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PALATABLE SNACKS SUPPLEMENTED WITH CHICKEN MEAT

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Abstract

Chicken light meat at 40 per cent was mixed with potato paste, rice flour and soy flour in three chips formulas namely chicken-potato, chicken-rice and chicken-soy respectively. These snacks in fried form were nutritionally and organoleptically compared to fried standard potato chips. The shelf life of the chips supplemented with chicken was measured during storage at room temp. Chips supplemented with chicken were of high protein content and energy value as compared to standard potato chips. The high organoleptic scores were also given to these snacks.

INTRODUCTION

Snacks are widely consumed over the world by different human ages especially children as a popular light foods. They are usually manufactured from vegetables or cereals origin having a low nutritional value i.e. rich in carbohydrates and poor in protein being about 3.8 per cent (Paul and Southgate, 1978). Consumption of snacks gives a feeling of satisfaction without fulfilling the nutritional requirements. Therefore, many attempts were carried out to fortify the snacks nutrional value.

DeFreitas and Molins (1988) prepared snack dips containing 50 per cent ham. 26 per cent bacon in combination with sour cream, unflavored yogurt and tofu. Park *et al.* (1993) investigated the characteristics of potential nutrious snack products by adding chicken meat to formulations. Ponnath and Schmelz (1997) formulated a snack product from bread, cheese and ham.

The objective of this study was to develop a nutrious, palatable and snack formulations by mixing light chicken meat with potato, rice and soy flour.

MATERIALS AND METHODS

A-Materials:

Skinless deboned chicken light meat was obtained from 45 days old hubbard strain carcasses. Defatted soy flour (about 6 per cent fat) was purchased from the soy plant at the Food Technology Research Institute (ARC). Potatoes, rice flour, corn starch and table salt were obtained (high grade) from the local market.

B-Formulation:

Snacks in this study were processed in three formulas. The main ingredients in each formula were as per cent: 40.00 chicken light meat, 2 corn starch, 2. NaCl and 1 per cent ascorbic acid. In one formula namely chicken-potato chips. 55 per cent of potato paste was incorporated. The second formula, contained, however, 55 per cent gelatinized rice flour and designated as chicken-rice chips. The last chips namely chicken-soy chips, 55 per cent of semi-dough soy flour was incorporated with the other ingredients.

Chicken meat was firstly minced in a fine mesh meat grinder and was thoroughly homogenized in a meat cutter. The peeled potatoes were boiled for 10-15 min, after which were minced, homogenized and thoroughly mixed with the other ingredients in a meat cutter until a fine thick paste was obtained. The mix was then shaped into clynder forms of 5 cm diameter and 15 cm length. The forms were semi-frozen at –30° C for about 1 hr. sliced into chips in the frozen state and immediately fried in 105° C preheated corn oil. The hot fried chips were spread on strains and dried in 50° C fan oven until about 2 per cent moisture content. The dried chips were packaged under vaccum in aluminium foil packages. The packages were then stored at room temp (20-22° C) and samples were taken for analysis every 15 days until the detection of rancid-off flavor.

The same technical steps were consequently applied for preparing chicken-rice and chicken soy chips. Differences, however were in preparing gelatinized rice and soy dough. Gelatinized rice was prepared by mixing (rice flour and corn starch) with water at a ratio of 1:2 in a double jacket pan boiler at 100° C for 15 min. until full gelatinization.

Soy dough was obtained by mixing soy flour and corn starch with water at a ratio of 1:1 in a dough mixer for about 10 min. in which a semi dough was shaped.

The standard potato chips (control sample) were prepared by slicing the peeled potatoes into chips to which 2 per cent salt were added and fried in 105° C preheated corn oil until golden color develops. The fried chips were then dried by the same way used for other chips supplemented with chicken.

C-Analytical Methods:

Moisture, protein, ash and fat per cent of fried chips were determined following the methods described in the AOAC (1990). Carbohydrates per cent was calculated by difference. Energy value was estimated by multiplying the carbohydrates and protein per cent by 4, and by 9 for fat per cent.

Minerals were estimated by dissolving ash in 100ml INHCL. using the atomic absorption spectroscopy technique described in the AOAC (1990) for minerals analysis, using a pye unicam Sp 1900 atomic absorption.

