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Production of Some Healthy Snacks for Children

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ABSTRACT

This study was conducted to produce and evaluate some healthy food for children (snacks) using some raw materials available in Egyptian markets. Ten formulas were prepared by mixing and kneading the corn flour with carp fish, apple, carrot, paprika and parsley powder by different ratios, then formed and roastedin an air oven. Evaluation results of this product refers to: the higher acceptability (89.2%) was showed in formula No.3 (15% carrot) followed by 88.6 % in formula No. 5 (10% paprika). The total crude protein in all formulas ranged from 37.31 – 40.83%, while the total energy ranged from 374.37 – 395.71 kcal / 100g. All formulas showed a good levels of vitamins B, A, D, E, K and β-carotene, whereas vit. B3, B6, K, and β-carotene ranged from 24.75 -62.43, 20.55- 23.02, 2.34- 4.89 and 1.01- 3.55 mg/ 100g respectively. Also the formulas showed a high level of polyphenols, whereas formula No. 6 (15% paprika) recorded 220.04 mg/100g of total polyphenols. Finally, the essential amino acids ratio reached to 65.18, 65.15, 66.16 and 65.47 in formulas 3, 5, 7 and 10, respectively.

Key words: Healthy food, children, snacks, raw materials, formulas

Introduction

In recent years, turnout increased to ready-made fast food, especially for children. Most of these foods are unhealthy where often content synthetic colored and flavored which causes many health problems. Moreover, these fast foods may be lacking to the essential nutrient. Thus, it was a trend towards the production of healthy foods containing most of the nutrients as well as a natural sources for color and flavor.

Snack foods were defined as being something consumed primarily for pleasure rather than for social or nutritive purpose and not ordinarily used in a regular meal (Matz, 1993). Snacks are normally eaten in between meals and are usually smaller than regular meals. Snacks are known to contribute significantly to the daily nutrient and calorie intake (Badau, *et al*. 2013; Bhattacharyya *et al*., 1997).

Children are growing and developing rapidly, and as such, have increased need for energy as well as other essential nutrients. They need to eat more frequently to meet this need. Snacks help to bridge the gap between meals. Healthy snacks can help to ensure that children are getting the nutrients they need to fuel their growth and development (Thakur and Saxena, 2000).

Snacks can be made with a combination of different raw materials containing different properties. It is possible to improve the nutritional quality of cereal proteins by combination with animal sources or with cheaper and more available plant protein sources such as legumes (Akpapunam and Darbe, 1994).

Corn: commonly known as maize (*Zea mays* L.) Maize is used as human food in the form of tortillas, porridge, pop-corn an barbecues and as forage. Corn flour is an important food ingredient, mainly in Latin America countries. In most countries of the world cereals grain supplies of humans nutrition needs by the highest calories, protein, insoluble fiber, some vitamins and minerals (Gastro *et al.,* 2007).

Carp fish: (*Cyprinus caprio*) is one of the oldest domesticated species of fish for food according to the FAO statistics of (FAO, 2005). Fish are generally considered high in nutritional value, due to the high quality protein with a higher biological value of 15-23%. The nutritional value of fish meat is reflected in favorable content of proteins, fats, minerals and vitamins (Cirkovic *et al.,* 2002). Further, fish have a good complement of the essential amino acids, particularly lysine which is low in cereals, thus providing a nutritional balance in the overall quality of a mixed diet (FAO, 2005). Fish are important sources for many other nutrients namely vitamins such as vitamin A, D and E as well as minerals including calcium, iodine, selenium etc. (Kyle, 1999; Connor, 2000).

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Apples**:** (*Mallus pumilla*) Fam. Rosaceae, apples are one of the main dietary source of antioxidants, phenolic compounds such as flavonoids. Flavonoids reduces the risk of cardiovascular disease by increasing the release of endo the lial nitric oxide No and inducing vase dilatation (Nicholas *et al.,* 2010). Recently around 60% of such production is destined for exports, mainly as fresh produce and the other part is processed to produce juice concentrates, frozen and dried products (Carolina *et al.*, 2010).

