Original Research Article

DEVELOPMENT AND ANALYSIS OF CARROT POWDER ENRICHED PASTA

ABSTRACT

Pasta is gaining popularity in the diet of an individual specially among the young. Due to health consciousness and maintain optimum health it is important to enhance the nutritional quality of pasta. However, the present study was designed to developed nutrient rich pasta by using carrot powder and refined wheat flour. The developed products were analyzed for their nutritional quality, sensory characteristics and storability using standard procedures. It was observed that the nutritional quality of all developed enriched pastas were increased significantly ($p<0.05$) with increased in the level of supplementation of carrot powder with refined wheat flour. In sensory characteristics evaluation it was found that there was a significant ($p<0.05$) difference among the formulated pastas. Results indicated that CP_1 (refined wheat flour 95% with carrot powder 5%) pastas were having higher nutritional value i.e. moisture (8.95%), ash (1.07%), crude protein (10.71%), crude fat (1.19%), crude fiber (1.98%), carbohydrate (75.51%), calcium (43.51 mg/100g), iron (2.02 mg/100g), zinc (1.12 mg/100g), magnesium (44.85 mg/100g), phosphorus (108.61 mg/100g) and potassium (172.51 mg/100g) and higher overall acceptability than all the formulated pasta and control (100% refined wheat flour) pasta. Formulated pasta products were obtained in acceptable category even after 60^{th} days of keeping and stored in laminated pouch which showed lower significant changes in color.

KEY WORDS: Carrot powder, Refined wheat flour, sensory characteristics evaluation, nutritional quality, storability

1. INTRODUCTION

Pastas are traditionally cereal based ready to cook food product introduced by Italy in 13^{th} century. In India pastas are becoming well liked due to their economic convenience and palatability among children and adolescents. Now-a-days pasta products are occupying major proportion in breakfast, snacks and dinner preparation [6]. Grain one of the basic food groups

in healthy diet from which pasta is made. Due to unique appearance, colour, texture and cooking quality pasta made up of durum wheat flour, semolina flour and all-purpose flour. Awareness and demand of delicious and nutritious food is increasing day by day. Now a days maintain optimum nutrition and good health are the most challenging and demanding. Due to the increased awareness about food components for health promotion, it is important to improve the nutritional quality of pasta by addition of healthy ingredients which are rich in fiber, protein, micro-nutrients, vitamins etc.

Carrot (*Daucus carota*) has gained attention over the years due to its richness in antioxidants and β-carotene (pro-vitamin-A) activity [7,19]. Among the processed vegetables, carrots are recognized as fair and good source of bioactive compound i.e., β-carotene which is act as precursor of retinol which is great for eyes. It is a good source of calcium pectate (pectin fiber), α-carotene, β-carotene, vitamins, minerals and dietary fiber. β-carotene which is present in carrot may inhibit the cancer and certain chronic diseases. Addition of carrot into pasta contribute fair source of nutrients and helps to reduce the vitamin-A deficiencies and glycemic index.

2. MATERIALS AND METHODS

To bring out the objectives the present study entitles "**Development and analysis of carrot powder enriched pasta**" has been precisely described under the following headings and subheadings.

- **I.** Raw materials
- **II.** Carrot powder preparation
- **III.** Preparation of Pasta
- **IV.** Methods of analysis
- **V.** Nutritional composition of raw materials
- **VI.** Nutritional composition of developed pasta
- **VII.** Sensory evaluation of developed pasta
- **VIII.** Storability study of developed product

2.1 Raw materials

Refined wheat flour and carrot roots were purchased from local market in Siripur, Bhubaneswar.

2.2 Carrot powder preparation

Carrot roots were cleaned, washed**,** cut to sliced, and oven dried at 120°C for 30 to 45 minutes then grounded in to fine powder.

2.3 Preparation of Pasta

Five types of composite flours were formulated by incorporating carrot powder at 5%, 15%, 25%, 35% level with refined wheat flour in the ratio of 100:0 (control), 95:5 (CP_1), 85:15 (CP_2), 75:25 (CP_3), 85:35 (CP_4).

