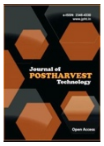

Journal of Postharvest Technology
2022, **10**(1): 122-133
www.jpht.in

RESEARCH ARTICLE

Assessment of shelf stability of noodles fortified with button mushroom and chickpea starch

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Received: 09.11.2021 Accepted: 03.01.2022

ABSTRACT

Instant noodles were prepared by supplementing wheat flour with mushroom and chickpea starch at different concentrations (100:0:0, 90:5:5, 80:10:10, 70:15:15, 60:20:20:: wheat flour: mushroom powder: chickpea starch). In present study, the further assessment was undertaken to assess the effect of value addition of mushroom powder and chickpea starch on the nutritional profile, cooking quality, bioactive properties and shelf stability of fortified noodles. The addition of mushroom powder resulted in increase in crude protein, fibre content, yellowness (b*) and redness (a*) and decrease in carbohydrate, lightness (L*) and cooking time. The developed noodles also showed increase in antioxidant activity, water absorption capacity and cooking loss. Sensory scores showed that the addition of 10% mushroom powder resulted in better quality noodles with highest overall acceptability. However, with the advancement of storage there was decrease in the nutritional profile but still can be beneficial for human health.

Keywords: Fortified noodle, fortification, shelf life, nutritional quality

Citation: Shams, R., Singh, J. and Dar, A. H. 2022. Assessment of shelf stability of noodles fortified with button mushroom and chickpea starch. *Journal of Postharvest Technology*, **10**(1): 122-133.

INTRODUCTION

Mushrooms are low in fat, high in protein, dietary fibre, and are good sources of minerals, vitamins, and possess various nutraceutical benefits (Papoutsi et al., 2020). Mushrooms are mostly grown on agricultural waste, allowing these waste products to be converted into viable human food source. Mushrooms are filamentous higher fungus with high nutritional benefits, low calorie content, flavour, and nutraceutical characteristics. They are utilized as a dietary supplement because to their unique nutritional and textural qualities (Asgar et al., 2010). Furthermore, mushrooms are high-quality protein source that may be generated in large quantities by recycling worthless agro-waste, such as agro-industrial waste, per unit area and time (Kakon et al., 2012). As a result, enriching foods with a good source of protein containing all essential amino acids can assist to reduce the occurrence of protein energy malnutrition (Oyetayo et al., 2007). The button mushroom (*Agaricus*

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bisporus) is most frequently produced and consumed mushroom in the world, accounting for over 40% of total global mushroom production (Walde et al., 2006). It is a good source of food as well as a number of vital bioactive compounds. The button mushroom is highly perishable, and its shelf life at ambient conditions is only around 24 hours. After harvest, these mushrooms undergo a variety of physiological and morphological changes that render them unfit for human consumption (Liu et al., 2006). As a result, they should be consumed or processed as soon as possible after harvest, which is why mushrooms are primarily marketed in dried form on the global market. Instant noodles have become a popular snack all around the world, and their popularity is growing rapidly. Many researchers are investigating if fortifying noodle could be used as a public health intervention to increase nutritional qualities. The popularity of noodles is increasing due to their taste, nutrition, convenience, protection, prolonged shelf life, and low price (Pakhare et al., 2018). Texture, color, flavour, cooking consistency, rehydration rate during final preparation, and absence or presence of rancid taste after prolonged storage are all important quality characteristics of instant noodles (Gulia et al., 2014).

The replacement of wheat flour in preparation of noodles with flours is becoming increasingly important, as the incorporation of other types of flour to wheat-based goods can improve the nutritional quality of product. Legume flour, which contains sufficient proteins, complex carbohydrates, and some minerals and water-soluble vitamins, can be used to replace or combine with wheat flour (Sreerama et al., 2012). The chickpea (*Cicer arietinum* L.) is one of the most consumed pulses in the world, mostly in tropical and subtropical regions. Chickpeas are considered to be one of the best sources of protein for human consumption. Pulses (grain legumes) such as chickpea are recommended by nutritionists as they possess nutritional benefits. Chickpea seed has high protein digestibility and is high in complex carbohydrates (low glycaemic index), minerals and vitamins, and relatively free from anti-nutritional components (Muzquiz and Wood, 2007). The present study was carried out to determine the effect of incorporation of mushroom powder and chickpea starch on noodles. The further assessment was undertaken to determine the effect of incorporation of mushroom powder on the nutritional profile and shelf stability of fortified noodles.

