ORIGINAL RESEARCH PAPER

Volume - 10 | Issue - 02 | February - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

DEVELOPMENT OF NOODLES SUPPLEMENTED WITH PEARL MILLET FLOUR

Engineering

Deshmukh A. S*
Ph.D Scholar, Department Of Food Process Engineering, Vaugh Institute Of Engineering & Technology, SHUATS Prayagraj 211007.*Corresponding Author

Parmar A.
Ph.D Scholar, Department Of Food Process Engineering, Vaugh Institute Of Engineering & Technology, SHUATS Prayagraj 211007.

ABSTRACT

The aim of this work was to optimize the formulations for wheat-based noodles incorporated with pearl millet flour and guar gum. A blend of wheat and pearl millet flour (90:10) with guar gum (2%) was extruded. Incorporation of pearl millet flour and guar gum resulted in nutritionally rich noodles as compared to control due to increased cooking yield and sensory attributes pearl millet incorporation improved the textural attributes i.e., increased firmness and caused significant cooking loss. Based on the nutritional, textural and sensory acceptability, guar gum and pearl millet incorporated noodles was most acceptable. The effect of storage time was not significant on noodle quality parameters, indicating that noodles was acceptable up to 1-2 months stored in polyethylene bags without any preservative under ambient conditions.

KEYWORDS

noodles, pearl millet, guar gum

INTRODUCTION

Noodles in various contents, formulations, and shapes have been the staple foods for many Asian countries since ancient time. They can be made from wheat, rice, buckwheat, and starches derived from potato, sweet potato, and pulses. Noodles based on wheat are prepared mainly from three basic ingredients; flour, water, and salt (**Fu, 2007**). Noodle qualities are defined by visual attributes of the uncooked and cooked noodles. The noodles should remain firm and not sticky after cooking. Excellent starch noodles are expected to have transparent threads with high tensile strength and less cooking loss even with prolonged cooking (**Collado *et al*, 2001; Purwani *et al*, 2006**).

Asian noodles are made from common wheat (*Triticum aestivum*) flour. Depending on the final product and its intended pH, the formulation will also include water in which is dissolved either or both table-salt or alkaline salts. The most commonly used alkaline salts are sodium and potassium carbonates. After mixing, the relatively dry crumbly dough is compressed by passing it through steel rollers to make a crude sheet. Dough sheets are then gradually reduced to the desired thickness by further rolling before being cut into strips (**Miskelly *et al,* 1996**).

Millets are a group of small seeded species of cereal crops or grains belonging to the family Gramineae and widely grown around the world for food and fodder. The most widely cultivated species in order of worldwide production are pearl millet (*Pennisetum glaucum*), Foxtail millet (*Setaria italica*), Proso millet (*Panicum miliaceum*) and Finger millet (*Eleusine coracana*) (**Crawford and Lee, 2003**). The most important characteristic of millet is their unique ability to tolerate and survive under adverse condition of continuous or intermittent drought as compared to most other cereals like maize and sorghum (**LCRI, 1997**).

Millets are principally food sources in arid and semi-arid regions of the world (**Ikwelle *et al*, 1993**).Pearl millet as the most important cereal in the southern Sudan and the northern guinea. The grain serve as food for the majority of people of Africa who utilize it in the form of porridge produced from flour called '*tuwo*', refreshing drink '*kunu*', dessert '*dan wake*' and palp '*ogi*', millet beer in Cameroon , millet flour called '*Bajari*' in western India *Nkama* (**LCRI, 1997**).

Pearl Millet is indigenous minor millet used in the preparation of geriatric, infant food and health foods both in natural and malted forms. It is usually used for preparation of flour, pudding, porridge and roti (**Chaturvedi and Srivastava, 2008**).

For the last decades, the demand for nutritional and health standards has increased considerably. This has been characterized by rising cost and often decreasing the availability of raw material with the changes in scenario of utilization of processed products and awareness of the consumers about the health benefits. Pearl millet has gained importance because of its chemical composition and the nutritional content. Wheat flour is extensively used in preparation of breakfast foods, noodles, rotti because of its tensile strength and elasticity. Food grade gaur gum is used for emulsifier, thickener and stabilizer. That is why there is great potential for utilization of wheat, pearl millet, gaur gum in products development for the benefit of society.

