Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(3): 3040-3045
Received: 14-03-2018
Accepted: 18-04-2018

Shere PD
MIT College of Food Technology, MIT Art, Design and Technology University, Lonikalbhor, Pune, Maharashtra, India

Devkatte AN
MIT College of Food Technology, MIT Art, Design and Technology University, Lonikalbhor, Pune, Maharashtra, India

Pawar VN
MIT College of Food Technology, MIT Art, Design and Technology University, Lonikalbhor, Pune, Maharashtra, India

Correspondence
Shere PD
MIT College of Food Technology, MIT Art, Design and Technology University, Lonikalbhor, Pune, Maharashtra, India

Cooking and textrual qualities of carrot incorporated instant noodles

Shere PD, Devkatte AN and Pawar VN

Abstract
The objective of this study was to explore the possibility of adding carrot puree in preparation of vegetable noodles. Carrot puree was added at 0, 10,20,30,40 and 50g per 100g of wheat flour. Noodles were prepared by cold extrusion process and were studied for its sensory, cooking and textural qualities. The results indicated that carrot puree can be incorporated in wheat flour up to 40g per100g of wheat flour without significant changes in its qualities. The sensory score for colour of carrot noodles was preferred the most. Cooking weight and water absorption were found to be increased with increase in level of carrot puree in noodles. Whereas, cooking loss and swelling index decreased with increase in carrot puree incorporation in noodles. The textural studies denoted decrease in values of hardness, springiness, cohesiveness and adhesiveness with increase in level of carrot puree addition in instant noodles.

Keywords: Carrot puree, noodles, cooking qualities, textural

Introduction

Noodles are very thin form mostly made of wheat flour, water, egg and salt. Noodles have been increasingly important food commodity world wide. 97.5 billion servings of instant noodles were eaten in 2016, by simple arithmetic as many as 270 millions servings are eaten every day (World Instant Noodle Association, 2016). The consumption level of noodles has become one of the fastest growing sectors in Asian countries, due to their ease of cooking and long shelf life. Traditional noodles are claimed to lack dietary fiber, vitamins and minerals.

Over the last decades consumer food demands have changed considerably. For these reason foods today are not only intended to satisfy the hunger and necessary nutrients, but also to prevent nutritional related diseases and enhance physical and mental well being of consumer Betoret *et al*. (2011) [3]. In this regard functional foods offer an outstanding opportunity to improve the quality of the product. Noodles in particular are an important basic food widely consumed across the world and is among first food to be authorized by food and drug administration as a good vehicle for addition of bioactive compounds, However, noodles enriched with bioactive compounds of vegetable origin is still limited Rekha *et al*. (2013) and Deep *et al*., (2014) [11]. Worldwide, people's lifestyle is continuously changing and with respect to eating habits, it is changing in an unhealthy direction Caballero, (2007) [5]. Both developed and developing countries are experiencing a nutrition transition. This phenomenon is characterized by a decrease in physical activity and a too low consumption of vegetables and grains. Eating habits are now characterized by an increase in the consumption of high energy-dense foods, i.e. foods with a high amount of calories per gram of food. This lifestyle is one of the factors for the development of diseases such as obesity, which is now acknowledged as a global epidemic. In turn, obesity has been linked to the development of other chronic diseases such as type II diabetes, hypertension, coronary heart disease and several types of cancer. When it comes to childhood obesity, concerns increase, since there are strong indications that it will persist into adulthood Wang *et al.* (2010) [28].

One of the most effective strategies to fight this problem involves the combination of physical activity and the consumption of low energy-dense foods, such as vegetables, at an early age. A hurdle for implementing this strategy is the fact that children often dislike vegetables. Vegetables are known to have health benefits but are often non-appealing to children/adolescents due to their bitterness, undesired texture, and their low satiating capacity Zeinstra *et al.* (2010) [30]. One of the possible solutions to increase vegetable intake by children is to incorporate vegetables in a food matrix that they do like. Several studies have shown that noodles are very much appreciated by children, making it an ideal candidate for the development of vegetable-enriched foods. Carrot is one of the important vegetable rich in beta carotene, minerals and antioxidants.

Beta carotene may prevent cancer and certain chronic diseases Sies and Krinsky (1995) [25]. Several research work has been carried on instant noodles in terms of Carbohydrate, protein and fiber improvement. However, no efforts have been made to deliberately improve the vitamin and fiber content of noodles using carrot puree. Addition of fresh carrot puree gives the advantage of homogenous mixing, intensifying the color and distribution of pigments in dough over the addition of dried carrot powder. Therefore, this work aims to enrich instant noodles with dietary fiber and vitamins to meet nutritional requirements of children.