MATERIALS AND METHODS

Procurement of raw material

Button mushroom, wheat flour, chickpea and salt were purchased from local market of Jammu, Jammu & Kashmir, India and were used without any modifications.

Preparation of mushroom powder

Button mushroom was washed cut into thin slices and dried using freeze dryer. In freeze dryer mushroom slices were frozen in a conventional freezer, and kept in a freeze-drier for 38 hours at -80°C temperature, and a pressure of 5 mTorr (0.666 Pa) till constant weight was obtained followed by grinding using grinder.

Chickpea starch extraction

Chickpea seeds were soaked for 24 hours at 20°C in water having 0.2 % sodium hydrogen sulphite, and the testa were manually removed. The decorticated grains were then ground. The ground slurry was filtered using sieves before being centrifuged at 2000rpm for 10 minutes. The sediment was then washed thoroughly with water. The washing steps were repeated till the colourless starch was obtained. After that, the starch was collected followed by drying in oven at 40°C for 12 hours.

Development of noodles

Noodles were prepared in Kent noodle & pasta maker, Model no. 16009 from Kent RO System Ltd. (India). Dry ingredients were mixed properly (Wheat flour, Mushroom powder, Chickpea Starch (Table 1), Salt 2.5%, followed by addition of by adding water to form dough and then extruded through die. Each noodle strand was 1.5 × 1.5 mm in thickness. The noodles were collected and cooked in steam for 5min followed by drying in oven at 105°C for 10min. The samples were then packed in plastic bags (LDPE).

Table 1: Formulation of wheat flour, mushroom powder and chickpea starch fortified noodles

Treatment	Wheat flour (%) (WF)	Button Mushroom powder (%) (BMP)	Chickpea starch (%) (CS)
Control	100	-	-
T_1	90	5	5
T_2	80	10	10
T_3	70	15	15
T_4	60	20	20

Physico-chemical Properties of Developed Noodles

The physico-chemical properties (moisture content, fat content, crude protein content, crude fibre content, ash content and total carbohydrate content) of samples were analyzed using AOAC (2005) method.

Water activity (a_w)

The sample was filled (3/4th) in a cup of water activity meter. Instrument was calibrated as per the instruction manual calibration. Sample was kept in a cup till constant reading was obtained.

Hunter color value

Color was expressed in parameters as L*, a*, b* values where L* stands for lightness/whiteness, a* for redness/greenness and b* for yellowness/blueness. The instrument was calibrated with the standard black tile followed by the white tile. A sample handling dish was filled with dried powder then placed on analyzing port and L*, a*, b* values were noted.

Bioactive properties of developed noodles

Total phenolic content

The total phenolic content of samples was measured using Folin-Ciocalteu method given by Wani and Basir (2018). TPC was calculated using gallic acid standard curve and results were represented as mg of gallic acid equivalents (GAE) per gram of dry weight.

Antioxidant activity

Antioxidant activity was measured in terms of DPPH scavenging activity and reducing power and were expressed in terms of IC_{50} (mg/ml) and EC_{50} (mg/ml) respectively. Antioxidant activity was calculated as per the method given by Wani and Basir (2018). In DPPH radical scavenging activity, the sample extract (0.2 ml) was mixed with 3.8 ml DPPH solution (0.1 mM

DPPH in methanol) and incubated for 30 minutes in dark at ambient temperature. The absorbance of the sample was then recorded at 517 nm in a UV-visible spectrophotometer. The DPPH radical scavenging activity was recorded using formula given below:

$$(\%\ \text{DPPH Radical scavenging}) = (\text{Ac} - \text{A}) / \text{Ac} \times 100 \tag{1}$$

Where, Ac = Absorbance of control, A = Absorbance of sample

However, to determine reducing powder of samples, the standard curve was plotted by different concentrations of ascorbic acid. The reducing powder was represented as µg ascorbic acid per g dry weight.

IC_{50} value (Concentration of sample extract necessary to inhibit 50% DPPH activity) was obtained from the graph plotted between each concentration and percentage inhibition.

Cooking properties of developed noodles

Cooking loss

Cooking loss of samples was calculated by determining the quantity of solids lost in cooking water. Cooked noodles were dried for 4 hours in oven at 105 ºC. Cooking loss was measured as the ratio of difference in weight of dried residue in cooking water to the weight of noodles before cooking and converted to percentage.

