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CONTENTS

Development and Evaluation Of Nutritious Mix Incorporating Papaya

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ABSTRACT

India is the second largest producer of fruits and vegetables in the world, yet the post-harvest losses seem to be 30 to 40 per cent. These types of losses could be diverted to produce the processed foods rich in macro and micro nutrients to avoid undernutrition. Papayas are available throughout the year, yet their utility in the processed foods are limited. Hence the study was undertaken with the broad objective of developing nutritious mix and extruded products based on locally available ingredients with wheat flour as the base incorporating semi riped papaya in dried form (2.5 to 10 per cent). Quality characteristics, nutrient analysis and microbial load were analysed for the best accepted products. The results of quality characteristics revealed that the wettability, cooked weight, rehydration ratio and percentage water in rehydrated material increased after dry roasting of the best accepted extruded products in the raw form. The protein content of standard manual noodles (16.3g per 100g) was found to be better than the other accepted incorporations. The vitamin and mineral content of the incorporated products were superior to the standard products. The total microbial load was below the BIS specifications. The cost of the developed products were economical than the commercial formulae.

Key words: *Nutritious mix, Extruded products, noodles, papaya, recipes, organoleptic evaluation, quality characteristics, nutrient analysis, microbial load.*

INTRODUCTION

Malnutrition may be manifested as undernutrition or overnutrition. The uneven availability of food itself or the nutrients from the food shows the impact in the form of 'malnutrition'. Babu (2005) noted that the strategies of third world look up to agriculture for their avenues and rightly so. The potential of agriculture for playing a pivotal role in reducing rural poverty and malnutrition has been well accepted. Food processing is an important element to prevent post harvest losses. The efficient improvement in food processing will improve food safety and nutrition. Thus agriculture is inter-related with nutrition vis-à-vis food processing. Convenience foods or processed foods are foods which are designed to save consumers time in kitchen, reduce costs due to spoilage and economies of scale. Convenience foods include instant dry mixes, canned and extruded foods, prepared or fabricated foods. Extruded products include macaroni, noodles, spaghetti, vermicelli and other pasta products. Pasta products are low in fat, high in fiber and a good source of protein. These foods require minimum preparation, typically no heating and are packed for a long shelf life with little loss of flavour and nutrients over time. These are developed to preserve the seasonal supply of agricultural products available at the time of harvest. India ranks second in vegetable and fruit production, but nearly 30 to 40 per cent of the produce is wasted. Value addition can be done by incorporating vegetables and fruits in convenience foods. Papayas are available throughout the year yet their utility in the processed foods is limited. Hence the study was undertaken with the broad objective of developing nutritious mix and developing extruded products wholly from the nutritious mix based on locally available ingredients with wheat flour as base incorporating papaya in dried form.

MATERIALS AND METHODS

A. Preparation of Nutritious Mix

The selection of ingredients for the development of nutritious mix and extruded products were based on the availability, nutrient content and the cost. The ingredients were selected from all the food groups containing whole wheat flour (45 per cent) as base. The other ingredients include legumes like red gram dhal (10 per cent) and green gram dhal (5 per cent), groundnut (10 per cent) and rest of the ingredients included were wheat bran (2.5 per cent), corn flour (12.5 per cent), rice flakes (5 per cent), oats (5 per cent) and skim milk powder (5 per cent).

The drying process of semi ripe papaya include sorting, washing, blanching in boiling water and sun drying. The papaya was sun dried. The blanching time were 2 minutes, increase in weight after blanching was +7/100g, minutes of sun drying were 66-83/100g and the usable dried form was 11.5g/100g.

The basic ingredients after processing were blended, powdered and developed in the form of a nutritious mix. Dried and processed papaya powder was incorporated at a level of 2.5 to 10 per cent.

B. Preparation of Extruded Products

From the formulated nutritious mix; extruded products like noodles (2.5 to 10 per cent) were prepared manually by steaming the nutritious mix, extrusion into noodles and sun dried. After the organoleptic evaluation of manually extruded product based recipes, the best accepted products were developed in the shape of swirl and vermicelli using pasta making equipment.

