A Study on Formulation Optimization of Pasta Supplemented with Aloe Vera Gel

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Abstract: *Pasta is a popular food and its quality can be measured by appearance, flavour and texture. Present study was undertaken to evaluate the quality of pasta supplemented with different quantities of aloe vera. In the present study four samples (C, C1, C2, and C3) of pasta were prepared by using refined wheat flour and different proportion of aloe vera gel. Sample C was prepared as control containing only refined wheat flour (100%) while sample C1 (refined wheat flour 99% aloe vera gel 1%), C2 (refined wheat flour 97% aloe vera gel 3%) and C3 (refined wheat flour 95% aloe vera gel 5%) were prepared by changing the concentration of refined wheat flour and aloe vera gel. All the four samples were evaluated for the physicochemical properties (ash, texture and viscosity analysis), nutritional properties (carbohydrate, protein, fat, and fiber), cooking time and sensory quality. On the basis of results sample C2 (refined wheat flour 97% aloe vera gel 3%) was found to be better in quality having more nutritional element and higher overall acceptability.*
Keywords: *Aloe vera, pasta, supplementation, nutrition.*

I.   Introduction

Pasta is a staple food conventionally made from refined wheat flour and semolina using water. Physical properties of good quality pasta are characterized by strength, elasticity, minimum cooking loss, less stickiness and reasonable firmness after cooking [1, 2]. Traditionally good quality pasta was prepared from durum wheat semolina flour due to its high gluten content. Wheat gluten is composed of glutenin and gliadin, these proteins together have excellent binding properties and are capable of firm and elastic network with starch and water during dough formation [3]. Pasta products are widely accepted by the children and elderly, but the major problem is that they are not accepted as a healthy food due to low nutrients and dietary fibres. The product can be made more healthy and acceptable by the incorporation of some ingredients such as aloe vera gel having more nutraceutical compounds.

Aloe vera (Aloe barbadensis) is a perennial plant of the Liliaceae family with pretentious green leaves. Parenchymal cells present in leaves contain a transparent, colorless mucilaginous semisolid gel like material which is referred to as aloe vera gel [4]. Major bioactive components of aloe vera include chromones, anthraquinones, polysaccharides, and enzymes. The anthraquinones and chromones present in aloe play a key role in the prevention of cancer and inflammation [5]. Aloe vera gel has a rich amount of lipids, proteins, amino acids, enzymes, vitamins, inorganic compounds, small organic compounds, carbohydrates and major elements like Al, B, Ba, Ca, Fe, Mg, Na, P, Si etc [6-8].

Aloe vera gel has become a unique component due to its medicinal and nutritious properties and their wide application in the food industry. Aloe vera gel is used as a flavouring agent and preservative in some foods. It is also used in many food products including milk, ice cream, confectionery etc. Different food products like aloe juice, health drink, aloe dessert are prepared from aloe vera gel [9].

The aim of the present study was the formulation and optimization of pasta supplemented with aloe vera gel. Fortification of pasta with aloe vera gel could lead the incorporation of nutritious properties of the aloe vera gel in the pasta to be more nutritious and acceptable.

II.   Materials And Methods

2.1. Procurement of raw materials

Aloe vera (Aloe barbadensis Miller) gel and refined wheat flour (Triticum aestivum) were procured from an authorized dealer of Jhansi, Uttar Pradesh, India.

2.2. Evaluation of physicochemical properties of raw materials

Protein content was determined as per (IS: 7219:1973): kjeldhal method, protein content was obtained by using the conversion factor of 6.25, crude fiber was determined by (IS: 11062) and carbohydrate content by difference method, ash and fat content were determined according to AOAC 2000 methods [10].

2.3. Sample preparation

Four Samples (C, C1, C2, and C3) were prepared using sample C as control containing only refined wheat flour (100%), while sample C1-C3 were prepared using different concentration of refined wheat flour and aloe vera gel. Proximate composition and concentration of different raw materials taken in the preparation of control (C) and other samples (C1-C3) is shown in Table 1. All the samples were passed separately through sieve no. 10 thrice to improve the mixing. Prepared samples were stored in an air tight polyethylene bag in cool and dry place for further study.