Methodology

Preparation of carrot puree

Fresh local red carrot variety was procured from local market of Pune city (India). Carrots were washed thoroughly to remove extraneous matte, shredded, steam cooked for 15 minutes and finely ground to pass through muslin cloth to obtain homogenous carrot puree.

Flow sheet for preparation of carrot puree

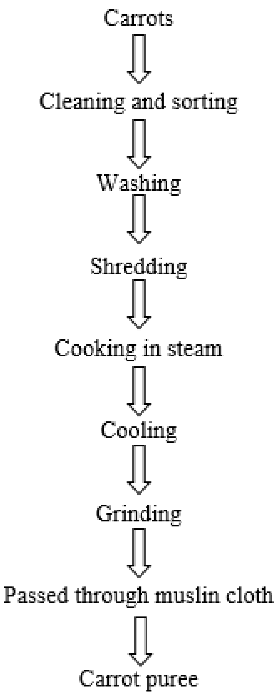

Fig 1: Flow sheet for preparation of carrot puree

Plate 1: Carrot Puree

Noodle Preparation

Noodles were prepared according to a method described by Collado and Corke (1996) [9] with some modifications. The noodles were prepared in an automatic laboratory Kent noodle maker. Dry ingredients were first mixed for about 5 minutes, followed by addition of whole egg, Salt and water to form crumbly dough and then extruded through a die with 12 outlets of 0.8 mm in diameter. The noodles were cut and cooked in steam for 5 minutes and dried at 50^{0}C for 5 hours and packed in polyethylene pouches. The noodles prepared from different carrot and wheat flour blend are shown in table 1.

Plate 2: Carrot puree incorporated instant noodles

Table 1: Formulation of instant noodles with carrot puree

Ingredients	C_0	C_{10}	C_{20}	C_{30}	C_{40}	C_{50}
Wheat flour(g)	100	100	100	100	100	100
Carrot puree (g)	-	10	20	30	40	50
Whole egg (g)	8	8	8	8	8	8
Water (g)	30	30	30	30	25	20
Salt (g)	1	1	1	1	1	1

C_0 – Control- 100% wheat flour noodles
C_{10} - 10g carrot puree in 100g flour
C_{20} - 20 g carrot puree in 100g flour
C_{30} - 30 g carrot puree in 100g flour
C_{40} - 40 g carrot puree in 100g flour
C_{50} = 50 g carrot puree in 100g flour

Chemical Analysis

All the chemicals used in the present research work were of analytical grade. The proximate composition (Moisture, crude fat, crude protein, total ash and fiber) were analyzed using AOAC (2000) [1] methods. The total carbohydrates were determined by difference method.

Sensory Evaluation

All dried noodles samples were prepared for sensory evaluation by cooking before testing. The cooking was carried for optimum cooking time and served hot for panel members to evaluate for its colour, flavour texture and overall acceptability using 10 semi trained panel members with 9 point hedonic rating where 9= like extremely and 1= dislike extremely.

Cooking Characteristics

Optimum cooking time

To determine optimum cooking time, 250 g of noodles were dispersed in 250ml boiling water. For every 30 seconds, a piece of noodle was held between a plastic paper and pressed gently until the white color of noodle at central portion of strand disappears. Optimum cooking time was achieved when the centre of noodles become transparent.

Cooking Loss

Cooking loss was determined by measuring the amount of solid substance lost to cooking water. 10 g noodle sample of was placed into 300 ml boiling distilled water in a 500 ml beaker. Cooking water was collected in an aluminum petri dish and placed in oven at 105^{0}C and evaporated to dryness. The residue was weighed and reported as a percentage of starting material.

$$\text{Cooking Loss (\%)} = \frac{\text{Dried residue in cooking water}}{\text{Noodle weight before cooking}} \times 100$$

Water Absorption

The water absorption was determined by the ratio of the weight of cooked noodles to the weight of noodles before cooking as described by AACC (2005) [2].

$$\text{Water absorption (\%)} = \frac{\text{Weight of cooked noodles} - \text{weight of raw noodles}}{\text{Weight of raw noodles}} \times 100$$

Swelling index

The swelling index of cooked noodles was determined according to the procedure described by Cleary and Brennan (2006) [8]. The Swelling index was expressed as weight of cooked noodle,

$$\text{Swelling Index} = \frac{\text{Weight of cooked noodles} - \text{weight of noodles after drying}}{\text{Weight of noodles after drying}}$$