C. Preparation of Recipes

The recipes thus prepared from the nutritious mix include adai, idli, missi roti, porridge and pittu. Recipes namely payasam, soup, vegetable noodles, pakoda and tomato bhath were prepared from manual noodles. Similar recipes were prepared from the vermicelli and swirl pasta. The prepared recipes were organoleptically evaluated with the five point rating scale. The recipes were evaluated by a trained panel of 25 judges. The best accepted incorporations were judged after the total mean scores of all the analysed sensory attributes of the prepared recipes. The best accepted incorporations were analysed for its quality characteristics, nutrient content and microbial load.

D. Analysis of Quality Characteristics

The quality characteristics of the accepted extruded products were analyzed for the wettability, cooking time, cooked weight, rehydration ratio and percentage water in rehydrated material. The characteristics were analysed before and after dry roasting was done without any addition of fat for a period of 3 to 5 minutes till a slight colour change in the product was observed. The characteristics per se include the characteristic criteria studied in the products in the raw forms.

E. Nutrient Analysis

The best accepted incorporations of nutritious mix (7.5 per cent papaya) and extruded products (5 per cent papaya) were analysed for their nutrient content. The best accepted incorporations of nutritious mix (7.5 per cent papaya) and extruded products (5 per cent papaya) were analysed for their nutrient content. Proximate principles like moisture, ash, protein, fat, calcium, phosphorus and iron, vitamins like â-carotene, thiamine and riboflavin were analyzed. The estimation of fat was done through soxhlet method. The carbohydrate analysis was done by anthrone method. The proximate principles were analyzed with the standardized AOAC (2000) methods. Thiamine, riboflavin content of the samples was analyzed by the fluorimetric methods. HPLC method was adopted for the analysis of â-carotene.

F. Microbial Analysis

One hundred grams of the accepted incorporations were stored in a polythene bag for a period of two months and kept at room temperature and analyzed for total microbial count for a period of two months.

RESULT AND DISCUSSION

Food functionally can be related to nutrients and non nutrients. Whereas others are manipulated using their physiochemical properties in order to make them "functional". Texture, colour, taste, odour and the other physico-chemical properties may affect the overall quality and hence acceptance of food products.

A. Organoleptic Evalauation of Recipes

The best accepted recipes were chosen according to the total mean scores of five sensory attributes. The term standard included here indicates the addition of 10 per cent of the prepared nutritious mix to the original ingredients of the recipes based on the nutritious mix preparations; for the noodles and extruded the products the whole nutritious mix was used. The organoleptic evaluation of nutritious mixes showed that standard missiroti was the best accepted recipe with score of 19 44. Porridge was found to be the best accepted recipe incorporated at 7.5 per cent level with the total score for papaya and porridge was found to be 14.28. The standard scores of recipes prepared with vermicelli were 19.16, 17.00, 16.00, 18.28 and 16.52 for payasam, soup, vegetable vermicelli, pakoda and tomato bhath respectively. Similarly for the 5 percent papaya incorporation it was found to be 17.76, 16.74, 16.88, 16.92, 16.28. The standard scores of recipes prepared with swirl pasta were 19.50, 18.84, 18.88, 19.00 and 17.30 for payasam, soup, vegetable pasta, pakoda and tomato bhath. The scores of the soup were noted to be above 18.00 out of 20 points. The scores of 5 per cent papaya incorporation were found to be 18.00, 18.08, 17.74, 15.00, 12.91.

B. Analysis of Quality Characteristics

Table I shows the results for the quality characteristics of the best accepted manual noodles, extruded vermicelli and swirl pasta (standard, 5 per cent papaya incorporation).

Prabhashankar *et al.*, (2007) on studying the effect of whey protein concentrate and additives on the quality of vermicelli made from the Indian durum wheat increased cooked weight from 82.5 to 88g per 25g when the levels of whey protein concentrate are increased. The addition of red gram dhal increases the cooked weight of the pasta products (Anonymous, 2006).

The changes in the quality characteristics were prominent. The cooking time for manual noodles, vermicelli and pasta were 7.0, 4.5 and 7.5 before roasting of the dry product and after roasting it was 5.0, 3.0, and 5.0 respectively. The cooked weight for standard manual noodles, vermicelli, swirl pasta was found to be addition of 82, 62, 92 before roasting and after roasting it was found to be addition of 114, 100, 118, respectively. For the papaya incorporated standard manual noodles, vermicelli, swirl pasta it was found to be 94, 32, 102 and 116, 92, 124 before and after roasting respectively. The cooking time was found to be inversely proportional to the roasted material that is cooking time decreased after roasting. Cooking time was the same for standard and no impact on cooking time for incorporations was noted. Rehydration ratio was almost double after dry roasting of the raw products. Cooked weight was found to be addition of almost 75 per cent before roasting and after roasting the cooked weight increased more than 100 per cent.