Water absorption capacity

Water absorption capacity was calculated by the ratio of weight of cooked noodle samples to the weight of noodle samples before cooking as given by AOAC (2005) method using following formula:

$$\text{Water absorption } (\%) = \frac{\text{Weight of cooked noodles} - \text{Weight of raw noodles}}{\text{Weight of raw noodles}} \times 100 \tag{2}$$

Cooking time

The cooking time was calculated by the procedure given by AOAC (2005) and was estimated by the disappearance of opaque center during the cooking of noodle samples in water.

Sensory evaluation

The cooked noodles were served hot for the panelists to evaluate for its texture, color, taste, and overall acceptability using 10 panelists with 9- point hedonic scale, where 1= dislike extremely and 9= like extremely.

RESULTS AND DISCUSSION

Physico-chemical Properties of Developed Noodles

Moisture content

The moisture content decreased significantly with the addition of button mushroom powder and chickpea starch which may be due to less water absorption of mushroom powder than the wheat flour (Table 2). The movement of water is driven by the gradients of water content. During baking process, water is removed rapidly from the surface of dough, offering optimal conditions for Millard reaction (Mondal and Datta, 2008). Parvin et al. (2020) also observed the moisture content of the prepared noodles was decreased with the incorporation of mushroom powder. Sutheeves et al. (2020) also observed the moisture content of noodles developed from rice flour and mung bean starch in the same range (5.01-7.80%). However, the overall moisture content increased significantly during the storage period of 2 months, this increment in the moisture content may be attributed to hygroscopic nature of flour. Taneya et al. (2014) also reported increased moisture content during storage periods in instant noodles from wheat flour supplemented sweet potato flour.

Table 2: Physico-chemical properties of developed noodles (moisture content, crude fat content and crude protein content)

Treatments (WF:BMP:CS)	**Moisture content (%)**			**Crude Fat content (%)**			**Crude Protein content (%)**		
	Storage (months)			Storage (months)			Storage (months)		
	1	2	Mean	1	2	Mean	1	2	Mean
Tc (100:0:0)	5.43	5.70	5.56	0.91	0.88	0.89	9.84	9.61	9.72
T1 (90:5:5)	4.98	5.04	5.01	0.82	0.76	0.79	14.21	13.90	14.05
T2 (80:10:10)	4.45	4.72	4.58	0.60	0.58	0.59	16.43	16.06	16.24
T3 (70:15:15)	3.90	3.98	3.94	0.53	0.50	0.51	19.17	18.75	18.96
T4 (60:20:20)	3.61	3.70	3.65	0.43	0.40	0.41	21.05	20.88	20.96

Crude Fat Content

It was found that with the addition of button mushroom powder and chickpea starch, the fat content of developed noodles decreased significantly (Table 2). The decrease in fat content with the increase in mushroom supplementation may be due to low fat content in raw mushroom (Chauhan 2013). Arora et al. (2018) also observed that the fat content (18.93 to 18.01 per cent) of noodles decreased with increase in mushroom powder. During storage period of 2 months, there was decrease in overall crude fat content. This might be attributed to the lipolytic activity of enzymes like lipoxygenase and lipase in response to the increased relative humidity of storage environment causing conversion of fats into esters and glycerol (Uchechukwu-Agua et al., 2015). Similar pattern was also observed by Premlatha et al. (2010) who reported the decrease in crude fat in high fibre khakra noodles.

Crude Protein Content

There was increase in crude protein content of noodles with increase in of button mushroom powder and chickpea starch concentration (Table 2). Nordiana et al. (2019) also observed that the protein content of mushroom fortified pasta increased with increase in mushroom flour concentration. The increase might be due to the fact that the mushroom flour had a high amount of protein. The similar results related to the increased value of protein in pasta were also found by Chauhan (2013). The protein content of prepared noodles decreased significantly after 2 months of storage period. The decrease in crude protein content may be due to the hydrolysis of peptide bonds by enzyme protease that can cause the breakdown of protein molecules during the storage period (Premlatha et al., 2010). Similar pattern was also observed by Premlatha et al. (2010) who observed the decrease in crude protein content in fibre rich khakra based noodles.

