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Studies on Preparation of Banana Smoothie by using Acid Modified Psyllium Husk

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ABSTRACT: In the present study efforts were made for preparing smoothie using acid modified psyllium husk. The prepared smoothie was analyzed for physiochemical, proximate, sensorial and microbial parameters. Smoothie was prepared with 400 ml of milk, 400 gm apple pulp, 80 gm sugar, 70 ml water and 50 ml honey. Acid modification of psyllium husk was done using HCL in ethanol as solvent. Acid modified psyllium husk of 0.75% HCL of ratio 1:6 in ethanol solvent had better functional properties, hence it was used in smoothie samples at different percentages of 0.4, 0.6 and 0.8. Blending of ingredients was done until fine mixture of smoothie was obtained and was stored at 2-10°C before addition of psyllium husk. Organoleptic evaluation of the smoothie with acid modified psyllium husk was performed and the results showed that 0.6% psyllium husk of 0.75% HCL in 1:6 ethanol solvent had maximum score among all the samples as per the hedonicscale.

Keywords: Psyllium husk, Acid Modified, Banana Smoothie, Isabgol, Fruit Smoothie.

INTRODUCTION

The husk is the seed's outermost skin, which is removed mechanically. From the seed, about 25 to 26 percent of the husk is recovered. In normal and traditional storage circumstances, the shelf life of psyllium husk is only 6 months. On a dry weight basis, the husk makes up about 10% to 25% of the seed. *P. ovata* is a 119- to 130-daycrop that thrives in chilly, dry conditions. In India, *P. ovata* is mostly grown as a "Rabi," or post–rainy season crop, in North Gujarat (October to March). Average temperatures are in the range of 15–30°C (59–86°F) during this season, which follows the monsoons, and moisture is scarce (Verma and Mogra 2013).

The amazing feature of mucilage from seed husk as a thickening, the seed husk finds a variety of applications in the food industry; it might be utilized as such in food businesses. It's used as a base stabilizer in ice creams, as well as a component in chocolates and other foods. Psyllium can be used as a fiber substitute, thickener, and binder in the food and beverage industry, such as in health drinks, beverages, ice cream, bread, biscuits, and other bakery products, rice, cakes, jams, instant noodles, and breakfast cereals, to achieve better fiber content of food products and to increase the bulkiness of the food products with various health benefits.

Psyllium Husk can also be added to fresh fruit drinks or flavored drinks to increase the mouth feel, richness, and consistency of the beverage. Psyllium is used in the food and beverage industries to improve softness and body texture, as well as to give strength as a binder and stabilizer (Chan *et al.,* 1988). Psyllium is a laxative that forms a bulk. It works by enlarging the feces and relieving constipation. It begins by attaching to partially digested food as it passes from the stomach and into the small intestine. It then aids in the absorption of water, resulting in larger and moist stools. The ultimate result is larger, easier-to-pass stools that aid in the relief of constipation. It can thicken stools and make them take longer to move through the colon. Psyllium can assist to regular bowel motions by preventing constipation and reducing diarrhea (Washington *et al.,* 1998).

Prebiotics are non-digestible substances that nourish and aid the growth of intestinal flora. Intestinal bacteria can ferment a tiny amount of psyllium fibers, despite the fact that psyllium is fairly resistant to fermentation. Short-chain fatty acids (SCFA), such as butyrate, can be produced via this fermentation. Psyllium does not induce gas or stomach pain because it ferments more slowly than other fibers (Jalanka, *et al.,* 2019). Fiber of any kind is beneficial to the heart. Dietary fiber lowers the risk of heart disease, stroke, type 2 diabetes, and obesity by improving cholesterol levels. Psyllium and other water-soluble fibers may help lower blood lipids, blood pressure, and the risk of heart disease.

The various sorts of links between milk products and the dairy processing industry characterize the dairy sector. The dairy processing business is dominated by a few large cooperatives/companies that cater mostly to urban consumers, with unorganized small processors still capturing a large share of the market. According to

India's dairy report 46% of milk was sold in India in 2007. The structured sector processes about 13% of total milk produced in the country, whereas the unorganized sector processes 22% of talmilk.

