Egypt. J. Agric. Res., 71 (2), 1993.

LOW NUCLEIC ACIDS DRIED YEAST AS MEAT SUBSTITUTE IN BEEF SAUSAGE

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(Manuscript received 27 March 1990)

Abstract

In this study low nucleic acids dried yeast (L.N.A. D. Y.) was prepared to overcome the side effects of high content of nucleic acids on puplic health. The L. N. A. D. Y. was diluted with water (at the ratio1:1) before it was used to reduce the production cost of beef sausage . Beef sausages were prepared by replacement a part of meat (0, 10 , 20 and 30%) with an equal amount of diluted (L. N. A. D. Y.). All sausages met the requirements of the Egyptian Standards. Organoleptic evaluation showed that beef sausages containing 10% and 20% L. N. A. D. Y. were good . Therefore , it could be commercially produced . The physical properties of the prepared sausages including yield, feder value , W. H. C. and Plasticity were acceptable.

INTRODUCTION

In Egypt , yeast cells recovered as a by-product of an alcoholic fermentation, is a strain of *S. Cerevisiae*. It is a product of the Egyptian Sugar and Distillation Company.

The high nutritive value of dried yeast (D.Y.) is due to the quality of it's protein and vitamin contents according to Hedenskog *et al.* (1971). Ilnicka and Lipiec (1973), found that the crude protein in dried distillers *S. cervisiae* was 51.5 %. Martini *et al.* (1979), mentioned that the amino acid composition of the intact cells of *S . cerevisiae* was chaacterized by a high contents of threonine and lysine and a deficiency in methionine and cystine.

Eid (1977), found that most of nucleic acids Present in *S. cerevisiae* was in RNA being 9.8 % while DNA being 0.71%. About 50 years ago, Dirr and Sodan (1942), found that high nucleic acid content in the diet causes percipitation of uric acid crystals in Joints (gout) , soft tissues or the formation of stones in the urinary tract. The combined results for blood uric acid levels suggest that 2g of single - cell protein (SCP) nucleic acid per day is probably a safe limit to feed most normal subjects , but 3g of SCP nucleic acid per day might place some normal subjects at risk (Edozien *et at.* 1970).

Therefore, in the present work the nucleic acids content of the inactive dry yeast cells was reduced and the new product was used in meat sausages.

MATERIALS AND METHODS

1 - Materials

One fodder yeast *S. cerevisiae* sample was obtained from Egyptain sugar and distillation Company. Obtained sample was inactive dried yeast (D.Y) Before being used nucleic acids content of the D. Y. was reduced.

Beef obtained from the hind quarter of the animal's carcass, (about 18 months of age) was used in this study . Beef fat tissues were also used in sausage formulation.

Spices were finely ground before use. Spices mixture was composed of: cubab 5.50%, black pepper 26.37 %, ginger 4.40 %, cloves 4.40 %, caraway 8.97 and cardamon 4.40 % Spices were purchased from the local market.

2 . Prepatration of sausage

Beef sausage (control), conteained 65.0 % beef, 10.0% beef fat tissuse , 10.0 % powdered rusk, 1.5 % sodium chloride, 1.5% spices mixtrue and 12.0 % water (as ice). Emulsion type fresh sausage was prepared by mincing beef and fat tissues separately, then all ingredients were treated in a laboratory cutter for 15 minutes (for emulsifying) after which emulsion was stuffed in prepared mutton casing. Different types of sausage were prepared by replacing 10, 20 and 30% of beef with equal proportions of diluted L. N.A.D.Y. The L.N.A.,D.Y. mixed with water at the ratio of (1:1) (W:W) before it's addition to beef for the preparation of sausages.

Fodder yeast (20 g) was mixed with 0.33 N Hcl (300ml), heated on a boiling water bath for 30 min, decanted and washed twic, with 0.12 HCL (400ml) then washed twic with water (Paccetti and Carbani 1974)

For yeast , RNA was determined as described by Mejbaum (1939), while DNA was determined using the method given by Burton 1956 .

Sausages were analyzed for moisture, protein (Microkjeldahl method , NX 6.25), fat (hexane solvent , Soxhlet apparatus) , ash and fibers according to the methods described in the A. O. A. C. 1975, and Carbohydrates were determined by difference. Energy value was calculated by multiplying protein and carbohydrate by 4.0 and fat by 9.0.

Determination of RNA and DNA contents in tissue were adopted for sausages using the method of Astawrov, (1974).

Individual amino acids were determined by paper chromatography as described by Block, (1958) after acid hydrolysis using 6- N HCl solution. Tryptophan was determined colorimetrically after alkaline hydrolysis accoreding to Blauth *et al* . 1963.

Quality of sausage protein was evaluated by comparison with the FAO reference protein (FAO / WHO, 1973) and by caluclation of essential amino acid index (E. A. A. I) and biological value (B. V.) in relatoin to egg protein as described by Oser, 1959.

The Yield and cooking loss were determined and presented as percentages of the initial weight (Ameen 1976). Feder value was also determined (Pearson 1970). Water holding capacity (W. H. C.) and plasticity were measured using the filter press method described by Soloveiv 1966.