METHODOLOGY

Procurement Raw materials

Wheat flour

Wheat flour obtained from local market of Allahabad the flour was creamy white colored and free bean fragment. The wheat flour was basic structural component of dough product.

Pearl millet flour

Pearl millet flour of good quality was purchased from local market of Allahabad. Pearl millet flour was grey colored and it was key ingredient in product.

Guar gum

Guar gum was purchased from local market of Allahabad. This was used as emulsifier, stabilizer and it has ability of hydrate rapidly in water at low concentration and helps in better sheet formation.

Baking powder

Baking purchased from local market of Allahabad. This was used as leavening agent. Baking power is combination of sodium bicarbonate and an acid salt when moisture heating, baking powder lightens the product and make easy digest.

Salt

Salt was purchased from local market Allahabad. Salt helps in increase gluten stability of dough it develop flavor and retain water.

Chemicals used

Fat test – Petroleum ether

Protein test – Mixed indicator- (bromo cresol and methyl red), 2% of boric acid (W/V), 0.001N Hcl, 30% NaoH (W/V), catalyst for digestion (silinium-dioxide, copper sulphate, potassium sulphate).

Formulation of noodles

The effect of variables as different levels of ingredients added in the noodle mix before the preparation of dough. Dough was prepared and fed to the extruder. The following table shows the different levels of ingredient in the noodles.

Table - formulations of noodles

SAMPLE	WHEAT FLOUR	PEARL MILLET	GUAR GUM	SALT	BAKING POWDER
T_1	100	0	0	2	1
T_2	100	5	0	2	1
T_3	100	10	0	2	1
T_4	100	15	0	2	1
T_5	100	0	1	2	1

T_6	100	5	1	2	1
T_7	100	10	1	2	1
T_8	100	15	1	2	1
T_9	100	0	2	2	1
T_{10}	100	5	2	2	1
T_{11}	100	10	2	2	1
T_{12}	100	15	2	2	1

Flow chart for preparation of noodles

Wheat flour
↓
Mixing pearl millet flour
↓
Add gaur gum
↓
Add salt
↓
Addition of hot water with baking powder
↓
Making dough
↓
Kneading
↓
Resting (for 10 min)
↓
Extrusion (by hand operated extruder)
↓
Drying (at 50ºc)
↓
Dried noodles

RESULT AND DISCUSSION

Optimal cooking time

The cooking quality of noodles was evaluated by the optimal cooking time, cooking loss, and texture of cooked noodles. **Yu-Chan Huang *et al* (2010).** Optimal cooking times for the examined noodles are reported in table 4.1. From this table it emerged that optimal cooking time of noodles was longer for prepared noodles using guar gum than control sample. The optimal cooking time increasing gradually with increasing levels of guar gum which can be seen in T1,T5,T9 That is 0%,1%, and 2% but in the other hand multiple different levels of pearl millet is not showing an significant difference in cooking time.

Optimal Cooking Time of Noodles

Sample	Cooking time(s)
T_1	421
T_2	447
T_3	432
T_4	429
T_5	463
T_6	432
T_7	423
T_8	444
T_9	485
T_{10}	492
T_{11}	483
T_{12}	479

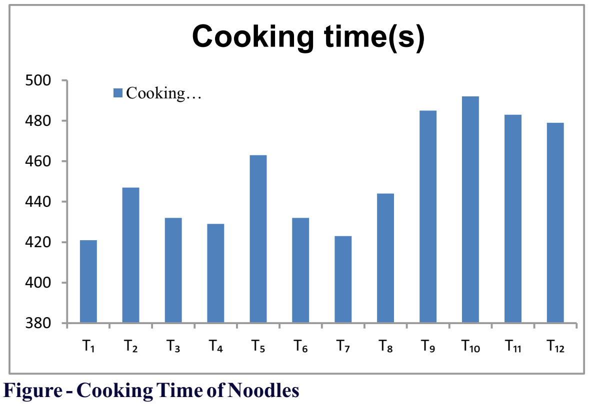

Figure - Cooking Time of Noodles

Optimal Cooking Time of Noodles

Cooking quality of noodles could be assessed by measuring the cooking yield. The cooking yield of the noodles ranged between 200-362% **Gan *et al* (2009)**.The obtained cooking yields are presented in table 4. Prepared noodles having variation in yields compare to (T_1) control sample 103.28% but the significant change occurs in (T_{11})112% at 10% pearl millet sample which were showing low yield in same level in (T_3) and (T_7). The only difference here in guar gum level were (T_{11}) is at 2% and other gradually at0% and 1%.

