© 2018 IJSRST | Volume 4 | Issue 7 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Development and Quality Evaluation of Noodles Prepared From Wheat Flour Supplemented with Tamarind Kernel Powder

Shailaja Ananthu *[1], Jyoti Kiran Singh[2]

*[1]M Tech, Food Technology, College of Technology, Osmania University, Telangana, India

[2]Assistant Professor, Department of Food Technology, College of Technology, Osmania University, Telanagana, India

ABSTRACT

The study was conducted with the aim of increasing protein content of the noodles and utilizing the underutilized more nutritious tamarind kernel powder. Formulations were prepared by keeping semolina constant at (50%) and added whole wheat flour and tamarind kernel powder in the ratios (50%:0%, 40%:10%, 30%:20, 20%:30%) respectively. These were extruded using single screw extruder. These were assessed for their sensory properties, nutritional composition and shelf life studies. the formulation S2 (10% tamarind kernel powder) containing 13.69% protein,2.25% fat, 1.97% crude fiber, 2.95% minerals,66.05mg/100g of calcium,143.98mg/100g of potassium was found to be the most accepted. The sensory evaluation results showed that noodles prepared with 10% tamarind kernel powder perceived as the most accepted product.

Keywords: Tamarind Kernel Powder, Noodles, Wheat Flour, Semolina

I. INTRODUCTION

In the present world, the biggest challenge for the food industry is to develop the health promoting food. The future of the food products ultimately regards how it affects the consumer health and the raw materials that will deliver such health benefits. Today's lifestyle of individual is becoming more hectic, and people have very less time in preparing meals, this eventually affecting the rise in interest towards snacking patterns. Noodles are a staple food in many cultures made from unleavened dough which is stretched, extruded, or rolled flat and cut into one of a variety of shapes. While long, thin strips may be the most common, many varieties of noodles are cut into waves, helices, tubes, strings, or shells, or folded over, or cut into other shapes. Instant noodles are currently consumed and enjoyed worldwide due to convenience, ease of cooking, widely acceptable taste, flavor as well as affordable prices. When pasta is eaten with other healthy ingredients, like olive oil, spinach, or chicken, the Glycemic Index of the complete pasta meal is even lower. Those looking for an even bigger nutrient punch can choose whole grain pasta, which provides more fiber and protein, along with many essential vitamins and minerals. Tamarindus indica is an abundantly grown plant in Asian countries. Its seed is an abundant and cheaply available by-product of tamarind pulp industry. Tamarind is a multipurpose tree species; almost every part of it finds some use. The fruit contains about 55% pulp, 34% seed, and 11% shell. The fruit is pendulous, the pods are oblong or sausage shaped, curved or straight, with rounded ends. The shell is light greenish or scruffy brown and minutely scaly, often irregularly constricted between seeds, brittle, and easily broken, if pressed. Tamarind seed consists of the seed coat or testa (20-30%) and the kernel or endosperm (70-75%). Seed portion in tamarind is about 40% of the total weight. It is rich in protein; containing high amount of many essential amino acids, like isoleucine, leucine, lysine, methionine, phenylalanine, valine. In addition to this, seeds are also good source of essential fatty acids, minerals particularly calcium, phosphorous and potassium which is relatively high compared to other legumes. The seeds of Tamarind are reported to possess pharmacological activities such as ant diabetic and hypoglycemic, antioxidant, anti-ulcer, anti-venom, hepatoprotective, antibacterial, inhibition of nitric oxide production and serine proteinase inhibitor. Fruits and leaves of Tamarind are reported with antiasthamtic, hepatoprotective and antimicrobial activities. Tamarind seed protein has a very favorable amino acid balance; hence it could be used not only to complement cereals but also to supplement legumes with lower methionine and cysteine content. Wheat has been a leading cereal crop for many centuries and continues to provide staple foods for consumers across many countries around the world. This partly reflects the versatility of wheat flour as a food ingredient. Wheat based products are a major food source worldwide, with the crop taking over more land area for its cultivation than any other.