Currently, the dairy business is involved in product development both actively and articulately. This includes new formulations and imitated products that are designed to compete with or replace existing products based on their superiority in terms of convenience, cost and quality, indicating product development progress.

Smoothies were first imagined in the 1990s and is one of the fastest growing beverage industry. Smoothies are easy to make and delicious. They growingly well-known method of consuming organic product. It should include at least one portion of fruit. to boost consumption and eating interest. It is the best way to process fruits and vegetables in the eyes of consumers (Bates and Price, 2015). Smoothies are typically created by combining whole foods grown from the ground, which maintains fibre, despite the fact that squeezing will generally eliminate a mash containing fibre, which retains its nutritious advantage (Clemens *et al.,* 2015). Smoothies have long been promoted as a fitness freak beverage that promotes wellness and a healthy lifestyle. Non-thermally processed smoothies are only held for a shorter amount of time due to the likelihood of increased microbial spoilage. It's also possible that the prolonged storage duration has a negative impact as a result colour fading and complete phenols (Cano-Lamadrid *et al.,* 2018).

MATERIALS AND METHODS

Proximate composition such as moisture, fat, crude protein, ash and crude fibre were determined as per AOAC, 2000 and carbohydrate by difference method.

A. Viscosity

The viscosity of the almond milkshake samples was determined using a Brookfield viscometer (spindle-type). The viscometer was fixed with UL adaptor and spindle no. 63 before viscosity measurement of the samples. The viscometer was subjected for auto zeroing in air. After this, the type of spindle and speed of rotation (rpm) were mentioned in the viscometer as per instructions 63 spindle was selected for viscosity measurement of almond milkshake samples at 30 rpm. Viscosity measurement of almond milkshake samples was carried out at 20°C.

B. Acid modification

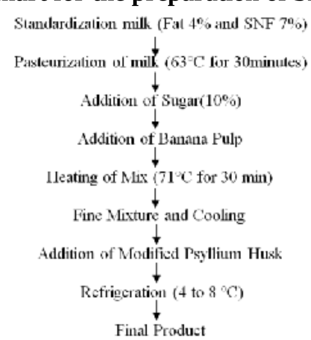
The acid modification of psyllium husk was carried out according to the process developed by Pei, (2008), with minor changes in the concentration of HCl in ethanol solvent based on the findings of a research study conducted by Syed *et al*., (2018) on the standardization of acid concentration and solvent ratio for psyllium husk modification. Acid modified psyllium husk of 0.75% HCL in ethanol as solvent of psyllium husk-solvent ratio had better functional properties 1:6 (w/v) and used. The solvent ratio was changed to improve the functional properties of psyllium husk, which is required for further research into the value addition of processed foods.

The solvent used to treat psyllium husks was vacuum filtered, rinsed twice with95 percent ethanol and 100 percent ethanol, then dried and stored. For the control during the process of vacuum filtration 95% and 100% ethanol was used once and followed the same steps as in the Table 3.

Preparation of smoothie with modified psyllium husk: Milk with fat 4 percent and SNF 7% percent was taken and pasteurized to 63°C for 30 minutes followed by cooling of milk up to 12°C. The banana fruits that were sorted and washed were made crushed into pulp. Blending of ingredients until obtaining fine thin paste of mixture. These above steps lead to the final product. Psyllium husk of 0.75% HCL treated with 1:6 PSH: solvent ratio was used. The final product of milkshake was divided into three samples and 0.4%, 0.6% and 0.8% acid modified psyllium husk was added respectively to the smoothie samples aseptically. Then the smoothie was refrigerated to 4-10°C for 36 hours. The standard recipe for the preparation of smoothie is mentioned below.