Texture profile analysis of noodles

30g carrot noodles were cooked in 300ml in water using controlled hot plate for 8 minutes. The cooked noodles were drained and cooled for 3 minute in a sieve. Noodle strands of 50mm length were used for Texture profile analysis using Texture analyzer (TA-XT PLUS, Stable micro system limited, Godalamay, UK). The test conditions used were as follows-pretest speed- 1mm/sec, test speed- 1mm/sec, post test speed-5mm/sec, 80% strain and 20g trigger force. The parameters calculated were hardness, adhesiveness, springiness, cohesiveness and gumminess. The measurements were replicated 10 times for each treatment.

Statistical analysis

The data obtained from the laboratory experiment was analyzed using completely randomized design and appropriately interpreted as per the methods described in" Statistical methods for agricultural workers" by Panse and sukhatme (1985) [21]. Appropriate standard error (S.E) and critical differences (C.D.) at 5% level were worked out as and when necessary and used for data interpretation.

Results and Discussion

The proximate composition of refined wheat flour, carrot puree and egg is shown in table no.2.

Table 2: Chemical composition of raw material

Sample	Moisture (%)	Fat (%)	Protein (%)	Carbohydrate (%)	Fibre (%)	Ash (%)
Refined wheat flour	10.86	1.56	11.6	71.38	1.67	0.59
Carrot puree	91.6	0.20	0.65	4.95	1.00	1.40
Egg	73.30	11.20	12.5	0.20	Trace	2.8
SE ±	0.5151	0.1056	0.5172	0.3865	0.1155	0.1007
CD at 5%	1.6798	0.3444	1.6867	1.2604	0.3997	0.3284

The wheat flour contained 10.86% moisture, 1.56% crude fat, 11.6% protein, 1.67% fibre and 0.59% ash. Carrot was rich in moisture (91.6%), ash (1.40%), fibre (1.00%) and fat (0.20%). Egg was also rich in fat, protein and ash. The results are in agreement with several workers.

Sensory evaluation of carrot puree added noodles

Results pertaining to the sensory qualities of noodles added with carrot puree are presented in fig.1

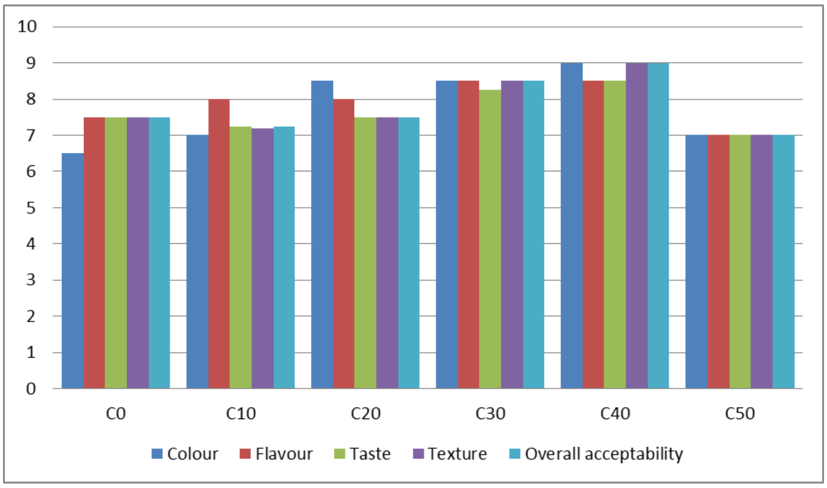

Fig 1: Sensory score of carrot puree added noodles

Significance differences were found among various parameters. The colour is the first quality parameter for consumer identification of food. Due to addition of carrot puree colour of the carrot noodle improved with attractive yellow-orange colour to the product. The sample C40 scored maximum as compared to control. Flavour, taste and texture were also significantly improved with addition carrot puree in sample C40. Sample C40 scored maximum on overall acceptability however, flavor scores showed non-significant difference compared to control. Similar results with respect to color were reported by Rekha *et al*., (2013). Similar results of increasing in sensory parameters with reference to appearance were reported by Keyimu (2013) [13] with addition of sea weed in noodles up to 3 % level.

Cooking qualities

Cooking qualities as affected by addition of carrot puree in noodles are presented in table no.3.