II. MATERIALS AND METHODS

A. **Raw materials collection:** The raw materials wheat flour (Triticum aestivum), semolina, tamarind (Tamarindus indica) kernel powder were procured from local market. Flours were sieved to remove chaff, other grains and stones.

B. noodles formulation and preparation

Ingredients were cleaned and weighed according to the proportions

⬇

Keeping the extruder in kneading mode

⬇

Flour is fed in to the extruder

⬇

Kneading the flour and adding adequate amount of water (150ml)

⬇

Keeping the extruder in extrusion mode

⬇

Extrusion

⬇

Collecting the product in trays

⬇

Drying the product in hot air oven (at 60^0Cfor 50mints)

⬇

Product cooled at room temperature

⬇

Cutting

⬇

Packing

Figure 1. Flow chart of noodles preparation

Table 1. Formulation

Ingredients	S1	S2	S3	S4
Semolina	50	50	50	50
Wheat flour	50	40	30	20
Tamarind kernel powder	-	10	20	30

C. ANALYTICAL METHODS FOR EXPERIMENTAL SAMPLES

1. **Determination of moisture content:** Weigh accurately about 5 grams of sample in a previously dried and tare moisture dish. Place the dish in the hot air oven maintained at 105°C temperature and dry at least for 2 hours. Cool in a desiccator and weigh. Repeat the process of heating, cooling, and weighing until the difference between the two consecutive readings doesn't exceed 2mg. Record the lowest weight.

$$\text{Moisture (\%)} = \frac{(w1-w1)-(w3-w2)}{(w2-w1)} x100$$

Where,

W1 = Initial weight of petri dish (g)

W2 = Weight of the petri dish with sample before drying (g)
W3 = Weight of the petri dish with sample after drying (g)

2. Determination of ash value: The ash value is mainly due to potassium and phosphorous and the composition of it. One gram of the samples was weighed accurately into a porcelain crucible. This was transferred into a muffle furnace set at 55°C and left for about 4hours. About this time it had turned into white ash. The crucible and its content were cooled to about 100°C in air then to room temperature in desiccators and weighed (AOAC 1984).

$$\% \text{ Ash content} = \frac{\text{weight of Ash}}{\text{Original weight of sample}} \text{x}100$$

3 .Determination of crude fiber: Determine separately the sample moisture by heating in an oven at 105°C to constant weight. Cool in a desiccator. Weight accurately 1 g about of grinded sample (1 mm about) approximately with 1 mg. ==> W1. Add 1.25% sulfuric acid up to the 150 ml notch, after preheating by the hot plate in order to reduce the time required for boiling. Add 3-5 drops of n-octanol as antifoam agent. Boil 30 minutes exactly from the onset of boiling. Connect to vacuum for draining sulfuric acid. Wash three times with 30 ml (crucible filled up to the top) of hot deionized water, connecting each time to compressed air for stirring the content of crucible. After draining the last wash, add 150 ml of preheated potassium hydroxide (KOH) 1.25% and 3-5 drops of antifoam. Boil 30 minutes.

Filter and wash Perform a last washing with cold deionized water aimed to cool the crucibles and then wash three times the crucible content with 25 ml of acetone, stirring each time by compressed air. Remove the crucibles and determine the dry weight after drying in an oven at 105°C for an hour or up to constant weight. Let cool in a desiccator. This weight (W2) represents the crude fiber plus ash content in comparison to initial weight.

