CHANGES IN GROSS CHEMICAL COMPOSITION, AMINO ACID COMPOSITION AND MINERAL CONTENT IN HUBBARD CHICKEN TISSUES DURING BOILING AND FRYING

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SUMMARY

This investigation was performed in an attempt to study the effect of boiling and frying on some quality attributes of breast and leg cuts of Hubbard chicken meat, i.e. gross chemical composition, amino acid composition and mineral content.

The data revealed that total lipid content was least in breast and relatively high in leg recording 1:3 ratio respectively. However, both breast and leg have similar protein content. Breast of Hubbard chicken had lower fat content as well as lower caloric value than that of leg.

Moreover, data showed that both breast and leg cuts contain rather similar levels of all essential amino acids except that of histidine, valine and tryptophan. In general, breast and leg cuts of Hubbard chicken may be considered as a good source of dietary phosphorus, zinc and iron but rather poor in calcium.

Boiling, resulted in decreasing phosphorus, calcium, sodium and potassium contents in both breast and leg cuts. However, frying did not introduce significant loss in such minerals.

INTRODUCTION

With the amounting worldwide concern for nutrition and the need to feed the tremendous over growing population, interest is increasingly focused on animal protein. Poultry meat is the most efficient and effective means for producing such protein. The former has low caloric value and cholesterol content but contains considerable levels of both essential amino and fatty acids (Mountney 1976).

The proteins in poultry constituting approximately one-fifth the edible portion, are of high quality. Moreover, poultry is a good source of iron and phosphorus (Bowers and Fryer 1972).

Wing and Alexander (1972) pointed out that poultry, like all lean meat is a good source of B-vitamins. Dark meat of chicken is richer in riboflavin than light meat, but the latter is richer in niacin.

The above-mentioned advantages, combined with its relatively low market price, make poultry very attractive to the consumer. Accordingly, there is an increasing demand for poultry meat through over the world.

Work on the storage of uncooked chicken meat has shown that the amount of protein-breakdown products increased concomitantly with the development of off-odour and off-flavour during storage at both above- and below-freezing temperatures (Khan 1964; Khan and Van den Berg 1964). Since protein-breakdown products are formed as a result of proteolysis, it is of interest to study the effect of frozen storage on pre-cooked frozen poultry in which the proteolytic activity is destroyed by cooking. Such a study also permits comparison of biochemical and quality changes that occur in chicken muscle in the absence of proteolysis and might indicate objective methods for the evaluation of quality in cooked poultry meat (Khan and Van den Berg 1965).

This study was carried out to investigate the effect of two processing methods namely, boiling and frying on some specific quality attributes of breast and leg cuts of Hubbard chicken meat, namely: gross chemical composition, amino acid composition and mineral content.

Table (1): Effect of boiling and frying on gross chemical composition and energy value of certain Hubbard chicken tissues.

Chemical composition	Treatments					
	Breast			Leg		
	Fresh	Boiling	Frying	Fresh	Boiling	Frying
Protein %	15.987	17.451	16.910	13.980	16.050	15.240
Fat %	7.680	6.800	6.410	24.660	23.180	22.770
Moisture %	74.716	71.863	69.987	64.081	61.445	60.085
Ash %	1.117	0.986	1.083	1.071	0.963	1.032
Cal/100 g*	133	131	125	277	272	266

* Energy values were calculated on the basis of 4 calories/g for protein, and 9 calories/g for fat.

Table 2: Effect of boiling and frying on the essential amino acids content of certain Hubbard chicken tissues (g/100 g. protein).

Essential amino acids	Treatments					
	Breast			Leg		
	Fresh	Boiling	Frying	Fresh	Boiling	Frying
Arginine	1.93	1.01	0.91	2.03	1.80	1.61
Histidine	2.15	2.10	2.08	2.96	2.92	2.84
Lysine	3.26	2.34	2.27	3.38	3.09	2.83
Leucine + isoleucine	7.48	7.15	7.02	7.64	7.23	7.18
Methionine	1.34	1.18	1.09	1.29	1.08	0.97
Phenylalanine	3.51	3.37	3.24	3.47	3.29	3.20
Threonine	2.37	2.19	2.12	2.41	2.24	2.15
Tryptophan	0.66	0.60	0.54	1.18	0.84	0.76
Valine	3.69	3.41	3.15	2.85	2.60	2.42

Table (3): Effect of boiling and frying on the mineral content of certain Hubbard chicken tissues (mg/100g.)