Table 1 - Composition of different samples prepared with refined wheat flour and aloe vera gel

Ingredients	Sample			
	C	C1	C2	C3
Refined wheat flour (g)	1000	990	970	950
Aloe vera gel (g)	-	10	30	50

2.4. Pasta Preparation

Different samples of pasta (C-C3) were prepared using different concentrations of refined wheat flour and aloe vera gel in the ratio of 100:00; 99:01; 97:03, 95:05 respectively. In each case, an amount of 1000 g of the respective composition was taken for the preparation of pasta. Refined wheat flour and aloe vera gel were mixed with optimum amount of water in the mixing chamber of pasta extruder (Le Monferrina Masoreo Arturo and C.S.N.C., Italy) for 10 minute to distribute the water uniformly. The moist flour aggregate was extruded through pasta extruder fitted with an adjustable die. The speed of revolving sharp blade cutter in the front of the die was adjusted so that the length of the pasta finished at 2 cm for each sample. Drying of final pasta sample was carried out in hot air oven at 75ºC for 3 h [11]. The dried product was packed in polyethylene. The main objective of the drying was to reduce the moisture content of the sample to about 8-10%. Final dried products of various samples were packed in high density polyethylene bags. The resultant dried products were then used for further study such as cooking time, chemical composition, viscosity, texture and sensory analysis.

2.5. Evaluation and optimization of developed pasta samples

The developed pasta products were analyzed for their different quality parameters. The cooking quality of samples was determined by the minimum cooking time as per AACC 2000 [12]. Rapid visco analyzer (RVA) was used to determine the pasting properties of raw material of pasta products. The texture analysis was carried out with the help of stable micro system texture analyzer TA-XT2i. It was used in cutting mode to record to require force to break pasta sample. Sensory evaluation was carried out as per 9 point hedonic scale with the degree of liking: 1 = extremely dislike, to 9 = extremely like. Each pasta sample were cooked separately in a stainless steel pan, in the each case, 100 g pasta sample was taken and cooked in 500 ml of water. The pasta was added in to the boiling water and was boiled for the time already determined. Boiled pasta was then drained, fried in a pre standardized method by using oil, mustard, onion and tomato with salt and used for sensory evaluation. A ten member panel of panelists evaluated the cooked samples of pasta and marked their observations in the sensory card. Each of the samples was randomly numbered using a three-digit code. Pasta was evaluated for color, texture, aroma, taste and overall acceptability.

2.6. Statistical analysis

The results are expressed as Mean ± SD (standard deviation). The statistical significance was analyzed using One-way Analysis of Variance (ANOVA) followed by Dunnett Multiple Comparisons Test by employing statistical software, GraphPad, InStat 3. Differences between groups were considered significant at $P < 0.05$ level.

III.   Result and Discussion

3.1. Evaluation of chemical composition of raw material

The composition of the raw material is depicted in Table 2.

Table 2. Chemical composition of raw materials

Raw materials	Carbohydrate	Protein	Fat	Fiber	Ash
Refine Wheat Flour	74.67±0.03	10.70±0.11	1.21±0.09	0.50±0.16	3.62±0.04
Aloe vera Gel	17.70±0.01	5.05±0.13	0.30±0.02	2.42±0.03	1.29±0.01

Note: All value are represented as Mean ± SD (standard deviation) n=6.

3.2. Nutritional composition of prepared pasta samples

The protein content of C, C1, C2 and C3 pasta samples were found to be 9.73, 9.58, 9.41, and 9.25 respectively. Fortification of pasta with different level of aloe vera gel slightly decreases the carbohydrate, protein, fat and ash content of the final products. While fiber content of prepared aloe vera gel pasta increases in

comparison to control pasta, the result agreed with other researchers [13, 14]. The nutritional composition of prepared pasta samples is shown in Table 3.

Table 3 Nutritional composition of prepared pasta samples

Sample	Carbohydrate	Protein	Fat	Fiber	Ash
C	74.00±0.61	9.73±0.24	1.15±0.02	0.48±0.01	3.54±0.06
C1	74.00±0.57	9.58±0.91	1.16±0.04	0.53±0.06	3.40±0.10
C2	73.16±0.47	9.41±0.91	1.11±0.06	0.53±0.03	3.09±0.05
C3	73.00±0.44	9.25±0.61	1.07±0.03	0.56±0.07	2.98±0.09

Note: All value are represented as Mean ± S.E.M. (standard error mean), n=6; data were analyzed by one-way ANOVA (Analysis of variance) employing Dunnett Multiple Comparisons Test using GraphPad, InStat 3 software. Where C= Control sample, C1= 1% aloe vera gel sample, C2= 3% aloe vera sample, C3= 5% aloe vera gel sample.