Crude fiber% = (W2-W1)/W*100

Where

W (g) =weight of the sample

W1 (g) = crude fiber plus dried content

W2 (g) = crude fiber plus ash content after heating at 600°C

4. Determination of protein: Protein in the sample was determined by Micro-Kjeldahl distillation method (AOAC 1990) [4]. The samples were digested by heating with concentrated sulphuric acid (H_2SO4) in the presence of digestion mixture, Potassium sulphate (K_2SO4) and copper sulphate (CuSO4). The mixture was then made alkaline with 40 % NaOH. Ammonium sulphate thus formed, released ammonia which was collected in 4% boric acid solution and titrated against standard HCl. The percent nitrogen content of the sample was calculated the formula given below. Total protein was calculated by multiplying the amount of percent nitrogen with appropriate factor (6.25).

$$\%\text{Nitrogen} = \frac{1.4 \text{ X } (\text{mL HCl} - \text{mL blank}) \text{ X Conc.of HCl}}{\text{Weight of sample (g)}}$$

% Protein = % N X Factor (6.25)

5. Determination of fat: Fat was estimated by soxtherm method .Take an empty thimble (container) weight. Weigh 5 grams of sample into a dry thimble. Difference in weight gives sample weight. Weight the empty soxtherm flask with boiling stone. Keep the thimble in soxtherm extractor. Pour the solvent (150 ml of hexane) into the soxtherm flask. Fix the soxtherm flask in soxtherm extraction apparatus with a reflux condenser. Keep the total arrangement of process for at least 4 hours. After 4 hours, take out the solvent from hexane and thimble from extraction apparatus. Keep the soxhlet flask in the hot air oven for 10 minutes to evaporate the solvent and cool it in a desiccator. Then weigh the flask with extracted fat.

% Fat content = 100 × (W3–W2) / (W1–W)

Where,

W - Weight in grams of empty thimble
W1 - Weight in grams of thimble with sample
W2 - Weight in grams of empty soxtherm flask
W3 - Weight in grams of soxtherm flask with extracted fat

6. Determination of carbohydrates: Total CHO (g/100g dry weight) = 100- (g moisture + g protein + g crude fiber + g ash + g fat)

7. Determination of calcium: For the determination of minerals viz., calcium, phosphorous and iron acid soluble ash was used (AOAC, 2000). Ash obtained from 5 g of sample was boiled with 25 ml of 10 per cent hydrochloric acid for 30 min and filtered through an ash less filter paper (Whatman No. 42), washed with hot water until washings were acid free. The filtrate was made up to a 100 ml and retained for the estimation of calcium, phosphorous and iron. Calcium content in samples was determined by AACC (1976) procedure. Thirty ml of ash solution (obtained above), 25 ml of distilled water and 10 ml of saturated ammonium oxalate were taken in a beaker. To this, 2 drops of methyl red indicator were added and the pH of the contents was adjusted to 5.0 using dilute ammonia (1:1) and dilutes acetic acid (1:4) solution. The contents were boiled and left at room temperature for overnight. Next day, the contents were filtered through whatman No. 42 filter paper. The residue thus obtained was washed with hot distilled water until it became oxalate free. The filter paper was broken by a pointed glass rod and washed with 10 ml of hot dilute sulphuric acid (1:4) followed by distilled water. The contents were heated to 80°C and titrated against 0.01 N potassium permanganate to a stable pink color. Finally, the filter paper was also dropped in the solution and titration was completed. Calcium content was calculated as follows:

$$\text{Calcium} = \frac{\text{Titre value} \times \text{N of KMnO4} \times 20 \times \text{vol.of ash sol}}{\text{ml of ash sol} \times \text{wt of sample taken for estimation}} \times 100$$

8. Cooking quality: Optimal cooking time was evaluated by observing the time of disappearance of the core of the noodle strand during cooking (every 20 sec) by squeezing the noodles between two transparent glass slides. Cooking yield and cooking loss of the noodles were determined as described in the AACC (American Association of Cereal Chemists, 2000) method. Ten grams of the noodles were added to a beaker containing about 150 ml boiling water. The beaker was covered with a watch glass and noodles cooked for 10 min with slight agitation. The cooked noodles were allowed to drain for 5 min and then weighed. The cooking yield was then calculated. The gruel was poured into a 200 ml volumetric flask and adjusted to volume with distilled water. Ten milliliter of the solution was pipetted into an aluminum dish and dried to a constant weight at 105^{0}C.

