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NUTRITIOUS EXTRUDED PRODUCT-A REVIEW

Anant. C. Gahire

Department of Food Technology,

University Institute of Chemical Technology

Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon

Abstract

Different extruded products are prepared from the various types of raw materials such as legumes, pulses, cereals and oilseeds etc. Due to variation in the composition these are supplementary to each other and results in superior quality product.

In present review, weaning food and noodles are studied which are prepared from the different types of raw materials such as chickpea, maize, peanut, soybean and other raw material. Weaning food are prepared containing varying amount of protein mainly required for children .Weaning food prepared by using 25% oilseed portion helps to increased protein level. extruded product(noodles) made from defatted soya flour is more nutritious containing 47.60% protein,3.2% fat, and mineral content 5.54%.corn –soya-safflower paste is also rich I protein if used in 83:11:6 gives 45.9% of protein.These are prepared by the various methods. These products can fulfill the protein requirement of the children.

Keywords: weaning food; cereal; legumes; oilseeds; noodles protein.

Introduction

Providing adequate nutrition during early childhood is of paramount importance for maintaining health. Inadequate intake of nutritionally balanced foods results in inhibition of growth. Poor growth during childhood affects a large portion of the world's population. Therefore, development of nutritious supplementary foods has been suggested by FAO to combat malnutrition among children. The nutritional quality of cereals, legumes and oilseeds can be improved and also exploited as human foods by processing techniques such as extrusion. Extrusion cooking can manufacture a wide range of food material into a ready-to-eat form economically. Extruded corn and soy-based snacks, weaning foods have an improved nutritional quality, enhanced shelf life of products, and are well accepted by children and mothers Extrusion cooking not only enhances the acceptability of the product by improving its appearance, taste and texture, but also inactivates anti-nutritional factor. Various nutritious extruded products prepared by using different raw materials some these are included in this review

Corn-Soy Based extruded products:

Pre-extrusion addition of soy to corn products has been studied for developing supplementary foods with improved nutritional value. Extrusion cooking using soy-corn blends to serve as a tool to produce health foods. The development of ready-to-eat nutritious supplementary foods employing extrusion cooking using de-branded, de-germ corn flour and defatted soy blends. Their proximate composition and nutritional quality with respect to protein efficiency ratio (PER) and net protein utilization (NPU) were also evaluated so as to check its suitability for human consumption. (V. Baskaran & Suvendu Bhattacharaya).

Table: Nutrient composition (%) of extruded supplementary foods based on corn-soy blends.

Sr.no.	Product Moisture	Crude protein	Total fat	Total carbohydrate	Total ash	Energy (kcal/100 g)
1	SF (sweet) 4.7 ± 0.1	18.6 ± 0.8	0.4 ± 0.02	73.6 ± 2.3	2.8 ± 0.1	392. 4 ±2.2
2	SF (salty) 1.3 ± 0.1	23.4 ± 1.2	3.4 ± 0.3	67.9 ± 2.1	5.0 ± 0.2	397.5 ±3.8

Note. Values are mean ± SEM of 5 independent analyses estimated by differential method (13).

Maize and Chickpea Extruded Based Weaning Food:-

The maize and chickpea are used for preparation of weaning food. These mixed together, the proteins of maize and chickpeas complement one another to produce a protein of a better quality by providing to each other significant amounts of the respective limiting amino acids.

The weaning food prepared from maize and chickpea mixture as basic ingredient contained 4.52 g proteins, 1.28 g lipids, 24 g carbohydrates, 0.69 g minerals and 126 Cal/100 g; furthermore, it had an in vitro protein digestibility and C-PER of 92.1% and 1.93, respectively. The panelists found the weaning food sensory acceptable, it was evaluated with 4.31 in a 6-points hedonic scale, that means than its acceptability was between like very much and like extremely.(J. Mila´ N-Carrillo,C. Valde´Z-Alarco´ N,R. Gutie´Rrez-Dorado, O. G. Ca´ Rdenas Valenzuela, R. Mora-Escobedo,J. A. Garzo´ N-Tiznado & C. Reyes-Moreno)

Weaning Food by Using Peanuts, Maize and Soybeans:

The ratios of soybeans and peanuts making up the desired 25% were found to significantly affect the ease of extrusion and the physical characteristics of the product . Because of the relatively high fat content of the peanuts, formulations with more peanuts than soybeans produced extrudates that were oily with poor physical consistency. The resulting protein content was also found to be below the desired 15% or more. At lower peanut concentrations in the blend, the protein content of the product was high (15.4% protein at 10% level of peanut and 16.1% protein at 5% level of peanut), and there was ease of extrusion and the physical characteristics of the extrudates were good.

