fect of Adding Peanut Meal on Physical, Chemical and Organoleptic Properties of Sausage

A. HUSSEIN, M.B. DOMA, T.M. DESSOUKI and A.M. HASSAN

od Science Department, Mansoura University, Egypt.

INTRODUCTION

In Egypt, there is a great shortage in meat, moreover its price is high. This investigation was designed substitute some part of meat in sausage manufacture with peanut meal (10-40%).

Fillers and binders such as bread, dried yeast, skim milk and cereals are widely used in sausage to reduced e cost of production, increase the nutritional value and to improve flavour, colour, slicing characteristics d binding properties. Binder, aids in emulsifying fat and binds water. The principal functional ingredients binder is its protein contents. The binder, thereby, contains greater amounts of protein than fillers which e mostly carbohdrates. Binders may be of animal (skim milk, casein) or vegetable (soy products) origin ilson, 1960).

Ameen (1976) prepared beef sausage containing 20% of prepared meat substitute i.e. chick peas, dried yeast, d horse beans. Chick peas, dried yeast and horse beans sausages contained 58.25, 61.91, 57.22% moisture; 35.19, .33, 35.30% protein; 40.58, 40.67, 40.44% fat; 8.85, 11.40, 8.66% ash respectively (on dry weight basis).

Groltry et al., (1976) used sog protein as meat substitute for sausage at different levels, being 0,10,20 d 30% (on wet weight basis for sausage mixture). It was found that using 10% soy protein showed the best lavour, juiciness and general acceptability.

MATERIALS AND METHODS

Materials

1- Meat

The beef used in this study was obtained from the hind quarter of 18 month old male animals (buffalo) from e local market of Mansoura. Fat and thick connective tissues were removed. Twice minced in electrical mincer. en analyzed or processed (to sausage).

2- Fat

Fat tissues were obtained fresh from different parts of the buffalo's carcass, then minced.

3- Casing :

Fresh mutton casing were obtained, then fat tissues and mucosa were removed manually.

4- Peanut meal :

Peanut seeds, Arachis Hypogaea were obtained from the local market of Mansoura, roasted at 150°C for 45 inutes, then freed from the internal fine cortex. Seeds were bruised in a morter so as to obtain a peanut aste.

Preparation of sausage :

Beef sausage (control sample) containing lean meat 61.57%, fat tissues 20.37%, saturated sodium chloride olution 10.68%, garlic 4.12%, black pepper 0.82% , gubeb 0.82%,cummin 0.41%, cardamom 0.08%,cloves 0.08%, uthneg 0.01% sugar 0.82% and nitrate plus nitrite 0.02% For sausages prepared with meat substitutes 10,20,30 nd 40%, sausage mixture was replaced by equal amount of peanut meal. In case of using 40% peanut meal ausage, 10% of water were added to facilitate kneading and stuffing.

B- Chemical analysis :

Moisture, ash, crude protein, crude fat and starch content were determined according to the methods of he A.O. A.C. (1965)., while carbohydrates were calculated by difference.

Energy value was estimated as follows :

Energy value = (% carbohydrates x 4.1) + (% protein x 4.1) + (% fat x 9.1).

The essential amino acid composition were determined according to Block et al., (1958) While tryptophan as determined after alkaline hydrolysis according to the method discribed by Blauth et.al., (1963).

C. Physical Evaluation :-

1- The water holding capacity (WHC) and plasticity :

he WHC and plasticity were measured according to the method described by Volovinskia and Merkolova (1958).

2- Feder Value :

Feder Values were estimated in sausages according to the method described by Pearson (1970).

$$\text{Feder value} = \frac{\% \text{ water}}{\% \text{ organic non fat}}$$

where: % organic non fat = 100 - (% fat + % ash + % moisture).

3-Texture indices :

Protein water coefficient (PWC) and protein water fat coefficient (PWFC) were calculated accordng to Tsoladze (1972).

$$\text{PWC} = \frac{\% \text{ protein}}{\% \text{ water}}$$

$$\text{PWFC} = \frac{\% \text{ protein}}{\% \text{ water} + \% \text{ fat}}$$

4- Cooking loss of sausage :

Sausage samples were weighed immediately before and after cooking at 100°C for 15 minutes and/or 80°C for 10 minutes. To calculate the percent of loss, frying at 130°C in hydrogenated oil was carried out for ausage boiled for 15 minutes at 100°C.

5- Organoleptic evaluation of fried samples :

Boiled samples at 15 minutes followed by frying in hydrogenated oil for 5 minutes subjected to organoeptic tests according to Molander (1960).

Results & Discussions

a- Chemical properties

1- Main chemical composition :

Replacement of part of sausage mixture with peanut meal reduced the moisture content, while increased protein, fat, starch, carbohydrates and energy values; the effect on the ash content was slight. Changes were more pronounced as the percentage of peanut increased in the beef sausage (table 1). Thereby, the main chemical composition may reveal that the nutritional value of peanut sausage was higher than the beef sausage.