Carrot: (*Dacus Carota* L) is one of the popular root vegetables grown throughout the world and is the most important source of dietary carotenoids in western countries including the United States of America (Sharma *et al.,* 2012). Carrots are good source of carbohydrates, calcium, phosphorous, iron and potassium. It's an excellent source of vitamins and classified as vitaminized food, in addition to lack in protein and fat (Ikken *et al.,*1998; Raum, 2003; Hashimoto and Nagayama, 2004), of all the carotenoids,β-carotene is the most important one, because it is not only be converted to vitamin A in humans ,but also it can be function to prevent photosemitization and formation of skin tumors and potentially to increase immune response (Rao andRao,2007).

Paprika: (*Capsicum annum* L.) is a widely consumed as condiment. Paprika powder is used both domestically and for industrial purposes. In the food industry it is mainly used as a natural colorant to correct or reinforce the color of foodstuffs or to provide flavoring (Fernandez-Trujillo, 2007). The color of paprika mainly comes from the carotenoids formed in the fruit during ripening (Topuz *et al*., 2009). Capsanthin is the main carotenoid in paprika, followed by capsorubin and provitamin A carotenoids (Gallardo-Guerrero, 2010).

Parsley: (*Petroselinum Crispum*) is a number of Apiaceous family that has been employed in the food, pharmaceutical, perfume and cosmetic industries. (Lars and Volker, 2011).Parsley leaves are used as condiment, garnish, and flavoring ingredient (Simon and Quinn, 1988).It was used either in fresh or dried from since it gives meals such as meat, fish or soup a very fresh and harsh odor(Mordy,1999). Parsley leaf is a rich source of natural antioxidants, which serve a lot of functions in human body and prevent food from oxidation processes (Paula *et al*., 2014).

The objective of this study is to produce a healthy snacks product for children characterized by high quality and high nutritional value with a natural color and flavor.

Materials and Methods

Raw materials:

The raw materials used in this study were brought from the local market at Cairo, Egypt.

Corn:

White maize seeds were selected carefully from impurities, washed and blanched in water boiler until being well cooked.

Carp fish:

The fish were cleaned by removal of viscera, head, scales of skin, blanched in boiling water for 5minuts, bone and skin were removed.

Apples:

Prepared by cutting to slices into acidic water for 2 minutes.

Carrots:

Slices were washed with tap water and blanched in boiling water until cooked, then cooled by tap water.

Red Pepper and parsley:

Washed with tap water and the edible portions were cut into slices.

All the previous materials were dried over night at 50-60 ºC in an air dryer oven, milled using a small laboratory mill, then sifted by using household sieve to obtain fine powder packed in polyethylene bags and stored at -20 ºC until use.

Preparation of the product (snack):

Ten formulas were prepared by mixing and kneading the previous raw materials with 1% corn oil and 1% salt. Cut into forms and roasted in an air oven.

Ingredients and the composition of the formulas are shown in Table (1).

Table 1: Formulas composition by grams of different prepared snacks

Formula	Corn flour	Carp fish	Apples	Carrots	Red Pepper	Parsley
1	45	40	10	5	0	0
2	40	40	10	10	0	0
3	35	40	10	15	0	0
4	45	40	10	0	5	0
5	40	40	10	0	10	0
6	35	40	10	0	1 5	0
7	45	40	10	0	0	5
8	40	40	10	0	0	10
9	35	40	10	0	0	15
10	50	40	10	0	0	0

Sensory evaluation:

The samples were sensory evaluated for color, odor, taste, texture and general appearance based on 10 points for each. The mean value of these sensory properties was evaluated as percentage of accepted public by a taste panel comprising of 10 staff members at the department of Special Food & Nutrition of Food Technology Research Institute.

Chemical analysis:

1-The moisture, protein, fat, Ash and fiber were determined according to (AOAC, 2000).Carbohydrates were determined by difference. The caloric value was calculated using values of 4kcal/g of protein, 4kal/g of carbohydrate and 9kcal/g of fat according to Livesy, (1995).

2-Calcium, potassium, iron and Zink concentration were determined by atomic absorption (Thermo-Tarrell, Ash, Smith-Hieftje -1000) in their digested solutions according to AOAC, (2000).

