The Pharma Innovation Journal 2021; 10(10): 1064-1068

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(10): 1064-1068
© 2021 TPI
www.thepharmajournal.com
Received: 06-07-2021
Accepted: 15-09-2021

A Mithila
Researchers, Dr. NTR CFST, ANGRAU, Bapatla, Andhra Pradesh, India

K Sowjanya
Assistant Professor, Department of Food Processing Technology, Dr. NTR CFST, ANGRAU, Bapatla, Andhra Pradesh, India

Blessy Sagar Seelam
Assistant Professor, Department of Food Processing Technology, Dr. NTR CFST, ANGRAU, Bapatla, Andhra Pradesh, India

M Akhila
Researchers, Dr. NTR CFST, ANGRAU, Bapatla, Andhra Pradesh, India

J Suma Madhuri
Researchers, Dr. NTR CFST, ANGRAU, Bapatla, Andhra Pradesh, India

Corresponding Author:
K Sowjanya
Assistant Professor, Department of Food Processing Technology, Dr. NTR CFST, ANGRAU, Bapatla, Andhra Pradesh, India

Fiber enriched multi-millet noodles-incorporated with sweet potato flour

A Mithila, K Sowjanya, Blessy Sagar Seelam, M Akhila and J Suma Madhuri

Abstract
Now a days millets based products consumption was very low. This study was carried out to increase consumption of millets with most common product Noodles. Noodles made from a mixture of flour, water and eggs usually cooked in soup or boiling water. Traditional noodles are usually made from common wheat flour, water and/or salt by a process of dough mixing, sheeting and cutting. The study reports on the effect of the Wheat flour, Sweet potato flour, Sorghum flour, Bajra flour and Foxtail flour on the Physico-chemical and sensory properties of the fiber enriched Multi-Millet Noodles. Sweet potato flour was incorporated along with the Wheat flour at flour replacement levels of 0,5,10 and 15% by keeping multi-millet composite flour at constant level that is 30%. Millets are rich in protein, dietary fiber and B- complex vitamins and minerals. So the noodles prepared with multi-millet flour increases the nutritional value. In addition to that sweet potato flour which contains high amount dietary fiber.

Keywords: Multi-millet noodles, sweet potato, refined wheat flour

Introduction
Noodles are widely consumed throughout the world and their global consumption is second only to bread. As the world market is expanding, studies for the development and improvement of noodles qualities satisfying consumer demands is of immense importance. Wheat flour is the main ingredient used to make noodles is not only low in fibre and protein contents but also poor in essential amino acid, lysine and therefore, characteristics of wheat flour are important for noodle making.

In recent years, the demand to use novel sources as substitute for wheat flour has increased. Now-a-days, in order to enrich the varieties of noodles, wheat noodles have been fortified with various ingredients. So, as a part of replacement the sweet potato is being tried. As, flours from alternative sources such as sweet potato, and other tubers are being used as potential wheat flour substitutes for noodle making adding variety and functionality to the product. Tubers and roots do not contain any gluten, and these are rich source of carbohydrates in the form of starch, which plays important role in establishing the textural properties of products like noodles.

There is now a renewed effort to broaden the food base in developing countries by creating new food products based on indigenous raw materials such as sweet potato, etc. Sweet potato (*Ipomoea batatas*) is an important starch rich tuber crop which is available throughout the country. Sweet potato flour is less expensive, nutritious and ordinarily harmless source of carbohydrates, calories. 100g flesh of sweet potato contains 7 IU vitamin A which are about one and half times more than daily requirement of Vitamin A for an adult. Sweet potato is low in protein content, its lysine content (an essential amino acid limiting in cereals) is higher than that of rice; hence when taken in combination with rice, it improves the amino acid spectrum and hence the biological value of the diet. To reduce pressure on rice and change food habits which involves the use of non-rice commodity for production of convenient food products. Formulation of breads, biscuits, cakes, noodles etc. could be developed using sweet potato flour mixed with wheat flour. This sweet potato-wheat flour blend could be a valuable raw material to substitute for rice. Processing of sweet potato flour into value added product like noodles have potential to increase income and improve livelihood of sweet potato growers.

