03	5.7±0.01	8.0±0.01	35.7±2.5
Loin	4.3±<.01	2.7±<.01	1.9±<.01	8.9±1.0	4.9±<.01	2.9±<.01	2.1±<.01	9.9±0.9
Rack	5.0±<.01 <sup>b</sup>	1.9±<.01 <sup>b</sup>	2.6±<.01 <sup>b</sup>	9.5±0.3 <sup>b</sup>	3.9±0.01 <sup>c</sup>	1.0±<.01 <sup>c</sup>	2.2±0.02 <sup>c</sup>	7.1±0.4 <sup>c</sup>
Shoulder	14.7±0.04	3.8±0.01 <sup>b</sup>	6.3±<.01	24.8±1.7	15.7±0.04	2.2±<.01 <sup>c</sup>	7.4±0.03	25.3±1.3
Breast	9.7±0.04	3.5±0.02	4.3±<.01	17.5±1.1	9.9±0.03	3.0±<.01	4.7±0.03	17.6±1.1
Flank	2.1±<.01	3.2±<.01 <sup>b</sup>	0.1±<.01	5.4±0.7 <sup>b</sup>	2.1±<.01	1.8±0.02 <sup>c</sup>	0.1±<.01	4.0±0.1 <sup>c</sup>
Total side	57.1±4.12	20.6±1.33 <sup>b</sup>	22.5±1.31 <sup>c</sup>	100.2	58.5±3.78	16.6±2.14 <sup>c</sup>	24.5±2.04 <sup>b</sup>	99.6

<sup>a</sup> Combined percentage of separable lean, fat and bone.

<sup>b,c</sup> Means bearing different superscripts within each variable among Najdi and Naeimi rams differ (P<0.01).

Kemp *et al.* 1981, Lirette *et al.* 1984 and Dahmen *et al.* 1985), it is the adipose tissue contents of the carcass that may differ between animals. Fat deposition in animals similar in weight is particularly influenced by the stage of maturation imposed on the animals. This phenomenon is more accentuated in small early maturing breeds. Thus at similar weight, early maturing breeds, likely Najdi, possess more fat than late maturing breeds. Also, as illustrated in Table 3, the Najdi carcass had a significantly ( $P < 0.01$ ) higher percentage of wholesale rack cut, although they had a smaller rib eye area value than those produced from the Naeimi carcasses. Therefore, these results indicated that Najdi ram lambs possess wider and longer backs in comparison with Naeimi ram lambs. Sents *et al.* (1982) reported that the percentage rack and kidney fat increased significantly with age, while the percentage shoulder and loin changed only slightly. These changes reflect the different rates of development among the wholesale cuts as was previously reported by Palsson and Verges (1952) who stated that the leg matures relatively early, while the rack and loin are later maturing regions.

In conclusion, these results show that Najdi and Naeimi ram lambs are comparable with respect to lean production at 50 kg live body weight, while the greatest variation is in the distribution of fat, particularly in the wholesale rack and shoulder cuts, internal and tail fat. However, these findings permit some useful valid generalizations about Najdi and Naeimi sheep, but further studies are needed to identify the body composition at different stages of maturity in relation to animal age.

#### *Acknowledgement*

This study was supported by a grant from the Agricultural Research Center, King Saud University. The authors are grateful to the staff members of the Riyadh Slaughterhouse.