Crude Fibre

The results depicted that the crude fibre content varied among treatments and storage periods (Table 3). The crude fibre content was increased with the incorporation of mushroom powder and chickpea starch concentration. The increased crude fibre content of prepared noodles might be due to the natural dietary fibre content present in mushroom powder. It can be suggested that the mushroom flour can be considered as an alternative to enhance the fibre content of noodles (Nordiana et al., 2019). Similar pattern was also observed by Parvin et al. (2020) and Arora et al. (2018), where fiber content of noodles was increased with the supplementation of mushroom flour. However, the crude fibre content decreased significantly in prepared noodles during the 2 months of storage period which might be due to the degradation of hemicellulose and cellular polysaccharides (Hussain 2016). Also breakage of weak bonds takes place between polysaccharide chains and glycosidic linkages which makes dietary fibre less recognizable (Munaza 2018). Similar pattern was also observed by Slathia et al. (2016) in mung bean based noodles.

Table 3: Physico-chemical properties of developed noodles (crude fibre content, ash content, carbohydrate content)

Treatments (WF: BMP: CS)	**Crude Fibre content (%)**			**Ash content (%)**			**Carbohydrate content (%)**		
	Storage (months)			Storage (months)			Storage (months)		
	1	2	Mean	1	2	Mean	1	2	Mean
Tc (100:0:0)	5.68	5.51	5.59	0.58	0.56	0.57	83.24	83.25	83.24
T1 (90:5:5)	5.86	5.8	5.83	0.96	0.93	0.94	79.03	79.37	79.20
T2 (80:10:10)	6.13	6.01	6.07	1.63	1.60	1.61	76.89	77.04	76.96
T3 (70:15:15)	6.41	6.38	6.39	1.84	1.81	1.82	74.56	74.96	74.76
T4 (60:20:20)	7.65	7.46	7.55	1.91	1.90	1.90	73.00	73.12	73.06

Ash Content

The total ash content in prepared noodles and showed that the ash content was increased with increase in mushroom powder and chickpea starch concentration (Table 3). Similar pattern was found by Parvin et al. (2020) who showed that the ash content increased with the incorporation of mushroom powder levels in the prepared noodles. The total ash content also increased with increase in durum semolina and mushroom flour fortified pasta (Chauhan 2013). Sutheeves et al. (2020) also observed the same range of ash content (1.56 -1.94%) of noodles developed from rice flour and mung bean starch. The total ash content of prepared noodles was decreased but the change in ash content with respect to storage period was not significant. The decreased ash content may be due to the interaction of minerals with other components like carbohydrates and proteins (Akhtar et al., 2005). This decrease in ash content may also be attributed to mineral losses resulting from binding of minerals by Millard reaction products and increase in moisture content during storage (Nadarajah and Mahendran 2015).

Carbohydrate Content

The carbohydrate content of prepared noodles decreased significantly with the addition of button mushroom powder and chickpea starch (Table 3). Sutheeves et al. (2020) also observed the same range of carbohydrate content (73.98 -77.83%) of noodles developed from rice flour and mung bean starch. Herken et al. (2007) also observed the same trend of decreased carbohydrate contents in macaroni prepared with cowpea flour. The decrease in the carbohydrate content with the increase in mushroom in wheat flour might be attributed to the presence of low and non-digestible carbohydrates that can produce laxation, stimulate short-chain fatty acid formation, and affect gut microbial growth (Hess et al., 2018). However, the carbohydrate content increased significantly in prepared noodles during the 2 months of storage period. This increase might be attributed to the degradation of complex and structural polysaccharides into simple sugars (Jan 2018).

Colour Profile

The colour values of developed noodles was measured in terms of Hunter L* (lightness), a* (redness) and b* (yellowness). The L* value of the noodles decreased while as the a* and b* values increased with the addition of mushroom powder and chickpea starch (Table 4). Similar pattern was also obtained by Petitot et al. (2010) and Wood (2009) in pasta incorporated with fava bean and split pea flour and chickpea flour respectively.

Concurrently, an increased a* values was found in pasta incorporated with fava bean flour (Petitot et al., 2010). Kumar and Prabhasankar (2015) observed the increase in b* of noodles fortified with pea flour. The L* value decreased while as the a* and b* values increased during the storage period of 2 months. This might be attributed to Millard reaction and non-enzymatic browning readily occurring during drying resulting in increase in the formation of brown pigments that may lead to darkening of noodles (Jan 2018).