Table 3: Cooking qualities of carrot puree added noodles

Sample	Cooking time (min)	Cooking weight (%)	Cooking loss (%)	Swelling index (ml/g)	Water absorption (%)
Control	6.24	215.20	14.33	2.55	125.30
C_{10}	5.42	221.0	13.92	2.36	128.10
C_{20}	5.31	232.7	9.99	1.40	130.90
C_{30}	4.57	245.4	8.87	1.44	158.50
C_{40}	4.50	250.5	8.74	1.98	176.20
C_{50}	4.35	259.7	5.07	2.24	185.30
SE ±	0.2714	1.8058	0.4128	0.2932	7.8036
CD at 5%	0.8363	5.5647	1.2721	NS	24.0557

C_0 - Control 100% wheat flour noodles
C_{10} - 10g carrot puree in 100g flour
C_{20} - 20 g carrot puree in 100g flour
C_{30} - 30 g carrot puree in 100g flour
C_{40} - 40 g carrot puree in 100g flour
C_{50} - 50 g carrot puree in 100g flour

Cooking time refers to the time in minutes to gelatinize the starch marked by dis appearance of central white core in the noodles strand De pilli *et al*., (2013) [10]. The results indicated that there were significance differences ($P < 0.05$) in time required to cook the noodles. The cooking time varied from 6.24 min (control) to 4.35 min (C50). This might be due to dilution of gluten in dough. Gluten is primarily responsible for the development of starch/protein complex; which in term determines the noodles structure and cooking properties. The dilution of these constituents might be reducing the coking time. The results are in agreement with those described by (Petitot *et al.* 2010) [23] and Kuchtowa *et al.* 2016) for supplementation of wheat flour in pasta with faba bean flour and pumpkin powder. Reduction in cooking time was also observed by Padalino *et al.* (2017) [20] by fortification of tomato peel powder in pasta.

Cooking weight was significantly increased with increase in quantity of carrot puree in wheat flour. It was increased from 215% (control) to 259.7% (C50). This may be due to high fibre content in the formulation which might cause higher water binding as fiber have greater affinity to water.

Cooking loss

Cooking loss is amount of solids that dissolve in water during cooking and may be an indicator of noodles structure integrity during cooking Li *et al*. (2015) [18]. Cooking loss is commonly used as predictor of overall noodle cooking performance Tudorica *et al*. (2002) [26]. Type of ingredients added directly affect the loss of soluble and solids during cooking and has been reported that a compact texture of noodles often results in less cooking loss than the loose textured noodle Krishnan *et al*., (2012) [15]. From the results it can be clearly seen that cooking loss was maximum (14.33%) in control. There was a progressive reduction in cooking loss with increasing level of carrot puree in formulation. This could be due to better binding of starch granules with added vegetable puree in gluten matrix. Rekha *et al*. (2013) also reported decrease in gruel loss for vegetable paste incorporated pasta.

Water Absorption

Water absorption is an indication of quantity of water absorbed by the noodles during cooking, an important characteristic in deciding the cooking quality Li *et al*. (2015) [18]. Results indicated that, there was slight and progressive increase in water absorption with increase in carrot puree in noodles. The water absorption for control was least and with increase in carrot puree in formulation, water absorption progressively increased from 125.30% (control) to 185.30% (C_{50}). The addition of vegetable puree enhances the interaction between starch granules and protein matrix resulting in better quality noodles. Since, vegetables have greater water holding capacity therefore carrot puree added noodle samples had more water absorption as compared to control. Vegetable noodles had higher fiber content than control noodles, which resulted in higher water absorption due to strong water binding ability of fibers Chen *et al*. (1988) [6].

Swelling Index

Concerning swelling index the noodles samples with carrot puree recorded slightly lower values as compared with control samples. The results can be interpreted in terms of competition between fiber and starch for water absorption means that starch components might have absorbed less water at optimum cooking time giving rise to lower swelling indices. Therefore increasing the amount of fiber generally results in lower swelling of starch and lower swelling index. Padalino *et al*. (2017) [20] also reported lower swelling index in spaghetti incorporated with tomato peel flour.

Textural qualities of carrot puree noodles

Textural properties in terms of hardness, springiness, gumminess and adhesiveness are main criteria are main criteria for assessing the overall quality of cooked noodles that determines its consumer acceptance. The textural quality parameters analysis is shown in table no.4.