Amino acids were determined according to the method given by Pellet and Young (1980), cysteine and methionine were determined according to Gujard and Mauron (1963) using LKB 4151 Alpha plus amino acid analyzer. Results were calculated using LKB 2220 Recording integrator. Tryptophan was estimated colorimetrically in the alkaline hydrolyzate according to the method of Blauth *et al.* (1963).

Amino acid scores (A.A.S.) were calculated in relative to FAO/WHO/UNA (1985) reference proteins to indicate the first limiting amino acid.

$$AAS = \frac{\text{A.A. in the test protein (gm/16 gm N)}}{\text{A.A. Pattern reference protein}}$$

Grams of chips consumed to meet the daily requirements of human individual essential amino acids (G.D.R.) were calculated in relation to daily requirements given by RDA (1989).

Thibarbituric acid value (T.B.A.) as A at 538 n.m was colormetricially determined by following the method given by Pearson (1970).

Chips yield per cent was calculated by multiplying the weight change from raw to final product by 100.

Palatability attributes of different chips were evaluated by ten trained panelists according to scores given by Self *et al.*, (1990) with modifaications of description

terms being; (A) crispness 1-extremely tender, 2-very tender, 3-moderately tender, 4-slightly tender, 5-Slightly crispy, 6-moderately crispy, 7-very crispy and 8 to 9 extremely crispy; (B) color intensity; 1-extremely brown, 2-very brown, 3-moderately brown, 4-slightly brown, 5-slightly golden, 6-moderately golden, 7-very golden, and 8 to 9 extremely golden; (C) Chips flavor intensity being: 1-extremely weak, 2-very weak, 3-moderately weak, 4-slightly weak, 5-slightly strong, 6-moderately strong, 7-very strong and 8 to 9 extremely strong; (D) overall acceptability scores were 1-extremely unacceptable, 2-very unacceptable, 3-moderately unacceptable, 4-slightly unacceptable, 5-slightly acceptable, 7-very acceptable and 8 to 9 extremely acceptable.

The ranking method and critical values were used to find out the best product and testing the significant differences according to the method of Basker (1988).

RESULTS AND DISCUSSION

Physical and chemical composition of snacks:

Proximate and ultimate composition of different chips in addition to physical properties are given in table 1. The chips supplemented with chicken were of a relatively high energy value as compared to standard potato chips (control sample). Such effect was mainly due to high protein and fat content of chicken extended chips and not to carbohydrate content which was of high per cent in standard potato chips. Variations between the four examined snacks concerning the proximate composition were not due to differences in moisture content which was about the same value in the four chips being about 2.00 per cent as a result of drying step after oil frying.

It could be seen from the data presented in table 1 that mixing of chicken light meat with other plant ingredients markedly increased the protein content of fried chips as compared to the control sample. Accordingly, the high protein per cent was found in chicken soy chips being 45.07 per cent followed by 32.06 per-cent in chicken potato chips, 21.25 per cent in chicken rice chips and lately 8.46 per cent of control sample. Differences between protein content directly reflects protein variations in the used plant ingredients.

Results presented in table 1 also reveal that mixing of soy flour dough and/or potato paste with chicken meat slightly increased ash content of fried chips as compared to standard potato sample. Such effect was propably due to high content of magnesium and iron in the chicken potato and chicken soy chips being; 70 and 244 mg/100 gm; 1.41 and 7.45 mg/100 gm respectively as compared to 61.00 and 1.21

Table 1. Chemical and physical composition of fried chips supplemented with chicken meat with reference to palatability attributes.

