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RESEARCH ARTICLE

ORGANOLEPTIC EVALUATION OF HEALTH MIXES AND RECIPES INCORPORATED WITH FRUIT PEEL AND SEED POWDERS

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ABSTRACT

India is the second largest producer of Fruits after China, with a production of 44.04 million tones. Only minimum percent is processed and remaining goes as waste. Hence the present investigation was undertaken to study the anti nutritional components of fruit wastes and incorporate into recipes and testing their acceptability. Commonly consumed fruits like grapes, mango, pomegranate and watermelon peels and seed were selected and their anti nutritional factors were analysed. Based on anti nutritional factors grape peel, watermelon peel and seed powders were incorporated into health mixes, commonly consumed recipes like wheat roti, adai, pakkoraand murukku and curry powers like idly powder and paruppu powder at 5, 10 and 15% level to evaluate their acceptability. Health mixes, recipes and curry powders added with 5% level was judged to be highly acceptable and on par with standard having almost same scores.

INTRODUCTION

India is the second largest producer of Fruits after China, with a production of 44.04 million tonnes. Although fruit is grown throughout of the country, the major fruit growing states are Maharashtra and Tamil Nadu (Vanangamudi et al 2011). Fruits and vegetables are more prone to spoilage than cereals due to their nature and composition, hence spoilage occurs at the time of harvesting, handling, transportation, storage, marketing and processing resulting in wastage (Manini and Vijaysethi, 2000). Efficient management of these wastes can help in preserving vital nutrients of foods and feeds, bringing down the cost of production of processed foods, besides minimizing pollution hazards.

Recycling of fruit and vegetable waste is one of the most important means of utilizing them in a number of innovative ways yielding new products and meeting the requirements of essential products required for human, animal and plant nutrition as well as in the pharmaceutical industry. (http://practicalation.org). Groups of cancer fighting antioxidants known as "carotenoids" are found in greater concentration in the peels of fruits than in the pulp (Yao *et al* 2004). The seeds of many fruits contain high quantities of flavonoids known for its high antioxidant property (Negomi et al 2002). The problem of waste disposal and pollution of environment can be effectively overcome by recycling the plant fruit wastes. The present investigation was undertaken to study the anti nutritional components of fruit wastes and incorporate into recipes and testing their acceptability.

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MATERIALS AND METHODS

Selection and dehydration of fruit peels and seeds

Based on the percentage of fruit wastes and seasonal availability, commonly consumed fruits like grapes, mango, pomegranate and watermelon, fruits with maximum waste percentage were selected for the study and procured from the local market. The selected fruits were washed thoroughly and nonedible portions like peels and seeds were removed. The peeled out skins were chopped into small pieces, weighed, placed on trays and dried in the hot air oven at a temperature of 60-70°C for 5-7 hours till they became crisp. The seeds were dried separately. The dried peels and seeds were powdered individually and used for further study.

Analysis of antinutritional factors

The peels and seeds may contain some anti nutritional factors which will inhibit the utilization of nutrients in body. Hence the important anti nutritional factors like oxalate, phytate and tannins were estimated in the dehydrated peel and seed powders. Phytate was estimated by thiocyanate method. Tannin content was estimated by Folin-Denis method (Sadasivam, S. and Manikam, 1996) and oxalate content by NIN method(NIN 2003).

Acceptabilty trials

The fruit peel and seed powder were incorporated into health mixes, commonly consumed recipes like wheat roti, adai, pakkoraand murukku and curry powers like idly powder and paruppu powder at 5, 10 and 15% level. The acceptability was tested for each criteria with 25 semi trained panel members.

RESULTS AND DISCUSSION

Antinutritional factors of dehydrated powders

The anti-nutritional factors may be defined as those substances generated in natural feed stuffs by the normal metabolism of the species and by different mechanisms (e.g., inactivation of some nutrients, diminution of the digestive process or metabolic utilization of feed) which exert effects contrary to optimum nutrition **(**Aberoumand. 2011)**.** Details regarding the antinutritional factors like oxalate, phytate and tannin present in the selected dehydrated fruit wastes are given in Figure 1, 2 and 3 According to Savage (2002), oxalate and its contents have deleterious effects on human nutrition and health, mainly by decreasing calcium absorption and aiding the formation of kidney stones. The formation of oxalate crystal is said to take place in digestive tract (Thompson and Yoon, 1984) Among the seven samples, pomegranate peel had the highest oxalate content of 1.728 mg /100g followed by mango kernel with 1.233 mg/100g. A similar trend of oxalate content (1.49 ± 0.01 mg/100 g) was noticed in mango seed by Fowomola (2010). All the other samples had very low amounts of oxalate ranging from 0.063 to 0.423mg in 100g. In addition, dietary oxalate has been known to complex with calcium,magnesium and iron leading to the formation of insoluble oxalate salts and resulting in oxalate stone (Wardlaw and Kessel, 2002). Phytic acid binds calcium, iron, zinc and other minerals, thereby reducing their availability in the body FAO (FAO. 1990), It also inhibits protein digestion by forming complexes with them (Wallingford, 1985). However, the phytate content can further be lowered by processing (Eriyamremu and Adamson, 1994).
The knowledge of the phytate level in foods is necessary because high concentration can cause adverse effects on the digestibility. Phytate forms stable complexes with Cu2+,Zn2+, Co2+, Mn2+, Fe2+ and Ca 2+. With regard to phytate content, pomegranate peel had a highest amount (208.3 mg/100g) and mango kernel with a lowest value (29.16mg /100g). In the case of tannins, mango kernel contained a maximum of 14.6mg and mango peel had a minimum of 2.3mg per 100g. The tannin content of all the other samples ranged between 2.6-10mg per 100g of sample. Tannins can be considered as being grape's natural antioxidants, able to protect the color and aroma compounds from the action of oxidative enzymes, such as lactase, as well as from the free radicals that are formed from the oxidation of polyphenolic molecules (Vergara-Valancia, 2007). In spite of the anti-nutritional properties ascribed to the various constituents investigated , the levels found in peels of grapes, water melon and watermelon seed might not constitute a health hazard when ingested were selected for further incorporation into health mixes and other recipes.