The cooking loss during cooking was calculated as given below.

Cooking yield (g) = Weight of Noodles after cooking (g) –Weight before cooking (g)

$$\text{Cooking loss (\%)} = \frac{\text{Weight of gruel and dish} - \text{weight after drying} \times 100}{\text{weight after drying}}$$

10. Sensory Evaluation: All dried noodle samples were prepared for sensory evaluation. The samples were boiled using water for the optimum cooking time. cooked noodles with masala mix were evaluated for appearance, flavor, taste, texture and overall acceptability of the samples by 10 untrained panelists using nine-point hedonic scales, where 9 = extremely like and 1 = extremely dislike. The optimal ratio of tamarind kernel flour in the noodles was investigated using sensory qualities in comparison to the control noodles.

III. RESULTS AND DISCUSSION

A. NUTRITIONAL ANALYSIS OF EXTRUDED SAMPLES

Table 2. Nutritional composition of different extruded samples with added tamarind kernel powder

Nutrients	S1	S2	S3	S4
Moisture(g/100g)	8.268	8.445	8.577	8.618
Protein(g/100g)	12.732	13.691	14.481	15.263
Fat(g/100g)	1.914	2.253	2.514	2.682
crude fiber(g/100g)	1.683	1.974	2.256	2.584
Minerals(g/100g)	2.812	2.957	3.204	3.293
Carbohydrates(g/100g)	72.598	70.485	68.925	67.568
Calcium(mg/100g)	59.952	66.056	72.102	77.841
Potassium(mg/100g)	140.402	143.988	148.158	152.876

1.Protein content: Protein plays an important part in the body building.it consist of amino acids which are beneficial for the daily body functioning. In this study of extruded samples, the protein content is in the range of 12.732-15.263g/100g respectively.in these extruded products, it is observed that there is an increase in protein content gradually with the increase in proportion of tamarind kernel powder.

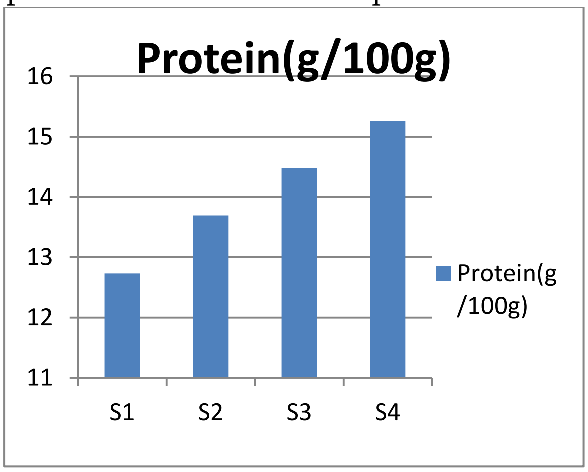

Figure 2. Protein

2. Fat content: One strategy frequently used for weight reduction is to eat foods low in caloric density. biologically due to high percentage of carbons in fats; they are stored nutrients with the highest energy or calorific value of food constituents. The fat content of the extruded sample is in the range of 1.914-g/100g.the fat content slightly has been slightly increased with the added tamarind kernel powder.