TABLE-1 *Quality Characteristics of Best Accepted Manual Noodles Extruded Vermicelli and Swirl Shaped Pasta*

Criteria	Cooking Time (mts)	Cooked Weight (g)	Rehydration Ratio (1:x)	Percentage Water in Rehydrated Material	Wetta (g
Manual Noodles Before Roasting					
Standard	7.0	+82	1:1.85	45.05	+3(
Papaya	7.0	+94	1:1.94	48.45	+4(
After Roasting					
Standard	5.0	+114	1:2.54	53.27	+54
Papaya	5.0	+116	1:2.01	53.70	+1
Extruded Vermicelli Before Roasting					
Standard	4.5	+62	1:1.62	38.27	+34
Papaya	4.5	+32	1:1.32	24.24	+54
After Roasting					
Standard	3.0	+100	1:2.00	50.00	+71
Papaya	3.0	+ 92	1:1.92	47.92	+11
Extruded Swirl Shaped Pasta Before Roasting					
Standard	7.5	+ 92	1:1.62	47.92	+14
Papaya	7.5	+102	1:1.31	50.49	+25
After Roasting					
Standard	5.0	+118	1:2.00	54.13	+21.
Papaya	4.7	+124	1:1.92	55.36	+55.

C. Nutrient Analysis

The nutrient analysis showed that the moisture content of tiou was found to be lower when compared to the rest of the acce developed products. The â-carotene values for the papaya incorpo products were found to be more than the standard. Table 2 show nutrient analysis of best accepted nutritious mix and manual noodle

TABLE-2 *Nutrient Analysis of best accepted Nutritious Mix and Ma Noodles (g/100g)*

Criteria (g/100g)	Nutritious Mix		Manual Noodles	
	STD	7.5 P	STD	5 p
Proximate Composition				
Moisture	9.50	7.10	9.00	9.05
Protein	15.80	14.90	16.3	15.20
Fat	7.50	9.00	5.85	8.30
Ash	3.20	2.50	3.60	3.50
Carbohydrate	70.00	65.21	72.00	72.00
Crude Fibre	2.35	0.62	2.42	2.15
Vitamin And Mineral Composition				
â-Carotene (mcg)	405.09	706.86	207.02	360.58
Thiamine (mg)	0.31	0.31	0.28	0.23
Riboflavin (mg)	0.23	0.28	0.14	0.12
Calcium (mg)	151.92	133.00	136.86	120.32
Phosphorous (mg)	305.00	359.00	410.00	355.00
Iron (mg)	2.00	5.10	4.30	4.00

STD – standard 5P-5 per cent papaya incorporation

The analysis of proximate composition reveals that the moisture content of the products was well below the BIS specifications of 11g/100g. The moisture content of best accepted nutritious mix was found to be 9.50, 7.10g for standard and 7.5 per cent papaya incorporation respectively. In the case of manual noodles it was found to be 9.00 and 9.05g for standard and 7.5 per cent incorporation respectively. The protein content of best accepted nutritious mix and manual noodles satisfies the USDA specifications of 13g/100g. The protein content of the standard manual noodles was found to have better protein content of 16.3g per 100g than the rest of the developed products. The protein content of the standard and 7.5 per cent papaya incorporated nutritious mix was found to be 15.80 and 14.90g respectively. Khetarpaul and Goyal (2007) analysed the nutrient content of processed noodles supplemented with wheat flour soy and sorghum, soy and maize, soy and rice resulted in 14.2, 19.5 and 3.1 per cent increase in protein content than the process control noodles.

The calcium content of all best accepted products was above 110mg/100g. The phosphorous content of standard and 7.5 per cent papaya incorporated mix was found to be 305.00 and 359.00mg respectively. It was noted that the phosphorous content of 7.5 per cent papaya incorporated nutritious mix was superior to the rest of the developed products. The β- carotene content of standard and 7.5 per cent papaya incorporation of nutritious mix was found to be 405.09 and 706.86 ìg/100g respectively. Table 3 shows the nutrient analysis of extruded vermicelli and swirl pasta.