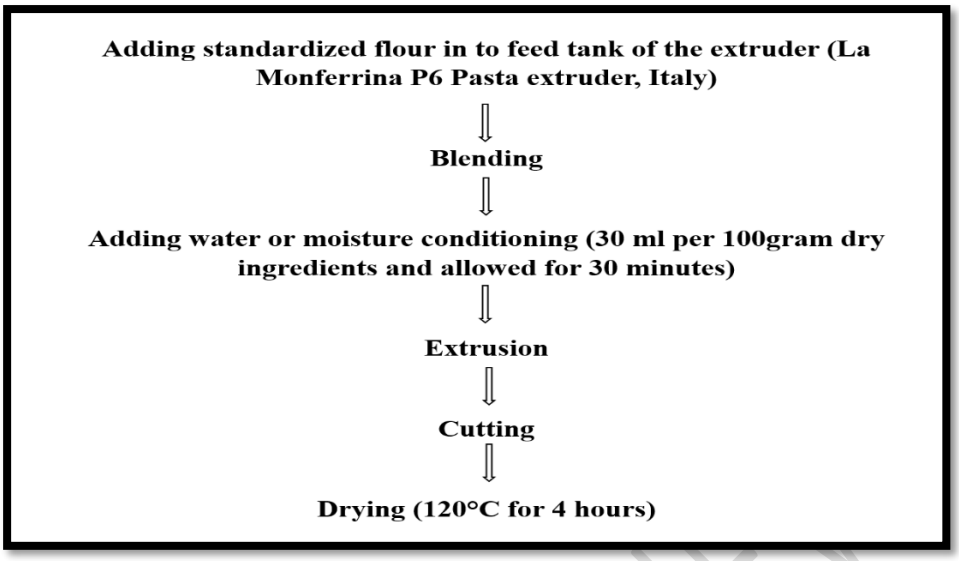

Fig 1 Flowchart for preparation of pasta

Fig 2 Raw materials

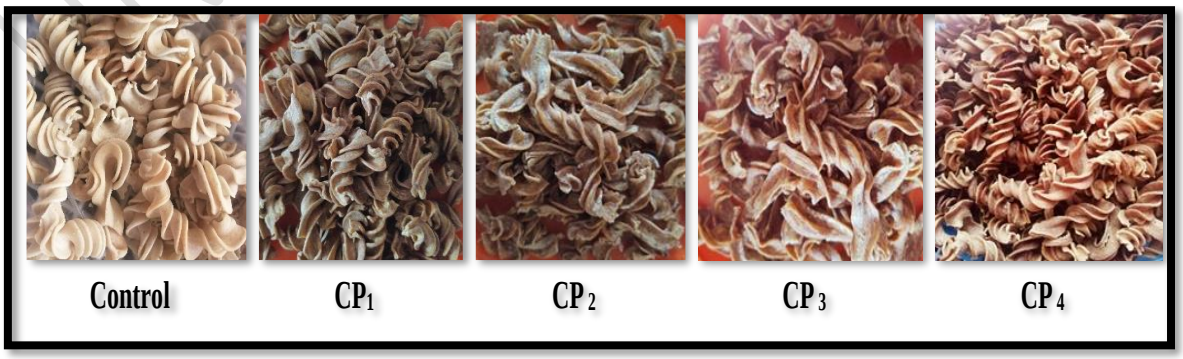

Fig 3 Developed pasta products according to various blend

2.4 Methods of analysis

The proximate compositions i.e. moisture, ash, crude protein, crude fiber contents of raw materials and developed pasta were analysed using standard methods by AOAC (2005). Carbohydrate content was determined by difference.

Mineral compositions i.e. calcium, iron, zinc, magnesium, phosphorus and potassium contents of raw materials and developed pasta were analysed by employing methodology of Jackson (1973).