Parameters	Fried Chips			
	Standard Potato	Chicken Potato	Chicken Rice	Chicken Soy
Moisture (Per cent)	2.44	2.50	2.23	2.09
Protein (Per cent)	8.46	32.06	21.25	45.07
Fat (Per cent)	6.90	10.80	8.18	11.03
Ash (Per cent)	2.07	2.70	1.59	3.36
Carbohydrates (Per cent)	80.13	51.99	66.75	38.45
Energy Value (Cal/100 gm)	416.46	433.4	425.62	433.35
Minerals (Mg/100):				
Na	316	317	151	139
Ka	1330	1098	332	1806
Ca	16	24	11	194
Mg	61	70	31	244
P	117	388	508	643
Fe	1.21	1.41	0.66	7.45
Cu	0.40	0.43	0.20	0.13
Zn	1.21	1.60	0.60	0.49
S	72	377	232	146
Cl	133	199	79	49
Total	**2047.82**	**2476.44**	**1345.47**	**3229.07**
Chips yield (per cent)	**63.50**	**73.50**	**69.06**	**76.50**
T.B.A. Value (O.D. at 528 nm)				
- Unstored chips	0.77	0.90	0.82	1.02
- After 15 days of shelf-life	6.00	5.00	5.00	4.5
- Shelf-life at room temp (months)	6.00	5.00	5.00	4.5
Palatability parameters:				
- Crispness.	8.20	7.0	8.00	7.63
- Golden color intensity.	8.26	8.34	6.80	8.00
- Chips flavor intensity.	8.55	8.50	7.25	8.08
- Overall acceptability.	7.00	8.50	7.80	8.20

successively for standard potato chips.

Although of increasing the iron content in the fried chips supplemented with chicken, it was still low than that recommended by FNB/NRC (1989) for children and adults (10mg). Therefore, it was suggested mixing of chicken, potato, soy flour and spleen powder in one snack due to the high iron per cent in soy flour and spleen being 9.1 and 0.8 mg/100 gm respectively (Paul and Southagate 1978 and Bittel *et al.*, 1981).

Concerning phophrous content it was increased in all chips supplemented with chicken compared to the control sample. Generally it was recommended to fortify the snacks formula rich minerals sources to fulfill the requirements recommended by FNB/ NRC (1989).

Concerning chips yield it was increased in chicken-extended chips being with high rate in chicken-soy chips 76.50 per cent followed by 73.50 and 69.06 per cent in chicken-potato and chicken rice chips respectively as compared to 63.50 per cent in standard potato chips. From the economical view point, increasing the frying yield of final product directly affects the factory income which is the main objective of all industries.

Rancidity of different processed chips was taken in this study as an index of onset of spoilage on the basis that fried chips are dried foods. Studies of Fernandez and Oneill (1933) on the raw and cooked rabbits that rancid off flavor took place at TBA values of 0.5 A at 538 n.m. From table 1. it could be noticed that TBA values of freshly unstored chips ranged from 0.01 to 0.025 A. By following TBA values during storage of different chips at room temp, it was noticed that optimum storage periods for standard, chicken-potato, chicken-rice and chicken-soy chips were 6.0, 5.0, 5.0 and 4.5 months 15 days from these periods, the values of TBA were more than 0.5 A being 0.77, 0.9, 0.82 and 1.02 respectively (table 1). The onset of rancid off-flavor was also organoleptically detected.

The incorporation of ascorbic acid in the formula of chicken extended snacks as well as control samples might be a reason of extending the shelf-life of chicken containing chips which acts as antioxidant and anti-browning reagent (El-Sisy, 1981).

B. Palatability attributes of different chips:

Palatability attributes scores were given in table 1. The scores given for crispness indicated that standard potato and chicken-rice chips were the extremely crispy

samples. The other chicken extended chips were of low crispy in which were described as very crispy chips. When, the characterized golden color of chips was scored it was found that standard potato (control sample), chicken-potato and chicken soy had the superiority of this color in which were described as extremely golden color. Chicken-rice chips was of less golden color since it ranked moderately golden color.

Scoring of chips flavor intensity of different evaluated chips declared that chips flavor was concentrated in control sample. Chicken-potato and chicken-soy chips which were designed as extremely chips flavor. The chicken-rice snack was scored as very strong chips flavor being less than other examined snacks.

When the overall acceptability was organoleptically evaluated, the high scores were given to chicken potato and chicken-soy chips which were examined as extremely acceptable chips. The standard-potato and chicken-rice chips were less acceptable being described as very acceptable chips.

The best product detected by rank values was given in table 2. Critical values at p 0.01 and 0.05 were presented in the same table. It could be noticed that the lowest sum hanks being; 12 was given to the best chicken-potato chips designed as (B). The other chips samples were arranged according to their rank values as follows: chicken-soy, chicken rice and standard potatoes chips being 20.28 and 40 (the lowest rank values the best product should be).