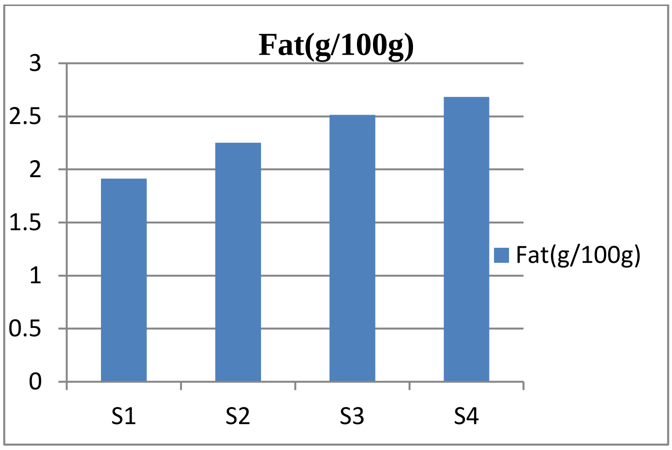

Fig 3. fat

3. Crude fiber: It gives bulk to the diet, consisting largely of cellulose followed by hemicellulose, pentosans and nitrogenous substances. Fiber helps to maintain the health of gastrointestinal track, but in excess it may carry away some trace elements without absorption. The crude fiber content of the extruded sample is in the range of 1.683-2.584g/100g.

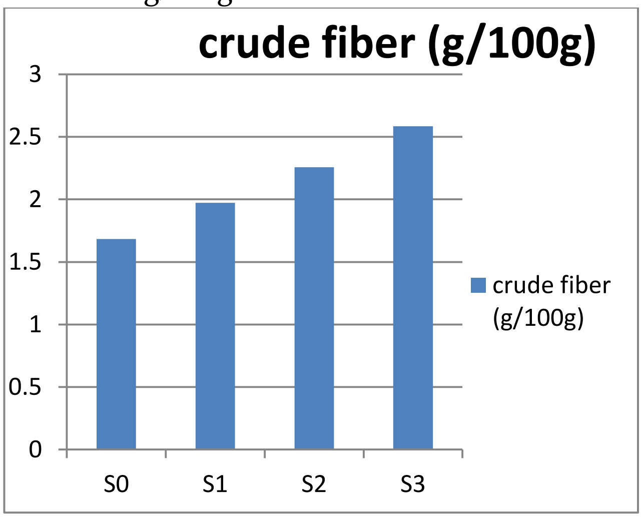

Fig 4: Crude fiber

4.Mineral content: The ash value refers to the inorganic residue that remains after burning of the organic matter in a food sample this residue arises from the mineral matter in the sample and it exist in the organically bound form or in the inorganic form. The ash obtained helps in determination of individual minerals the ash value of extruded samples in the range of 2.812-3.293g/100g.

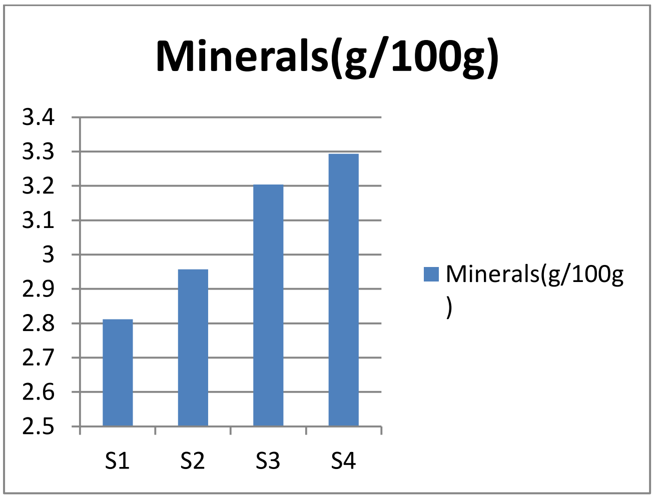

Figure 5. Minerals

5. Carbohydrate content: Carbohydrates provide major source of energy in the human diet.in the extruded product the carbohydrate content in the range of 72.598-67.568g/100g.