Mean Acceptability Scores of Health Mixes Incorporated with Dehydrated fruit peel and seed Powder

Table 1 gives the mean acceptability scores of health mixes incorporated with dehydrated grape peel powder. Health mixes added with five per cent of grape peel (A) powder was judged to be highly acceptable and got a score of 17.4 out of 20. It was followed by a health mix score of 15.1 with 10 per cent addition (B) with grape peel. The least acceptable health mix was the one where grape peel was added at a ratio of 15 per cent (C) with score of 12.6. Increased amount of grape peel incorporation resulted in a health mix with sour taste and fairly acceptable flavour. It is evident from the sensory evaluation that with five per cent level of incorporation of grape peel powder into health mixes was found to be highly acceptable.

Table 1. Mean Acceptability Scores for Health Mixes

Criteria	Scores	Grape peel			Watermelon peel			Watermelon seed		
		5%	10%	15%	5%	10%	15%)	5%	10%	15%)
Appearance	5	4.5	4.0	3.6	4.5	4.5	4.0	5.0	4.5	4.5
Colour	5	4.4	3.6	3.3	4.0	4.0	3.2	5.0	5.0	5.0
Flavour	5	4.5	4.2	3.6	4.2	4.0	3.3	5.0	4.5	4.5
Taste	5	4.0	3.3	2.1	4.6	3.5	2.9	5.0	4.6	3.4
Total	20	17.4	15.1	12.6	17.2	16.0	13.4	20.0	18.6	17.4

Table 2. Mean acceptability scores of common recipes

Sample	Variation	Scores			
		Wheat Roti [1]	Adai[2]	Pakkoda[3]	Murukku[4]
Standard	-	23.15	23.54	24.85	23.60
Grape peel	A	22.85	23.15	24.05	22.65
	B	21.64	22.75	23.54	20.30
	C	19.70	21.05	22.85	19.70
Watermelon peel	A	22.65	22.55	23.15	21.70
	B	21.05	21.70	22.80	20.10
Watermelon seed	C	18.60	19.08	20.80	18.60
	A	23.70	23.15	23.70	23.42
	B	22.85	22.25	23.15	22.90
	C	20.80	20.30	22.85	19.80

A-5% incorporation B-10% incorporation A-15% incorporation

Foot note:

1. Wheat Roti is flat unleavened product cooked by shallow fat frying method made from whole wheat flour, traditionally known as atta flour.
2. Adai is a shallow fat fried item made with fresh batter of rice and mixture of pulses, red chillies, small onion and seasonings
3. A *pakkoda* is a deep-fried vegetable fritter made with a spiced chickpea-flour batter.
4. Murukku is typically made from a mixture of urad and rice flour, salt, and flavourings such as chili, asafoetida, ajawain, or cumin. The mixture is made into a batter, mechanically extruded, formed into a spiral or coil, and fried to a crisp.