Table 4: Textural qualities of carrot noodles

Sample	Hardness (kg)	Springiness	Cohesiveness	Gumminess (kg)	Adhesiveness (-kg.sec)
Control	10.320	5.304	0.812	8.377	-0.063
C_{10}	9.090	1.118	0.811	7.371	-0.062
C_{20}	8.724	1.079	0.808	7.048	-0.060

C_{30}	8.134	1.092	0.807	6.569	-0.060
C_{40}	7.527	1.072	0.806	6.066	-0.059
C_{50}	5.763	1.083	0.805	4.639	-0.057
SE ±	0.1558	0.0259	0.822	0.822	-0.0058
CD at 5%	0.4801	0.0798	0.2533	0.2533	-0.0179

C_0 - Control 100% wheat flour noodles
C_{10} - 10g carrot puree in 100g flour
C_{20} - 20 g carrot puree in 100g flour
C_{30} - 30 g carrot puree in 100g flour
C_{40} - 40 g carrot puree in 100g flour
C_{50} - 50 g carrot puree in 100g flour

The hardness is the height of peak force of the first compression cycle Brennan (2004) [4]. In this study hardness of cooked noodles was reduced significantly with increase in proportion of carrot puree in noodles. The hardness of control (10.320) was highest and progressively decreased with addition of carrot puree in formulation. This may be due to presence of sugars and fibers in carrot puree. Both sugar and fibers are known to have high affinity for water and therefore water was partially available for gluten network Chinachoti (1993) [7], Wang *et al*., (2002) [28]. This may also due to the dilution of gluten content. Addition of carrot puree in formulation disturbs the gluten matrix which leads to the weakening of noodles structure. Similar results for decrease in firmness values were reported by Rekha *et al*., (2013) by addition of vegetable puree in pasta, Mishra and Bhatt (2016) [19] in fortified pasta with ginger powder. Krishnan and Prabhasankar (2014) also reported decrease in firmness of noodles prepared by incorporation of green banana flour.

The springiness which indicates recovery percentage was found to be decreased significantly with increase in amount of carrot puree in noodles. The decline in springiness and cohesiveness was thought to be due to corresponding decrease in amount of gluten in blend. Gluten is primarily responsible for giving elastic structure to the noodles. Lee *et al*., (1998) [17] also reported decrease in springiness and cohesiveness by substitution of garbanzo bean in wheat flour. The high ash content in vegetables and low gluten content might have reduced the cohesiveness of noodles Park and Baik, (2009) [22].

Adhesiveness is defined as negative area under the curve when probe lifts up from the sample. The degree of stickiness of noodles is measure of adhesiveness in the TPA profile is very important parameter of noodles. Stickiness of noodles is considered as undesirable property. The adhesiveness was slightly decreased with in increase in proportion of carrot puree in noodle. The decrease in adhesiveness is a desirable property from quality point of view Hou, (2001) [12]. In general by addition of carrot puree firmness, springiness, cohesiveness and adhesiveness were decreased progressively and constantly with slight increase in gumminess.

Conclusion

The experiment concluded instant noodles as a good carrier medium for incorporated carrot puree. The level of carrot puree incorporation was found to be acceptable up to 40g per 100g wheat flour without affecting the sensorial qualities of the instant noodles. Carrot puree being rich in dietary fibres affected the cooking and textural quality parameters of instant noodles. Cooking time and cooking loss decreased while water absorption and swelling index increased with level of addition of carrot puree in noodles. Hardness, springiness, cohesiveness and adhesiveness of noodles were found to be decreased with progressive increase in level of carrot puree.