Ingredients	Standardization
Milk (ml)	400
Banana pulp(gm)	400
Sugar(gm)	80
Water (ml)	70
Honey (gm)	50

Flow chart for the preparation of Smoothie



RESULTS AND DISCUSSION

The proximate composition of Native and modified psyllium husk is depicted in Table 1 and it revealed that moisture content in psyllium husk was 6.91 percent and was increased to 7.11 percent in modified psyllium husk. Carbohydrate and dietary fiber content were found to be increased from 86.82 to 89.01 percent and 76.59 to 78.65 respectively. Crude fiber and Ash content decreased from 3.2 to 2.75 percent and 2.64 to 2.24 percent respectively. Total fat content decreased from 1.81 to 0.65 percent. Total protein in native PSH was found to be 2.31 percent and decreased to 1.11 percent in modified PSH. Present results are also in corroborated with the finding of Guo *et al.,* (2008), they were found to be similar. There was decrease in fat, protein, ash and crude fiber content due to gel hardness of psyllium formed by partial degradation after acid modification. The carbohydrate content was increased due to acid hydrolysis of psyllium husk caused by HCL and the results are similar with results shown by Syed *et al.,* (2018).

Table 1: Effect of acid modification on proximate composition of psyllium husk.

Chemical parameters	Native psyllium husk	Modified psyllium husk
Moisture (%)	6.91	7.11
Ash (%)	2.64	2.24
Total fat (%)	1.81	0.65
Total protein (%)	2.31	1.11
Total carbohydrate (%)	86.82	89.01
Crude fiber (%)	3.2	2.75
Dietary fiber (%)	76.59	78.65
Energy value (Kcal/100g)	375	369

The results from the Table 2 indicate that the iron content was the highest with 7.88±0.04 mg followed by per, Manganese and zinc with the values of 0.713±0.002 mg, 0.650±0.003 mg, and 0.356±0.001 mg respectively.

Table 2: Mineral composition of native psyllium husk.

Parameters	Results (mg/100 g)
Iron (Fe)	7.88±0.04
Copper (Cu)	0.713±0.002
Manganese (Mn)	0.650±0.003
Zinc (Zn)	0.356±0.001

Table 3: Acid treatment levels for psyllium husk.

Concentration of HCL in ethanol solvent	Psyllium husk : Solvent ratio
0.75%	1:6 (w/v)
0.00% for control	1:6 (w/v)

The results from the Table 4 show that hydration capacity was highest for native psyllium husk with 3.1 ml/g followed by control sample with 2.6 ml/g. After modification hydration capacity was decreased to 0.8 ml/g. The water holding capacity of the husk is decreased due to the charge imbalance caused by the PH of hydrochloric acid (Warner, 2017). The oil absorption capacity was found to be 1.0 ml/g for native psyllium husk and there showed a slight reduction for the control sample with 0.9 ml/g. Modified psyllium husk had showed better oil absorption capacity among all with 0.3 ml/g due to the major chemical component affecting OAC is protein, which is composed of both hydrophilic and hydrophobic parts.

Lower OAC might be due to the non-partial denaturation of proteins with exposition of high hydrophobic proteins which show lesser binding to hydrocarbon chains of lipids (Oladele and Aina 2007). Water up-taking rate from the Table 4 show that native psyllium husk and control sample had higher water up-taking rate with 2.20 (mg/(g×min) and 1.54 (mg/(g×min) respectively. After modification with 0.75% HCL in ethanol solvent had decreased rate with 1.54 (mg/(g×min) and the results for the water up-taking rate are in good agreement with the results found by the Pei, (2008); Cheng *et al*., (2009) for water up-taking rate for acid treated PSH.

Table 4: Effect of acid modification on functional properties of psyllium husk.

Concentration of HCl in Ethanol	Psyllium Husk : Solvent Ratio	Hydration capacity (ml/g)	Oil absorption capacity (ml/g)	Water up-taking rate (mg/(g×min)
Control	1:6	2.6	0.9	1.80
0.75%	1:6	0.8	0.3	1.54
Native Psyllium Husk	—	3.1	1.0	2.20

Table 5: Organoleptic evaluation of prepared Smoothie.