Mineral content	Treatments					
	Breast			Leg		
	Fresh	Boiling	Frying	Fresh	Boiling	Frying
Sodium	187.80	136.40	162.90	193.20	149.60	178.50
Potassium	269.00	232.80	250.30	242.30	190.40	236.40
Calcium	9.80	6.20	9.72	11.40	7.90	11.31
Iron	2.70	2.81	2.90	3.50	3.56	3.61
Zinc	5.30	5.36	5.41	5.60	5.68	5.70
Phosphorus	224.60	180.30	221.00	260.10	218.41	248.81

MATERIALS AND METHODS

Materials

At marketable age (7 weeks), a random sample of male Hubbard chicken were obtained from Assiut University Experimental Farm and used in this study. The samples were taken from selective tissues of dressed chickens namely: breast and leg. The samples were divided into three parts, and every part was subjected to different treatments as follows:

a) The first part: Raw meat was cut into small pieces, mixed, chopped twice in a meat chopper, then kept as control in glass containers and stored at +4C for chemical analysis.

b) The second part: The meat was cooked in boiled water for 45 minutes. The samples were minced, thoroughly mixed, then kept in glass containers and stored at +4C for chemical analysis.

c) The third part: The samples were fried in a Mies Commercial pressure fryer, as previously reported by Lee and Dawson (1973) except that no fats were added. The samples were prepared as above-mentioned for raw and boiled samples.

Methods:

Moisture, crude fat, total nitrogen and ash contents were determined according to AOAC standard methods (AOAC, 1975). While, the caloric value was calculated using Pearson's method (1976).

Essential amino acids content:

Essential amino acids except tryptophan were determined qualitatively and quantitatively applying thin layer chromatography, as described by Block et al. (1958).

Tryptophan content:

Tryptophan was estimated by the Spies and Dorries standard colorimetric method (1948).

Minerals content:

Sodium and potassium contents were determined flame photometrically by using a Carl-zeiss Jena flame photometer (Jackson 1958). While, phosphorus content was measured colorimetrically by Pearson's ammonium molybdate method (1976).

Calcium, iron and zinc contents were determined using unicam sp 1900 atomic absorption spectrophotometer according to Gorsuch (1959).

RESULTS AND DISCUSSION

1. Gross chemical composition:

The meat proximate composition and energy value per 100 gram of breast and leg cuts of Hubbard chicken meat during boiling and frying process are tabulated in Table (1).

The data revealed that the total lipid content was least in breast and relatively high in leg, recording 1:3 ratio, respectively, which is in close agreement with Katz et al. (1966) findings. However, it is apparent that both breast and leg have similar protein content. Cooking caused a decrease in moisture content, with a resultant increase in protein content of chicken meat. In general, breast of Hubbard chicken had lower fat content as well as lower caloric value than that of leg. The results are in good accord with those previously reported by Khan and Van den Berg (1965).

The results indicate a close relationship between the increase in protein content and the proteolysis taking place in cooked chicken.

2. Essential amino acids content:

Results of the essential amino acids composition of the breast and leg tissues separated from fresh, boiled and fried Hubbard chickens are outlined in Table (2). The data revealed that both breast and leg cuts contain rather similar levels of all the amino acids, except that histidine, valine and tryptophan were found in variable levels.

Furthermore, the data revealed that fresh, boiled and fried chicken meat had a similar histidine content, while boiled and fried chicken meat contained very low levels in the other essential amino acids. This might be due to the effect of cooking on chicken meat. Such data are in close agreement with Khan (1962); Khan and Van den Berg (1965) and Heine et al. (1973).

Levels of amino acids in chicken meats in the present study are rather comparable to the FAO pattern (1973), which suggests that Hubbard chicken meats are reckoned as good source of supplying amino acids to the diet as well as in maintaining nitrogen balance in the human adult.

3. Minerals content:

Table (3) represents the average contents of nutritionally important minerals, i.e. sodium, potassium, calcium, iron, zinc and phosphorus in breast and leg cuts of Hubbard chicken meat during boiling and frying process. These results revealed that both breast and leg cuts were rather similar in their sodium, calcium, iron and zinc contents with variable levels in potassium and phosphorus.

Moreover, the data proved that breast and leg cuts of Hubbard chicken might serve as good source of dietary phosphorus, zinc, iron, potassium and sodium but rather poor in calcium. These findings are in good accordance with those previously reported by Pellet and Shadarevian (1970), Price and Schweigert (1970) and Underwood (1977).

Boiling, resulted in decreasing phosphorus, calcium, sodium and potassium contents in both breast and leg

cuts. Such finding coincides with Price and Schweigert (1970), who found that boiling may cause some loss of fluid containing a small portion of minerals. However, boiling produced a contrary effect on zinc and iron. The increasing of the latter minerals due to boiling may be attributed to its presence in an insoluble form and to the probable uptake of the zinc from water which contained 0.968 ppm (Aziz 1976).

On the other hand, the rate of decrement of phosphorus, calcium, sodium and potassium were relatively lower in fried than in boiled chicken meats.

In conclusion, on the basis of the above-mentioned data, it is noteworthy that both boiling and frying more or less improved the nutritive value of chicken meat.

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