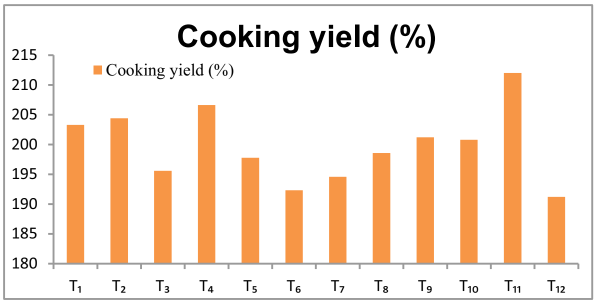

Figure - Cooking Yield of Noodles

Optimal Cooking Yield of Noodles

Sample	Cooking yield (%)
T_1	203.28
T_2	204.4
T_3	195.6
T_4	206.64
T_5	197.76
T_6	192.32
T_7	194.56
T_8	198.56
T_9	201.2
T_{10}	200.8
T_{11}	212
T_{12}	191.2

Optimal Cooking Loss of Noodles

Cooking loss defined as weight of total solids lost in the cooking water. the ratio of cooking loss is not significant as well as showing various readings in every test except for T7, T11 both are showing exact same result which has common ratio of pearl millet (90:10) but guar gum ratio is different gradually 1 per cent and 2 per cent The obtained cooking loss data from prepared noodles are below.

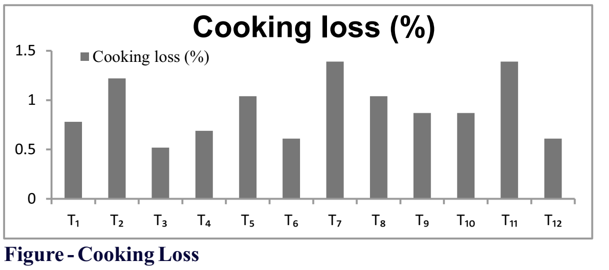

Figure - Cooking Loss

Table - Optimal Cooking Loss of Noodles

Sample	Cooking loss (%)
T_1	0.78
T_2	1.22
T_3	0.52
T_4	0.69
T_5	1.04
T_6	0.61
T_7	1.39
T_8	1.04
T_9	0.87
T_{10}	0.87
T_{11}	1.39
T_{12}	0.61

Sensory Evaluation of Noodles

Sensory analysis represents the unique tool for determination of organoleptic properties of food using human senses, because it is highly correlated with the consumers' attitude, **Mladenka *et al* (2012)**.Sensory evaluation was carried out with the help of team of trained people by using9 point hedonic scale on attributes like appearance, colour, taste, texture for the best sample determination. Pearl millet content of noodles have major impact in their appearance and colour were guar gum showing its relevance in texture i.e. 2% guar gum added sample having soft texture and good tensile strength.T11 sample shows higher overall acceptability in sensory evaluation as well as cooking properties of T11 are greater in terms of cooking yield.

Table - Sensory attributes

Sample	appearance	colour	taste	texture	Overall acceptability
T_1	7.5	7.75	6	7.25	7.12
T_2	8	8	6.75	7	7.43
T_3	7.25	7	7	6.75	7
T_4	7	6.25	6.75	7	6.75
T_5	7.5	6.75	7.5	6.5	7.1
T_6	6.75	7.25	7	7	7
T_7	7.5	7.25	7.25	7.25	7.31
T_8	7.25	7.25	5.75	6.25	6.62
T_9	7.25	7.75	7	5.75	6.93
T_{10}	7.25	7	7.25	7	7.12
T_{11}	8	7.25	8	8	7.81
T_{12}	6.25	6.25	7	7	6.62