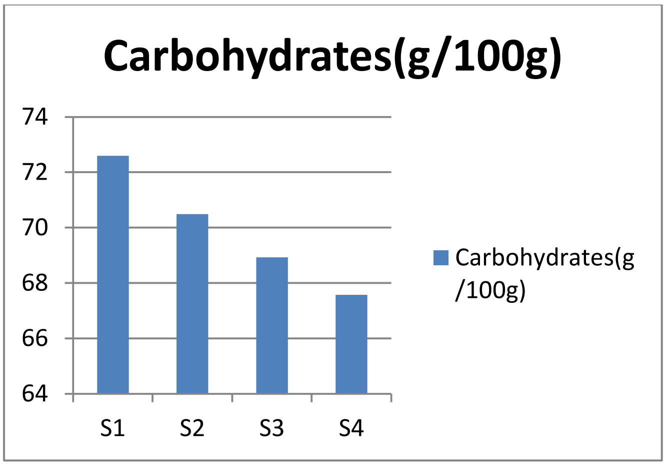

Figure 6. Carbohydrates

6. Calcium content: Calcium is abundant mineral in our body. In bones calcium occurs as calcium phosphates within a soft fibrous, organic matrix. Calcium deficiency in children leads to rickets, while in adults it may result in osteomalacia. The calcium content in the extruded sample is in the range of 59.952-77.84g/100g

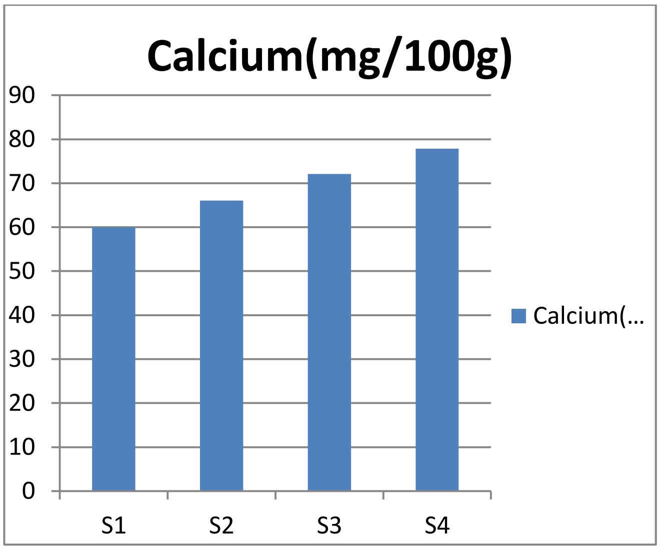

Fig 7. Calcium

7 .Potassium content: Potassium is very important in the human body. Along with sodium, it regulates the water balance and the acid-base balance in the blood and tissues. Potassium enters the cell more readily than sodium and instigates the brief sodium-potassium exchange across the cell membranes. In the nerve cells, this sodium-potassium flux generates the electrical potential that aids the conduction of nerve impulses. there is an increase in the potassium content with the increase in the tamarind kernel powder

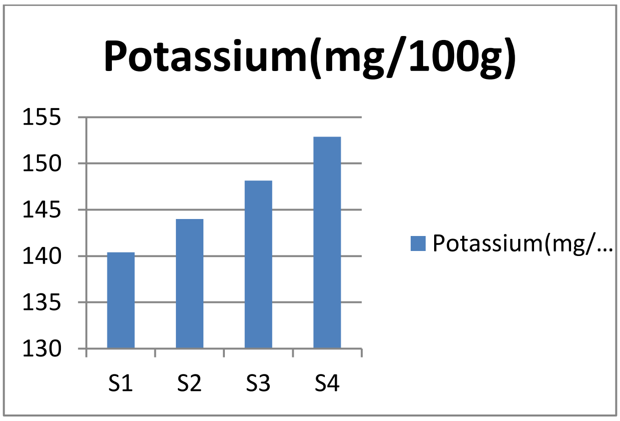

Figure 8. Potassium

8. Moisture content: Moisture content is an important factor that determines the product shelf life. The moisture content of the product is in the range of 8.268-8.618g/100g.it is an important aspect in the determination of shelf life which ii the main requirement for the survival of microorganisms.