Apart from value addition, through novel food products development there is also scope for variety, convenience and cost efficiency. Most snack foods being cereal based are monotonous in regard to their nutritional quality.

Use of abundant supplies of sweet potato in countries like India to substitute partially for wheat flour in quality products like noodles will not only reduce the excessive dependence on cereal grains but also improve the imbalance of nutrients through consumption of products based upon flour mixtures.
Hence the present study is planned to develop multi-millet noodles incorporated with sweet potato flour. So, that the less utilized sweet potato flour and millets flour, which are rich in carbohydrates, vitamins and minerals will enchane the nutritional properties of the noodles.

Objectives

This study was planned with the objectives

- To develop Multi-Millet Noodles incorporated with sweet potato flour.
- To evaluate Physico-chemical and cooking properties of Multi-Millet Noodles.
- Assessment of quality characteristics and organoleptic evaluation of developed noodles.

Materials and Methods

The present research study was conducted in the Dr. NTR College of Food science and Technology, Bapatla, Guntur District. The study was conducted on "Development of Multi-Millet noodles incorporated with sweet potato flour". Multi-Millet noodles incorporated with sweet potato flour were analyzed for their Physico-chemical properties, cooking properties and sensory properties. The details of the materials and methodologies adopted in this study is presented below:
The main ingredients used in the development of multi-millet noodles incorporated with sweet potato flour are procured from local market and Cooking time, solid loss %, Swelling index, water absorption, thickness of multi millet noodles was carried out using (AACC) International Approved Method and

Table 1: Basic formulation of flours in multi-millet noodles incorporated with sweet potato flour

Sl. No.	Ingredients	Samples			
		C	T_1	T_2	T_3
1	Refined Wheat flour (g)	95	60	55	50
2	Millets flour (g) (Sorghum, Bajra, Foxtail)	0	30	30	30
3	Sweet Potato flour (g)	0	5	10	15
4	Corn flour (g)	2	2	2	2
5	Xanthan gum (g)	2	2	2	2
6	Salt (g)	1	1	1	1
7	Oil(ml)	3	3	3	3
8	Water (ml)	45	39	43	49

C = Control noodles with wheat flour only; T_1= multi-millet noodles with 60% wheat flour, 5% sweet potato flour; T_2= multi-millet noodles with 55% wheat flour, 10% sweet potato flour and T_3= multi-millet noodles with 50% wheat flour, 15% sweet potato flour.

Procedure for the preparation of multi-millet noodles
All ingredients such as refined wheat flour, millets flour (i.e., sorghum, Bajra, Foxtail flour), sweet potato flour were weighed as shown in Table1. The composite flour was added with oil and mixed properly with the required amount of water. Dough was kneaded for 10 minutes and kept resting for 20 minutes. Then the dough was transferred to a vertical noodles making machine and longer type of noodles were made. The prepared noodles were then steamed at 100°C for 10 minutes. The noodles were dried in hot air oven at 60°C for 5 hours. The dried and cooled multi-millet noodles were packed in polythene bags.

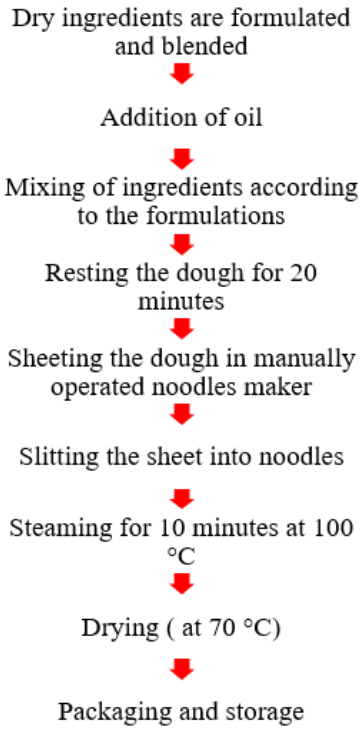

Fig 1: Flow chart of Noodles preparation

Results and discussion

Product Evaluation

The Multi-Millet noodles incorporated with sweet potato flour were analyzed for their cooking qualities, proximate nutrient composition, and organoleptic qualities.