Effect of Extrusion Variables on Extrudate Quality:

The effects of feed moisture content and extrusion temperature on ease of extrusion and product quality characteristics were determined in terms of four feed moisture ranges and three temperature variations (representing low, medium and high temperatures of extrusion). The bulk density of the extrudates increased while expansion index decreased with increase in feed moisture content. Hardness increased between feed moisture contents of 13–15% and 16–18%, remained the same between 16–18% and 19–21%, and actually decreased between 19–21% and 22–24% feed moisture content. At a feed moisture content of 13–15%, the product was highly puffed and light with low bulk densities ranging between 180.4 and 250.4 kg/m3 depending on the temperature of extrusion. Increasing the water flow rate to give a feed moisture content of 16–18% almost doubled the bulk density for all extrusion temperatures, to values ranging from 310.8 to 526.7 kg/m3. At this feed moisture level, extrusion was found to be smooth and the extrudates were well formed and highly manageable.

Increases in feed moisture content beyond 18% did not result in proportionate increases in the bulk density although significant ($p < 0.05$) increases were observed. Product hardness also increased significantly ($p < 0.05$) at low and medium temperatures of extrusion with increases in feed moisture content up to 21%, after which a more elastic product requiring a low compression force resulted. Product moisture content also increased as the water flow rate was increased. A gradual decrease in color intensity was observed with increasing feed moisture content. Based on these findings, the feed moisture content for desirable extrusion and extrudate characteristics was fixed at 16–18%.(W.A. Plahar, B. Onuma Okezie & C.K. Gyato)

Cereal/ legume-based weaning food supplements:

The ingredients, maize, blanched peanuts, decorticated cowpeas, decorticated soybeans and soybean oil, were combined and processed by three different schemes.

In process 1, although both the maize and cowpea/oilseed components (either cowpeas/peanuts or cowpeas/soybeans/soybean oil) of the mixture were extrusion cooked, they were processed separately and later combined. The maize grains were ground through a hammer mill fitted with a 1.0 mm aperture discharge screen and extrusion cooked with a commercial thermo-stable α-amylase enzyme (Termamyl_120L) to facilitate maximum starch degradation. A co rotating twin-screw extruder (APV Baker, Model 1700-30, Newcastle-on- Tyne, England) with an L/D ratio of 25:1 and equipped with a slit die (1mm × 20mm) was used. The screw profile featured a combination of forwarding; reversing and twin lead feed screw elements to facilitate conveying, working, thorough mixing and cooking of the feed material.

The maize flour was introduced into the feed zone of the extruder barrel at a rate of 10 kg/hr (dry matter basis) and the temperatures at the four heating zones along the barrel were set and maintained at 100 ◦C, 125 ◦C, 125 ◦C and 150 ◦C by the circulation of cooling water through the jacket surrounding the barrel. Enzyme solution was introduced into the extruder barrel through a proportioning pump (Bran and Lube, Model N-P31, Buffalo Grove, IL) calibrated to deliver 4 ml of enzyme/kg dry feed material while raising the moisture content to 35 g/100 g dry matter. The extruded maize was dried in a forced air oven

for 16–18 hours at 60 ◦C and ground into flour using a hammer mill. In this process (p1), the cowpea/oilseed component was co milled into a meal and extrusion cooked. Tap water was introduced into the extruder barrel se the moisture content of the dough to 30 g/100 g of dry matter.

The cowpea/oilseed extrudate was dried in a forced air oven for 16–18 hours at 60 ◦C and ground into flour using a hammer mill. The enzyme-converted maize flour was then combined with extrusion cooked cowpea/peanut (CP)and cowpea/soybean/soybean oil (CS) flours to produce formulations CPp1 and CSp1 with ingredient ratios 43:42:15 (w/w) (maize:cowpeas:peanut) and 50:35:10:5 (w/w) (maize:cowpeas:soybeans:soybean oil) respectively.