The developed products were prepared for organoleptic evaluation by cooking before testing and served hot to the panel members to evaluate for its organoleptic parameters like colour, flavour, texture and overall acceptability using 10 semi trained panel members with nine-point hedonic scale.

The developed pastas were packed in polypropylene (PP) pouch and laminated pouch to study the sensory properties and storability The packaging materials were sealed by using hand operated sealing machine and sample from different packaging materials were taken for study on 30^{th} days intervals up to 90^{th} days.

The nutritional composition & sensory qualities data were statistically analysed by using analysis of variance (ANOVA) techniques and storability of pasta products by using Factorial Completely Randomized Design (FCRD) methods to see the significant and non-significant difference among them.

3. RESULTS AND DISCUSSION

3.1 Nutritional composition of raw materials

Result in the Table1 indicated that refined wheat flour contained 11.87% moisture, 3.02% ash, 10.62% crude protein, 1.32% crude fat, 0.62% crude fiber and 72.55% carbohydrates. Shree (2018) *et al.* also reported comparable results of proximal contents for moisture%, fat%, protein%, carbohydrate%, fiber% and ash% i.e. 10.86, 1.56, 11.6, 71.38 and 1.67 respectively. The mineral contents of refined wheat flours as described in Table1 were calcium (28.10 mg/100g), iron (2.63mg/100g), zinc (2.53mg/100g), magnesium (53.10 mg/100g), phosphorus (124.61mg/100g) and potassium (139.32mg/100g) which was obtained almost similar findings with Gopalan (1982) *et al*. The nutritional compositions of carrot powder moisture, ash, crude protein, crude fat, crude fiber and carbohydrate percentage were 9.04%, 3.24%, 4.48%, 0.68%, 18.62% and 63.94% respectively (Table1) and mineral compositions were calcium(209.13mg/100g), iron (4.95mg/100g), zinc (1.44mg/100g), magnesium (117.30mg/100g), phosphorus (344.61mg/100g), and potassium (556.26mg/100g) were depicted in Table1.Jalgaonkar (2017) *et. al.* explores comparable similar findings for proximal and mineral contents with the present study.

Nutritional composition	Refined wheat four	Carrot powder	CD at 5%
Moisture (%)	$11.87^{a} \pm 0.02$	$9.04^{b} \pm 0.06$	0.15
Ash (%)	$3.02^{b} \pm 0.05$	$3.24^{a} \pm 0.08$	0.21

Crude protein (%)	10.62^{c} ±0.24	4.48^{a} ±0.13	0.59
Crude fat (%)	1.32^{a} ±0.12	0.68^{b} ±0.19	0.33
Crude fiber (%)	0.62^{b} ±0.11	18.62^{a} ±0.07	0.37
Carbohydrate (%)	72.55^{a} ±0.17	63.94^{b} ±0.15	0.63
Calcium (mg/100g)	28.10^{b} ±0.09	209.13^{a} ±0.03	5.95
Iron (mg/100g)	2.63^{b} ±0.03	4.95^{a} ±0.06	0.14
Zinc (mg/100g)	2.53^{a} ±0.02	1.44^{b} ±0.01	0.05
Magnesium (mg/100g)	53.10^{b} ±0.03	117.30^{b} ±0.04	0.10
Phosphorus (mg/100g)	124.61^{b} ±0.01	344.61^{a} ±0.04	0.92
Potassium (mg/100g)	139.32^{a} ±0.04	2544.39^{a} ±0.04	0.12
Note: Values are mean ± SE of three independent replications. Mean with same superscript (a and b) in the same column differ significantly (p>0.05).			