Assesment of cooking quality of the formulated multi-millet noodles

The results pertaining to various parameters studied under the cooking quality are presented in the given table.

Table 2: Assessment of cooking quality of the formulated Multi-millet noodles incorporated with sweet potato flour

Samples	Cooking Time (min)	Solid Loss (%)	Swelling Index (%)	Water Absorption (%)	Thickness (mm)	
					Dried	Cooked
C	10.0± 0.577	5.36±0.08	2.88±0.015	98.53±0.020	1.59±0.245	2.80±0.026
T1	20.33±0.882	8.80±0.20	2.80±0.026	92.81±0.01	1.47±0.100	2.69±0.083
T2	22.83±1.16	10.63±0.19	2.64±0.019	88.61±0.015	1.45±0.075	2.66±0.22
T3	26.86±0.46	11.52±0.08	2.51±0.006	78.48±0.021	1.33±0.055	2.49±0.020

C = control with wheat flour only; T_1= multi-millet noodles with 60% wheat flour, 5% sweet potato flour; T_2= multi-millet noodles with 55% wheat flour, 10% sweet potato flour and T_3= multi-millet noodles with 50% wheat flour, 15% sweet potato flour.

Cooking time

The data in the table 2. Shows the values of cooking time for the developed multi-millet noodles incorporated with sweet potato flour. The cooking time for the Control, T_1, T_2 and T_3

samples are 10.0, 20.33, 22.83 and 26.86 (min) respectively.
The results showed that the cooking time is highest for the T_3 sample than control, T1, T2, T3. It may be due to the more starch content which requires more time for cooking that is obtained by the incorporation of sweet potato flour at the level of 15% in the T_3 sample. It was due to, cooking time shortened with increasing water absorption, but with minimal effect on the textural attributes of cooked alkaline noodles

Solid Loss
The data in the table 2 shows the values of solid loss for the developed multi-millet noodles incorporated with sweet potato flour. The solid loss for the control, T_1, T_2 and T_3 samples are 5.40, 8.70, 10.36, and 11.61 percent respectively.
The results showed that the solid loss is having a variation from the control to T_3 sample. Solid loss is more for the T_3 sample due to the presence of water soluble compounds like starch.

Swelling index
The data in the table 2 shows the values of swelling index for the developed multi-millet noodles incorporated with sweet potato flour. The swelling index for the control, T_1, T_2 and T_3 samples are 2.89, 2.80, 2.68 and 2.50 percent respectively.
The results showed that the swelling index is more for control sample and less for T_3 sample. It may be due to the variation in the wheat flour levels.

Water absorption (%)
The data in the table 2 shows the values of water absorption for the developed multi-millet noodles incorporated with sweet potato flour. The water absorption for the control, T_1, T_2 and T_3 samples are 98.52, 92.81, 88.60 and 78.48 percent respectively.
The results showed that the water absorption percentage is gradually decreasing from the control sample to T_3 sample which may be due to the presence of water insoluble fiber and variation in the wheat flour levels.

Thickness
The data in the table 2 shows the values of thickness for both dried and cooked multi-millet noodles incorporated with sweet potato flour. The thickness for the dried control, T_1, T_2 and T_3 samples are 1.59, 1.47, 1.45, and 1.33 mm respectively. Whereas for the cooked control, T_1, T_2 and T_3 samples are 2.80, 2.69, 2.66 and 2.49 mm respectively.
The results showed that thickness of cooked noodles is more than that of the dried noodles for all samples. High value of thickness has been correlated negative with WAC and positively with swelling capacity of starches in control, T_1, T_2 and T_3.