Determination of water, fat soluble vitamins, β-carotene and phenolic compounds were done in Food Technology Research Institute. HPLC Agilent 1200 series equipped with quaternary pump, auto sampler, mat wave length detector, Zorbax ODS 4.6x250mm and degasser column were used for fractionation.

3-Vitamins soluble in water (B complex) were determined by HPLC according to Batifoulier *et al.* (2005).

4- Vitamins soluble in fat (A, D, E and K) were determined by HPLC according to the method of Noll, (1996); Pyka and Siliwiok, 2001; Ruiz, *et al.*, 2007).

5-β-carotene and phenolic compounds were determined by HPLC methods according to Kimura *et al.*, (2007; Goupy *et al.*, 1999).

6-Total phenolic content were determined using Folin-Ciocalteu reagent according to the method described by Danial and George, (1979).

7-Amino acids were determined by automatic amino acid (AAA400INGOS Ltd) in Central Laboratory for Food and Feed according to the method of Csomos and Simon-Sarkadi, (2002) as follow:

The dried and defatted grinding sample was hydrolyzed with 6 NHCL (10ml) in sealed tube, heated in oven at 100ºC for 24 hours. The resulting solution was completed to 25 ml with de-ionized water. After filtration, five ml of hydrolysate was evaporated until to be free from HCL vapor. Then the residue was dissolved in "citrate buffer".

Statistical analysis:

Values of different parameters were expressed as the means with last significant different (LSD) at the level of $P<0.01$ applied to data to establish significant differences between the samples (Duncan, 1995).

Results and Discussion

The results of sensory evaluation for all prepared snack formulas are listed in Table (2). From these results it could be noticed that, formulas from 1-5 and 7showed no significant different in color. Also, formulas 1,3,4,5 and 6 showed no significant different in taste. While all formulas showed no significant different in texture except 6 and 9. On the other hand the first five formulas showed the highest scours in color (8.4, 9.2, 8.8, 9.0 and 9.1) and overall acceptability (83.2, 88.0, 89.2, 86.6 and 88.6 %) respectively. This may be due to the yellow and orange colors of carrot and paprika which are granulated for humans, (Arscott and Tanumihardjo, 2010; Horvath and Hodur, 2011).

It could be noticed that also, overall acceptability was increased by increasing the percentage of carrot powder from 5- 15 and paprika powder from 5-10while decrease by increasing parsley powder from 5-15.Formula No.3 which contain 15 % carrot powder showed the highest scour 89.2 %. While formula No.9 which contain 15 % parsley powder showed the lowest scour 58.8 %, this may be due to increasing in cloudy green color of parsley moreover degradation of the green color (Chlorophyll) by heating and oxidation, (Erge *et al*., 2008).

Table 2: Sensory evaluation of the prepared snack formulas

Formula	Color	Taste	Odor	Texture	Appearance	Overall Acceptability%
1	8.4 ^{ab}	8.8^{abc}	7.7^{ab}	8.3^{ab}	8.4^{d}	83. 2
2	9.2^{a}	8.4 ^{bc}	8.7^{ab}	8.6 ^{a}	9.1^{bc}	88.0
3	8.8^{a}	9.2^{a}	8.5^{a}	8.6^{a}	9.5 ^{ab}	89.2
4	9.0^{a}	9.1 ^{a}	7.7^{ab}	8.0 ^{abc}	9.5 ^{ab}	86.6
5	9.1^{a}	8.8^{abc}	8.5 ^{a}	8.0 ^{abc}	9.9^{a}	88.6
6	6.3 ^{c}	9.4^{a}	8.0^{ab}	7.5 ^{bc}	5.2 ^{e}	72.8
7	8.3 ^{ab}	8.1^{c}	7.5^{b}	8.7^{a}	8.7^{cd}	82.6
8	6.3 ^{c}	7.0^{d}	7.6^{b}	7.8^{abc}	5.6^{c}	68.6
9	4.6^{d}	6.5^{d}	7.6^{b}	7.1 ^{c}	3.6^{f}	58.8
10	7.8^{b}	8.1 ^{c}	8.5^{a}	8.3 ^{ab}	8.7 ^{cd}	82.8
L S D	0.95	0.75	0.83	1.00	0.64	-