Table 1 Nutritional composition of raw materials (per 100g on dry mater basis)

3.2 Nutritional composition of developed past

The pasta products prepared by formulating carrot powder with refined wheat flour were subjected to proximate compositions analysis and result observed were presented in the Table 2. The results reported that with increased amount of carrot powder up to 35% there was increased in contents of ash (1.04 to 2.26%), crude fat (1.19 to 1.39%), crude fiber (1.98 to 4.43%) and crude protein (10.71 to 11.85%) whereas carbohydrate (75.51 to 71.35%) and moisture (8.95 to 8.72%) content was inverse relation to carrot powder incorporation. The increase in mineral contents calcium (43.51 to 84.32mg/100g), iron (2.02 to 3.62mg/100g), zinc (1.12 to 1.25mg/100g), magnesium (44.85 to 71.56mg/100g) and potassium (172.51 to 626.49mg/100g) is directly related to increasing level of carrot powder substitutions. Omachi and Yusufu (2017); Stephen *et al.* (2019); Nwachukwu *et al.* (2020) earlier recorded similar relation of carrot powder supplementation with the proximal and mineral contents.

Table 2 Nutritional composition of Finger Millet Flour enriched developed pasta products (per 100g, on dry matter basis)

Nutritional composition	Control	CP_1	CP_2	CP_3	CP_4	CD at 5%
Moisture (%)	$11.84^{a} \pm 0.03$	$8.95^{b} \pm 0.02$	$8.94^{c} \pm 0.02$	$8.84^{d} \pm 0.03$	$8.72^{e} \pm 0.03$	0.07
Ash (%)	$1.04^{d} \pm 0.03$	$1.07^{b} \pm 0.11$	$1.19^{b} \pm 0.09$	$1.34^{b} \pm 0.15$	$2.26^{a} \pm 0.09$	0.32
Crude protein (%)	$10.60^{a} \pm 0.14$	$10.71^{de} \pm 0.34$	$11.03^{cd} \pm 0.21$	$11.41^{bc} \pm 0.12$	$11.85^{a} \pm 0.09$	0.73
Crude fat (%)	$0.67^{b} \pm 0.08$	$1.19^{a} \pm 0.0.7$	$1.28^{a} \pm 0.7$	$1.30^{a} \pm 0.19$	$1.39^{a} \pm 0.12$	0.34
Crude fiber (%)	$0.44^{b} \pm 0.06$	$1.98^{c} \pm 0.10$	$2.15^{b} \pm 0.05$	$3.29^{b} \pm 0.18$	$4.43^{a} \pm 0.13$	0.62
Carbohydrate (%)	$75.62^{b} \pm 0.17$	$75.51^{a} \pm 0.15$	$75.41^{a} \pm 0.31$	$73.82^{b} \pm 0.05$	$71.35^{c} \pm 0.27$	0.72
Calcium (mg/100g)	$14.97^{e} \pm 0.30$	$43.51^{d} \pm 0.37$	$59.67^{c} \pm 0.18$	$75.59^{b} \pm 0.21$	$84.32^{a} \pm 0.12$	0.79
Iron (mg/100g)	$1.39^{d} \pm 0.03$	$2.02^{d} \pm 0.02$	$2.17^{c} \pm 0.03$	$2.89^{b} \pm 0.04$	$3.62^{a} \pm 0.04$	0.11
Zinc (mg/100g)	$1.08^{c} \pm 0.01$	$1.12^{ab} \pm 0.02$	$1.14^{ab} \pm 0.03$	$1.20^{ab} \pm 0.04$	$1.25^{a} \pm 0.07$	0.12
Magnesium (mg/100g)	$39.85^{e} \pm 0.02$	$44.85^{d} \pm 0.40$	$56.24^{c} \pm 0.07$	$60.55^{b} \pm 0.24$	$71.56^{a} \pm 0.30$	0.70
Phosphorus (mg/100g)	$104.20^{e} \pm 0.03$	$108.61^{d} \pm 0.03$	$113.07^{c} \pm 0.04$	$113.32^{b} \pm 0.03$	$114.17^{a} \pm 0.04$	0.19
Potassium (mg/100g)	$113.08^{e} \pm 0.04$	$172.51^{d} \pm 0.04$	$268.39^{c} \pm 0.02$	$426.68^{b} \pm 0.03$	$626.49^{a} \pm 0.03$	0.10

Note: Values are mean ± SE of three independent replications. Mean with same superscript (a, b, c, d, e) in the same column differ significantly ($p>0.05$).