Table 3. moisture content of different samples

Samples	Moisture content (%)
S1	8.268
S2	8.445
S3	8.572
S4	8.618

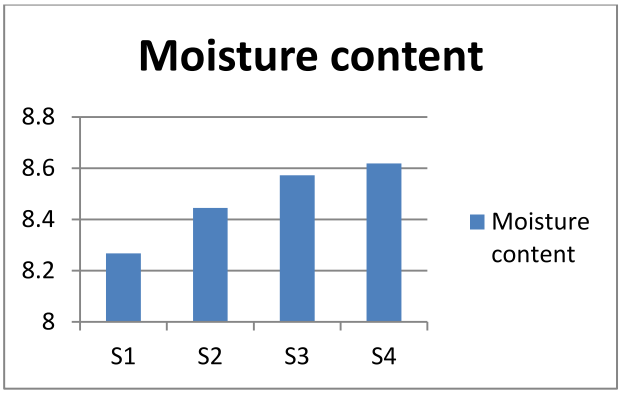

Figure 9. Moisture

10. Cooking quality: cooking loss decreased with the increase in the tamarind kernel powder which has more protein content than the wheat. Protein in the food is not soluble in the water .time for the cooking of noodles increased with the increase in tamarind kernel powder. Cooking of Protein takes more time than carbohydrates.

Table 4. cooking quality of different samples

Samples	Cooking time(mints)	Cooking yield(g)	Cooking loss (%)
S1	13.02	153	9.41
S2	13.35	161	9.24
S3	14.20	173	8.97
S4	14.50	179	8.75

11. Sensory evaluation: S2 (10% tamarind kernel incorporated) as the most accepted product as compared with the other S1, S3, S4 formulations. Nutty flavor developed in the product with the incorporation of tamarind kernel powder. Flavor of the extruded products decreased with the increase in tamarind kernel powder. Noodles were consumed with different masala mix, formulation S2 was most accepted by the panelist.

Table 5. sensory evaluation of different samples

samples	Color	Flavor	taste	Appearance	texture	Overall acceptability
S1	8.1±0.4830	8.2±0.6245	8.1±0.6666	8.2±0.7378	8.3±0.8755	7.9±0.5674
S2	8.3±1.7378	8.1±0.7378	8.3.±1.2292	8.3±0.9944	8.6±1.2292	8.2±0.9189
S3	8.3±0.9718	7.8±0.7888	7.6±1.0593	8.5±1.1352	8.1±0.6749	7.1±1.1972
S4	8.5±0.988	7.3±0.8164	7.1±0.8164	7.6±0.4216	7.4±1.0593	6.9±1.1973

IV. CONCLUSION

In this study, ready to eat noodles were developed with an aim of high protein content. Tamarind kernels are rich in protein content. These proteins have a favorable amino acid composition and could supplement cereals and legumes poor in methionine and cysteine. Hence, they can be used as a cheaper source of protein to alleviate protein malnutrition, which is widespread in many developing countries. Besides a good source of protein and fatty acids, they are rich in some essential minerals, such as Ca, P, Mg and K. the Noodles were prepared from locally available raw materials such as whole wheat flour, semolina, tamarind kernel powder. The quantity of tamarind kernel powder added was increased to improve the protein content of the product. The proximate analysis of the noodlesS1, S2, S3, S4 obtained values in the range of12.73-15.26% protein, 1.91-2.68% of fat, 1.68-2.57% of crude fiber, 72.59-67.56%of carbohydrates, 2.81-3.29% of minerals,59.96-77.84mg/100g of calcium,140.4-152.87g/100g of potassium. The moisture content was being increased maximum 9.62% but was still in the range of less than 10% as per FSSAI. Sensory evaluation results showed that the S2 (10% tamarind kernel incorporated) as the most accepted product as compared with the other S1, S3, S4 formulation. On increasing the incorporation of tamarind kernel powder, cooking time increased and the cooking loss decreased. The noodles were tried with various flavors and forms to improve its palatability. Shelf life studies of the extruded samples showed changes in various factors which include increase in the moisture content, decrease in protein, and fat, crude fiber in a period of storage from 0 to 180 days in polyethylene stored at room temperature. After a storage period of 150 days there seemed to be development of slight off flavor due to the rancidity of fats.so, recommended storage life for the noodles S1, S2, S3, and S4 is 150 days i.e. 5 months when stored at room temperature in polyethylene.

