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EVALUATION OF POTATO-EGG PATTIES EXTENDED WITH DIFFERENT SOY PROTEINS

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Key words: potato patties, soy proteins, acceptability scores, biological value.

Potato patties were enriched with different soy proteins. This incorporation increased the protein and ash content and improved the biological value of the patties.

INTRODUCTION

Potato protein, though low in quantity, is of high nutritional quality compared to most plant proteins. It is rich in lysine and has superior amino acid balance [7]. Also, soy products are becoming increasingly important in human diet as economical sources of high quality protein with valuable functional properties and favoral amino acid pattern [5, 16]. Protein efficiency ratio test showed soy-egg flours to have significiantly improved protein quality as compared to soy flour [11]. The addition of whole egg to a potato soy combination shuld further round out the amino acid balance and increase the level of fat soluble vitamins and other micronutrients [7].

The objective of this work was to develop a patties containing potato-whole egg- different soy products and to evaluate the nutrional quality of the food formulations.

MATERIALS AND METHODS

Five formulations of potato-whole egg patties were prepared by replacing 30% of potato with different soy products (full fat soy, deffated soy flour, concentrate or isolate soy protein). Potato was blanched in tap water for 30 min, cooled then milled at medium speed for 5 min in a waring blender. For all formulations whole eggs were beaten to homogenity and added to boiled potatos by 10%. Whole soy bean and soy flour were heated for 20 min at 98.9°C in an air drier [7]. Soy products, soy flour and soy proteins before they mixing with potato-whole egg mixture were rehydrated with tap water by two parts of water to each part soy products (W/W) as recomended by Seidman et al. [13].

CHEMICAL ANALYSES

Total protein (N × 6.25), ether extract and ash were determined by the methods described in the A.O.A.C. (1975). Total carbohydrates were estimated by difference. Minerals (Potassium, Calcium, Iron, Magnesium, Manganese Zinc and Sodium) were determined in the digested sample solution according to the method of Gorsuch [6], using Pye Unicam Atomic Absorption spectrophotometer model sp 1900. Phosphorous was determined spectrophotometrically [12].

SENSORY EVALUATION

A hedonic scale ranging from 1-9 [7] was used to detect differences in hedonic value between potato-whole egg patties and that containing various soy products.

BIOLOGICAL EVALUATION

Net protein utilization [9], digestibility coefficient [10], biological value [2] and protein efficiency ratio (A.O.A.C.., 1975) were conducted to determin the protein quality of various soy products with potato whole egg mixture. Diets were propared according to A.O.A.C. (1975). Each albino rats (fed group ad libitum) received a 10% protein diet contributed by different potato-egg-soy products.

RESULTS AND DISCUSSION

NUTRIENT COMPOSTION

The proximate composition of potato-whole egg (90:10) patties and that extended with different soy products (potato 60 : whole egg 10 : soy product 30) appears in Table 1. The protein content of potato-whole egg patties was only 12.7%. Incorporation of soy products in patties increased the protein percent. Maximum increase (36.7 and 40.8%) was obtained by mixing concentrated and isolated soy protein respectively compared with fully fat soy ((22.4%) or deffated soy flour — 26%). Adding full fat soy to potato-egg mixture raised greatly lipids percent in patties (13.25%). Replacing 30% of potato with deffated soy flour, contentrated or isolated soy protein increased ash percent in descending order. The percentage of total carbohydrates in patties decreased by soy additives specially in the concentrated or isolated forms. These findings go in line with that recorded by Miles et al. [8].

The mineral content of the patties did differ in the five formulations as shown in Table 1. Calcium and phosphorus content increased by added soy products, except calcium in patties containing isolated soy protein. On the other side,

Table 1. Nutrient content of potato-whole egg patties extended with different soy proteins