Control- RWF: CP (100:0) CP_1- RWF: CP (95:5) CP_2- RWF: CP (85:15) CP_3- RWF: CP (75:25)

CP_4- RWF: CP (65:35) RWF- Refined wheat flour CP- Carrot powder

3.3 Sensory evaluation of developed pasta

Results related to the organoleptic characteristics of pastas incorporated with carrot powder are shown in the Fig.2 indicated that increasing the concentrations of carrot powder up to 35% there was decline in the sensory attributes appearance, taste, texture, colour and overall acceptability from 7.80 to 5.80, 7.50 to 7.20, 7.50 to 6.50 and 7.90 to 6.90 (declined from category of like moderately to neither like nor dislike) CP_1 Pasta made from 95% refined wheat flour and 5% carrot powder were more acceptable than other three treatments along with refined wheat flour pasta(control). Turksoy and Ozkaya (2011); Sule *et al*. (2019) reported the similar results.

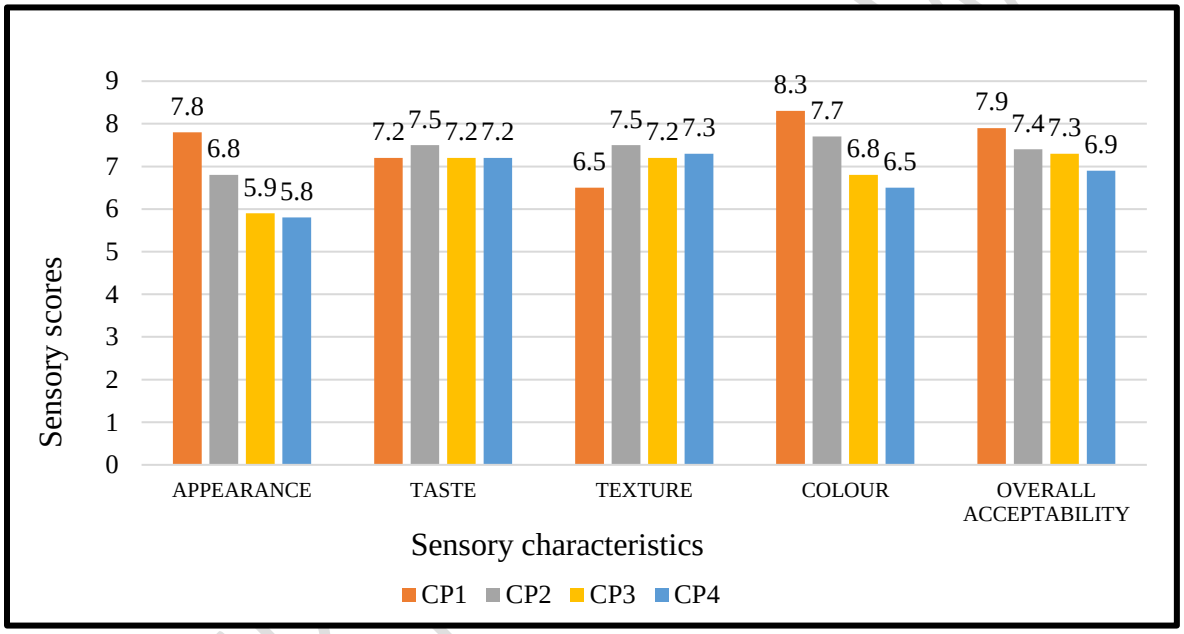

Fig 4 Mean organoleptic acceptability of carrot powder enriched developed pasta products

3.4 Effect of storage on carrot powder enriched developed pasta products

The data depicted from Table 3 explained that all the sensory qualities of carrot powder formulated pasta along with control decreased significantly with increased in the storage intervals at 0^{th}, 30^{th}, 60^{th} and 90^{th} days. From the present study it was found that carrot powder incorporated developed pasta products were acceptable up to 60^{th} days of storage periods without any significant change in sensory acceptability. It was found that sensory attribute taste and colour changed were higher in PP pouch than laminated pouch. Similar results revealed by Samta and Jood (2018); Nousheen (2013) with the present exploration process.