So, it could be observed that the addition of peanut meal favoured the composition of sausage in as much as the three main nutrients, i.e. protein crude fat and carbohydrates were increased.

Table (1) : The chemical composition of peanut meal sausage (on wet weight basis).

Samples		Moisture	Protein N x 6.25	Crude fat	Ash	Starch	Carbohydrate	Ener. Value
Level of peanut meal	10%	55.50	14.31	21.25	3.21	2.22	5.73	276
	20%	50.16	15.62	23.83	3.30	2.75	7.09	310
	30%	45.44	16.65	26.18	3.38	3.17	8.35	341
	40%	45.10	16.20	26.43	2.75	3.22	9.52	346
Beef Sausage (control)		61.37	13.64	18.38	3.10	2.13	3.51	238
Beef		71.93	22,14	3.32	1.00	--	1.61	129
Peanut meal		0.84	24.69	48.59	2.66	5.61	23.22	639

2- Essential amino acids :

From table (2) it could be noticed that the decrease of lysine in 10 and 20% peanut sausage (compered to control sausage) was slight. The dilution effect of fat, spices and other ingredients in control sausage reduced tryptophan content compared to peanut meal, and hence, the addition of peanut actually increased tryptophan in peanut meal sausages. Only methionine was reduced with addition of peanut meal.

With regard to sausages, peanut sausage meets the daily requirements of adult man in all essential amino acids (including methionine), except for tryptophan (lower by 36%). But control sausage was more difficient in tryptophan (by 44%).

Table (2): Essential amino acids content peanut meal sausages (gm./100 gm. wet sample).

Samples		Lys.	Hist.	Argi.	Thre.	Meth.	Val.	Phen.	Leuc. + Isol.	Tryp.
Level of peanut meal	10%	1.08	0.35	1.15	0.50	0.30	0.72	0.57	2.10	0.15
	20%	1.08	0.35	1.28	0.51	0.28	0.82	0.68	2.17	0.16
	30%	1.07	0.36	1.52	0.53	0.26	o.89	0.77	2.27	0.17
	40%	0.99	0.33	1.61	0.51	0.21	0.86	0.81	2.18	0.16
Beef sausage (control)		1.10	0.34	0.87	0.48	0.34	0.68	0.51	1.99	0.14
Beef		2.51	0.97	1.92	1.16	0.92	1.54	1.18	4.04	0.29
Peanut meal		1.07	0.41	3.74	0.79	0.18	1.53	1.43	3.18	0.23
Daily requirements for man(g./day)	*	0.80	-	-	0.50	0.20	0.80	0.30	1.80	0.25

* Nat Acad. Sci. U.S.A. (1959).

Results in table (3) showed that in order to supply the daily requirements of adult man in essential amino acids, if sausage was the only source of protein, one should consume 167, 156, 147, 156 and 179 grams of 10,20,30,40% peanut meal sausages and control sausage respectively (based on tryptophan) taking into consideration that such high amounts may be reduced to 50% if supplementation with tryptophan was done.Control samples were also difficient in tryptophan.

Table (3): Grams of sausages required to supply the daily requirement of adult man with essential amino acids.

Samples		Lysine.	Threon.	Methio.	Valine	Pheny.	Leucine + Isole.	Trypto.
Level of peanut meal	10%	74.07	100.00	66.67	111.11	52.63	85.71	166.67
	20%	74.07	98.04	71.43	97.56	44.12	82.95	156.25
	30%	74.77	94.34	76.92	89.89	38.96	79.30	147.06
	40%	80.81	98.04	95.24	93.02	37.04	82.57	156.25
Beef sausage (control)		72.73	104.17	58.82	117.65	58.82	90.45	178.57
Beef		31.87	43.10	21.74	51.95	25.42	44.56	86.21
Peanut meal		74.77	63.29	111.11	52.29	20.98	56.60	108.70

Physical properties.

1- Water holding capacity (WHC), cooking loss and feder value.

From table (4) it was found that the WHC improved with addition of peanut meal in the beef sausage.The was much better as the peanut meal level increased either before or after cooking which may be due to the effect of carbohydrates. Cooking reduced the WHC of sausages possibly because of proteins denaturation.

Results in table (5) show that the highest cooking loss was found for the control samples. Cooking loss decreased proportionally with increased of peanut meal level and increased as the time and temperature of cooking increased. Frying of sausages increased the cooking loss.

All sausages showed feder value less than 4.0 indicating the good quality as mentioned by Pearson (1970).

ble (4): The WHC of beef and peanut meal sausages (cm^2).

mples	Beef sausage (control)	Level of peanut meal Water Holding Capacity			
		10%	20%	30%	40%
esh	4.83	4.76	3.73	2.43	2.10
ooked at 100 c for 15 minutes	5.20	5.00	4.10	4.10	3.51

Table (5) : Cooking loss (%) and feder value of beef and peanut meal sausages.