#### **References**

- Abouheif, M.A., Abdo, G., Basmaeil, S. and Alsobayel, A.A. (1985) The consumptive pattern of different breeds of sheep among the Saudi citizens in Riyadh, Saudi Arabia, *8th Symp. Biol. Aspects of Saudi Arabia, King Faisal Univ.*, 12-14 March, pp. 146-147.
- Boylan, W.J., Berger, Y.M. and Allen, C.E. (1976) Carcass merit of Finnsheep crossbred lambs, *J. Anim. Sci.* **42**: 1413-1420.
- Dahmen, J.J., Hinman, D.D., Jacobs, J.A. and Everson, D.O. (1977) Suffolk sired lambs from Panama and Finn X Panama dams, *J. Anim. Sci.* **45**(suppl. 1): 366.
- Dahmen, J.J., Jacobs, J.A. and Morrison, E.J. (1985) Suffolk versus Lincoln rams: The influence of sire and breed cross on carcass traits of heavy market lambs, *J. Anim. Sci.* **61**: 98-106.
- Kemp, J.D., Ely, D.G., Fox, J.D. and Moody, W.G. (1981) Carcass and meat characteristics of crossbred lambs with and without Finnish Landrace breeding, *J. Anim. Sci.* **52**: 1026-1033.
- Lirette, A., Seoane, J.R., Minvielle, F. and Froehlich, D. (1984) Effects of breed and castration on conformation, classification, tissue distribution, composition and quality of lamb carcasses, *J. Anim. Sci.* **58**: 1343-1357.

- McClelland, T.H. and Russell, A.J.F.** (1972) The distribution of body fat in Scottish Blackface and Finnish Landrace lambs, *Anim. Prod.* **15**: 301-309.
- Palsson, H. and Verges, J.B.** (1952) Effects of the plan of nutrition on growth and the development of carcass quality in lambs. Part 1. The effects of high and low plans of nutrition at different ages, *J. Agric. Sci. (Camb)* **42**: 1-88.
- Prud'hon, M.** (1976) La croissance globale de l'agneau: Ses caractéristiques et ses lois, Journées de la recherche ovine et caprine, *INRA, France*: 6-26. (cited from **Lirette et al.** 1984).
- Romans, J.R. and Ziegler, P.T.** (1974) *The Meat We Eat*, The Interstate Printers and Publishers, Inc., IL, USA.
- SAS User's Guide** (1982) *Statistical analysis system*, Box 8000, Cary, North Carolina 27511, USA.
- Sents, A.E., Walters, L.E. and Whiteman, J.V.** (1982) Performance and carcass characteristics of ram lambs slaughtered at different weights, *J. Anim. Sci.* **55**: 1360-1369.
- Solomon, M.B., Kemp, J.D., Moody, W.G., Ely, D.G. and Fox, J.D.** (1980) Effect of breed and slaughter weight on physical, chemical and organoleptic properties of lamb carcasses, *J. Anim. Sci.* **51**: 1102-1107.
- Steel, R.G. and Torrie, J.H.** (1960) *Principles and Procedures of Statistics*, McGraw-Hill Book Co., New York, USA.

(Received on 10/01/1987;  
in revised form 03/10/1987)

## توزيع اللحم والدهن والعظام في ذبائح الحملان النجدي والنعيمي

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ذبح في هذه التجربة ١٥ حمل نجدي و ١٥ حمل نعيمي عند وزن حي مساوي لـ ٥٠ كجم للرأس وذلك للمقارنة بين السلالتين في توزيع مكونات ذبائحها. وقد لوحظ عدم وجود فروقات معنوية بين السلالتين في الوزن الحار والمبرد للذبيحة، وكذلك في نسبة التصافي وسمك طبقة الدهن فوق الضلع رقم ١٣. وعلى العكس من تلك النتائج فقد لوحظ أن الحملان النجدي تمتلك جداراً اسماً للجسم وكمية دهون داخلية أثقل من الحملان النعيمي، بينما كمية دهن الذيل ومساحة العضلة العينية لها كانت أقل من الحملان النعيمي.

وقد أثبتت نتائج فصل مكونات الذبيحة أن الفروق في توزيع اللحم الأحمر على القطيعات المختلفة للجسم كانت غير واضحة في كل من ذبائح الحملان النجدي والنعيمي، وأن ذبائح الأغنام النجدي تحتوي بصورة عامة على كميات من الدهون أعلى من النعيمي.