Table 3 Effect of storage on carrot powder enriched developed pasta

Organoleptic Parameters	Packaging	Storage duration (In days)	Control	CP_1	CP_2	CP_3	CP_4
Appearance		0^{th}	8.40±0.16	7.80±0.13	6.80±0.20	5.90±0.23	5.80±0.20
	PP	30^{th}	7.90±0.18	7.70±0.15	6.40±0.22	5.60±0.22	5.30±0.21
		60^{th}	7.80±0.13	7.30±0.15	6.10±0.23	6.30±0.30	5.00±0.30
		90^{th}	7.50±0.22	6.70±0.15	5.80±0.26	5.10±0.28	4.90±0.31
	Laminated Pouch	30^{th}	8.00±0.15	7.40±0.20	6.40±0.21	5.30±0.25	5.30±0.26
		60^{th}	7.80±0.13	7.20±0.20	5.90±0.31	5.20±0.20	5.10±0.28
		90^{th}	7.60±0.22	7.10±0.18	5.60±0.31	5.20±0.28	5.00±0.28
P-value	Composition level (A)= <0.01 Storage period (B)= <0.01 Packaging (C)= NS A×B=NS A×C=NS B×C=NS A×B×C=NS						
Taste		0^{th}	8.30±0.21	7.20±0.20	7.50±0.22	7.20±0.13	7.20±0.13
	PP	30^{th}	8.20±0.13	7.00±0.21	7.10±0.18	7.00±0.21	6.70±0.21
		60^{th}	7.50±0.17	6.70±0.15	6.60±0.16	6.50±0.17	6.10±0.28
		90^{th}	5.80±0.15	6.10±0.31	5.90±0.28	5.80±0.33	5.50±0.33
	Laminated Pouch	30^{th}	7.70±0.21	6.80±0.20	6.90±0.28	6.90±0.18	6.60±0.16
		60^{th}	7.50±0.22	6.30±0.21	6.10±0.23	6.30±0.30	5.90±0.23
		90^{th}	7.20±0.25	5.90±0.31	5.60±0.34	5.90±0.23	5.70±0.21
P-value	Composition level (A)= <0.01 Storage period (B)= <0.01 Packaging (C)= NS A×B=NS A×C=NS B×C=0.01 A×B×C=NS						
Texture		0^{th}	8.50±0.17	6.50±0.27	7.50±0.22	7.20±0.13	7.30±0.15
	PP	30^{th}	8.10±0.18	6.10±0.23	6.80±0.25	6.70±0.21	6.90±0.28
		60^{th}	7.70±0.22	5.70±0.30	6.30±0.37	6.20±0.20	6.10±0.28
		90^{th}	6.80±0.25	5.50±0.34	5.60±0.27	5.90±0.23	5.80±0.36
	Laminated Pouch	30^{th}	8.20±0.20	6.10±0.18	6.70±0.30	6.60±0.16	6.80±0.20
		60^{th}	7.80±0.20	5.60±0.22	6.20±0.13	6.10±0.25	6.20±0.25
		90^{th}	6.50±0.34	5.30±0.30	5.60±0.16	6.00±0.26	5.90±0.23
P-value	Composition level (A)= <0.01 Storage period (B)= <0.01 Packaging (C)= NS A×B=NS A×C=NS B×C=NS A×B×C=NS						
Colour		0^{th}	8.70±0.15	8.30±0.21	7.70±0.15	6.80±0.20	6.50±0.17
	PP	30^{th}	8.30±0.15	7.90±0.18	7.20±0.13	6.60±0.22	6.30±0.26
		60^{th}	7.80±0.20	7.60±0.22	6.80±0.20	6.30±0.26	6.10±0.23
		90^{th}	7.10±035	7.20±02.0	6.60±0.16	6.10±0.28	5.80±0.20
	Laminated Pouch	30^{th}	8.20±0.20	7.80±0.25	7.10±0.18	6.70±0.21	6.40±0.31
		60^{th}	7.90±0.18	7.60±0.16	6.70±0.15	6.30±0.21	6.20±0.20
		90^{th}	6.90±0.23	7.30±0.15	6.50±0.27	6.30±0.21	6.10±0.23
P-value	Composition level (A)= <0.01 Storage period (B)= <0.01 Packaging (C)= NS A×B=0.02 A×C=NS B×C=NS A×B×C=NS						
Overall acceptability		0^{th}	8.40±0.16	7.90±0.10	7.40±0.16	7.30±0.15	6.90±0.10
	PP	30^{th}	8.00±0.16	7.60±0.16	7.10±0.16	6.90±0.19	6.60±0.26
		60^{th}	7.70±0.15	7.30±0.15	6.90±0.23	6.70±0.15	6.20±0.25
		90^{th}	7.10±0.35	6.80±0.25	6.50±0.22	6.30±0.23	5.90±0.15
	Laminated Pouch	30^{th}	7.90±0.31	7.60±0.16	7.20±0.20	6.90±0.18	6.70±0.21
		60^{th}	7.60±0.27	7.10±0.23	6.70±0.21	6.80±0.13	6.40±0.16
		90^{th}	6.90±0.31	6.60±0.27	6.30±0.21	6.50±0.17	6.00±0.30
P-value	Composition level (A)= <0.01 Storage period (B)= <0.01 Packaging (C)= NS A×B=NS A×C=NS B×C=NS A×B×C=NS						

