Survey study on the minced meat of local market in form of sausage or mixtures of minced meat and meat substitutes.

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Introduction

The chemical composition of local market sausage varies according to many factors such as type of meat, meat cut used, filling materials, spices, chopping temperature; Helmer and Saffle (1963), Sadek (1964), Lotfi and Youssef (1966), Baliga and Madaiah (1971), and Sholokova et al.(1975). Meat substitutes may contain high quality plant protein such as soya protein, soya flour and other different legume proteins; Ziemba (1969), Gerrard (1969) and Wolf (1970). Such meat substitutes may affect the nutritive value and/or water holding capacity and cooking losses.

Water holding capacity and plasticity are considered two of the most important physical properties of the meat and meat products stipulating its quality and characterestics ; Volvinskaia (1953), Wierbicki and Deatherage (1958), Amein (1976), El-Dashlouty (1978) and El-Nemr (1979). Meat cooking loss may be affected by many factors such as type and quality of meat, method and temperature used in cooking; Saffle and Bratzler (1959), Poul and Bratzler (1955).

Histological or microscopic examination of market sausage samples may reveal the presence of parts of intestine tissues and/or any frozen material formulated in the minced meat or sausage.

The present work was carried out to study the chemical, technological and histological characteristics of sausage and soy meat sample collected from local market in Cairo. It is hoped that the results obtained may be of some value from the application point of view and the preparation of new standard specifications and quality control of such food product.

Materials and methods

Nine samples of sausage were collected from local market in Cairo. Sample of soy meat used was brought from super market. This kind of meat is a mixture of minced meat and soy protein prepared by the Egyptian Meat Company.

Moisture, ash, ether extract and total acidity were carried out according to the method described in the A.O.A.C. (1970). Free amino nitrogen were determined as glycine by ninhydrine test as described by Stein and Moore (1954). For the determination of pH-value, and starch and glycogen the methods mentioned by Krilova and Liskovskaia (1961) and Winton and Winton (1958) were adopted.

Water holding capacity and plasticity were measured according to the method described by Grau and Hamm (1957) as modified by Volvinskaia and Merkolova (1958). Cooking loss was determined as follows; One hundred gram of the sample was boiled in one liter of water for 5, 10 and 15 minutes. After boiling for 15 minutes, the sample was fried in hot butter for 5 minutes.

Histological evaluation were determined according to the method described by Kisily (1962).

Results and discussion

Chemical composition : Data obtained concerning the chemical composition (table I) showed that the chemical composition of the nine samles varied widely. Such variation may be due mainly to unstandarised composition for such a product. On the other hand, the ratio of different components used in sausage manufacture such as meat cuts, butchery wastes, and flavorings vary from factory to another and from day to day leading to great difference in the sausage composition. Such findings coincide with that reported by Saffle and Bratzler (1959), and Sholokova et al. (1975), who indicated that the meat of good cuts produces sausages of higher water holding capacity. Also, Abd El-Salem (1978) attributed the great variation in sausage composition of market samples to the initial substitutes used in such sausages.

It is clear that the high fat content in some sausage samples is on the account of the protein content and vice versa, which could be explained by the use of more fatty tissues the manufacture of such samples. Results obtained did not significantly differ than those reported by Meyer (1971). Sample No. 7 has the lowest pH (4.60) which is near to the isoelectric point of meat proteins. The low pH may be attributed to the breakdown that occured in the glycogen leading to the formation of lactic acid or to souring due to bacterial contamination and accordingly lower pH value. So, less WHC is expected for this sample. Nevertheless, the measured WHC of this sample was high. This may be due or interpretated by the presence of a high percentage of starch(which acts as a water binding substance), which appeared from the chemical composition of this sample (Table I). Such behaviour is confirmed by that reported by Volovinskaia (1953). She concluded that the WHC could be improved at boiling by the addition of 2-7% starch in sausage manufacture. Also,Baliga and Madaiah (1971) stated that the incorporated dried powder (starchy material) in sausage production reduced the cooking loss.

Technological properties : Generally, a positive correlation could be established between the initial moisture content in the sausage and the cooking loss. Tis could be interpreted according to the fact that the proteins from either meat or soy bean are denaturated at the high temperature during cooking leading to their shrinkage. Accordingly a loss in the moisture content which was bound to such proteins especially more if the initial moisture content was higher. Such a correlation was also reported by Baker (1942), Wierbicki et al.