3.3. Cooking time

Cooking time of pasta sample was significantly decreased as compare to the control sample, in each case 50g of each sample was taken and cooked separately for the evaluation of cooking time. The result is shown in Table 4.

Table 4 Cooking time of prepared pasta sample

Sample	Cooking Time (Minute)
C	5.50±0.03
C1	5.12±0.16[*]
C2	4.74±0.08[*]
C3	4.36±0.11[*]

Note: All value are represented as Mean ± S.E.M. (standard error mean), n=6; data were analyzed by one-way ANOVA (Analysis of variance) employing Dunnett Multiple Comparisons Test using GraphPad, InStat 3 software, [*]$P<0.01$.

3.4. Rapid Visco Analyzer (RVA)

Rapid visco analyzer (RVA) was used to determine the pasting properties of raw material of pasta products. The peak viscosity (maximum viscosity of the sample during the heating and holding phase of the procedure) as well as the final viscosity (viscosity reading at the end of the test profile) was recorded for all samples. Sample is cooked at 95ºC then cooled to 65ºC, and its viscosity measured, using a RVA. The paste temperature of 65ºC is used to rapidly stabilize viscosity and minimize retro gradation.

Table 5 - Viscosity values of different samples

Samples	Peak viscosity	Hold viscosity	Final viscosity
C	2846±4.45	1965±2.96	3548±1.52
C1	2838±3.47	1843±2.24[*]	3382±1.37[*]
C2	2761±2.67*	1763±2.25[*]	3322±1.66[*]
C3	2186±0.76*	1376±3.38[*]	2696±1.00[*]

Note: All value are represented as Mean ± S.E.M. (standard error mean), n=6; data were analyzed by one-way ANOVA (Analysis of variance) employing Dunnett Multiple Comparisons Test using GraphPad, InStat 3 software, [*]$P<0.01$.
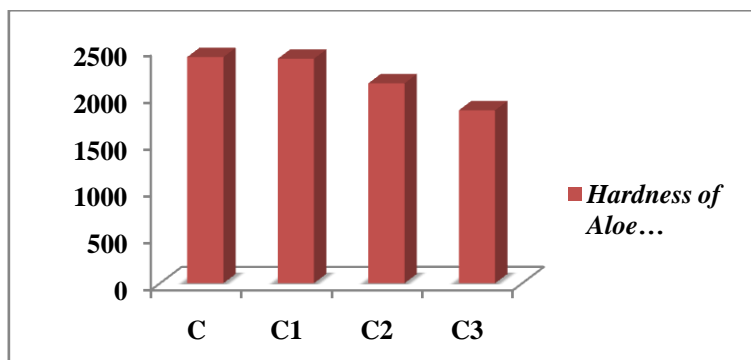
3.5. Texture analysis

The texture of the samples was analyzed and it was found that the force (in g) required was decreasing to cut the pasta sample with increasing amount of aloe vera. The results of the analysis are presented in the table No 6. The cutting force of C, C1, C2 and C3 were 2410.12±0.40, 2392.00±1.07, 2129.90±1.60, 1843.00±0.87, respectively. The increase in the percentage of aloe vera is resulting in the softer texture of the product.

Table 6. Cutting force (g) of the pasta samples

Samples	Aloe vera gel pasta cutting force
C	2410.12±0.40
C1	2392.00±1.07[*]
C2	2129.90±1.60[*]
C3	1843.00±0.87[*]

Note: All value are represented as Mean ± S.E.M. (standard error mean), n=6; data were analyzed by one-way ANOVA (Analysis of variance) employing Dunnett Multiple Comparisons Test using GraphPad, InStat 3 software, [*]$P<0.01$.