Samples		Cooking in water 10min.at 80 c	10 min. at 100 c	Frying in Oil for 5 min.	Feder value
		Cook. loss	Cook. loss	Cook. loss	
Peanut meal level	10%	25.26	42.38	51.75	2.77
	20%	19.28	37.36	49.33	2.21
	30%	13.18	26.45	39.96	1.82
	40%	8.28	18.18	28.87	1.75
Beef sausage (control).		37.50	47.61	61.91	3.58

2-Texture of sausages.

From table (6) it was noticed that peanut meal reduced the tenderness of beef sausage as indicated by the increase of PWC, PWFC and the decrease of plasticity. Changes, however, were relatively low in case of 10 and 20% peanut meal sausages, cooking reduced the tenderness of both control and peanut meal sausages. Again 10 and 20% peanut meal levels were not marked changes compared to the control samples.

3-Organoleptic properties

It could be observed (table 7) that addition of peanut meal showed no effect on tenderness, while a decrease of tenderness was found using the texture indices table (6). This may be explained on basis that the higher crude fat content in peanut meal sausages (table 1) gave the sensation of tenderness to panel testers (plastic effect). Moreover, the flavour i.e. taste and aroma were improved on addition of peanut, colour however, was somewhat reduced upon replacement of a part of sausage mixture with peanut, probably due to the dilution effect on the myoglobin - the red pigment of muscle tissues.

It should be mentioned that differences between peanut and control sausage with regard to nutritional value and acceptability were not marked. Concerning the taste and aroma peanut sausages were better than the control sausage.

Table (6): The texture of sausages as affected by the level of peanut meal.

Samples		Texture cofficients		Plasticity $(cm)^2$	
		PWC	PWFC	before cooking	After cooking
Level of peanut meal	10%	0.2578	0.1864	4.65	3.00
	20%	0.3114	0.2111	4.54	3.00
	30%	0.3664	0.2324	4.43	2.90
	40%	0.3592	0.2264	3.26	2.70
Beaf sausage (control)		0.2222	0.1710	5.19	3.20

Table (7): Organoleptic evaluation of Peanut meal and beef (control) sausages.

Samples		Tender-ness.	Taste	Aroma	Colour
Level of peanut meal	10%	7.7	8.1	8.4	7.7
	20%	7.7	8.1	8.4	7.7
	30%	7.7	7.5	8.1	8.1
	40%	7.7	7.8	7.8	7.7
Beaf sausage (control)		7.7	7.5	8.0	8.5

REFERENCES

Ameen, M.A. (1976).
Chemical and Technological Studies on Some Spiced Meat in the Local Market. M.Sc. Thesis, Faculty of Agriculture, Al-Azhar University.

A.O.A.C. (1965).
Official Methods of Analysis of the Association of Official Agriculture Chemists, Mashigton, D.C.

Blauth, O.J. , Charezinski, M. and Borbec, H., (1963).
A new rapid method for determining tryptophan, Analytical, Biochemistry 6 : 67 - 70.

Block, R.J., Dwrrin, E.L. and Zweig. G., (1958).
A manual of paper chromatograph and paper electrophoresis, 2nd, Ed., Academic press, Ine Pub. M New-York.

Groltry, S.J., Stringer, W,C, and Baldwin, R.E., (1976).
Sensory evaluation of pork sausage containing textured vegetable protein, J.Food Sci., 41 (4) : 973-976.

Molander, A.L., (1960).
Discerment of Brimary Taste Substance Probable Ability to Judge Food, Iowa State University, Food Scince and Technology, Ames, Iowa, U.S.A, C.F., Sorour, A.A., Utilization of Aged Buffalo Meat For Processing of Some Kinds of Sausage, M.Sc. Thesis, Faculty Agriculture, Cairo University (1978).

National Academy of Science, (1959).
Amino acids requirement by different categories of people, Rescearch Cuncil, Pub. 711 , Washington, U.S.A.

Pearson, D., (1970).
The chemical Analysis of Food, National College of Food Technology, University of Reading Weybridge, Surry. J. and A. Chirchill.

Tsoladze, E.A., (1972).
The relationship between the tenderness of fish meat and its protein water and protein water fat coefficients. Fish Industry, 48 . (7) : 68 - 69.

Volovinskia , V.P. and Merkolova, A., (1958).
Methods for determining the water holding capacity of meat, proceedings of All Union Scientific Research Institute of Meat Industry, Bulletin No. 21.

Wilson, D.G., (1960).
Sausage Products, The Science of the Meat Products, American Meat Institute Foundation, W.H. Freeman and Company, San Francisco and London.