Note: Values are mean ± SE of three independent replications NS: Non significance

4. SUMMARY AND CONCLUSION

It was observed that pasta developed from refined wheat flour contents moisture 11.84%, ash 1.04 %, crude protein 10.60%, crude fat 0.67%, crude fiber 0.44% and carbohydrate 75.62% and mineral contents calcium 14.97 mg/100g, iron 1.39 mg/100g, zinc 1.08mg/100g, magnesium 39.85 mg/100g, phosphorus 104.20 mg/100g and potassium 113.08 mg/100g which were significantly ($p<0.05$) increased with increased in the level (5%, 15%, 25% and 35%) of substitutions of carrot powder in refined wheat flour. The maximum nutritional contents were observed in CP_4 and minimum contents in CP_1 composite flour developed pasta. Pasta made from 95 percent refined wheat flour with 5 percent carrot powder (CP_1) was within acceptable range in term of overall acceptability by the penal members. CP_1 composite flour pasta depicted desirable nutritional quality and sensory characteristics. All the sensory characteristics of carrot powder formulated pasta along with control decreased significantly with increased in the storage intervals at 0^{th}, 30^{th}, 60^{th} and 90^{th} days. From the present study it was observed that the carrot powder incorporated developed pasta products were acceptable up to 60^{th} days of storage periods without any significant change in sensory acceptability. Hence, this nutrient enriched pasta can be a good source of diet for vulnerable groups.

Disclaimer (Artificial intelligence)

Option 1:
Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.
Option 2:
Author(s) hereby declares that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology.

REFERENCES

1. Adsule RN and Kadam SS. Quality of wheat In: Quality of wheat and wheat products (Salunkhe, D. K., Kadam, S. S. and Austin, A., eds.), Metropolitan Press, New Delhi.1986; 1-6.
2. A.O.A.C. Official Methods of Analysis. Association of Official Analytical Chemists, Washington, DC, USA.2000.
3. A.O.A.C. Official Methods of Analysis. Association of Official Analytical Chemists, Washington, DC, USA. 2005.
4. Chepkosgei TM and Orina I. Quality and sensory properties of instant fried noodles made with soybean and carrot pomace flour. African Journal of Food Science. 2021; ISSN: 1996-0794, 15(3): 92-99.
5. Gopalan C, Rama SBV, Balsubramaniam SC and National Institute of Nutrition (India). Nutritive Value of Indian Foods. Hyderabad, India: National Institute of Nutrition, Indian Council of Medical Research. Revised ed.; 1989.