Organoleptic evaluation of cooked sausage was carried out according to Molander (1960), by aid of 10 panelists.

Marking score were as follows

Very good	8 - 9	Good	6 - 7
Fair	4 - 5	poor	2 - 3
Very poor	0 - 1		

RESULTS AND DISCUSSION

1. level of nucleic acids of dried yeast

Before single cell protein (SCP) can be used as the sole source of protein in man's diet the content of RNA must be within the reasonable daily intake of RNA such as mentioned by Edozien *et al* . (1970) . Levels of nucleic acids in dried yeast (D. Y.) and in low nucleic acids yeast (L. N. A. D. Y.) are shown in Table 1.

Table 1. RNA and DNA contents of dried yeast as affected by acid solution treatments

Nucleic acide	D. Y.	L.N. A.D.Y.	% Reduction
RNA %	6.16	1.78	71.10
DNA%	0.25	0.07	72.00

Data presented in Table1 show that RNA and DNA Percentage were reduced from 6.16 to 1.78 , and from 0.25 to 0.07, respectively. After treating the dried yeast with hydrochloric acid the reduction percent of RNA and DNA were 71.10 % and 72.00 %, respectively.

2 . Gross chemical Composition

Data given in Table 2 show the gross chemical composition of beef sausge as influenced by the different levels of L. N. A. D. Y. It could be observed that as the L. N. A. D. Y. increased in beef sausage, the moisture, protein , fat content some what decreased while ash , fiber, carbohydrate, RNA and DNA increased .

Energy value was increased also with increasing of L. N. A. D. Y. All different sausages meat the Egyptian standards (1966), which required that meat sausage should not contain more than 60 % moisture , not less than 15 % protein , not more than 30 % fat and not more that 5 % ash.

Even at 30% L. N. A. D. Y. level, total nucleic acids were markedly less (0.282g) than the safe limit (2g) to feed normal subjects (Edozien *et al.* 1970) . The value of L. N. A. D. Y. Will be evident when we caluclated theoretically the total nucleic acid for beef sausage containing 10 , 20 and 30% intact D. Y. values were 0.33 , 0.65 and 0.97 g total nucleic acids respectively. The consumption of 250 g of 30 % D.Y. sausage will raise the daily intake to 2.42g (total nucleic acids) which is over the safe limit (2g)

Tabel 2. Gross chemical composition of beef sausages as influenced by the addition of different levels of low nucleic acids dried yeast (L.N.A.D.Y.) (on wet weigh)

Components	Control	Level of L.N.A.D.Y.		
	0 %	10%	20%	30%
Moisture %	59.44	57.66	55.87	53.99
Protein %	15.87	15.68	15.50	15.44
Fat %	18.96	18.50	17.99	17.58
Ash %	1.88	2.36	2.89	3.42
Carbohydrates %	13.85	5.80	7.75	9.75
Energy value cal / 100 g	148.72	250.72	252.68	255.08
RNA mg / 100 g	3.24	91.92	18.60	269.28
DNA mg / 100 g	2.75	5.97	9.19	12.41

* L. N. A. D. Y. = Low rucleic acids dried yeast.

3 . Amino acid composition

Amino acid composition of the prepared sausage is presented in Table 3. It was found that amino acids composition in protein for L. N. A. D. Y. sausages was different from that of the control (0% L.N. A. D. Y.) sample.

Of L. N. A. D. Y. in beef sausage, some amino acids were reduced while others increased . When sausages proteins were compared with the FAO pattern Table 3, no deficiency was recorded in any of the essantial amino acid in control, 10% and 20 % L. N. A. D. Y. samples, while methionine plus cystine were low in 30% L. N. A. D. Y. sausage. On the other hand Oser's (E. A. A. I) and (B. V.) decreased slightly as

the proportion of L. N. A. D. Y. in beef sausage increased. This, however, showed that incorporation of L. N. A . D. Y. at the level of 20 % did not influence the quality of protein. It should be noted that accoreding to Martini *et al* . (1979), S . cerevisiae has high contents of threonine and lysine and low sulphur amino acids. In present work incroporation of L. N. A. D. Y. however, raised the level of threo-

Table 3. Amino acid composition of beef sausage as in fluuenced by the addition of different levels of L.N.A.D.Y. (g / 16 g N).

