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EFFECT OF SEX, AGE, CUT AND PROCESSING METHODS ON CHEMICAL COMPOSITION AND CALORIC VALUE OF RABBIT MEAT

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INTRODUCTION

Rabbit meat has several advantages over other meats.It is produced under controlled farm conditions, highly nutritious, easily digested and the carcass is of popular size for the moderate family.It is suitable for those adapting on medically prescribed diets requiring white meat with a high protein and low fat content (Netherway, 1977). Domestic rabbit meat is extremely low in calories and high in protein content (Bennett, 1984). The two main African producers of rabbits are Ghana and Egypt (Lebas *et al.*, 1986). Different projects focused their investments on rabbit production in Egypt (El-Seesy, 1989). Improved information about cooking method is needed for increased consumption of rabbit meat (Joh, 1975). However, available information on rabbit meat is limited in contrast to that for poultry meat (El-Gamal *et al.*, 1984; Holmes *et al.*, 1984; Lukefathr *et al.*, 1989 and Youssef *et al.*, 1992). Therefore, the present investigation performed to evaluate the gross chemical composition and caloric value of rabbit meat as affected by sex, age cut as well as processing methods.

MATERIALS AND METHODS

Sampling

Sixty four Californian and New Zealand White rabbits (equal number of both sexes) of a marketable age (two and three months) procured from Al Barari Investment Company farm at Ismaila Governorate, Egypt were used in the present study. The rabbits were slaughtered and carcasses were skinned, eviscerated, washed and split along the backbone into two halves. One half of each carcass was packaged in polyethylene bag and kept frozen at -20°C until withdrawn for treatments.

Treatments

The investigated rabbit carcasses were divided into four specified groups treated as follows:
(a) The first group was analyzed fresh and served as control.
(b) The second frozen at -20°C group was thawed at 4°C for eight to 10 hours, then cooked in pressure cooker pan applying the sterilization regime: 10-15-10/100°C as recommended by Ball and Olson (1957) and Helwan Engineering Industries Catalogue (Anon., 1988) for cooked rabbit meat. The pressure used in the pressure cooker pan was about 1.991mm mercury.
(c) The third frozen at -20°C group was thawed, wrapped with aluminum foil and roasted in an electric oven at 167(±2)°C to an internal temperature of 95°C according to the method of Greenhouse *et al.*, (1984).
(d) The fourth frozen at -20 °C group was thawed, hot cured at 50°C in a brine solution consisting of 15% Nacl, 3% sucrose and 1.5ppm sodium nitrite for 20 hours, then cold smoked for three hours within the temperature range of 30-35°C in the smoke chamber according the method of Owen *et al.*, (1979).

Preparation of samples

Fore limb, loin and hind limb cuts were withdrawn from fresh and treated carcasses according to Deltro and Lopez (1985). Each cut was deboned and rapidly fine minced through a mechanical meat chopper, then all determinations began promptly without any delay.

Analytical methods

Moisture, crude fat and ash contents were determined according to AOAC (1980) while, total nitrogen was determined by the Kjeldhal method (1980). Crude protein content was calculated as N x 6.25. The caloric value was calculated as described by Zaitsev *et al.*, (1969).

RESULTS AND DISCUSSION

The results of the gross chemical composition and caloric value of Californian and New Zealand White rabbit meat as affected by sex, age and cut are presented in Table 1. The moisture content of rabbit meat was 73.86 and 73.62% for the two studied strains, respectively. Such results are in agreement with those reported by Scheibner (1970); Gilka (1975); Holmes *et al.*, (1984) and Bayoumy (1986). Data in Table 1 indicated that males had a higher moisture content than females, which might be due to the relatively lower content of fat in the former than in the latter. Such data are in good agreement with Kawinska *et al.*, (1980); El-Gamal *et al.*, (1984) and Kowalski *et al.*, (1986) who reported that females rabbit meat had higher fat content than males. The data revealed that the males had higher protein and ash contents than females. The data indicated that the caloric values were 124.81 and 124.97Kcal/100g in Californian and New Zealand White rabbit meat, respectively. Such results are in accordance with those reported by Paul *et al.*, (1988), who reported that caloric value of rabbit meat was 124Kcal/100g. The females rabbit meat recorded higher caloric value than males. As age advanced, protein content decreased, while fat content and caloric value were increased. Ash content was almost nearly the same. Similar results were noted by Rudolph *et al.* (1980), who found that there was a tendency for protein content to decrease and fat content to increase with increasing age of white New Zealand rabbits, while ash content was nearly the same with age advancement. Regardless of sex and age, the fore limb recorded the lowest protein value and highest fat content and caloric value among the three studied cuts. However, it was difficult to detect any specific trend for ash between the three studied cuts. Similar results were recorded by El-Gamal *et al.* (1984) for Bouscat rabbit meat. Deltro and Lopez (1978) studying Californian and New Zealand White rabbit meat, indicated that hind leg meat and *longissimus lumbaris* muscle had higher protein and lower fat content than the remainder of the carcass.

