Impact of Different Levels of Guar Gum on Quality and Texture Profile (TAXT-2 Texture Analyser) of Noodles Fortified with Pearl Millet Flour

Dr. R. R Andhale[1]*, M. B Katkade[2], A. C Dagadkhair[1], R. A Dagadkhair[1] and A. A Jadhav[2]

1. MIT College of Food Technology, MIT Art Design and Technology University, Pune

2. Department of Food Chemistry and Nutrition, College of Food Technology, Vasantrao Naik Marathawada Krishi Vidyapeeth, Parbhani.

Abstract:

Noodles are made from unleavened dough that has been shaped into thin flat strips or round cylinders and cooked in a boiling liquid. In the present investigation noodles were prepared by using the wheat flour, pearl millet flour and impact of varying levels of guar gum as stabilizer and thickener on quality attributes of noodles were studied. The physical attributes such as colour, cooking yield, cooking loss and pH were determined. Further, the chemical parameters moisture, carbohydrate, protein, fat, ash and minerals content were analysed. Texture profile analysis of noodles incorporated with different levels of guar gum was also studied using TAXT2 plus the result revealed that the hardness was found to be decreased from 110.02 g to 105.98g and cohesiveness and gumminess were increased, slight difference was noted for the tensile strength where as the elasticity was found to be decreased with increasing the level of guar gum. Finally, it would be concluded that highly acceptable noodles can be prepared by using 87% wheat flour, 10% pearl millet, 2% salt, 1% baking powder and 2% level of guar gum (G_2).

Key Words: Noodles, Cooking loss, Cooking yield, Pearl millet, Texture Profile analysis.

INTRODUCTION

Asian noodles differ from the Italian pasta in raw materials and processing methods. Asian noodles are popular foods around the world, where in Asia nearly 50% of all wheat is consumed in noodle form various types of noodles are characterized by their distinct flavor, texture and quality. With the increasing awareness of the benefits of eating whole grains, the concept of noodles and whole grains has gained the attention in the food industry. Noodles are an important diet in many countries of eastern and south eastern Asia (Huo *et al.*, 1998).

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. (Bin, 2007).

Noodles 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).

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).

Guar (*Cyanopsis tetragonolobus*) seed is a major source of gums, a galactomannan, which has several industrial applications. The fraction remaining after the extraction of guar gum is a rich source of proteins (38-55%) and is used is animal and poultry rations. Gums are plant exudates and are often misunderstood with resins, rubbers and latex. So more specifically the gums are those substances which can be dissolved or dispersed in water to form more or less viscous colloidal solutions or dispersions. The guar gum is able to form a high viscous solution even at low concentration. Upon dispersion in water the galactose side chains attached to mannose back bone interact with water molecule leading to an inter-molecular chain entanglement of guar gum molecule in the aqueous phase, which leads to development of viscosity in the solution causing gelling or thickening (Doyle *et al.*, 2006).

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, roti because of its tensile strength and elasticity. In the view of the above importance of the wheat flour, pearl millet and guar gum the present investigation is carried out.

MATERIALS AND METHODS

Raw materials

Raw materials such as wheat, pearl millet flour, guar gum and packaging materials were collected from the local market.

Chemicals and equipment

Chemicals used in the present investigation were of analytical grade. All the chemicals were obtained from department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani.

Equipments and glass wares

The equipments were used like texture analyser (TA.XT2), oven, weighing balance and glass wares etc. were available in Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani.

Standardization of formulation of noodles with varying concentration of guar gum

Noodles were prepared in laboratory by adding wheat flour, pearl millet flour, salt and baking powder and varying concentration of guar gum. Formulations for the preparation of noodles are given in the following table1.

Table 1: Standardization of formulation of noodles

Sr. No	Ingredients	Quantity(g)			
		C	G_1	G_2	G_3
1	Wheat flour	87	87	87	87
2	Pearl millet flour	10	10	10	10
4	Salt	2	2	2	2
5	Baking Powder	1	1	1	1
6	Guar gum	0	1	2	3

Where, C =Control, G_1 = C+1% of guar gum, G_2= C+ 2% of guar gum and G_3= C+ 3% of guar gum.