Items	Potato-whole egg	Potato-whole egg full fat soy	Potato-whole egg-deffated soy flour	Potato-whole egg-soy concentrate	Potato-whole egg-soy isolate
Protein %	12.7	22.4	26.05	36.7	40.8
Lipids %	4.75	13.25	5.1	5.08	5.06
Ash %	4.50	4.81	5.35	5.21	5.11
Carbohydrate %	78.05	59.54	63.55	53.01	50.97
Minerals (mg/100 g dry-wt.)					
Ca	54.9	90.2	96.5	86.6	50.5
P	320	357.0	378.0	356.0	333.0
Mg	170	158.5	162	145.5	120.0
Na	73.6	70.8	69.8	67.5	161.6
K	1880	1200	1275	1195	1055
Fe	4.0	3.08	4.2	4.05	4.07

sodium content of the patties with added soy isolate was much higher than that in all of other formulations. In general soy additives to potato-whole egg mixture decreased patties content of magnesium and potassium than control (potato-whole egg patties). Iron content decreased only in patty extended with whole fat soy. These results reflect high calcium and phosphorus content in soy products, while potato is rich in magnesium and potassium [4].

SENSORY EVALUATION

In addition to the nutritional data, panel evaluations of potato-whole egg with and without soy products additive are presented in Table 2. For colour mean acceptability scores showed potato-egg patties extended with full fat soy or isplated soy protein significantly acceptable. Patties with added soy flour or soy concentrate ranked the second in this respect. However, soy products under study exept concentrated soy protein, improved significantly odour of potato-egg

Table 2. Sensory analysis of potato-whole egg patties extended with different soy proteins

Characteristics*)	Potato-whole egg	Potato-whole egg full fat soy	Potato-whole egg deffated soy flour	Potato-whole egg-soy concentrate	Potato-whole egg-soy isolate
Color	8.5±0.6 a	8.6±0.75 a	7.7±0.92 b	7.5±0.95 b	8.1±0.67 a
Odor	8.2±0.57 b	8.8±0.53 a	8.6±0.83 a	8.1±0.60 b	8.8±0.55 a
Taste	9.0−0.87 a	8.7−0.79 a	8.4−0.94 a	8.2−0.81 a	8.7−0.92 a

Means without a letter in common differ significantly at the 5% level of significance

*) Hedonic means: 9 = like extremely; 1 = dislike

After mixing variable products, the dough was scaled to 70 g and shaped into patty form. They were cooked in oven at 170°C (to internal temperature 73°C) for 25 minutes. The products were cooled for chemical analyses, sensory and biological evaluation.

paties. As for taste, panelists did not prefer patties made from one formulation over the other. Therefore, it can be concluded that extending of potato-egg patties with 30% of full fat soy or isolated soy proteins improved general acceptability scores of the patties. Similarly, Steinke et al. [15] concluded that isolated soybean protein functions well as a complementary protein for most plant protein sources.

BIOLOGICAL EVALUATION

The results of feeding study conducted to evaluate protein quality of patties made from potato-whole egg (90 : 10) and potato egg-soy products (60 : 10 : 30) are expressed in Table 3. It should be pointed out that nutritive value of the sample

Table 3. Net protein utilization (NPU), digestibility coefficient (DC), biological value (BV) and protein efficiency ratio (PER) of potato-whole egg patties extended with different soy products

Items	Casein	Potato-whole egg	Potato-whole egg-full fat soy	Potato-whole-egg deffated soy flour	Potato-whole egg-soy concentrate	Potato-whole egg-soy isolate
NPU	77.78 a	36.64 d	36.64 d	42.28 c	50.2 b	51.33 b
DC	94.07 a	59.79 c	59.79 c	83.74 b	85.04 b	86.73 b
BV	82.68 a	45.27 d	45.27 d	50.49 c	59 40 b	61.68 b
PER	2.36 a	1.71 e	1.71 e	1.78 d	1.83 c	1.93 b

Means in the same line not sharing common letters are different at 5% level of significance

was inferior to that of casein. This might be due to their lower content of S-containing amino acids compared to casein [15]. Since egg protein is high in histidin, the limiting amino acid of potato, and methionine, the limiting amino acid of soy [15], it is expected that egg protein supplementation shoud improve the overall amino acid profile of potato and potato-soy patties by supplying more of these amino acids. O'Connor et al. [11] also showed a significantly improved protein quality of soy-egg flours compared to soy flour. Generally, data showed negligible differences between NPU and DC of potato-whole egg patties extended with different soy products. However it appears from the results higher nutritional values of potato-whole egg patties extended with different soy products than only potato-egg patties. The BV and PER values for mixture fortified with 30% isolated soy protein was better than all other soy products. Potato-egg patties supplemented with deffated soy flour or concentrated soy

protein as well have significantly higher nutritional values than patties extended with full fat soy. The results agree very well with the findings of Tsen et al. [16] and Hargett et al. [7] as they obtained improvements with soy fortified bread, Bressani [3] explained a more favorable protein quality of two proteins when combined than either protein alone to the complementary effects of the two amino acid contents.