(1954) and Paul and Bratzler (1955).
The decrease that occured in WHC of some samples may be attributed to the higher initial moisture and fat contents in the sausage as indicated by Lavorova et al.(1973) who noticed that the increase of fat content in sausage reduces the WHC and sausages quality.They added that meat of low pH value excludes more fluids during salting. The low moisture content in some samples is referred to its storage for longer periods leading to moisture loss by evaporation. The high cooking loss is ascribed to the higher content of fats which melts during cooking, boiling or frying. Existence of moisture affects the sausage plasticity, as the samples containing higher moisture content are characterised with higher plasticity. The prolonged cooking time resulted in more reduction in the sausage weight which was relatively less than detected in frying. In cooking, it ranged between 0.5I-7.59% while in frying, it varied from I4.5 to 27.7I %. Which was ascribed to the melting obtained. Such results are in agreement with those reported by Baliga and Madaiah (I970).

Microscopic structure : The section prepared from sausage and mixture of minced meat and soy protein showed a special structure (Fig. I-a and I-b). This special structure of sausage showed muscle fibers of visible sarcomeres (Fig.2 and 3), connective tissues, granulated substances, fat tissues (Fig.4 and 5), blood vessels and substances of plant origin as spices (Fig.6).
The muscle tissues took the form of either intact of long fibers (Fig.7) or small (Fig.8) fragments of short fibers. The same section may also show a cross section of muscle tissues, which indicated that some muscle tissues lay in perpendicular position to the knife of the microtome (Fig.9). The substances of plant origin were stained in dark-brown to black color and hence were easily distinguished from the animal origin muscle, fat and connective tissues (Hassan I976).
The presence of intact muscle fibers in such unhomogenized sample sausage, enables easily to carry out the measurements of the muscle fiber diameters and sarcomere lengths (Table 3). The muscle fibers were straight or slightly waved. The "U shape" in the meat fiber (Fig. I0) may be ascribed to the natural special structure of the muscle. Similar deformation was noticed by Tinikov (I967), on the Bicepts femoris muscle of cows.
The microscopic examination reveald that some sausages were prepared from previously frozen meat (samples No. I,3,6,7 and 8). Such treatment reduces the muscle fiber diameters and sarcomere lengths by shrinkage resulting from migration of water outside the cells. Shrinkage due to freezing was particularly obvious in samples No. I and 8 as indicated by the small muscle fiber diameters and for sample No. 7 as indicated by the markedly short sarcomere lengths. Nevertheless, such samples did not show the lowest WHC and plasticity as expected for the frozen tissues (Mohamed I974). The increase of the crystal size due to frozen storage lead to pressure and rupture of tissues and consequently accumulation of pressed fibers and bundles into groups. Thus wide clear areas between such groups were clear Similar observations were found by Hafiz (I973), Mohamed (I974), Ghaly (I977) and Abd El-Salam (I978) using buffalo, chickens, fish and crub meat.
No relation was found between the sarcomere lengths,muscle fiber diameter and the physical properties of sausages, WHC and plasticity, Table 2. Many factors may play a role in the data obtained as animal age, post mortem conditions, the amount of connective and fat tissues as well as the amount of plant substances. Moreover, the variable processing conditions may markedly affect both the histological and physical parameters of sausage. Samples No. 2,4,5,9 and I0 showed no sign that such samples were made from frozen meat especially for samples No. 2 and 5 in which big pieces of indamaged intact muscle tissues occupied a relatively large area of the microscopic fields. In the aforemention samples, the muscle tissues were predominated over the other components of sausages, i.e. the fat, connective and plant tissues. The amount of connective tissues and fat tissues as judged visually varied widely among the samples.
The addition of intestine tissues in such samples is also, possible as indicated from the firm and rope-like especially in samples No.4 and 8. Samples No. 4,8 and 9 showed high amounts of connective tissues, which were firm and rope like specially in sample 4 and 8. Sample No. 5 showed intermediate amount while samples No. I,2,3,6,7 and I0 retained relatively low amounts of connective tissues. Samples No. 6 and 9 showed the highest amount of fat tissue, while samples No. I,2,3,4,5 and I0 showed lower amounts.