V. REFERENCES

[1]. Ahmed, M.F.U. and Rahman, S.M.L. (2004) Profile and use of multi-species tree crops in the homesteads of Gazipur District, Central Bangladesh. Journal of Sustainable Agriculture, 24(1):81-93.

[2]. Ali, M.S., Ahmad, V.U. and Usmanghani, A.K. (1998) Chemotropism and antimicrobial activity of Tamarindus indica. Fitoterapia, LXIX(1): 43-46.

[3]. Allen, O.N. and Allen, E.K. (1936) Plants of the sub family Caesalpiniodeae observed to be lacking nodules. Soil Science, 42(2): 87-91.

[4]. Bhattacharya, P.K. (1974) A note on the presence of anthocyanin pigment in the stem of red fruited variety of tamarind. Indian Forester, 100(4): 255-258.

[5]. Bhattacharya, P.K., Bal, S. and Mukherji, R.K. (1994) Studies on the characteristics of some products from tamarind (Tamarindus indica L.) kernels. Journal of Food Science and Technology (India), 31(5): 372-376.

[6]. Bhatta, R., Krishnamoorthy, U. and Mohammed, F. (2001) Effect of tamarind (Tamarindus indica) seed husk tannins on in vitro rumen fermentation. Animal Feed Science and Technology, 90(3/4): 143-152.

[7]. Bhattacharya, P.K. (1974) A note on the presence of anthocyanin pigment in the stem of red fruited variety of tamarind. Indian Forester, 100(4): 255-258.

[8]. Baik, B. K., Czuchajowska, Z., & Pomeranz, Y. (1995). Discoloration of dough for oriental noodles. Cereal Chemistry, 72(2), 198-205.

[9]. BAILEY, L. N., HAUCK, B. W., SEVATSON, E. S. and SINGER, R. E. (1995) Ready-to-eat breakfast cereal production.In: A. Turner (ed.) Food Technology International Europe, Sterling Publications International, London,pp. 127-132

[10]. GUY, R. (1993) Creating texture and flavour in extruded products. In: A. Turner (ed.) Food Technology International Europe. Sterling Publications International, London, pp. 57-60.

[11]. Reid J. S. G., Edwards, M. E., Dea, I. C. M., Enzymatic modification of matural seed gum. In “Gums and Stabilisers for the food Industry 6”, Edited by Phillips, G. O.,Williams, P. A., Wedlock, D. J., IRL Press, Oxford, 1988, 6,391-98.

[12]. Rama Rao M ,Flowering plants of Travancore ,Bishen singh, Mahendra Pal singh,

Dehradun,India,reprint,484 40. Benthall AP. Dehradun: Thacker Spink

[13]. Raina, C. S., Singh, S., Bawa, A. S., & Saxena, D. C. (2005). Textural characteristics of Pasta made from rice flour supplemented with proteins and hydrocolloids. Journal of Texture Studies, 36, 402-420.

[14]. Sone Y, Sato K., Measurement of oligosaccharides derived from Tamarind xyloglucan by competitive ELISA assay. Biosci Biotechnol Biochem,. 1994;58:2295-6.

[15]. Shankaracharya, N., Tamarind-Chemistry; Technology and Uses -a critical appraisal; Journal of Food Technology, 2008; 35(3), 193-208.