The data in table (3) show the chemical composition and total energy value of the prepared snack formulas. The total crude protein ranged from 37.31- 40.83, fat from 2.30- 3.07, fiber from 1.35- 5.51, ash from 2.56- 3.81 and carbohydrate from 49.50- 53.86 %.Also, the total energy value ranged from374.37-395.71 kcal/100g sample on dry weight. Al-Salem, (2014) reported that, the total caloric requirements for children from 7-12 years ranged from 60-75 kcal/kg body weight/day. This mean, each 100 gram of these formulas can provide these children by approximately 20% of the energy needs in the day.

Table 3: Chemical composition of the prepared snack formulas (g/100g) on dry weight basis

Formula	Protein	Fat	Fiber	Ash	Carbohydrate*	Energy kcal/100g
1	39.41	2.49	1.80	2.56	53.74	395.01
2	39.27	2.57	3.00	2.87	52.29	389.37
3	38.68	2.63	3.51	3.05	52.13	386.91
4	39.60	2.43	1.39	2.72	53.86	395.71
5	39.20	2.62	2.45	3.03	52.70	391.18
6	37.99	3.07	4.12	3.70	51.12	384.07
7	40.83	2.31	4.31	3.05	49.50	383.11
8	38.82	2.82	4.75	3.59	49.98	380.85
9	37.31	2.97	5.51	3.81	49.60	374.37
10	40.18	2.30	1.35	3.22	52.95	393.22

**Carbohydrate were determined by difference on dry weight basis.*

The high level of protein in these formulas mainly due to carp fish powder which was added by a fixed ratio (40 %) in all formulas. Carp fish contain 18.34 %protein, 3.5 % fat, 1.17 % ash and 76.79 % water, (Ozyurt *et al.,* 2009).In a similar study conducted by EL-Kholie, *et al.* (2014) to fortified some baby food (Cerelac) by dried surimi of carp fish, it was found that, adding 30% of dried common carp fish surimi increased the level of protein from 7.32 to 19.65 and ash from 1.71 to 2.59 %, while decrease the level of fat from 1.75 to 1.45, fiber from 2.16 to 1.46 carbohydrate from 87.06 to 74.9 % and total energy value from 381.66 to 367.00 kcal/ 100g.

Also corn flour, apples, carrot, paprika and parsley powder shad a variation level of protein as well as the high level of fiber, ash and carbohydrate. From these data it could be noticed that, increasing level of carrot, paprika and parsley to 15% for each led to increasing in fiber and ash contain and decreasing inprotein level (formulas 3, 6 and 9).

The minerals contain are shown in table (4). The concentrations of K, Ca, Zn, Fe, Na and Mg ranged from (154.39 - 291.89), (201.82 - 403.27), (40.43 - 80.13), (56.34 - 102.32), (316.18 - 450.23) and (50.93 - 182.05) mg/100g respectively. Formula No. 4 showed the highest level of K: 291.89, formula No. 7 showed the highest level of Ca : 403.27 and Fe :102.32,while formula No.9 showed the highest level of Na :450.23 and Mg :182.05 mg/100g.This is due to the high minerals contain of the involved ingredients specially, carrot, paprika and parsley which were added detracting from the corn flour by 5, 10 and 15%.

Parsley and paprika powder contains(2683, 2280), (1140, 229),(5.44, 4.33),(22.04, 21.14)(452, 68) and (400, 178) mg/100g of K, Ca, Zn, Fe, Na and Mg respectively (USDA, 2016).On the other hand, the Na and K ratio are important in determine the health status of an individual, whereas sodium and potassium are important intercellular and extra cellular action (Caunii, *et al.* 2010). The formula No.4 may be the favorite whereas produce Na to K ratio: 1.08 which is nearly from the recommended ratio which is less than 1.

