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Determination of cooking quality of the composite flour noodles incorporated with chia seeds powder

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Abstract
The present study was conducted to determine the effects of addition of chia seeds powder on the cooking qualities of whole wheat-sorghum composite flour noodles. Chia seeds powder was added at the levels of 8, 10 12 and 14 per cent. In composite flour mixture about 70 per cent whole wheat flour and 30 per cent sorghum flour was used. The prepared noodles samples were subjected for analysis of cooking qualities. Results obtained showed that cooking time increases with increase in level of chia seeds powder. Cooking loss decreased with the addition of chia seeds powder. Warer uptake and cooked weight found to be increased.

Keywords: Chis seeds powder, noodles, composite flour, cooking quality

Introduction
Noodles are foods that are consumed across world with high consumer acceptance because they are used by many peoples as a part of diet and are comparatively cheap in cost and can be easily made (Silvana *et al*., 2014) [13]. Instant noodles are consumed worldwide because of their ease of consumption, can be easily produced for large number of peoples, mostly acceptable taste and texture and made available in low cost (Li, 2003) [5]. Popularity of instant food is being increased because of the varieties of products with unique sensory attributes and convenience in preparation (Ranjani *et al*., 2000) [11].

Instant noodles are convenient and available in low market price, this leads to increase of popularity of instant noodles very rapidly during recent decades (WINA, 2009) [16]. However, very less data is available which is associated with the nutritional status of consumers eating instant noodles in western and Asian countries (WINA, 2009) [16]. The consumption of instant noodles is carried out in more than 80 countries of the world and it has got international recognition (Sood *et al.*, 2018) [14]. The demand of the instant noodles is continuously increasing and consumption of instant noodles is about 95.4 billion servings annually worldwide (Sood *et al.*, 2018) [14]. China has got first rank in the instant noodles consumption followed by Indonesia, Japan, and Vietnam, although instant noodles consumption in India had been low (WINA, 2011) [17]. WINA (2011) [17] also reported that the instant noodles consumption has increased appreciably in the past five years, i.e., it has increased by more than five times, with current consumption of instant noodles of 2940 million packets (bags/cups). The share of instant noodles in Indian market was INR 93.66 bn in the year 2017 and it may expand at a compound annual growth rate (CAGR) of 5.6% during 2018-2023 (WINA, 2017) [18]. was valued at Instant noodles are often condemned as unhealthy food and it is also categorized as a junk food (Park *et al.*, 2011) [10]. Consumption of instant noodles provides high amount carbohydrates but it provides low fibers, minerals and vitamins (Park *et al.*, 2011) [10]. Manufacturers of instant noodle have made efforts to reduce the fat and sodium content of the instant noodle in relation to public health concerns (NongShim Co., Ltd., 2009) [7]. Fortification of flours used to make the Instant noodles or the seasoning powders consumed with the noodles, increases the nutritional value of the instant noodles and it is promoted as a nutrient vehicle in many developing countries (Kim, 1997; Winichagoo *et.al.*, 2006) [3, 19].

Noodles and Pasta products are used as staple foods in most of the countries in whole world from prehistoric period. These cereal products have gained importance worldwide due to their convenience, nutritional properties, special flavor, and taste. Noodles and Pasta are basically the same type of food but different types of raw materials are used and have different shapes, and the people and regions in the world consuming them are different. Noodle products and pasta contains many additives used for various purposes**.** Enzymes, Starch, organic acids, Edible gums, Natural polyols, Phytochemicals, protein concentrates etc. are the natural additives used in the noodles (Li *et al.*, 2014) [6].

The present study was carried out to determine the effects of addition of chia seeds powder on the cooking quality of the noodles made from whole wheat-sorghum composite flour.

Materials and methods

The present investigation was carried out in the Department of Food Engineering with collaboration of Department of Food Process Technology and Department of Food Chemistry and Nutrition, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra.

Materials

The raw materials such as Whole wheat flour, sorghum flour was obtained from local market of Parbhani, Maharashtra. Chia seeds were made available online. Other ingredients such as additives were used made from Department of Food Engineering, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani

Methods

Preparation of noodles

The noodles were made with slight modification according to the method given by Akaijiaku *et al*., (2017) [1].

Methodology for preparation of noodles

The noodles samples were manufactured in the laboratory. The key ingredients used for preparation of control noodles sample were whole wheat flour, soghum flour, water and salt. The wheat flour and sorghum flour were used in different proportions for preparation of composite flour noodles. Then the selected composite flour noodles sample was used as a control noodle sample for development of noodles incorporated with chia seeds powder. Noodles were prepared in four different combinations with incorporation of 8, 10, 12 and 14 per cent chia seeds powder in (whole wheat – sorghum) composite flour. These samples were then converted into noodles using extruder (Model no. 16009, Kent Noodle and Pasta Maker). Whole wheat flour, sorghum flour, chia seeds powder and salt were combined and added to the noodle making machine. Water is then added and noodles are formed having 2.0 mm thickness.

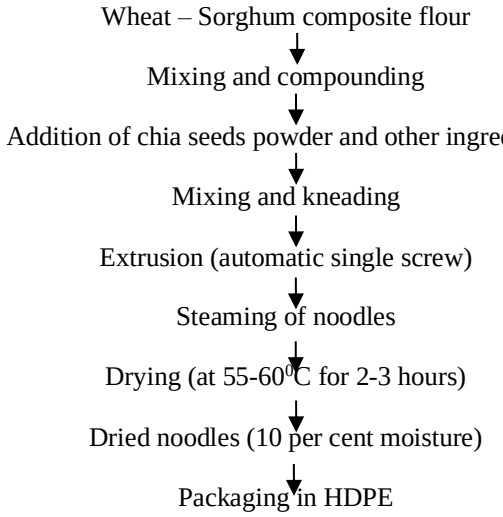

Fig 1: Flow chart for preparation of noodles

Formulation of noodles

The noodles are prepared by using composite flour (70 per cent whole wheat flour and 30 per cent sorghum) with the addition of chia seeds powder at the levels of 8, 10, 12 and 14 per cent.