References

1. AOAC. Official methods of analysis. 18th Edn. Association of Official Analytical Chemists, Washington DC, U.S.A, 2000.
2. AACC. Approved methods of the American Association of cereal chemists. St paul Minnesota, 2005.
3. Betoret E, Betoret N, Vidol D, Fito P. Functional foods development: Trends in Food Science & Technology. 2011; 22(9):498-508.
4. Brennan CS, Kuri V, Tudiroca CN. Inulin enriched pasta: Effect on textural properties and starch degradation. Food chemistry. 2004; 86(2):189-193.
5. Caballero B. The global epidemic of obesity: An overview. Epidemiologic Reviews. 2007; 9(1):1-5.
6. Chen H, Rubenthal L, Leung HK, Baranwski JD. Chemical physical and baking properties of apple fiber compared with oat bran. Cereal chemistry. 1988; 65(3):242-247.
7. Chinachoti P. Water mobility and its relation to functionality of sucrose containing food system. Food technology. 1993; 47(1):134-140.
8. Cleary L, Brennan C. The influence of (1→3)(1→4) β glucan rich fraction from barley on the physicochemical properties and *in vitro* reducing sugars release of duram wheat pasta. International Journal of Food Science and Technology. 2006; 41:910-918.
9. Collado LS, Corke H. Use of wheat -sweet potato composite in yellow alkaline and white salted noodles. Cereal chemistry. 1996; 73(4):439-444.
10. De Pilli T, Derossi A, Severini C. Cooking Quality Characteristics of Spaghetti based on Soft Wheat Flour Enriched with Oat Flour. International Journal of Food Science and Technology. 2013; 48(11):2348-2355.
11. Deep NY, Yadav M, Sharma N, Chilkara T, Anand SB. Quality characteristics of vegetable blended wheat-pearl millet composit pasta. Agri Res. 2014; 3:263-270.
12. Hou G. Oriental noodles. Advances in Food and Nutrition Research. 2001; 43(4):1-54.
13. Keyimu xiren guli. The effects of using seaweed on the quality of asian noodles. Journal of Food Process Technology. 2013; 4(3):1000216-1000219.
14. Krishnan M, Prabhasankar P. Effect of pasting, microstructure, sensory and nutritional profile of pasta influenced by sprouted finger millet (*Eleucina coracana*) and green banana (*Musa paradisiaca*) flours. Journal of texture studies. 2010; 41(6):825-841.
15. Krishnan JG, Menon R, Padmaja G, Sanjee MS, Moorthy SN. Evaluation of nutritional and physicochemical characteristics of dietary fiber enriched sweet potato pasta. European Food Research and Technology. 2012; 234(3):467-476.
16. Kushtova V, Kohajdova Z, Karovicova J, Mesterova E. Use of pumpkin fiber for the preparation of pasta. Chemicke listy. 2016; 110(11):808-811.
17. Lee L, Baik BK, Czuchajowska Z. Garbanzo bean flour usage in cantonese noodles. Journal of food science, 1998; 63:552-558.
18. Li Man, Ke-Xue Zhu, Xiao-Na Guo, Kristof Brijs, Hui-Ming Zhou. Noodle Products: Opportunities for

Enhanced Nutritional and Functional Properties. Institute of Food Technologists, 2015, 13.
19. Mishra P, Bhatt DK. A study on development of fortified pasta with ginger powder. Journal of Environmental Science. Toxicology and Food Technology. 2016; 10(8):14-18.
20. Padalino L, Conte A, Lecce L, Likyova D, Sicari V, Pellicanò TM *et al*. Durum wheat whole meal spaghetti with tomato peel: How by-products particle size can affect fine quality of pasta. J Food Technol. 2017; 6(10):500-505.
21. Panse VS, Sukhatme VS. Statistical methods for agricultural workers. ICAR. New Delhi, 1985.
22. Park SJ, Baik BK. Quantitative and qualitative role of added gluten on white salted noodles.Cereal Chemistry. 2009; 86:646-652.
23. Petitot M, Boyer L, Minier C, Micard V. Fortification of pasta with split pea and faba bean flours: pasta processing and quality evaluation. Food Research International. 2010; 43(2):634-641.
24. Rekha MN, Chauhan AS, Prabhashankar P, Ramteke RS, Venkateswara Rao G. Influence of vegetable paste on quality attributes of pastas made from bread wheat (*T.Aestivum*) Cyta J Food. 2012; 11:142-149.
25. Sies H, Krinsky NI. The present status of antioxidant, vitamins and beta-carotene. American Journal of Clinical Nutrition, 62(Supplimentary), 1995, 1299-1300.
26. Tudorica CM, Kuri V, Brenan S. Nutritional and physiological characteristics of dietary fiber enriched pasta. Journal of Agricultural and Food Chemistry. 2002; 50(2):347-356.
27. Wang N, Hatcher DW, Tyler RT, Toews R, Gawalko EJ. Effect of cooking on the composition of beans (*Phaseolus vulgaris* L.) and chickpeas (*Cicer arientinum* L.). Food Research International. 2010; 43:589-594.
28. Wang J, Rosell CM, Benidito DBC. Effect of the addition of different fibers on wheat dough performance and bread quality. Food chemistry. 2002; 79:221-226.
29. WINA. World instant noodles association, 2016. Http//instant noodles.org/noodles/report,htm.
30. Zeinstra GG, Koelen MA, Kok FJ, de Graaf C. The influence of preparation method on children’s liking for vegetables. Food Quality and Preference. 2010; 21(8):906-914.