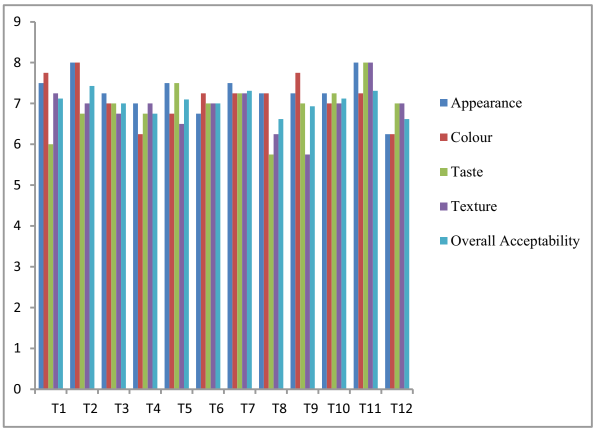

Figure - Sensory attributes

Chemical composition of prepared noodles

Chemical composition is measured of sample which is outcome of sensory evaluation i.e. beast sample (T11) which showing moisture content (8.2), ash content (2.2), fat content (1.43) and protein content (10.69) similar to **Yadav *et al,* 2014** shows similar chemical composition in exact proportion (90:10 wheat flour to pearl millet) in to their investigation of quality characteristics of vegetable-blended wheat–pearl millet composite Pasta.

Table -Chemical composition of prepared noodles

Sr. No	Content	(%)
1.	Moisture	8.2
2.	Ash	2.2
3.	Crude fat	1.43
4.	Crude protein	10.69

Figure - sampleT_1 (control)

Figure- sample T_{11}

SUMMARY AND CONCLUSION

The above research work shows that the increase in cooking properties of the pearl millet flour and guar gum incorporated noodles and also improve the physical and sensory attributes as increase in amount of guar gum and pearl millet flour during different treatment having 0%, 5%, 10% and 15% of pearl millet flour and guar gum having 0%, 1%, 2% in the noodles.

Among the various samples with the various concentration of guar gum in the above selected samples results showed that light brown colour is observed in all sample. Cooking time for preparation of the noodles was found to increase as the concentration of guar gum increases and longer time required for the sample T_{10} (492sec).. The cooking yield of noodle was found to be lowest for the control sample (203.28%) and increases with increase in guar gum level and highest for the sample T_{11} (212%). This study help us to determine that optimal cooking loss is not significant except T_7,T_{11} but both sample having different level of guar gum i.e. 1% and 2% which shows, guar gum does not affect the cooking loss, but pearl millet does affect the cooking loss i.e. both the sample T_7 and T_{11} has 10% pearl millet flour. Sensory evaluation of the guar gum incorporated samples shows that the sample T_{11} shows the highest reading for the appearance, colour, taste, texture and overall acceptability such as 8, 8, 8, 7.25 and 7.81 respectively as compared to the all other samples. Further major difference in texture was observed as there in increasing in the gaur gum as well as pearl millet flour concentration and acceptable level of guar gum was found up to the sample T_{11}(2%) and(10%) pearl millet having overall acceptability score 7.81.

CONCLUSION

Thus in the light of the scientific data of the present investigation, it is concluded that the noodles prepared with the incorporation of wheat flour, pearl millet flour and guar gum at different concentration levels, which were analysed for their physicochemical, cooking qualities and sensory acceptability Among those twelve Sample T_{11} was found to be more acceptable with respect to mentioned quality parameters. The present study showed that the incorporation of pearl millet flour and guar gum in noodles is techno-economically feasible and commercial exploitation can be done. In this way, a steady and consistent scientific ground may be attained in order to deliver a satisfactory product to the final consumer.