6. Gull A, Jan R, Ahmad Nayik, Prasad K and Kumar P. Significance of finger millet in nutrition, health and value-added products: A review, Journal of Science and Technology. 2014; 3: 1601-1608.
7. Haq R, Prasad K. Nutritional and processing aspects of carrot (*Daucus carota*)–A review. South Asian J. Food Technol. Environ. 2015; 1(1):1– 14
8. Jalgaonkar K, Jha SK, Nain L and Iquebal MA. Quality change in pearl millet-based pasta during storage in flexible packaging, Journal of Agricultural Engineering. 2017; 54(3): 22-31.
9. Kambe DK, Singh R, Kaur BP and Rani S. Storage stability and shelf-life prediction of multigrain pasta under different packaging material and storage conditions, Journal of Food Processing and Preservation. 2020; 48(8).
10. Kaur H, Bobade H, Singh A, Singh B and Sharma S. 2017. Effect of formulation properties and storage stability of nutritionally enriched multigrain pasta, Chemical Science International Journal. 2017; 19(1): 1-0.
11. Kumar Y, Shukla P, Singh P, Tanwar V, Thori MK, Sharma V. Effect of Dried Carrot Powder Incorporation on Quality Attributes of Chicken Cutlets. Journal of Ready to Eat Foods. 2015; 2(3):89–95.
12. Nousheen N I. Development of low glycemic functional pasta products. Department of Food Science and nutrition, TNAU; 2013.
13. Nwachukwu CN, Onyemechara EJ and Ukwujiagu CU. Proximate Composition and sensory properties of noodles fortified with soybean flour and carrot powder. International Journal of Innovative Food, Nutrition & Sustainable Agriculture. 2020; 8(3): 62-75.
14. Omachi DO and Yusufu PA. Physico-chemical, sensory and microbiological assessment of millet-based biscuits improved with cashew nuts (*Anarcadium Occidentale*), carrot flour (*Daucus Carota*). American Journal of Food Science and Nutrition. 2017; ISSN: 2157-0167, 7(1): 13-22.
15. Samta and Jood S. Cooking quality and acceptability of nutrient rich pasta developed from composite flour. International Journal of Current Microbiology and Applied Sciences. 2018; ISSN: 2319-7706, 7(4).
16. Sharma KD, Karki S, Thakur NS and Attri S. Chemical compositions, functional properties and processing of carrot- a review. Journal of Food Science Technology. 2012; 49(1): 22-32.
17. Shere PD, Devkatte AN and Pawar VN. Cooking and textrual qualities of carrot incorporated instant noodles. Journal of Pharmacognosy and Phytochemistry. 2018; 7(3): 3040-304.
18. Stephen S, Abu JO and Igyor MA. Effect of carrot powder incorporation on the quality of pasta. MOJ Food Process Technol. 2019; 7(3): 99-103.
19. Torronen R, Lehmusaho M, Hakkinen S, Hanninen MD, Mykkanen H. Serum β-carotene response to supplementation with raw carrotd, carrot juice or purified β-carotene in healthy nonsmoking women. Nutrition Reserch.1996; 16(4): 565-575.
20. Turksoy S and Ozkaya B. Pumkin and Carrot Pomace Powders as Source of Dietary Fiber and Their Effects on the Mixing Properties of Wheat Flour Dough and Cookie Quality. Food Science and Technology Research. 2011; 17(6):545-553.
21. Verma S and Mishra S. Organoleptic properties and acceptability of ragi flour to prepare noodles. Journal of Pharmacognosy and Phytochemistry.2019; 8(6): 213-216.