TABLE-3 *Nutrient Analysis Of Extruded Vermicelli And Swirl Pasta (g/100g)*

Criteria (g/100g)	Vermicelli		Swirl Pasta	
	STD	5 P	STD	5 p
Proximate Composition				
Moisture	8.95	6.00	8.25	8 75
Protein	12.42	11.00	11.05	11.75
Fat	4.70	5.75	4.00	5.75
Ash	3.20	3.60	3.20	3.80
Carbohydrate	52.00	55.00	55.00	55.00
Crude Fibre	2.12	1.98	2.02	1.32
Vitamin And Mineral Composition				
â-Carotene (mcg)	289.35	327.92	288.03	324.85
Thiamine (mg)	0.33	0.29	0.29	0.26
Riboflavin (mg)	0.19	0.16	0.18	0.17
Calcium (mg)	223.20	118.80	223.20	122.40
Phosphorous (mg)	310.00	355.00	310.00	355.00
Iron (mg)	3.00	2.00	3.00	2.00

STD – standard 5P-5 per cent papaya incorporation

The moisture content of the machine made standard extruded products (vermicelli and swirl pasta) ranged from 8.10 to 8.95. The alterations in the standard thiamine and riboflavin values were noted for standard nutritious mix and the standard extruded products. This is due to the various processing techniques adopted for the development of these products. The alterations were noted upto 0.1g/100g for the standard products. A decrease in the standard â- carotene content of manual noodles vermicelli and swirl pasta was observed when compared with that of standard nutritous mix. Their â- carotene values were found to be 207.02, 289.05and 288.03 ìg/100g. The loss of vitamin is higher in the case of standard manual noodles.

The cost comparison of the developed products showed that the developed products are more economical than the commercial formulae. The processing charges incurred in the development of standard manual noodles per Kg are Rs.10 and for the machine extruded products, it is Rs.20 per Kg. The cost of the nutritious mix ranged from Rs.50 to 135 per Kg and that for manual noodles it ranged from Rs.60 to 145 and that of the extruded products it ranged from Rs.80 to Rs.165 respectively.

SUMMARY AND CONCLUSION

The findings of the study revealed that the nutritious mix could be developed into manual noodles and machine made extruded products. The commonly consumed recipes prepared from the developed mix and extruded products were found to be acceptable. Papaya could be incorporated in such mixes proving food security and micronutrient enrichment. The shelf life studies for a period of two months showed that the products are safe for consumption. The cost of the developed products was lower when compared to the commercial formulae.

RECOMMENDATIONS

- Studies on the use of binding agents, electron microscopic structure of the products and product stability.
- In depth studies on the use of novel source of protein to enhance the nutritional security.
- Long term studies related to microbial analysis to strengthen the safety and shelf life of the developed products.

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c) Emphasis should be put on the establishment of new food-industrial plants in the production catchments to minimise transport cost, make use lower cost land and more abundant water supply, create employment opportunity in the rural sector and utilise process waste and by-products for feed, irrigation and manure.

d) Infrastructure in the production catchments selected for food-industrial development should be improved, because of uncertain grid power supply to rural areas, decentralised power generation using locally available resources may becomes an integral part of food-industrial development.

e) The national plan should provide for management at food-processing industrial activities in the catchment area, both by private companies and individuals as well as co-operatives.

f) Arrangements to supply of market information to the farmer and food processor should be put in place.

Conclusions

The growth of food processing industry will bring immense benefits to the economy raising the agricultural yields. Creating employment and raising standards of living of large number of people throughout the country specialy in rural arms. There is enormous potential in Indian to make profitable business in food processing.

Extensive training should be provided to the farmers and co-operatives in the area of PHM of agro-produce to encourage creation of pre-processing facilities close to the area of production to avoid wastage and transportation of raw materials to far away peaces and to ensure increased value addition especially for horticultural produce.

A well run food processing industry ensures that while on one hand the producer gets remuneration prices for his products. The consumers paysless for higher and assured quality.

By adopting these measures, India will became stronger economically, socially and politically among the developing nation of the world.