Sample	Appearance	Color	Taste	Flavour	Texture	Overall acceptability
M0	7.8	7.0	6.7	6.8	7.8	7.2
M1	7.4	7.4	8.2	6.6	8.1	7.7
M2	**7.3**	**7.6**	**8.1**	**6.7**	**8.3**	**8.0**
M3	7.1	7.8	7.8	6.5	8.0	7.9
SE ±	0.029	0.018	0.053	0.042	0.076	0.075
CD@5%	0.072	0.052	0.086	0.126	0.183	0.212

M0: Control with native psyllium husk psyllium husk
M1: Smoothie with 0.4% modified psyllium husk of 0.75% HCL in ethanol M2: Smoothie with 0.6% modified psyllium husk of 0.75% HCL in ethanol M3: Smoothie with 0.8% modified psyllium husk of 0.75% HCL in ethanol.

The results from the Table 5 show sample M2 had the best hedonic score of appearance, color, taste, flavor and texture with 7.3, 7.6, 8.1, 6.7 and 8.3 respectively when compared with the milkshake with native psyllium husk.

The proximate composition of smoothie was depicted in Table 6 and it revealed that moisture content in psyllium husk was 77.2 percent and total carbohydrate content found to be 11.98 percent. It is clear from the Table 6 that Ash, Total fat, Total protein and Crude fiber content were found to be 1.15 percent, 2.85 percent, 4.31 percent, 2.38 percent respectively. Calculated energy value was found 79 Kcal/100ml. The following results are good confirmatory with Odiye, (2021).

Table 6: Proximate Composition of smoothie.

Chemical parameters	Mean value
Moisture (%)	77.2
sAsh (%)	1.15
Total fat (%)	2.85
Total protein (%)	4.31
Total carbohydrate (%)	11.98
Crude fiber (%)	2.38
Energy value (Kcal/100g)	90

The results from the Table 7 show that the zinc content was the highest with 0.768 mg followed by iron, copper and manganese with the values of 0.527 mg, 0.215 mg and 0.196 mg respectively.

Table 7: Mineral composition of Smoothie.

Parameters	Results (mg/100 g)
Iron (Fe)	0.527
Copper (Cu)	0.215
Manganese (Mn)	0.196
Zinc (Zn)	0.768

Table 8: Textural properties of Smoothie.

Sample	Viscosity (Pa-s)
Control	0.87
A	0.65
B	0.71
C	0.77

From the above Table 8 results showed that viscosity of control sample with native psyllium husk had more viscosity 0.87 Pa-s when compared to smoothie with modified psyllium husk. Viscosity of the samples A, B and C were 0.65, 0.71 and 0.77 Pa-S respectively. There was a decrease in viscosity due to reduced swelling of the psyllium particles caused by the acid for the modified psyllium husk. The results for the viscosity of smoothie were supported by the findings of (Sun-Waterhouse *et al.*, 2014) in literature.

Table 9: Microbial quality of Smoothie.

Time in weeks	Total Plate Count (cfu/g)×10^4	Yeast and Mold (cfu/g)×10^4	Coliform count(cfu/g) ×10^4
1	1.2	ND	ND
2	2.9	1.7	ND
3	3.5	2.6	ND

The results from the Table 9 show that TPC growth was found to be 1.2×10^4, 2.9×10^4 and 3.5×10^4 (cfu/g) for the first, second and third weeks respectively. There was no yeast and mold growth in the first week but in the second and third week growth of 1.7×10^4 and 2.6×10^4 (cfu/g) can be seen. Coliform count was not found in the first two weeks under good hygienic and refrigeration of smoothie.

CONCLUSION

Modified psyllium husk had better functional properties than the native psyllium without affecting the nutritional and sensory parameters, hence it was used in the preparation of sample. Smoothie prepared with 0.6% modified psyllium husk of 0.75% HCL of ratio 1:6 ethanol solvent was the best among all the other samples with the hedonic score of overall acceptability 8.0. Further the microbial quality results show that that it was stored under hygienic conditions and found to be safe for consumption.

Conflict of Interest: Nil.

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