Effect of processing methods

The data given in Table 2 revealed the effect of the three studied processing methods on the gross chemical composition and caloric value of Californian and New Zealand White rabbit meat. The three studied processing methods caused a marked decrease in moisture content of rabbit meat. However, the highest loss in moisture content was found in roasted meat (10.50 and 9.69%) and the least loss in smoked meat (8.68 and 8.92%) while, pressure cooked meat recorded intermediate loss (9.43 and 9.85%) in Californian and New Zealand White rabbit meat, respectively. On the other hand, Owen *et al.* (1979) reported that smoked rabbit meat recorded moisture content ranging between 57.29 and 66.38% while, Altman and Dettmer (1986) indicated that moisture content of cooked rabbit meat was 59.8g/100g. Results shown in Table 2 indicated that the three studied processing methods generally reduced the protein content. Similar results were reported by Khan and Van den berg (1965). The higher percentage of protein was recorded for roasted rabbit meat followed by pressure cooked meat while, the lowest percentage was for smoked rabbit meat. The rather high decrease in protein content in smoked meat might be due to the loss during curing and smoking drippings. The data given in Table 2 showed that roasted rabbit meat has the highest fat content followed by smoked meat, while the least content was recorded for pressure cooked meat. However, the three studied processing methods reduced the fat content,

which could be attributed to the loss of fat by heating during the processing. Table 2 illustrates the change in ash content of rabbit meat by processing methods. The smoked rabbit meat had the highest ash content, while the pressure cooked meat had the lowest content. The high content of ash in smoked meat might be due to the hot curing treatment before the smoking process. Such results are in agreement with those reported by Owen *et al.* (1979) who reported that mean values of salt percentage ranged between 4.21-10.21% in smoked rabbit meat. Furthermore the three studied processing methods increased the caloric value of rabbit meat (Table 2). The increase of caloric value might be due to the reduction in moisture content. The highest caloric value was recorded for roasted meat and the least was noted for smoked meat, while pressure cooked meat had intermediate value. Similar results were indicated by Paul *et al.* (1988) who reported that caloric value of cooked rabbit meat was 179Kcal/100g, while Altman and Dettmer (1986) recorded 216Kcal/100g.

CONCLUSION

From such results it could be concluded that rabbit meat is low in calories and high in protein content in contrast to other meats. Besides, the roasting process caused minimal loss in protein and fat content in rabbit meat recording a higher caloric value. Therefore, roasting could be considered the best recommended cooking method for the rabbit meat.

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Table 1. Influence of sex, age and cut on the gross chemical composition and caloric value of Californian and New Zealand White rabbit meats (per/100g).

Sex, age, cut	Moisture %		Protein %		Fat %	
	I	II	I	II	I	II
Male, 2 months						
A	73.8	73.5	76.7	76.6	19.4	17.4
B	74.6	73.9	79.5	77.0	16.2	15.7
C	74.7	74.3	79.5	78.2	16.2	16.3
Mean	74.37	73.90	78.57	77.27	17.27	16.47
Male, 3 months						
A	74.0	72.8	76.5	75.4	19.2	18.4
B	74.2	73.8	77.9	77.1	17.1	17.9
C	74.2	74.1	77.1	78.0	18.6	18.2
Mean	74.13	73.57	77.17	77.83	18.30	18.17
Male, Mean	74.25	73.74	77.87	77.05	17.79	17.32
Female, 2 months						
A	72.8	72.9	76.3	75.3	21.2	21.8
B	72.9	74.1	76.5	78.4	19.1	17.4
C	74.2	73.7	78.3	78.0	19.4	17.9
Mean	73.30	73.57	77.03	77.23	19.90	19.03
Female, 3 months						
A	73.0	72.9	73.7	75.3	21.9	22.1
B	73.7	74.1	76.4	76.8	19.4	18.9
C	74.2	73.2	77.9	76.9	20.2	19.0
Mean	73.63	73.40	76.00	76.33	20.50	20.00
Female Mean	73.47	73.49	76.52	76.78	20.20	19.52
Overall Mean	73.86	73.62	77.20	76.92	19.00	18.42

Table 1 (cont). Influence of sex, age and cut on the gross chemical composition and caloric value of Californian and New Zealand White rabbit meats (per/100g).

	Ash %		Caloric Value Kcal	
	I	II	I	II
Male, 2 months				
A	4.4	4.2	124.1	122.6
B	4.7	4.6	117.3	117.3
C	4.9	4.7	117.8	118.2
Mean	4.67	4.50	119.73	119.37
Male, 3 months				
A	4.5	4.0	124.6	127.0
B	4.9	4.6	120.0	123.1
C	4.8	4.6	122.8	123.1
Mean	4.73	4.40	122.47	124.4
Male Mean	4.70	4.45	121.1	121.89
Female, 2 months				
A	4.9	4.1	130.9	134.7
B	4.4	4.6	128.2	121.7
C	5.0	4.1	125.8	124.3
Mean	4.77	4.27	128.30	126.90
Female, 3 months				
A	4.5	4.1	132.7	135.6
B	4.9	4.6	126.3	123.7
C	4.3	4.1	127.2	128.3
Mean	4.57	4.27	128.73	129.20
Female Mean	4.67	4.27	128.52	128.05
Overall Mean	4.69	4.36	124.81	124.97

I = Californian; II = New Zealand White
* = on dry weight basis
A = Fore limb; B = Loin; C = Hind limb.

Table 2. Effect of processing methods on gross chemical composition and caloric value of rabbit meat.

Strain/ treatment	Moisture %	Protein* %	Fat* %	Ash* %	Caloric value Kcal /100g
Californian					
Fresh	73.86	77.20	19.00	4.69	124.81
Pressure cooked	64.04	75.60	18.46	3.40	168.41
Roasted	63.71	76.05	18.60	4.59	171.57
Smoked	65.18	71.92	18.54	10.78	158.31
New Zealand White					
Fresh	73.62	76.92	18.42	4.36	124.97
Pressure cooked	63.77	75.81	17.72	3.40	167.63
Roasted	63.66	76.35	18.01	4.53	169.99
Smoked	64.70	69.52	17.98	11.36	155.33

* On dry weight basis.