The critical values at significantly level 0.05 (table 2) indicated no significance between chicken-potato chips (B) and chicken-soy samples, the samples, the same effect was noticed between chicken-soy chips and chicken-rice from one hand, and between standard-potato and chicken-rice chips samples from the other hand. Significantly, however at 0.05 was found between the best product namely potato-chicken chips and the other chips products. The same effect i.e. significance was also detected between standard-potato and soy-chicken chips (table 2).

When the critical values at level 0.05 was calculated (table 2) it was found that except of standard potato samples, significance was not detected over the all investigated chips samples. Generally, the statistical analysis proved that, the best samples was chicken-potato chips followed in descending order by chicken-soy, chicken-rice and standard-potato samples.

C. Amino acid composition of investigated chips:

The amino acid composition of different fried chips expressed as gm per 100 gm

protein and gm per 100 chips was presented in table 3. Mixing of chicken light meat with potato paste and/or soy flour dough slightly increased the total essential amino acids (TEAA) as well as total amino acids (TAA) including EAA and NEAA. Incorporation of rice dough with chicken meat had approximately the same TEAA and TAA of the control sample. The amino acids scores (AAS) demonstrated that there were a five limiting amino acids in standard potato sample being leucine, lysine, threonine, valine and methionine + cysteine. The same limiting amino acids were also detected in chicken-rice chips in addition to isoleucine. No limiting amino acids were identified in chicken Soy chips, however, three limiting amino acids were found in chicken potato chips being; leucine, threonine and methionine + crysteine indicating the deficiency of these amino acids in potato fruits. Another suggestion might be undertaken for improving the protein quality of chicken-potato and chicken rice chips i.e. by incorporation of the whole eggs in their formula. Ultentuls (1983) reported that soybean flour contained a high quantities of EAA than FAO provisional pattern. Therefore, it was suggested incorporation of defatted soy flour with the formula of chicken-rice and chicken potato chips to avoid the deficiency of threonine, methionine + cysteine which limits the protein quality of human diet as mentioned by FAO/WHO (1985). Due to increasing of protein per cent in chicken extended chips as compared to control sample (table 1). G.D.R. was highly reduced in these samples (table 2). Such effect was more pronounced when G.D.R. was calculated on the basis of less AAS (68.29) methionine + cysteine in chicken rice chips in which GDR was 207.25 gm as compared to 440 gm of control sample. Accordingly, the increasing of protein per cent chips supplemented with chicken overcome the lacking of amino acids in chicken-potato and chicken-rice chips.

Generally, it could be concluded from the previous discussion that the three investigated chips supplemented with chicken proved their good nutritional value and palatability attributes. Therefore, it was recommended the utilization of these chips as a way for the fortification of popular snacks with proteins.

Table 2. Results of ranking method and critical differences of fried chips supplemented with chicken meat.

Indices		Standard Chips	Chicken Potato	Chicken Rice	Chicken Soy
		A	B	C	D
Sum of Ranks		40	12	28	20
Difference VS	A	-	28	12	20
	B	-	-	16	8
	C	-	-	-	8
Significance level		P = 0.05		P = 0.01	
Critical difference		15		18	
Preferable products (Descendingly)					
B		A		a	
D		ab		a	
C		bc		ab	
A		c		b	

- The lowest sum of ranks means the best product.
- The preferred products differs significantly (different letters in the same column) when the ranks sum difference between the products are greater than or equal to the critical value.

Table 3. Amino acid composition of different fried chips as extracted by chicken meat.