REFERENCES

1. **A.A.C.C. (1976).**Approved methods of the American Association of Cereal Chemists. St. Paul, MN.
2. **A.A.C.C. (2000).**Approved methods of the American Association of Cereal Chemists.10th edition, St. Paul, MN.
3. **A.O.A.C, (2005).**Official Methods of Analysis of AOAC International. Methods 920.39,934.01 and 996.11, eighteenth ed.. AOAC International, Gaithersburg, MD.
4. **A.O.A.C. (1990).** Official method of analysis of the association of official analytical chemist (15th edition), Washington D.C:992-995
5. **A.O.A.C. (2000)** Official methods of analysis of Association of Official Analytical Chemists International 7th ed. Gaithersburg, Method 991.3, Total Dietary Fibre, Enzymatic-Gravimetric Method.
6. **Anonymous (2001)** Market needs-tomato products, prepared food recipes for a prosperous future Sweden. *Journal of Food Science and Technology*, 21(44):45-49.
7. **Bhattacharya, M., Zee, S.Y. and Corke, H. (1999**). Physicochemical properties related to quality of rice noodles. Cereal Chem. 76: 861-867.
8. **Bin Xiao Fu. (2007).** Asian noodles: History, classification, raw materials, and processing Canadian International Grains Institute, *Food Research International,* 41 (2008) 888–902.
9. **Blouin, F.A., Zarins, Z.M. & Cherry, J.P. (1981**).Protein Functionality of Foods.J.P.Cherry, ed.Am.Chem.Soc.Symp.Ser.147.
10. **Chakraborty, M., Hareland, G.A., Manthey, F.A. & Berglund, L.R. (2003)**. Evaluating quality of yellow alkaline noodles made from mechanically abraded sprouted wheat. Journal.Sci. Food Agr. 83: 487-495.
11. **Chang, Y. H., Lin, C. L., & Chen, J. C. (2006).** Characteristics of mung bean starch isolated by using lactic acid fermentation solution as the steeping liquor. Food Chemistry, 99, 794e802.
12. **Chaturvedi, R. and Srivastava, S. (2008)** Genotype variations in physical, nutritional and sensory quality of popped grains of amber and dark genotypes of finger millet. *Journal. Food Science and Technology* 45: 443-446.
13. **Collado, L. S., Mabesa, L. B., Oates, C. G., &Corke, H. (2001)**. Bihon type noodles from heat moisture treated sweet potato starch. *Journal of Food Science,* 66, 604e60.
14. **Crawford, Gary W. and Gyoung-Ah Lee. (2003)**. Agricultural Origins in the Korean Peninsula, Antiquity 77 (295): 87-95
15. **Dexter, J.E., Kilborn, R.H., Morgan, B.C., Matsuo, R.R., (1983)**. Grain research laboratory compression tester: instrumental measurement of cooked spaghetti stickiness.Cereal Chemistry 60, 139–142.
16. **Doxastakis, G., M. Papageorgiou, D. Mandalou, M. Irakli, E. Papalamprou, A. D'Agostina, D. Resta, G. Boschin and A. Arnoldi. (2007)**. Technological properties and nonenzymatic browning of white lupin protein enriched spaghetti. *Food Chemistry* 101: 57-64.
17. **Dutta, S.K., Nema V.K.,** and **Bhardwaj R.K**. 1998.Physical properties of gram.*JournalAgric.Eng. Res*., 39: 259-268.
18. **Elizabeth F. and Glicksman M. (1967).**Hydrocolloids rheology in the formulation of convenience foods.*Journal of Food Technology,* 21: 535-538.
19. **Freeman, J.E. and Bocan, B.J. (1973).** Pearl millet: A potential crop for wet milling. *Cereal Science Today* 18: 69.
20. **Fu, B.X. (2007).** Asian noodles: History, classification, raw materials, and processing.

Food Research International.Canadian International Grains Institute.Winnipeg, Manitoba, Canada.

21. **Gan, C. Y. Ong, W. H., Wong, L. M. and Easa, A. M (2009).** Effects of ribose, microbial transglutaminase and soy protein isolate on physical properties and in vitro starch digestibility of yellow noodles. Lebensm.-Wiss. U.-Technol. 42: 174-179
22. **Glicksman (1965).** Importance of hydrophilic gum constituents in processed foods. *Journal of Food Technology, 23(44):* 942-947.
23. **Glicksman, M. (1969)**. Gum technology in the food industry. Academic Press, New York.
24. **Hutchings, J.B. (1999)**. Food Colour and Appearance. 2nd ed. Maryland: Aspen Publishers, Incorporated.
25. **Ikwelle, M. C., Lube, D. A. and Nwasike, C. C.** (1993). Millet production in Nigeria: Constraints and prospects. In: Proceedings of the regional pearl millet improv. *W/shop (O. Youm, and K. A. Kumar, (Eds). ISC, Niger.*
26. **Jaybhaye, R.V.**, **Pardeshi, I.L., Vengaiah, P.C. Srivastav, P.P. (2014)** Processing and Technology for Millet Based Food Products: A Review Journal of Ready to Eat Food | Vol 1 | Issue 2 | Pages 32-48