Table 3: Proximate analysis of the formulated Multi-millet noodles incorporated with sweet potato flour

Parameters	Samples			
	Control	T_1	T_2	T_3
Moisture content (%)	10.23±0.145	8.76±0.186	6.93±0.176	4.43±0.233
Carbohydrates (%)	48.40±0.231	51.76±0.145	58.70±0.115	59.50±0.115
Protein (%)	12.83±0.080	19.46±0.098	21.59±0.075	22.96±0.336
Fat (%)	3.50±0.247	2.78±0.072	2.39±0.006	1.82±0.017
Crude fiber (%)	7.26±0.145	11.03±0.145	4.51±0.164	4.41±0.060
Ash (%)	1.02±0.012	1.37±0.012	1.58±0.012	1.66±0.017
Vitamin-A(I.U)	ND	1.79±0.113	2.46±0.095	2.99±0.041

Moisture content
The data in the table 3 shows the values of moisture content for the developed multi-millet noodles incorporated with sweet potato flour. The moisture content for the control, T_1, T_2 and T_3 samples are 10.23, 8.76, 6.93 and 4.43 percent respectively.
The results showed that the moisture content is less for the T_3 sample. It may be due to the difference in the water levels used that are used in the preparation of the dough, as around 49 ml of water is used for preparation of T_3 samples and around 15% of sweet potato flour is added in T_3 which decreased the moisture content.

Carbohydrates
The data in the table 3 shows the values of carbohydrate content for the developed multi-millet noodles incorporated with sweet potato flour. The carbohydrate content for the control, T_1, T_2 and T_3 samples are 48.40, 51.76, 58.70, and 59.50 respectively.
The results showed that the carbohydrate content is more for the T_3 sample. It may be due to the increase in the level of sweet potato flour at the rate of 15% and may be due to the presence of free sugars, starch and non starchy polysaccharides in wheat flour.

Protein content
The data in the table 3 shows the values of protein content for the developed multi-millet noodles incorporated with sweet potato flour. The protein content for the control, T_1, T_2 and T_3 samples are 12.83, 19.46, 21.59 and 22.96 respectively.
The results showed that the protein content in the formulated noodles was high for T_3sample. As the addition of multi millets increased in formulation protein content also increased drastically. Protein content in the T_1, T_2 is lower due to the absence of gluten forming proteins being abundant in wheat.

Fat content
The data in the table 3 shows the values of fat content for the developed multi-millet noodles incorporated with sweet potato flour. The fat content for the control, T_1, T_2 and T_3 samples are 3.50, 2.78, 2.39 and 1.82 respectively.
The results showed that the fat content in the formulated noodles is decreasing from the control to the T_3 sample. The fat is less for the T_3 sample. It may be due to the high protein content of sweet potato flour which is hindering the absorption of fat content during preparation of multi millet noodles with incorporation of sweet potato flour.

Crude fiber
The data in the table 3 shows the values of crude fiber content for the developed multi-millet noodles incorporated with sweet potato flour. The crude fiber content for the control, T_1, T_2 and T_3 samples are 7.26, 11.03, 4.51, and 4.41 respectively.
The results showed that the crude fiber content for the formulated noodles has gradually increasing from the control to the T_1 sample. Crude fiber content is less for the T_3 sample.

Ash content

The data in the table 3 shows the values of ash content for the developed multi-millet noodles incorporated with sweet potato flour. The ash content for the control, T_1, T_2 and T_3 samples are 1.02, 1.37, 1.58 and 1.66 respectively.

The results showed that the ash content for formulated noodles is gradually increasing from the control sample to T_3 sample.

Vitamin – A content

The data in the table 3 shows the values of ash content for the developed multi-millet noodles incorporated with sweet potato flour. The ash content for the control, T_1, T_2 and T_3 samples are 0, 1.79, 2.46, and 2.99 respectively.

The results showed that the vitamin- A content for the formulated noodles is not detected for the control sample. It may be due to the absence of sweet potato flour in the sample. But from the T_1 to T_3 sample there is a gradual increase in the vitamin-A content due to the incorporation of sweet potato flour.