Fig 1. Texture analysis of aloe vera gel pasta

3.6. Sensory characteristics

Sensory evaluation of the products was carried out by using 9 point hedonic scale sensory test. The colour score of C, C1, C2 and C3 samples was 7.16±0.04, 6.53±0.03, 7.28±0.07, 6.60±0.07, respectively. It was observed that the color of C2 was found best among all samples. The flavor score of C, C1, C2 and C3 samples was 7.83±0.03, 6.48±0.07, 7.30±0.07, 6.15±0.03, respectively. The score of C2 was found best in sensory evaluation. The texture, taste and overall acceptability score of C2 was 7.41±0.09, 7.03±0.04, and 7.22±0.41, respectively. There was improvement in colour and texture of the product. The taste might have some change with increasing concentration of aloe vera. The product with 3 percent aloe vera was found better in comparison to other combinations.
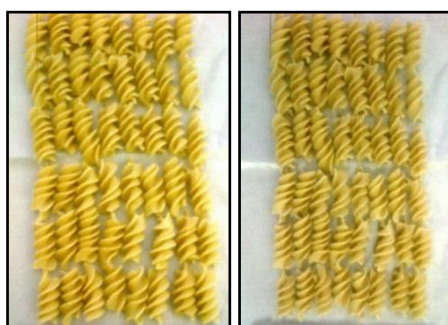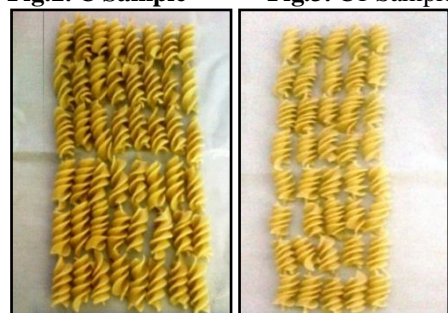

Fig.2. C Sample

Fig.3. C1 Sample

Fig.4. C2 Sample

Fig.5. C3 Sample

Table 6. Sensory scores of prepared pasta samples

Sample	Sensory Parameters				
	Color	Flavor	Texture	Taste	Overall acceptability
C	7.16±0.04	7.83±0.03	7.66±0.06	7.13±0.07	7.42±0.38
C1	6.53±0.03[*]	6.48±0.07[*]	6.56±0.08[*]	6.36±0.08[*]	6.42±0.28[*]
C2	7.28±0.07[**]	7.30±0.07[*]	7.41±0.09[**]	7.03±0.04[**]	7.22±0.41[**]
C3	6.60±0.07[*]	6.15±0.03[*]	5.91±0.07[*]	5.73±0.04[*]	6.10±0.37[*]

Note: All value are represented as Mean ± S.E.M. (standard error mean), n=6; data were analyzed by one-way ANOVA (Analysis of variance) employing Dunnett Multiple Comparisons Test using GraphPad, InStat 3 software, [*]$P<0.01$, [**]$P<0.05$.

It was observed that with the addition of aloe vera gel for making pasta, cooking time of Aloe pasta consistently decrease because aloe vera is having mucilaginous characteristics. Therefore the texture of pasta

showing consistently decreasing hardness as the aloe vera was giving smoothness to the product. RVA (Rapid Visco Analyzer) measure pasting properties of the flour, high peak viscosity C2 sample with compare to the control (C), it's preferred to the pasta production due to gives better texture of pasta. Over all on the basis of, physic-chemical, nutritional, cooking time, viscosity (pasting properties), and sensory quality of pasta certain sample C2 resulted in better quality having high overall acceptability.

IV.   Conclusion

Aloe Vera gel increased the fiber content of the pasta fortification decreased the cooking time, and increased the softness of pasta more than the control sample. Fortified pasta was highly acceptable with respect to sensory attribute and cooking time. On the basis of physic-chemical and nutritional properties, cooking time analysis of viscosity and sensory qualities pasta certain 97% refine wheat flour and 3% Aloe Vera gel (sample C2) resulted in better quality having more and high overall acceptability. Its carbohydrates are extremely beneficial for health conscious people due to it are containing more medicinal benefits. Aloe Vera gel prevents different diseases (diabetes, asthma, arthritis and heart diseases etc.). If we include Aloe Vera pasta in daily life style, it's prevent many diseases and delays the aging process and notice attractive youth appearance. Aloe Vera pasta can also be used as a nutritious food for low income peoples including patients those are suffering with different life style diseases.

Acknowledgements

Conflict Of Interest

The authors declare no conflict of interest.

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