With regard to the plant substances, the uneven distribution was noticed for all samples except sample No. I0. The different samples could be arranged in decreasing order with regard to amount of plant substances as follows : I0, 4, I, 8, 3, 7, 5, 2, 6 and 9. Actually samples No. 9 and 2 showed slight amounts of plant substances, which could be normally added spices. Sapmle 6 showed also small amounts of plant substances. The amount of plant substances was high in sample I0, followed by samples No. 4, I, 8, while samples No. 3, 7 and 5 showed an intermediate amount (Fig. I5, I6, I7, I8).

Table (1) : Chemical composition of local market samples; sausages and a mixture of minced meat and meat substitute.

Component* \ Sample No.	1	2	3	4	5	6	7	8	9	10**
Moisture%	45.95	44.79	45.16	28.20	54.49	33.36	30.30	49.05	43.88	70.21
Protein %	41.21	44.12	44.15	22.24	48.45	33.30	21.06	40.61	39.30	55.78
Ether extract %	56.99	49.70	49.76	75.80	47.33	63.06	58.08	56.39	58.03	30.59
Ash %	2.10	2.30	2.01	1.11	1.40	2.71	2.67	1.57	1.06	4.83
Glycogen+Starch%	0.50	1.45	1.84	0.32	2.20	0.53	15.52	1.22	1.73	1.98
Total acidity***	0.45	0.60	0.32	0.14	0.41	0.18	0.54	0.27	0.27	0.45
P^H value	5.55	5.35	6.00	6.20	5.50	6.40	4.60	6.00	6.20	6.30

* Determined on dry weight basis.

** Mixture of minced meat and soy protein.

*** Measured as percentage of lactic acid.

Table (2) Some technological properties of local market sausage samples, and mixture of minced meat and meat substitute*.

Sample No.	Water holding Capacity %	Plasticity in cm^2	Cooking loss %	
			Boiling for 15 min.	frying for 5 min.
1	75.63	2.91	45.9	63.3
2	75.12	2.82	46.7	69.0
3	92.93	2.48	29.7	55.0
4	88.28	2.18	42.4	56.6
5	74.67	2.91	37.9	55.0
6	94.91	1.80	26.2	50.5
7	98.61	1.87	13.1	35.2
8	91.61	2.66	35.9	48.2
9	94.96	2.75	35.2	48.8
10*	63.87	2.64	31.3	54.4

Table (3) : The average muscle fiber diameters and sarcomers lengthe of muscle tissue particles found in sausages obtained from the local market and ground meat with soya*(in microns).

Sample No	1	2	3	4	5	6	7	8	9	10*
Fiber diameters	10.43	27.52	12.80	18.11	16.00	22.40	21.50	8.00	24.00	19.20
Sarcomere lengths	2.48	3.36	2.29	2.38	2.71	2.78	2.04	2.63	2.59	2.85

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Fig. (1-a) : General appearance of sausage, sample No. 2, (5 x 10).

Fig. (1-b):General appearance of ground meat with soy, sample No.10 (5 x 10)

Fig.(2): Short sarcomeres, samples No. 3, (12 x 40).

Fig.(3):Tall sarcomeres, sample No. 10, (12 x 40).

Fig.(4): Fat tissues, sample No. 5, (5 x 10).

Fig.(5): Fat tissues,sample No. 10, (5 x 5).

Fig. (6): spices; sample No.1, (5 x 40).

Fig.(7) :Long muscle fiber spices with large muscle fiber diameters, sample No.2, (5 x 40).

Fig.(8) : Short fragments of muscle tissue fibers, sample No. 4 , (5x 40)

Fig. (9): Muscle fibers in the cross section , sample No. 5, (5 x 40).

Fig. (10): U-shaped fibers, sample No. 5, (5 x 40).

Fig.(11):Muscle fibers of sausages prepared from frozen tissues, large clear areas between the thin grouped muscle fibers, sample 8, (5 x 40)

Fig. (12): The firm, ropelike connective tissues, sample No. 8, (5 x 10).

Fig.(13): Pressed fat cells by the effect of freezing before processing, sample No. 8, (5 x 10)

Fig.(14): Rope-like connective tissues, sample No.4, (5 x 10).

Fig(15-a): Marked plant substances content, sample No. 10, (5 x 10).

Fig.(15-b): Marked amounts of plant substances, sample No. 10, (5 x 10).

Fig.(16): High amount of plant substances, sample No. 1, (5 x 10).

Fig. (17): Intermediate amounts of plant substances, sample No. 7, (5 x 10).

Fig. (18): Low amounts of plant substances, sample No. 6. (5 x 10).