Table 4: Sensory analysis for the formulated multi-millet noodles incorporated with sweet potato flour

Attributes	Control	T_1	T_2	T_3
Colour	7.8	7.4	6.45	5.9
Taste	6.25	7.25	6.5	5.65
Flavour	6.45	7.35	6.5	5.5
Appearance	7.45	7.15	6.3	5.5
Texture	6.68	6.65	6.0	5.2
Over all acceptability	6.97	7.25	6.04	5.15

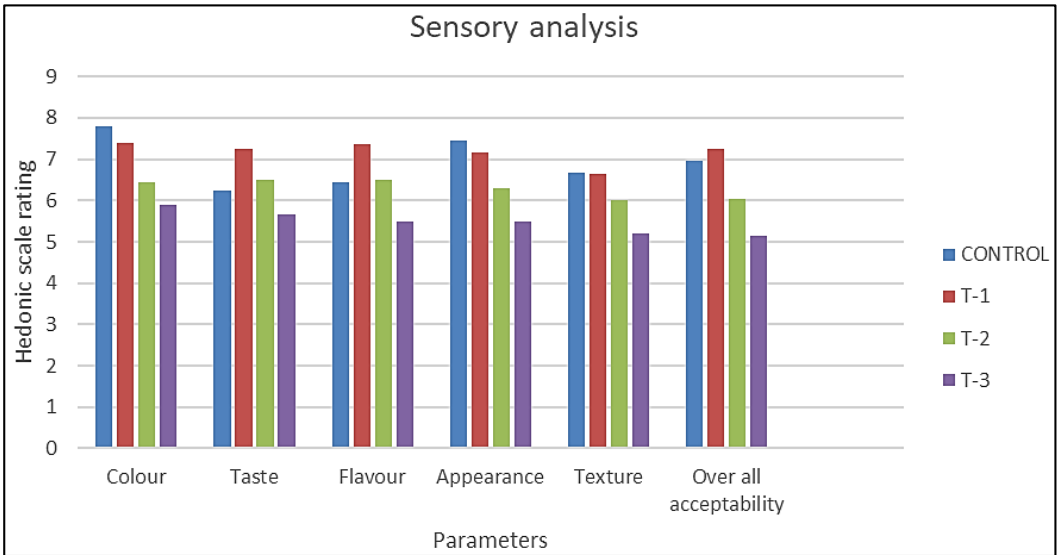

Fig 2: Graph showing the sensory analysis of formulated noodles

Colour

The sensory score obtained for control, T_1, T_2 and T_3 samples are 7.8, 7.4, 6.4, and 5.9 respectively. The colour acceptability for the control is more because it contains only wheat flour where as in T_1, T_2 and T_3 addition of millets and sweet potato flour lowered colour acceptability of the noodles.

Taste

The sensory obtained for control, T_1, T_2 and T_3 samples are 6.2, 7.2, 6.5, and 5.6 respectively. The taste acceptability for the T_1 sample is more because it contains only 5 % of sweet potato flour.

Flavour

The sensory obtained for control, T_1, T_2 and T_3 samples are 6.4, 7.3, 6.5, and 5.5 respectively. The flavour is more for the T_1 sample.

Appearance

The sensory obtained for control, T_1, T_2 and T_3 samples are 7.4, 7.1, 6.3, and 5.5 respectively. The appearance is more for the T_1sample.

Texture

The sensory obtained for control, T_1, T_2 and T_3 samples are 6.68, 6.65, 6.0, and 5.20 respectively. The texture is more for the T_1sample.

Overall acceptability

From the sensory analysis it is conclude that the overall acceptability is more for the T_1sample. Based on nutritional composition T_3 sample is more acceptable.

Conclusion

This study reports the effects of various levels of sweet potato flour and wheat flour on the quality of noodles with good acceptable, textural, eating and cooking quality. Four samples of multi-millet noodles incorporated with sweet potato flour were processed incorporating 0, 5, 10 and 15% levels respectively and were analyzed for physical, chemical and organoleptic characteristics. On the basis of composition and sensory attributes of the multi-millet noodles incorporated with sweet potato flour, it may be concluded that good quality of the multi-millet noodles can be processed incorporating 15% sweet potato flour. The results could encourage the application of non-conventional flours for the development of variety and value-added noodles with enhanced level of nutrients. This multi-millet noodles incorporated with sweet potato flour may find widespread by many health conscious people in the society.

References

1. AOAC. Official Methods of Analysis, 17th Edition. Association of Official Analytical Chemists, Gaithess Berg, MD 2000.