Table 1: Formulation of noodles

Ingredients	Control	T_1	T_2	T_3	T_4
Composite flour(g)	100	92	90	88	86
Chia seeds powder(g)	0	8	10	12	14
Water(ml)	40	40	40	40	40
Salt(g)	2	2	2	2	2

Control = 100 g composite flour
T_1 = 92 g composite flour and 8 g chia seeds powder
T_2 = 90 g composite flour and 10g chia seeds powder
T_3 = 88 g composite flour and 12 g chia seeds powder
T_4 = 86 g composite flour and 14g chia seeds powder

Cooking quality determination of noodles

The cooking qualities of the prepared noodles i.e. cooking time and cooking loss were determined by adopting the method of Shere *et al.,* (2018) [12]. For determination of optimal cooking time of the noodles 250 gm of noodles were cooked in 250 ml of boiling water. After every 30 seconds, a stick of noodle was held between a plastic paper and it was pressed slowly till the white color of noodle at central part of strand becomes invisible. The point at which the centre of noodles strand becomes transparent, the cooking time was obtained. The cooking loss of the noodle was calculated by measuring the quantity of solid substance lost throughout cooking to cooking water. A 10 gm of noodles sample was kept into 300 ml boiling distilled water in a 500 ml beaker. After cooking of the noodles cooking water was removed and placed in an aluminum dish and kept in oven at 105 ^{0}C and evaporated till dries completely.

The cooking loss can be determined by following formula,

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

The water absorption of the prepared noodles was determined by the method adopted by Shere *et al*., (2018) [12].

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

Results and dissection

Cooking quality of noodles

Cooking quality is important for determination of quality of the noodles. Cooking quality of the noodles includes cooking time, cooking loss, cooked weight and water uptake.

Table 2: Cooking quality of the prepared noodles

Sample	Cooking Time (Min.)	Cooking Loss (%)	Cooked Weight (%)	Water uptake (%)
Control	7.13	7.4	146.52	46.52
T_1	7.45	6.9	150.17	50.17
T_2	8.11	6.6	153.28	53.28
T_3	8.22	6.1	157.94	57.94
T_4	8.46	5.8	161.39	61.39
SE±	0.01291	0.01506	0.01721	0.01936
CD@5%	0.03886	0.04534	0.05182	0.05829

*Each value is a average of three determinations

Control = 100 g composite flour
T_1 = 92g composite flour and 8 g chia seed powder
T_2 = 90g composite flour and 10g chia seed powder
T_3 = 88g composite flour and 12g chia seed powder
T_4 = 86g composite flour and 14g chia seed powder

The data presented in table 2 indicated that the highest cooking time was obtained for sample T_4 (8.46 min). The cooking time values for samples T_1, T_2 and T_3 were 7.45, 8.11 and 8.22 min respectively. The lowest cooking time was observed for control sample (6.26 min). The cooking time of the noodles gradually increased with the addition of chia seeds powder. Optimal cooking time of the noodles is generally influenced by the rate of water movement in noodles and subsequent starch gelatinization (Sozer and Kaya, 2008) [15].

Cooking loss is the quantity of the dried solids leached in cooking water of noodles. The cooking loss of control noodle sample was 7.4 percent. The highest value of cooking loss was obtained for control sample (7.4 per cent). Whereas the lowest value of cooking loss was observed for sample T_4 (5.8 per cent). The cooking loss values for samples T_1, T_2 and T_3 were 6.9, 6.6 and 6.1 per cent respectively. The cooking loss of noodles was considerably decreased with increase in level of chia seeds powder in noodles.

The cooked weight of the noodles increased with the addition of chia seeds powder. This may be due to the mucilage present in chia seeds flour having high water absorption capacity which resulted in increase in weight and volume of noodles (Levent, 2017) [4]. The cooked weight of the noodle samples was ranged from (146.52 to 161.39 per cent). The lowest cooked weight was observed in control sample (146.52 per cent). The cooked weight for samples T_1, T_2 and T_3 were 150.17**,** 153.28 and 157.94 per cent respectively. The highest cooked weight was observed in sample T_4 (161.39 per cent). Omeire *et al.,* (2015) [9] also reported increase in cooking weight of noodles made by using wheat and cassava flour and this may be caused due to the high protein and starch content of the noodle samples. Results are in close agreements with the findings of (Joshi *et al.,* 2019; Shere *et al.,* 2018) [2, 12].

The water uptake of noodles increased with the addition of chia seeds powder level. The highest water uptake value was observed for sample T_4 (61.39 per cent), whereas lowest water uptake value was observed for control sample **(**46.52 per cent)**.** The water uptake for samples T_1, T_2 and T_3 were 50.17, 53.28 and 57.94 per cent respectively. Oliveira *et al.,* (2015) [8] also reported increase in water absorption of pasta made with incorporation of chia seeds powder.

The incorporation of chia seeds to the noodles enhanced the cooking qualities of the noodles by virtue of it's different physical and structural characteristics.

Conclusion

The incorporation of chia seeds powder in the noodles inproves the cooking qualities of the noodles. Cooking loss reduced with increase in concemntration of chia seeds powder. Water absorption increases due to high water absorbing capacity of the chia seeds and consequently weight of the noodles also increases. Therefore addition of chia seeds powder in noodles greatly enhances the cooking qualities of the noodles.

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