Table 4: Colour parameters of developed noodles

Treatments (WF:BMP:CS)	**L***			**a***			**b***		
	Storage (months)			Storage (months)			Storage (months)		
	1	2	Mean	1	2	Mean	1	2	Mean
Tc (100:0:0)	71.52	70.83	71.17	1.98	2.05	2.01	19.57	19.91	19.74
T1 (90:5:5)	69.32	68.78	69.05	3.58	3.62	3.60	25.73	26.15	25.94
T2 (80:10:10)	61.05	59.91	60.48	3.97	4.16	4.06	28.57	28.94	28.75
T3 (70:15:15)	59.16	58.84	59.00	4.91	5.07	4.99	30.91	31.05	30.98
T4 (60:20:20)	53.76	53.45	53.60	5.48	5.85	5.66	31.67	31.98	31.82

Bioactive Properties of developed noodles

Total Phenolic Content

It was found that the total phenolic content was increased with the incorporation of mushroom powder and chickpea starch concentration (Table 5). Similar pattern was also observed by Ajila et al. (2010) in mango peel powder fortified macaroni. Arora et al. (2018) also found that the total phenol content increased due to the incorporation of mushroom powder, increasing the antioxidant potential of noodles. During the storage period of 2 months, the total phenolic content decreased, which might be dilution and oxidation of total phenolic components during storage conditions (Ali et al., 2018). Similar trend was observed by Slathia et al. (2016) in mung bean blended noodles.

Table 5: Bioactive properties of developed noodles

Treatments (WF:BMP:CS)	**Total phenol content (mg GAE/g)**			**DPPH scavenging activity (IC_{50}; mg/ml)**			**Reducing power (EC_{50}; mg/ml)**		
	Storage (months)			Storage (months)			Storage (months)		
	1	2	Mean	1	2	Mean	1	2	Mean
Tc (100:0:0)	14.31	14.05	14.18	0.51	0.63	0.57	3.52	3.65	3.58
T1 (90:5:5)	15.61	15.38	15.49	0.40	0.43	0.41	3.31	3.38	3.34
T2 (80:10:10)	15.96	15.90	15.93	0.30	0.31	0.30	3.09	3.12	3.10
T3 (70:15:15)	16.20	16.13	16.16	0.25	0.27	0.26	2.96	2.99	2.97
T4 (60:20:20)	17.31	17.09	17.20	0.16	0.20	0.18	2.19	2.34	2.26

Antioxidant activity

The lower values of IC_{50} and EC_{50} depicted higher DPPH scavenging activity and reducing power respectively. Antioxidant activity of noodles was increased with the incorporation of mushroom powder and chickpea starch concentration (Table 5). Chauhan et al. (2017) observed that the antioxidant activity of macroni increased with the increased mushroom concentration. Similar trend was also observed by Ajila et al. (2010) in macaroni fortified with mango peel powder that increased the nutraceutical potential by enhancing its antioxidant activity. During storage period of 2 months, a significant decrease in DPPH Scavenging activity (IC_{50}) and reducing power (EC_{50}) value of prepared noodles was recorded. This decrease in antioxidant activity of prepared noodles during storage may be attributed to the oxidation of antioxidant components and their decreased concentration (Munaza 2018). Similar trend of decrease in antioxidant activity in macaroni enriched cowpea flour was also reported by Herken et al. (2007).

Cooking Properties of Developed Noodles

Cooking Loss

With increase in mushroom powder and chickpea starch concentration, the cooking loss increased significantly (Table 6). Similar pattern was obtained by Arora et al. (2018) who showed that the cooking loss increased with incorporation of mushroom flour. Cooking loss can be due to the weak protein-starch interaction between mushroom protein and wheat flour. The extent of cooking loss will mostly depend on the strength of the gel network-like structure and degree of starch gelatinization of the noodles. Cooking loss was also related to the structural strength of noodle samples, and a high value showed a low structural strength, as the starch and other soluble compounds, such as non-starch polysaccharides, leached in the water during cooking (Gull et al., 2018). During storage period, the cooking loss of noodles was significantly increased. This increase might be due to slight diminution of polymeric structure (Kaur et al., 2017). Similar pattern was also observed by Kaur et al. (2017) in brown rice pasta supplemented with gluten during 3 months of storage period.