2. Arun Kulamarva G, Venkatesh Sosle R, Vijaya Raghavan GS. Nutritional and Rheological Properties of Sorghum. International Journal of Food Properties 2009;12:55-69.
3. Baljeet S Yadava, Ritika B Yadava, Manisha Kumarib, Bhupender S, Khatkarc. Studies on suitability of wheat flour blends with sweet potato, colocasia and water chestnut flours for noodle making. LWT - Food Science and Technology 2014, 57.
4. Balmeet Singh Gill, Narpinder Singh, Saxena SK. The Impact of Starch Properties on Noodle Making Properties of Indian Wheat Flours. International Journal of food properties 2014;7(1):59-74.
5. Emily Frederick Trappey, Hanna Khouryieh, Fadi Aramouni, Thomas Herald. Effect of sorghum flour composition and particle size on quality properties of gluten-free bread. Food Science and Technology International 2014;0(0):1-15.
6. Himabindu P, Devanna N, Development of nutrient rich noodles by supplementation with malted Kodo millet flour. International Journal of Advancements in Research & Technology 2015;4(12).
7. Ho Minh Thao, Athapol Noomhorm. Physiochemical Properties of Sweet Potato and Mung Bean Starch and Their Blends for Noodle Production. Thao and Noomhorm J Food Processing Technology 2011;2:1.
8. Huayin Pu, Jianling Wei, Le Wang, Junrong Huang, Xuefeng Chen, Cangxue Luo *et al.* Effects of potato/wheat flours ratio on mixing properties of dough and quality of noodles. Journal of Cereal Science 2017.
9. Liman Liu, Thomas J Heraldb, Donghai Wanga, Jeff D Wilsonb, Scott R Beanb, Fadi MA. Characterization of sorghum grain and evaluation of sorghum flour in a Chinese egg noodle system. Journal of cereal science 2012, 55.
10. Pragya Pandey, Usha Malagi, Nirmala Yenagi, Pushpa Dhami. Evaluation of Physico-Functional, Cooking and Textural Quality Characteristics of Foxtail Millet (Setariaitalica) based Vermicelli. Int. J. Curr. Microbiol. App. Sci 2017;6(10):1323-1335.
11. Renjusha Menon G, Padmaja AN, Jyothi V Asha, Sajeev MS. Gluten-free starch noodles from sweet potato with reduced starch digestibility and enhanced protein content. Journal of Food Science and Technology 2016;53(9):3532-3542.
12. Suman Verma, Sarita Srivastava, Neha Tiwari. Comparative study on nutritional and sensory quality of barnyard and foxtail millet food products with traditional rice products. J Food Science Technology 2015;52(8):5147-5155.
13. Taneya MLJ, Biswas MMH, Shams-Ud-Din M. Studies on the preparation of instant noodles from wheat flour supplementing with sweet potato flour. J. Bangladesh Agril. Univ 2014;12(1):135-142.
14. Tcherena Amorim, Caroline Dario, Katiuchia Pereira, Tania Aparecida, Pinto de Castro. Physical, chemical and sensory properties of gluten-free kibbeh formulated with millet flour (*Pennisetum glaucum* (L.) R. Br.). Food Science and Technology 2015;35(2):361-367.
15. Thilagavathi T, Kanchana S, Banumathi P, Hemalatha G, Vanniarajan C, Sundar M *et al*. Physico-chemical and Functional Characteristics of Selected Millets and Pulses. Indian Journal of Science and Technology 2015;8(S7):147-155.
16. Thilagavathi, Kanchana S, Banumathi P, Ilamaran M. Standardization of Extruded products using modified millet flour and pulse flour. International Journal of food and nutritional sciences 2015, 4.
17. Vittal Kamble G, Bhuvaneshwari SL, Jagadeesh, Vasant M, Ganiger, Deepa Terdal. Development and Evaluation of Cooking Properties of Instant Noodles Incorporated with Drumstick Leaf Powder and Defatted Soybean flour Int. J. Curr. Microbiol. App. Sci 2018;7(2):3642-3651.