Amino acids	F A O reference Protein	Sausage control O%L.N. A.D.Y.	Level of L.N.D.Y		
			10%	20%	30%
Leucine	7	8.19	8.12	8.05	7.98
Isoleucine	4	5.06	5.08	5.10	5.12
Lysin	5.5	8.43	8.35	8.27	8.19
Methioine		2.31	2.24	2.17	2.11
Methionine+cystine	3.5	3.64	3.55	3.50	3.47
Phenylalanine		4.04	4.08	3.92	3.86
phenylalanine+tyosine	6.5	7.41	7.35	7.29	7.23
Threonine	4.0	4.10	7.17	4.24	4.31
Tryptophan	1.0	1.09	1.09	1.08	1.08
Valine	5.0	5.78	5.74	5.67	5.66
Argimine		6.71	6.91	7.11	6.77
Histidine		2.80	284	2.88	2.92
Tyrosine		3.32	3.34	3.36	3.83
Cystine		1.32	1.30	1.27	1.26
Proline		5.30	5.26	5.22	5.18
Alanine+glutamic acid		20.79	20.39	19.88	19.59
Glycine+Aspartic acid		16.41	16.45	16.49	16.53
Serine		3.22	3.32	3.42	3.52
E.A.A.I		81.51	81.04	80.54	80.25
B.V		77.12	76.60	76.06	75.74

nine and decreased methionine plus cystine in sausages protein, but did not increase the lysine, Neveretheless , the decrease of lysine due to addtion of L. N. A. D. Y. was actually slight, Table 3. Percent decrease of lysine (as compared with control in sausages proteins prepared with 10 , 20 and 30% L. N. A. D. Y. were 0.96; 2.85 % respectively .

4 . Physical evaluation

a - Yield and cooking loss

Immediately after cooking , the yield of sausage was calculated and the obtained results were tabulated as shown in Tabel 4.

The yield was increased by the addition of L. N. A . D. Y. The cooking loss was higher in control sample. It reached 23.61 percent from the orginal weight. The weight loss due to cooking could be ascribed to the denaturation of meat protein which escape in water as explained by Baliga and Madiha (1971).

b- Feder Value

The feder value is one of the tests used for assessing the quality of meat products . From Table 4, It could be noticed that the feder values in sausages were 3.13 , 3.12 and 3.12 by incorporation of 10,20 and 30 L. N. A . D. Y. respectively (as meat substitute) . While it was 3.13 in the control sample . The feder value in

Table 4. Physical properties of cooked beef sausage as influenced by the addition of different levels of L. N. A . D. Y.

Properties	Control	Level of L. N. A. D. Y.		
	%	10%	20%	30%
Yield %	76.39	78.64	80.02	81.21
Cooking loss %	23.61	21.36	19.98	18.79
Feder value %	3.31	3.13	3.12	3.12
W H C %	4.02	3.81	3.58	3.49
Plasticity %	2.33	2.20	2.22	2.14

L. N. A. D. Y. = lo nucleic acids dried yeast.

good quality prodcut should not exceed 4 as given by Pearson 1970.

Finally it could be concluded that all types of prepared sausage were acceptable as they fell below the maximum of the acceptable feder value.

C - The Water Holding Capacity and Plasticity

From results illustrated in Table 4, it could be noticed that the control sample showed low WHC and relatively high plasticity when compared with all added dried yeast sausage.

d - Organoleptic evaluation of sausages

Data presented in Table 5, show the organoleptic evaluation of sausages as influenced by the addition of different levels of L. N. A . D. Y.

It is evident that sausages containing 10% and 20% L. N. A. D. Y. were the best , where scores were similar to those of all beef sausage, except for a slight increase in texture for 10 % and 20% L. N. A . D. Y. sample. Accordingly, it could be concluded that sausage containing 20 % L. N. A . D. Y. could be produced on a commercial scale without influencing the eating qualities of beef sausage.

Table 5 . Organoleptic scores of beef sausage as influenced by the addition of different levels of L. N. A. D. Y.

Factor	Control	Level of L.N.A.D.Y.		
	%	10%	20%	30%
Aroma	9	9	9	9
Taste	9	9	9	8
Colour	9	9	8	7
Texture	7	8	9	8
Over all acceptability	9	9	9	8

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إستخدام الخميرة المحتوية علي كمية منخفضة من الأحماض النووية كبديل للحوم في سجق اللحم البقري

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في هذه الدراسة أمكن اعداد خميرة مجففه تحتوي علي كميه منخفضة من الأحماض النووية وبذلك يمكن التغلب علي الأثار الجانبية التي تؤثر علي الصحة العامة عند استخدام خميرة مجففة تحتوي علي نسبه عاليه من هذه الأحماض في منتجات اللحوم . علاوة علي ذلك يجفف الخميره المحتويه علي كمية منخفضة من الأحماض النووية بالماء بنسبة ١:١ قبل استخدامها، كذلك تستخدم الخميره لخفض سعر تكلفة سجق اللحم البقري، ويتم تجهيز سجق اللحم البقري مع استبدال صفر ، ١٠ ، ٢٠ ، ٣٠ ٪ من اللحم بكميه مساويه من الخميرة المخففة بالماء التي تحتوي علي كميه منخفضه من الأحماض النووية.

وقد تم عمل جميع منتجات السجق في هذه الدراسة طبقا للمواصفات القياسية المصريه وقد اوضح التقييم الحسي والخواص الطبيعيه أن سجق اللحم الذي يحتوي علي ١٠ ، ٢٠٪ من الخميرة المخففه بالماء المحتويه علي كمية منخفضة من الأحماض النوويه جيدة ومقبولة ويمكن انتاجها علي مستوي تجاري .