Amino Acids (A.A.)	A.A. as gm / 100 gm protein of fried								FAO/ WHO UNU1 985	Amino acids as gm/100 g fried chips								Daily Requirement of Adult man 1985
	Potato	(1) A.A.S.	Chicken Potato	(1) A.A.S.	Chicken Rice	(1) A.A.S.	Chicken Soy	(1) A.A.S.		Potato	(2) G.D.R. gm	Chicken Potato	(2) G.D.R. gm	Chicken Rice	(2) G.D.R. gm	Chicken Soy	(2) G.D.R. gm	
Ileu	4.16	104.0	4.26	106.5	3.65	91.25	4.10	102.5	4.00	0.36	194.44	1.38	50.73	0.79	88.61	1.85	37.84	0.70
Leu	4.48	64.0	5.41	77.29	6.90	98.57	7.22	103.14	7.00	0.38	289.47	1.75	62.86	1.47	74.83	3.26	33.74	1.10
Lys	5.44	98.91	6.68	121.46	5.28	96.00	6.30	118.18	5.50	0.46	173.91	2.15	37.21	1.13	70.80	2.94	27.21	0.80
Met	1.60	-	1.89	-	1.93	-	1.57	-	-	0.15	-	0.62	-	0.42	-	0.72	-	-
Cyst	1.26	-	1.28	-	0.46	-	2.77	-	-	0.13	-	0.42	-	0.12	-	1.26	-	-
Phe	4.31	-	4.32	-	4.04	-	4.11	-	-	0.38	289.47	1.40	78.57	0.87	126.44	1.86	59.14	1.10
Tyr	3.04	-	3.18	-	3.27	-	2.92	-	-	0.27	-	1.03	-	0.71	-	1.33	-	-
Thr	3.84	96.00	3.88	97.00	3.24	81.00	4.20	105.0	4.00	0.34	185.19	1.25	40.00	0.70	71.43	1.89	26.46	0.50
Trp	1.27	127.0	1.44	144.0	1.03	103.00	1.03	103.00	1.00	0.13	192.31	0.47	53.19	0.23	108.70	0.47	63.19	0.25
Val	4.88	97.60	5.12	102.4	4.59	91.8	5.23	104.60	5.00	0.42	202.38	1.64	51.83	0.99	85.86	2.36	36.02	0.85
T.E.A.A.	34.28	-	37.46	-	34.39	-	39.65	-	-	3.02	-	12.11	-	7.43	-	17.94	-	-
Arg	4.96	-	5.35	-	5.94	-	5.80	-	-	0.43	-	1.73	-	1.27	-	2.66	-	-
His	1.92	-	2.34	-	2.34	-	2.70	-	-	0.17	-	0.76	-	0.51	-	1.23	-	-
Ala	3.68	-	4.51	-	5.03	-	4.38	-	-	0.32	-	1.46	-	1.08	-	1.98	-	-
Asp	18.40	-	14.07	-	12.37	-	12.39	-	-	1.57	-	4.52	-	2.64	-	5.59	-	-
Glu	12.80	-	14.48	-	15.55	-	15.33	-	-	1.09	-	4.65	-	3.31	-	6.92	-	-
Gly	3.36	-	3.94	-	3.99	-	3.92	-	-	0.29	-	1.26	-	0.86	-	1.78	-	-
Pro	3.84	-	3.99	-	3.91	-	4.27	-	-	0.34	-	1.28	-	0.84	-	1.94	-	-
Ser	4.02	-	4.16	-	3.77	-	3.99	-	-	0.35	-	1.34	-	0.82	-	1.81	-	-
T.N.E.A.A.	52.98	-	52.84	-	52.90	-	52.78	-	-	4.56	-	17.00	-	11.33	-	23.91	-	-
T.A.A.	87.27	-	90.30	-	87.29	-	92.43	-	-	7.58	-	29.11	-	18.76	-	41.85	-	-
Phe+Tyr	7.36	122.67	7.49	124.83	7.31	121.83	7.03	117.17	6.00	-	-	-	-	-	-	-	-	-
Met+Cys	2.88	66.36	3.15	72.58	2.39	68.29	4.34	124.00	3.50	0.25	440	1.02	107.84	0.53	207.55	1.97	55.84	1.10

(1) Amino acid sores (2) grams consumed to cover the daily requirements of amino acids.

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أغذية خفيفة مدعمة بلحم الدجاج

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معهد بحوث تكنولوجيا الأغذية - مركز البحوث الزراعية - جيزة

فى هذا البحث تم إنتاج أغذية خفيفة بخلط ٤٠٪ من لحم الدجاج مع عجينة البطاطس ودقيق الأرز، ودقيق الصويا فى ثلاث خلطات منفصلة وتم قليها فى شكل رقائق شبيهة برقائق البطاطس وجففت وعبأت فى أكياس من رقائق الألومنيوم وخزنت على درجة حرارة الغرفة وتم تحديد أنسب مدد حفظ وأدى هذا الخلط إلى زيادة نسبة البروتين والطاقة فى الأغذية المحتوية على لحم دجاج ونالت هذه العينات أعلى الدرجات الحسية مقارنة بعينات (بطاطس شيبس عادية).