SUMMARY

Potato patties containing 10% whole egg were extended with four different soy proteins (30% replacement of potato) full fat soy, deffated soy flour, concentrated and isolated soy proteins. Incorporation of soy products in patties increased the protein and ash content, while decreased carbohydrate percent. Adding full fat soy raised lipids percent in patties. In general, calcium and phosphorus increased, but magnesium and potasium decreased in potato-egg patties by soy additives. Extending of potato-egg patties with full fat soy or isolated soy proteins improved general acceptability scores. Soy protein supplementation improves the biological value and the protein efficiency ratio of the patties.

LITERATURE

1. A.O.A.C.: Official Methods of Analysis of the Association of Official Analytical Chemists, 12 th ed., Washington D. C., 1975.
2. Bender A. E., Miller D. S.: Biochem. J., 1953, 53, VII.
3. Bressani R.: Complementary amino acid patterns in „Nutrients in Processed Foods, Protein" p. 149. American Medical Association. Publishing Science Group, Acton, Mass., 1974.
4. Church C. F., Church A. N.: Food Values of Portions Commonly Used. 10 Edition, pp. 154. J. B. Lippincott Co. Philadelphia 1966.
5. Coppock J.: J. Am Oil Chem. Soc., 1974, 51, 59A.
6. Gorsuch T. T.: The Analyst 1959, 84.
7. Hargett C. A., Nelson A. I., Weingartner K. E., Erdman J. W.: J. Food Sci., 1982, 47, 461.
8. Miles C. W., Ziyad J., Bodwell C. E., Steel P. D.: J. Food Sci., 1984, 1167.
9. Miller D. S., Bender A. E.: Brit. J. Nut., 1955, 392.
10. Mitchell H. H.: J. Biol. Chem., 1924, 58, 873.
11. O'Connor M. P., Erdman J. W., Nelson A. I.: J. Food Sci., 1979, 44, 839.
12. Perkind E. G.: Analysis of lipids and Lipoprotein published by American oil chemists Soc., Champaign, Ill., 1975, 81.
13. Seidman S. C., Smith G. C., Carpenter Z. L.: J. Food Sci., 1977, 42, 197.
14. Steel R. G. D., et al.: Principles and Procedures of Statistical. Mc Graw. Hill Book Co. New York, N. Y., 1960.
15. Steinke F. H., Prescher E. E., Hopkins D. T.: J. Food Sci., 1980, 45, 323.
16. Tsen C. C., Reddy P. R. K., Gehrke C. W.: J. Food Sci., 1977, 42, 402.

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OCENA PLACKÓW ZIEMNIACZANO-JAJECZNYCH UZUPEŁNIONYCH RÓŻNYMI POSTACIAMI BIAŁKA SOJOWEGO

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Streszczenie

W plackach ziemniaczanych, zawierających 10% całego jaja, 30% ziemniaków zastąpiono czterema postaciami sojowego białka: soją o pełnej zawartości tłuszczu, odtłuszczoną mączką sojową oraz koncentratem i izolatem sojowego białka. Dodatki produktów sojowych do placków podniosły zawartość białka i popiołu i obniżyły zawartość węglowodanów. Dodatek soi o pełnej zawartości tłuszczu podniósł procentową zawartość lipidów w plackach. Generalnie rosła zawartość wapnia i fosforu, natomiast malała magnezu i potasu w ziemniaczano-jajecznych plackach z dodatkiem soi. Dodatek ten w postaci soi pełnotłustej lub sojowego izolatu podnosił wskaźnik akceptacji. Wzbogacenie białkiem sojowym podnosiło biologiczną wartość i PER placków.