Proximate composition

Chemical constituents like moisture, fat, protein, carbohydrate, ash and dietary fiber content and total energy were determined by using method given by AOAC (2005).

Cooking yield

Cooking yield was obtained based on the approved AACC method (AACC, 2003). The dry noodles strands (5.0g) were boiled in 75g of water for 10 min with agitation. The noodles strand were then rinsed and drained for 5 min average readings of three measures were taken for each type of noodle.

Cooking loss

Cooking loss was determined by using the method given by the AACC (2003).

Texture profile analysis of guar gum Noodles

TPA of cooked noodles was carried out using TAXT2plus texture analyser.

Test Measurements

Test mode	Measure force in compression
Test mode	compression
Pre-test speed	1.0 mm/sec
Test speed	2.0 mm/sec
Post-test speed	10.0 mm/sec
Target mode	Distance
Distance	10 mm
Trigger force	5g

Organoleptic evaluation

The organoleptic evaluation of guar gum incorporated noodles was carried out as per the method given by the Sung and Stone (2004).

Statistical analysis

The data obtained from various parameters were recorded and statistically analysed as per method of Panse and Sukhatme (1987).

RESULT AND DISCUSSION

Physical properties of noodles incorporated with the different levels of guar gum

Physical properties of the cooked noodles such as color, pH, cooking time, cooking loss and cooking yield were determined and the results pertaining to the physical properties depicted in the table 2.

Table 2: Physical properties of noodles incorporated with the different levels of guar gum

Sr. No.	Levels of guar gum	Physical properties				
		Colour	pH	Cooking time(Min)	Cooking loss (%)	Cooking yield (%)
1	C	Light brown	6.68	6.85	7.42	290
2	G_1	Light brown	7.01	7.10	7.46	368
3	G_2	Light brown	7.02	7.40	7.98	397
4	G_3	Dull brown	7.02	7.85	8.18	426

*Each value represents an average of three determinations

Form the above table 2 it can be revealed that color of the prepared noodles was found to be light brown and as the guar gum concentration increases the color turns to dull brown. pH of the all the sample was found to near neutral with slight variation in the reading.

Cooking time for preparation of the noodles was found to increase as the concentration of guar gum increased and longer time required for the sample G_3 (7.85min). As there was increase in the concentration of guar gum the coking loss increased slightly. The cooking yield of noodle was found to be lowest for the control sample (290%) and increases with increase in guar gum level and highest for the sample G_3(426%) it is due the increase in the concentration of the hydrocolloids. Similar results were presented by the Sewata and Masubon (2012).

Sensory evaluation of prepared noodles with addition of guar gum

Sensory evaluation of prepared noodle with different levels of guar gum was carried out by panel of semi-trained judges consisting of 10 members by using 9 point hedonic scale and results are summarized in the following table 3.