Table 6: Cooking quality of developed noodles

Treatments (WF:BMP:CS)	**Cooking loss (%)**			**Water absorption capacity (%)**			**Cooking time (minutes)**		
	Storage (months)			Storage (months)			Storage (months)		
	1	2	Mean	1	2	Mean	1	2	Mean
Tc (100:0:0)	4.23	4.25	4.24	103.12	102.87	102.99	7.25	7.09	7.17
T1 (90:5:5)	4.48	4.60	4.54	114.05	113.65	113.85	6.31	6.04	6.17
T2 (80:10:10)	4.76	4.87	4.81	125.65	124.91	125.28	5.09	4.92	5.00
T3 (70:15:15)	4.96	5.05	5.00	135.72	135.06	135.39	4.42	4.15	4.28
T4 (60:20:20)	5.37	5.46	5.41	152.31	151.74	152.02	4.11	3.95	4.03

Water Absorption Capacity

The water absorption capacity of noodles was significantly increased with increase in mushroom powder and chickpea starch (Table 6). Yadav et al. (2011) also found that the water absorption capacity percentage was increased in pigeon pea starch noodles depicting higher water absorption than rice starch based noodles. During storage period, of 2 months, the water absorption capacity decreased significantly which might be due to the degradation of starch and protein during storage. Similar pattern was also observed by Seema et al. (2016) in millet fortified pasta during storage.

Cooking Time

The cooking time was significantly decreased with increase in mushroom powder and chickpea starch concentration (Table 6). Similar pattern was obtained by Parvin et al. (2020) who reported that the cooking time reduced with increasing mushroom flour concentration in noodles. Torres et al. (2007) also reported that with increase in the levels of germinated pigeon pea seed flour, the cooking time of developed pasta was reduced. During storage period, the cooking time of prepared noodles decreased significantly. This decrease might be due to the degradation of starch and protein during storage. Kaur et al. (2017) also reported decrease in cooking time in nutritionally enriched multigrain pasta.

Sensory Evaluation

On the basis of sensory score of overall acceptability (colour, texture, taste) of noodles fortified with button mushroom powder and chickpea starch, it was revealed that the incorporation of 10% mushroom powder resulted in higher overall acceptability of developed noodles (Table 7). However, during storage period of 2 months, the overall acceptability score decreased. The variation on overall acceptability score of developed noodles may be due to colour, texture and taste associated with the mushroom flour and chickpea starch. Sensory scores showed that treatment T_2 was observed to be at par with that of control noodle sample in almost all sensory attributes except for the colour. The results were also correlated with Mahmoud et al. (2012) in wheat flour noodles enriched with different protein products from lupine and Parvin et al. (2020) in noodles incorporated with mushroom powder. During storage period, the overall acceptability decreased. This decrease might be due to change in sensory attributes with increase in storage. Similar pattern was also observed by Kaur et al. (2012) in pasta incorporated with different cereals and Slathia et al. (2016) in noodles fortified with mung bean.

Table 7: Sensory score of developed noodles

Treatments (WF:BMP:CS)	**Colour**			**Texture**			**Taste**			**Overall acceptability**		
	Storage (months)			Storage (months)			Storage (months)			Storage (months)		
	1	2	Mean	1	2	Mean	1	2	Mean	1	2	Mean
Tc (100:0:0)	7.84	7.50	7.67	7.63	7.27	7.45	8.01	7.45	7.73	7.54	7.01	7.27
T1 (90:5:5)	7.63	7.25	7.44	7.01	6.74	6.87	7.65	7.26	7.45	7.32	6.57	6.94
T2 (80:10:10)	7.21	6.54	6.87	7.76	7.50	7.63	8.32	7.51	7.91	8.00	7.60	7.80
T3 (70:15:15)	6.48	6.06	6.27	6.77	6.03	6.40	6.5	6.03	6.26	7.25	6.38	6.81
T4 (60:20:20)	5.66	5.21	5.43	6.00	5.58	5.79	6.27	5.86	6.06	6.27	6.03	6.15

CONCLUSION

Noodles are most popular snacks, but noodles prepared by wheat flour only have relatively low amount of proteins, fibers, and minerals. Thus, it can be overcome by developing the noodles fortified with mushroom powder. It was concluded that the addition of of button mushroom powder and chickpea starch improved the nutritional profile, bioactive and cooking properties of developed noodles without affecting its palatability aspects. It was also found that the addition of mushroom powder resulted in increase in sensory scores of taste, color and texture with good acceptability at 10% mushroom powder concentration. Thus, noodles can be a good source of value added instant food.

ACKNOWLEDGEMENT

All authors are thankful to the Indian Council of Medical Research, for award of ICMR-Fellowship 2019 in favour of Ms. Rafeeya Shams (vide grant no. ICMR/SRF- 3/1/2/131/2019-(Nut).

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