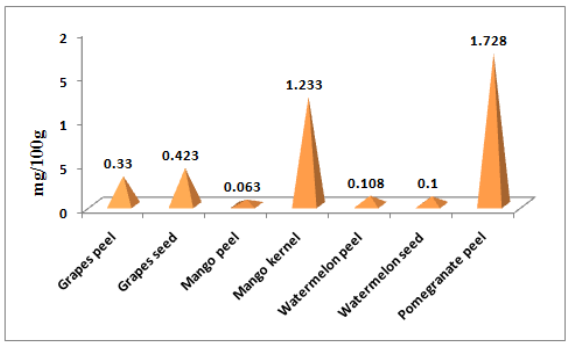

Figure 1. Oxalate Content

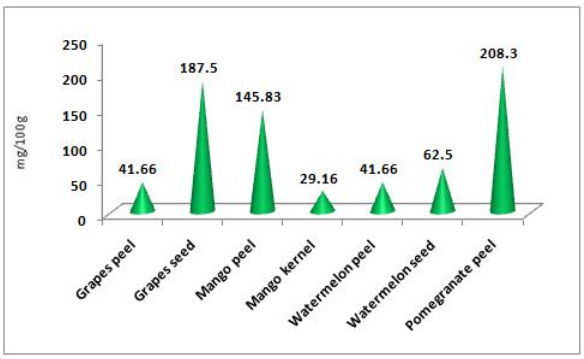

Figure 2. Phytate Content

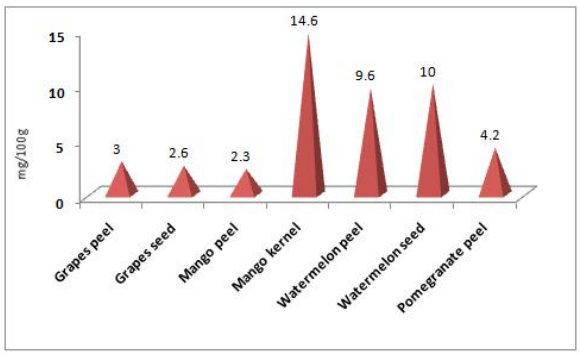

Figure 3. Tannin Content

From the Table it is observed that health mixes with five per cent addition of dehydrated watermelon peel powder (A) was highly acceptable with a score of 17.2 out of 20. Health mixes with ten per cent addition of watermelon peel powder (B) was also found to be moderately acceptable with a score of 16.0. Incorporation of watermelon peel powder at 15 per cent level resulted in an unacceptable product with astringent taste and scored only 13.4 out of 20. The findings confirm the fact that there is scope of incorporation of watermelon peel powder at five per cent level to increase the nutritional value of health mixes. Health mixes added with five per cent level of watermelon seed powder (A) was judged to be highly acceptable and on par with standard having same scores. Health mix with ten per cent addition of watermelon peel powder was also found to be highly acceptable with a score of 18.6. Incorporation of watermelon seed powder at 15 per cent level was found to be moderately acceptable with a score of 17.4 out of 20.

Mean Acceptability Scores of Common Recipes

The mean acceptability scores of the standard and incorporated recipes with dehydrated fruit peel and seed powders are given in Table 2.

Wheat Roti

The results indicated that wheat roti incorporated with watermelon seed powder at five per cent level was found to be highly acceptable with a score of 23.7 followed by watermelon seed and grape peel with scores of 22.85. Wheat roti with watermelon peel at five per cent incorporation scored the minimum.

Adai

With regard to Adai grape peel and watermelon seed powder incorporated at five per cent level had the highly acceptable scores of 23.15. Adai with 15 per cent watermelon peel incorporation fetched a least acceptable score of 19.08 out of 25 might be due to the raw flavour of dehydrated watermelon peel which affected the quality of adai when it was used at 15 per cent level.

Pakkoda

Five per cent incorporation of grape peel into pakkoda was highly acceptable with a score of 24.05. Grape peel and watermelon seed at 0 per cent level and watermelon peel at five per cent level resulted in similar scores of 23.15 out of 25. Like adai, pakkoda also received the least acceptable scores of 20.8 with 15 per cent incorporation.

Murukku

Rice murukku incorporated with five per cent level of watermelon seed was highly acceptable with a score of 23.42 out of 25. Incorporation of watermelon seed at 10 per cent also fetched better scores where as 15 per cent incorporation of all the three fruit wastes was found to be least acceptable. All the recipes with grape peel had a dark brown colour and more than five per cent had our taste. Water melon peel produced astringent flavour when incorporated into recipes above five per cent level. The findings revealed that dehydrated fruit peels and seed powders can be incorporated safely into various recipes to enhance the nutritive value especially in terms of fibre, vitamins and minerals.

Mean Acceptability Scores of Curry Powders

The mean acceptability scores of curry powders incorporated with dehydrated fruit peel and seed powders are given in Table 3. Among the two powders watermelon peel at 15 per cent (C) level of incorporation scored the minimum of 19.30 and 19 out of 25. The differences between the scores of the standard and five per cent level of incorporation of grape peel, watermelon peel and watermelon seed powders into idli powder and paruppu powder were found to be very minimum. This proved the fact that five per cent level of incorporation of fruit waste is highly acceptable and reveals that value addition can be brought with such levels to instant powders.

Table 3. Mean acceptability scores of curry powders

Sample	Variation	Scores	
		Idly powder	Paruppu Powder
Standard	-	24.0	24.0
Grape peel	A	23.70	23.60
	B	23.15	23.54
	C	21.70	22.75
Watermelon peel	A	23.15	23.15
	B	22.25	22.80
Watermelon seed	C	19.30	19.0
	A	23.54	23.15
	B	22.75	22.50
	C	21.64	21.05

A-5% incorporation B-10% incorporation A-15% incorporation

Conclusion

As India undergoes rapid development and popsulation dynamics start to take effect, being able to capitalize early on the new emerging consumer behaviors will be fundamental to future growth. This is particularly important for its lip smacking variety of snacks. Thus, proper utilization of fruit peels and seeds will add to the wealth of the nation and will benefit the consumers with boosted nutrition. However, further research could be undertaken to analyse the anti microbial factors of fruit wastes and assure the safety of incorporation of fruit wastes in dietaries to improve human nutrition.

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