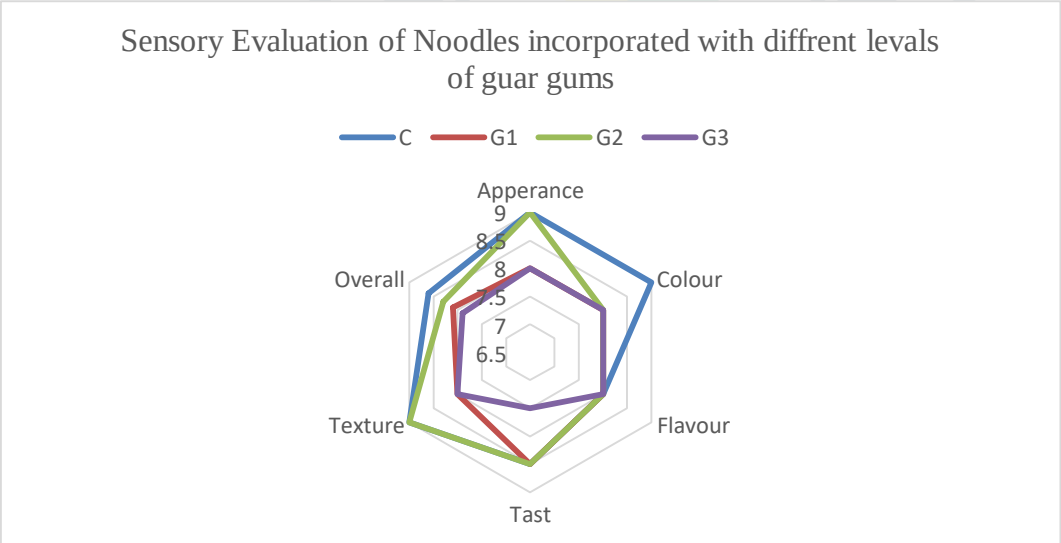
Table 3: Sensory evaluation of noodles incorporated with the different levels of guar gum

Sr. No.	Formulation	Sensory attributes					
		Appearance	Colour	Flavour	Taste	Texture	Overall acceptability
1	C	9	9	8	8.5	9	8.6
2	G_1	8	8	8	8.5	8	8.1
3	**G_2**	9	8	8	8.5	9	**8.3**
4	G_3	8	8	8	7.5	8	7.9
6	S.E±	0.045	0.064	0.036	0.028	0.032	0.120
7	CD at 5%	0.096	0.193	0.108	0.085	0.097	0.362

*Each value represents an average of ten determinations

It can be revealed from the above table 3 that the sensory evaluation scores given by the trained panelist shows that the sample G_2 recorded the highest sensory score for the appearance, color, flavor, taste texture and overall acceptability such as 9, 8, 8, 8.5, 9 and 8.3 respectively, as compared to all other samples. As there was increase in the concentration of guar gum no large difference in the scores given by the trained panelist only slight variations in appearance, colour, flavour and taste was observed. Further major difference in texture was observed as there was increasing in the gaur gum concentration but acceptable level of guar gum was found up to the sample G_2 (2%) having overall acceptability score 8.3. Furthermore concentration of guar gum affects on textural properties of the noodles samples.

Graph 1: Sensory evaluation of noodles incorporated with the different levels of guar gum



Texture profile analysis of noodles incorporated with different levels of guar gum

Texture profile analysis (TPA) of cooked noodles having different levels of guar gum was determined with a TA-XT 2 plus texture analyser. Textural properties such as hardness, adhesiveness,

springiness, cohesiveness, chewiness, stickiness and tensile strength were determined. Results obtained are summarized in the following table 4.

Table 4: Texture profile analysis of noodles incorporated with different levels of guar gum

Texture profile analysis					
samples	**Hardness(g)**	**cohesiveness**	**Gumminess(g)**	**Tensile Strength (KPa)**	**Elasticity (KPa)**
C	110.02	0.77	84.71	28.38	11.92
G_1	108.11	0.80	86.48	27.08	10.85
G_2	106.42	0.82	87.26	27.25	9.64
G_3	105.98	0.85	90.08	27.46	8.18

*Each value represents an average of three determinations

Hardness

Hardness is the most commonly evaluated characteristic in determining the texture of noodles. The change in hardness due to addition of different concentration of guar gum is presented in Table-4. The hardness of control Sample C (110.02g) was found highest compared to other samples. This represents that addition of guar gum reduces the hardness of noodles. Highest hardness of sample G_1 (108.11 g) may be due to lower concentration of guar gum content (1%). Similar results were also reported by Chin *et al.*,(2012).

Cohesiveness

Cohesiveness is the ratio of area under the second bite curve before reversal compression to that under the first bite curve. In terms of cohesiveness, G_3 sample of noodle showed superior results with highest cohesiveness among all other noodles samples. As the concentration of the guar gum increased the cohesiveness increases. Similar results are in accordance with Nura *et al.*, (2011).