Table 4: Minerals content of the prepared snack formulas (mg/100g)

Formula	K	Ca	Zn	Fe	Na	Mg
1	229.49	392.22	75.07	56.34	380.90	60.59
2	218.67	274.79	40 43	75.50	410.52	75.94
3	284.71	321.99	43.52	86.47	435.82	80.65
4	291.89	382.91	44.41	87.02	316.18	50.93
5	187.39	201.82	43.73	90.65	350.20	65.40
6	199.42	333.10	48.72	98.50	390.59	73.25
7	193.76	403.27	57.78	102.32	328.69	85.61
8	240.41	331.43	48.23	81.90	396.29	145.98
9	154.39	359.58	51.97	86.61	450.23	182.05
10	205.72	398.44	80.13	88.35	433.37	60.81

The data in table (5) show the water soluble vitamins contains. It could be observed that, all formulas contained appropriate levels of vitamin B complex and ascorbic acid. Vitamin B3 (nicotinic acid) and B6 (pyridoxine) showed the highest level, whereas ranged from 24.75– 62.43 and from 20.55 – 23.02mg/100g respectively. This is due to diversity of the sources involved in this formulas (animals and plants sources).

Carp fish, as well as a good source of fat soluble vitamins its also contain 68, 53 and 150 ug /100g of thiamine, riboflavin and pyridoxine respectively, (Steffens, 2006). Also contain 33.23ug / 100g folic acid, (Ozyurt, *et al.* 2009). The other ingredients (corn flour, apple, carrot, paprika and parsley) consider a good sources of water soluble vitamins.

Table 5: water soluble vitamins content in the prepared snack formulas (mg/100g)

Formulas	B1	B2	B3	B6	B9	B12
1	0.59	2.55	39.91	21.20	1.57	0.25
2	0.75	2.87	45.69	21.85	3.02	0.36
3	0.83	3.08	56.54	22.01	3.67	0.41
4	0.99	5.07	44.87	20.05	2.01	0.45
5	1.46	5.92	56.87	21.84	2.85	0.81
6	1.55	6.25	62.43	23.02	3.05	0.82
7	0.69	2.75	24.75	19.91	1.88	0.14
8	0.85	3.02	30.05	20.55	2.06	0.21
9	1.02	3.45	32.06	22.72	2.44	0.35
10	0.66	2.69	39.71	21.71	1.40	0.29

From the data in the same table it could be noticed that, the color sources ingredients (carrot, paprika and parsley) were the limited factor. Formula No. 6 which contain 15 % paprika showed the highest level of B1, B2, B3, B6 and B12 whereas recorded 1.55, 6.25, 62.43, 23.02 and 0.82mg/100g respectively. Followed by formula No.3 which contain 15 % carrot where recorded 3.67 mg /100g of B9.Paprika is a rich source of provitamin A and vitamins B, E, and minerals (Zaki *et al.,* 2013). Paprika powder contain 0.33mg vit. B1, 1.23 mg B2, 10.06 mg B3, 2.14 mg B6 and 49 ug B9 /100g (USDA, 2016). While carrot contain 0.07 mg vit. B1, 0.06 mg B2 and 0.98 mg B3 /100g fresh weight, (Arscott and Tanumihardjo, 2010).

The β-carotene and fat soluble vitamins are shown in table (6) β-carotene ranged from 1.01 – 3.55, formula No. 3 showed the high content 3.55, while formulas, 7 and 10 showed the lowest content 1.01 mg/100g. This is may be due to containing formula No. 3(15%) carrot powder which consider a main source of β-carotene. Orange carrot raw contain 12.8 mg β- carotene and 2.2 mg α-carotene/100g (Arscott and Tanumihardjo, 2010). β-carotene also known as precursor for Vit. A, this is clear in formula No. 3 also which showed the highest contain of Vit. A (0.0842 mg/100g).On the other hand Vit. K showed the highest concentration in all formulas compared to the other vitamins and ranged from 2.34 – 4.89 mg/100g. This may be due to multiple the involved sources such as fish, corn flour and other plant materials as well as corn oil which add by 1% during preparation the formulas. Green leafy vegetables contain the highest values of vit. K (400–700 ug/100 g), while the next best sources was found in certain vegetable oils which contain (50–200 ug/100 g), (FAO/WHO, 2001).Moreover fish consider a rich source of vit. A, D and E, fish species with a higher fat content, contained more vitamin K than lean fishes, Highest concentrations were found in muscle of marine and freshwater fish with high fat content (Ostermeyer and Schmidt, 2001).