In the second process (p2), maize grains were either combined with decorticated cowpeas and blanched peanuts in the ratio of 43:42:15 (w/w), or with decorticated cowpeas, decorticated soybeans and soybean oil in the ratio 50:35:10:5 (w/w). The mixtures were milled and extrusion cooked to produce CPp2 or CSp2, respectively. The same extrusion conditions used in processing the cowpea/oilseed component in process 1 (p1) were maintained. The extrudates were dried in a forced air oven for 16–18 hours at 60 ◦C and ground into flour using a hammer mill.

In the third process (p3), the maize grains were toasted in 3 kg batches on shallow aluminum trays in a preheated conventional oven at 400 ◦F for 20 minutes until a desirable light brown color developed. The toasted maize grains were ground into flour using a hammer mill. The toasted maize flour was then combined with extruded cowpea/peanut (CP) flour and cowpea/ soybean/ soybean oil (CS) flour prepared as in p1, to produce formulations CPp3 and CSp3, respectively. The only difference between processes p1 and p3 was that the maize component of the formulations processed by p3 was toasted and not precooked by extrusion as in p1. All the composite flours were kept in refrigerated storage at 4 ◦C until nutrient analyses were performed.

Table 1. The proximate composition (g/100 g) and energy (kcals/100 g) of cereal/legume formulations processed by extrusion cooking:

Sr. no.	Component.	CS	CS p1	CS p2	CS p3	CP	CP p1	CP p2	CP p3
1	Protein	5.35	17.40 ± 0.24bc	17.17 ± 0.04bc	6.88 ± 0.11c	16.78	18.76 ± 0.05a	18.74 ± 0.15a	17.59 ± 0.07b
2	Fat	9.23	7.55 ± 0.32a	6.16 ± 0.20b	8.61 ± 0.15a	9.64	7.79 ± 0.32a	8.13 ± 0.05a	8.37 ± 0.28a
3	Ash	637	2.35 ± 0.01ab	2.43 ± 0.06a	2.32 ± 0.02ab	2.30	2.34 ± 0.24ab	2.30 ± 0.02b	2.20 ± 0.10ab
4	Moisture	11	3.49 ± 0.25b	2.52 ± 0.16c	4.14 ± 0.05ab	11.00	4.30 ± 0.06a	4.86 ± 0.35a	4.89 ± 0.25a
5	Energy	389.90	414.4	411.0	417.2	381.9	412.4	421.0	413.4

1 Each value is mean ± standard deviation of three replications. Different letters indicate significantly different values ($p < 0.05$) (horizontal comparison). Values are expressed on a dry weight basis. 2CS and CP are the values derived from the software; CSp1 = enzyme converted maize/cowpeas/soybeans/soybean oil; CSp2 = co-extruded maize/cowpea/ soybeans/soybean oil; CSp3 = toasted maize/cowpea/ soybeans/soybean oil; CPp1 = enzyme converted maize/cowpeas/peanut (Y. Mensa-Wilmot, R.D. Phillips1, J. Lee And R.R. Eitenmiller)

Noodles Made with Various Supplements:

The influence of various supplements (extruded maize, maize, defatted soy flour and maize/soy flour blends, lecithin and wheat straw) on the pasta quality has been examined. Noodles were prepared by means of conventional laboratory equipment. Common wheat flour supplemented with 1% lecithin powder, 20% extruded maize flour, 20% maize flour, 10% defatted soy flour, 20% defatted soy and maize flour blend (1:1), and 7.5% wheat straw was used. The produced pasta was dried at 55°C in a laboratory dryer (Instrumentaria, Croatia) to 13.0% moisture.(Minolta, Japan).

(Zaneta Ugarcic-Hardi, Marko Jukic, Daliborka Koceva Komlenic, Mirjana Sabo and Jovica Hardi)

The nutritional qualities of the noodles are as follows:

Chemical composition (% on dry weight basis) of wheat, maize and defatted soy flours and wheat straw

Sr.no.	Component	Common wheat flour	Maize flour	Defatted soy flour	Wheat straw
1	Ash	0.47	0.44	5.54	5.79
2	Protein	9.8	5.4	47.6	2.9
3	Fat	0.7	2.9	3.2	1.7
4	Total dietary fiber	0.7	5.4	8.7	46.6

Extruded product made from corn supplemented with soybean and safflower pastes:

A puffed product was made by extruding corn flour supplemented with soybean and safflower pastes. Mixes with the following proportions of corn flour, soybean and safflower pastes: (i) 89:8:3, (ii) 83:11:6 and (iii) 80:17:3 were extruded. The corn flour, soybean and safflower pastes used had 6.6%, 45.9% and 32.9% protein content respectively. In addition, the soybean paste contained 11.78 units of inhibited trypsin/mg of sample, which means it was appropriate for human consumption. Sensory evaluation of extruded products showed that there were no significant differences in flavour, crunchiness and acceptance in the case of products 1 and 3, when compared with samples made from corn flour alone. Product 2 had lower scores, as it had a bitter taste because of the greater amount of safflower paste used. Biological testing showed that all the products containing soybean and safflower pastes were superior to the 100% corn diet in terms of food conversion, growth rate and weight gain.

Chemical composition of diets tested (g/100 g):

Sr.no.	Composition Diets	Control(100% corn)	Mix 1	Mix 3	Mix 5
1	Protein	6.4d	10.0c	11.8b	14.0a
2	Ether extract	9.4a	9.3a	9.4a	9.5a
3	Ash	5.2b	5.7ab	5.9a	6.2a
4	Fibre	9.3a	9.1ab	9.5a	9.2a
5	Extract free of nitrogen	69.7a	64.9b	62.4c	60.2

The high protein content of soybean and safflower pastes make them appropriate protein supplements for corn flour, which contains only 6.6%

protein. The high percentage of lysine available found in soybean paste and the high percentage of tryptophan found in both oilseed pastes are additional reasons why they are useful protein supplements for corn. The nutritional quality of the mixes in this experiment, tested by means of biological evaluation, indicate that soybean and safflower paste supplements lead to substantial improvements in corn-based diets.(H. E. Martinez-Flores, M. C. Cruz,S. A. Larios, G. E. Jime´nez, J. D. C. Figueroa & C. A. Go´mez-Aldapa)

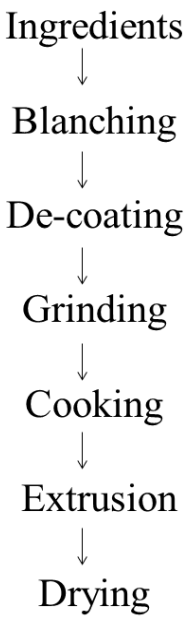
Extruded product with their nutritional content:

Extruded products	**Corn-soya blend**	**Maize-chickpea blend**	**Peanut-soyabean-maize blend**	**Enzyme converted maize, cawpea, peanut**	**Noodles (defatted soya flour)**	**Corn-soya-safflower paste(83:11:6)**
carbohydrate	73.6 ± 2.3 for sweet, 67.9 ± 2.1 for salty	24 g/100 gm.				
Protein	18.6 ± 0.8for sweet, 23.4 ± 1.2 for salty	4.52 g/100 gm	16.1% protein at 5% level of peanut	18.76 ± 0.05a	47.6	45.9%
Fat		1.28 g/100 gm		7.79 ± 0.32a	3.2	
Ash	2.8 ± 0.1for sweet, 5.0 ± 0.2 for salty	, 0.69 g/100 gm		2.34 ± 0.24ab	5.54	

Total energy	392.4 ±2.2 for sweet, 397.5 ±3.8 For salty	126 Cal/100gm		412.4		

From the above table we can concluded that the extruded product(noodles) made from defatted soya flour is more nutritious containing 47.60% protein,3.2% fat, and mineral content 5.54%.corn –soya-safflower paste is also rich I protein if used in 83:11:6 gives 45.9% of protein.

Common procedure for preparation of extruded products:



Conclusion:

The nutritious extruded products and weaning foods prepared from the cereals, legumes and oil seeds have importance in the human life. The combination of corn and soya extruded product provide good quality crude protein. Combination of maize and chickpea can be utilized for the preparation weaning food. extruded product(noodles) made from defatted soya flour is more nutritious containing 47.60% protein,3.2% fat, and mineral content 5.54%.corn –soya-safflower paste is also rich I protein if used in 83:11:6 gives 45.9% of protein. As oilseed and legume are good source of fat and protein can utilized in weaning food but at25% level so the protein content increased up to 15-18%. Weaning food is prepared by various methods and contains protein content at different level. Even the noodles can be prepared with supplementation of corn flour in soybean and safflower paste gives better option to fulfill protein requirement of children and adult also.

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