Gumminess

Gumminess is related to primary parameters of hardness and cohesiveness and is obtained by multiplication of these two parameters. Among all sample, Control sample C (84.71g) shown the lowest reading for the gumminess, while as the concentration of the guar gum increased the gumminess was also increased and found to be highest in case of sample G_3 (90.08g). Similar results were presented by Seung *et al.,(*2006).

Tensile strength

Tensile strength represents the consumption quality of noodles, and it also corresponds to elasticity and tenacity for the strain of noodles. Tensile strength of the prepared noodles goes on decreasing with increase in the concentration of the guar gum. The highest value of tensile strength was found for control sample (28.38Kpa) followed by the sample G_1 (27.08 Kpa). Similar results for the tensile strength were represented by Foo *et al.*,(2011).

Elasticity

Elasticity is defined as the ability of deformed noodles to return to its initial shape and size when the force creating the deformation is removed. Elasticity of the prepared noodles goes on decreasing with increase in the concentration of the guar gum. The highest value of elasticity was found for control sample (11.92Kpa) followed by the sample G_1 (10.85 Kpa). Further it was found

that the lowest value was reported for the sample G_3 (8.18 Kpa). Similar results in accordance with the results of Rachel *et al.*,(2014).

CONCLUSION

It is concluded from the result of the present finding that the highly acceptable noodles can be prepared by using 87% wheat flour, 10% pearl millet, 2% salt, 1 % baking powder and 2% level of guar gum (G_2).

REFERENCES

A.A.C.C. (2003). Approved methods of the American Association of Cereal Chemists. 10th edition, St. Paul, MN.

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.

Bin Xiao Fu. (2007). Asian noodles: History, classification, raw materials, and processing Canadian International Grains Institute, *Food Research International*, 41 (2008) 888–902.

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

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, 604e609.

Doyle J,P., Giannouli P, Martin EJ, Brooks M and Morris ER. (2006). Effect of Sugars, galactose content and chain length on freeze-thaw gelation of gallactomannan. *Carbohydrate Polymer*; 64: 391-401.

Foo, W. T., Yew, H. S., Liong, M. T. and Azhar, M. E. (2011). Influence of formulations on textural, mechanical and structural breakdown properties of cooked yellow alkaline noodles. *International Food Research Journal* 18(4): 1295-1301.

Huo, G., Kruk, M., Petrusich, J. and Colletto K. (1998). Relationships between flour properties and Chinese instant fried noodle quality for selected US wheat flours and Chinese commercial noodle flours (in Chinese). J. Chinese Cereal and Oil Assoc. (Beijing) 12:

Nura, M., Kharidah, M., Jamilah, B. and Roselina, K. (2011). Textural properties of laksa noodle as affected by rice flour particle size. *International Food Research Journal* 18(4): 1309-1312.

Panse V.G. and Sukhatme P.V. (1987). Statistical methods for agricultural workers *ICAR pub*., Edn. New Delhi.

Rachel thomas, t.k. yeoh, w.a. wan-nadiah & rajeev bhat. (2014).Quality Evaluation of Flat Rice Noodles (*Kway Teow*) Prepared from Bario and Basmati Rice. *Sains Malaysiana* 43(3)(2014): 339–347.

Seung-young lee,Jong-yea kim,Su-Jin Lee and Seung Taike Lim.(2006).Textural improvement of sweet potato starch noodles prepared without freezing using gums and other starches. Food *Science Biotechnol*,vol.no.6,pp.986-989.

Sewata Jarnsuwan and Masubon Thongngam. (2012). Effects of hydrocolloids on microstructure and textural characteristics of instant noodles. *Journal foodAg-Ind*.2012,5(6),458-492.

Sung, W. C., & Stone, M. (2004). Characterization of legume starches and their noodle quality. *Journal of Marine Science and Technology*, 12, 25-32