Table 6: β-carotene and fat soluble vitamins contain in the prepared snack formulas (mg/100g)

Formula	β-carotene	A	D	E	K
1	2.05	0.0708	0.0078	0.0014	3.51
2	3.01	0.0755	0.0055	0.0016	2.34
3	3.55	0.0842	0.0047	0.0018	2.99
4	1.51	0.0652	0.0048	0.0014	3.65
5	2.07	0.0695	0.0025	0.0015	4.68
6	3.02	0.0723	0.0020	0.0018	4.89
7	1.01	0.0612	0.0033	0.0012	4.14
8	2.52	0.0645	0.0030	0.0016	4.25
9	3.02	0.0667	0.0025	0.0017	4.50
10	1.01	0.0682	0.0114	0.0018	3.04

The data in Table (7) show the HPLC fractionation of some phenolic compounds which were identified in the prepared snack formulas. It's clear that, formula No.6 showed the highest levels of galic, benzoic, ferulic, protocatchoic, caffic, ellagic, coumaric, cinnamic, catechol, pyrogallol and salycillic acid which were 0.60, 2.85, 1.63, 1.52, 1.66, 1.04, 0.79, 1.02, 1.72, 19.57 and 1.42 followed by formula No. 9 which showed the highest levels of stolleuropein, reveresetroll, vanilic, chlorogenic, cinnamic, and catechin which recorded 5.23, 1.40, 2.16, 1.25, 1.02 and 1.80 mg/100g respectively. This may be due to presence of paprika and parsley by 15 % in both formulas.

Table 7: Phenolic compounds contain in the prepared snack formulas (mg/100g).

Phenolic compounds	1	2	3	4	5	6	7	8	9	10
Gallic	0.20	0.37	0.49	0.29	0.58	0.60	0.09	0.20	0.41	0.48
P-OH benzoic	0.41	0.61	0.88	2.37	2.64	2.85	1.23	1.42	1.52	0.94
Stolleuropein	2.15	2.46	2.58	4.10	4.89	5.05	4.15	4.90	5.23	2.22
Reveresetroll	0.04	0.09	0.13	0.12	0.34	0.54	0.95	1.12	1.40	0.39
Ferulic	0.44	0.64	0.70	0.56	1.26	1.63	0.59	1.03	1.50	0.57
Vanillic	0.13	0.28	0.35	0.65	0.76	0.84	1.23	1.80	2.16	0.27
Chlorogenic	0.78	0.89	1.24	0.11	0.36	0.57	0.70	1.03	1.25	0.27
Protocotehoic	0.15	0.30	0.38	0.85	1.10	1.52	0.25	0.45	0.68	0.12
Caffeic	0.78	0.87	0.91	1.14	1.43	1.66	0.20	0.46	0.79	0.74
Ellagic	0.17	0.22	0.30	0.32	0.73	1.04	0.47	0.62	0.84	0.12
α-Coumaric	0.18	0.24	0.39	0.29	0.59	0.79	0.26	0.45	0.63	0.30
Cinnamic	0.14	0.49	0.74	0.52	0.71	1.02	0.53	0.78	1.0.2	0.19
3-OHTyrosol	0.75	1.23	1.72	0.34	0.78	0.94	0.64	0.86	1.03	0.53
Catechol	0.20	-	0.48	0.57	1.13	1.72	0.61	0.93	1.22	0.3.3
Pyrogallol	7.07	12.39	14.68	9.26	18.02	19.57	0.71	1.51	4.03	--
Catechin	0.85	1.02	1.12	0.43	0.51	0.65	1.41	1.65	1.80	0.69
Salycillic	0.56	0.74	0.91	0.85	1.05	1.42	0.95	1.05	1.25	0.65
*Total polyphenols	109.39	142.04	154.29	191.02	203.36	220.04	116.73	150.20	165.29	151.84

**Determined by Folin-Ciocalteu method*

Paprika are an excellent source of antioxidants including flavonoids, phenolic acids, and carotenoids (Nora *et al.,* 2012).On the other hand formulas 4, 5 and 6 which contain 5, 10and 15 % paprika powder

showed the highest levels of total polyphenols whereas contain 191.02, 203.36 and 220.04 mg/100g respectively.

The source of polyphenols in these formulas not due to paprika only but there are other sources such as apple which added by 10% to all formulas.

Apple is one of the main natural sources of phytochemicals and the total polyphenolic contain reached to 111.45mg/100g of fresh weight (Ferretti, *et al.,* 2014).Apples belonging to green-delicious, red-delicious, and rose-red cultivars showed intermediate values of 68.29, 73.96, and 70.57 mg GAE/100 g of wet weight, respectively (Francini and Sebastiani, 2013).

From the results of sensory evaluation (table 2) it could be noticed that formula No. 3, 5 and 7 which contain 15% carrot, 10% paprika and 5% parsley respectively were the best acceptability. Therefore were selected it to amino acids analysis compared to formula No.10 which was free from theses additives.

From the data in table (8) it could be showed that the tested formulas contained the most essential amino acids except isoleucine, arginine and tryptophan. Formula No.3 showed the high level of threonine, valine, and methionine 2.00, 2.05 and 2.00%, while formula No.7 showed the high level of leucine, phenylalanine, histidine and lysine 2.62, 4.22, 9.82 and 46.00 %.

On the other hand, the ratio of essential amino acids reached to 65.18, 65.15, 66.16 and 65.47 % of protein for formulas No. 3, 5, 7 and 10 respectively. This mean that, this formulas contains most all the essential amino acids, therefore consumption of theses formulas is good for children health. Source of amino acids in this formulas is due mainly to fish powder and corn flour.

Fish are an excellent source of high quality animal protein and characterized by a balanced amino acid composition (Steffens, 2006).Approximately 52.3% essential amino acids and 47.7% non essential amino acids were present in both red and white meat of fish (James and Kumar, 2013).

Also maize protein content all the essential amino acids specially leucine, phenylalanine and valine which reached to 13.35, 5.30 and 4.81g/100g protein respectively (Paes and Maga, 2004).

An ideal protein should contain 5.5% lysine, 3.5% sulfur amino acids, 4% threonine, 1% tryptophan and 7% leucine (James and Kumar, 2013).Our results showed that, most formulas satisfy the ideal protein features except for tryptophan which is not detected.

From all previous results it could be summarized that, formulas No. 3, 6 and 7 which contain 15% carrot, 15% paprika and 5% parsley powder respectively may be the favorite. Whereas formula No.3 showed the highest levels of sensory evaluation, vit. B9, β-carotene and vit. A. Formula No. 6 showed the highest levels of vit. B1, B2, B3, B6, B12, E, K and phenolic compounds. While formula No. 7 showed the highest levels of total protein, Ca, Fe and essential amino acids. On the other hand formula No. 4 showed the optimum ratio of Na : K which was 1.08.

Table 8: Amino acids contain in the prepared snack formulas No. 3, 5, 7 and 10 (g/100g protein)

Amino acids	3	5	7	10
Threonine	2.00	1.05	1.18	1.09
Valine	2.05	1.80	2.00	1.99
Methionine	2.00	1.20	0.32	0.22
Leucine	2.40	2.50	2.62	2.51
Phenylalanine	3.50	4.20	4.22	4.19
Histidine	8.53	8.50	9.82	9.73
Lysine	44.70	45.90	46.00	45.74
Aspartate	10.55	10.80	10.52	10.99
Serine	2.32	2.45	2.50	2.64
Glutamate	9.00	9.10	9.20	9.19
Proline	1.35	1.26	1.30	1.31
Glycine	6.60	6.55	6.50	6.60
Alanine	3.50	2.75	2.90	2.97
Tyrosine	1.50	1.85	0.94	0.84

Conclusion

Children often needs of special feeding. Instead of unhealthy fast food, it could be produced some snacks foods for children. These foods characterized by safety, high nutrition, healthy value and without any synthetic additives. Some cheap raw materials with high nutrition value such as corn flour, apple, fish, carrot, paprika and parsley powder were used in this product.

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