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## Effect of moringa (*Moringa oleifera*) powder on quality of Shrikhand

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**Abstract**

Shrikhand is a popular Indian dessert prepared by fermentation of milk. It has a semi-soft consistency and is sweetish in taste. Preparation of Moringa leaf powder Shrikhand was carried out by incorporating aqueous Moringa leaf powder @ 1%, 2% and 3% indicated as T1, T2 and T3 respectively. Chakka was made from milk standardized to 4.5% fat and 8.5% SNF, 2% inoculum and later on adding 25% sugar. where T0 being the control sample with no Moringa leaf powder-Experimental product was evaluated for various physico-chemical (percent Ash, Acidity, Carbohydrate, Total Solids, Fat, Moisture, Protein) organoleptic (Colour and Appearance, consistency, overall acceptability) and microbiological parameters (yeast & mould and standard plate count) Four treatments combination were replicated five times in the study. Cost of production (Rs. Per kilogram of finished product) for experimental sample were T1 (132.4), T2 (142.3), T3 (152.2) and that for control was T0 (122.5).

**Keywords:** Shrikhand, chakka, moringa leaf powder, shelf life of Shrikhand, lactic culture

**Introduction**

Shrikhand is one of the important fermented milk products which derive its name from the Sanskrit word "Shikharani" meaning a curd prepared with added sugar, flavoring agents (Saffron), fruits and nuts. The semi-solid dahi mass obtained by the removal of whey from lactic fermented dahi is commonly known as Chakka, which is base material for making Shrikhand. It is popular in western part, especially in Maharashtra, Gujarat and Karnataka. (David, 2015). Shrikhand. is known for its high nutritive, characteristic flavor, taste, palatable nature and possible therapeutic value. It is very refreshing particularly during summer months. It can be recommended as health food for specific patients suffering from obesity and cardiovascular disease due to its low fat and sugar contents. It has nutritive goodness of fermented milk products. The organized sector of dairy industry is yet to accept it as a commercial product. This indigenous fermented milk product contains high percentage of casein and large amount of sugar therefore; it is a heavy dish for digestion. Gastric juice secreted by dahi improves digestion and according to research work of Nebraska University in the United State consumption of dahi has definite inhibitory action against certain type of cancer cells. The amino acid methionine in the curd which removes the excessive fat from the liver can improve the general condition of arteriosclerosis which usually leads to heart attack. Fermented milk products have better keeping quality and are easily digestible because of breakdown of proteins into peptides and free amino acids as a result of microbial action. The substances like lactic acid, alcohol, nonprotein substances, volatile acids, calcium and phosphorous appear in more assimilable level in curd as compared to milk (Laxminarayan and Shankar, 1980). Typically Shrikhand constitutes 39.0% moisture and 61.0% of total solids of which 10.0% is fat, 11.5% proteins 78.0% carbohydrates and 0.5% ash, on a dry matter basis. It has a pH of about 4.2–4.4 (Boghra and Mathur, 2000).

**FSSAI Standard of Shrikhand**

Parameters	Shrikhand
Total solids, minimum, % (m/m)	58.0
Milk fat, minimum, % (m/m) on dry basis	8.5
Milk protein, minimum, % (m/m) on dry basis	9.0
Titration acidity, maximum, % (m/m) on dry basis	1.4
Sugar (sucrose), maximum, % (m/m) on dry basis	72.5
Total ash, maximum, % (m/m) on dry basis	0.9

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*Moringa oleifera* is the most widely cultivated species of the genus *Moringa*, which is the only genus in the family *Moringaceae*. It is a fast-growing, drought-resistant tree, native to the southern foothills of the Himalayas in northwestern India, and widely cultivated in tropical and subtropical areas where its young seed pods and leaves are used as vegetables. It can also be used for water purification and hand washing and is sometimes used in herbal medicine. (Flora and Pachauri, 2011). All parts of the *Moringa* tree are edible and have long been consumed by humans (Prabhu *et al.*, 2011). *Moringa* is used worldwide in the traditional medicine, for various health conditions, such as skin infections, anemia, anxiety, asthma, blackheads, blood impurities, bronchitis, catarrh, chest congestion, cholera, infections, fever, glandular, swelling, headaches, abnormal blood pressure, hysteria, pain in joints, pimples, psoriasis, respiratory disorders, scurvy, semen deficiency, sore throat, sprain, tuberculosis, for intestinal worms, lactation, diabetes, and pregnancy (Fuglie, 2001; Mahmood *et al.*, 2010; Sairam, 1999). In many regions of Africa, it is widely consumed for self-medication by patients affected by diabetes, hypertension, or HIV/AIDS (Mbikay, 2012). *Moringa* oil has tremendous cosmetic value and is used in body and hair care as a moisturizer and skin conditioner. It has been shown that aqueous, hydroalcohol, or alcohol extracts of *M. oleifera* leaves possess a wide range of additional biological activities including antioxidant, tissue protective (liver, kidneys, heart, testes, and lungs), analgesic, antiulcer, antihypertensive, radio protective, and immune modulatory actions (Stohs and Hartman, 2015). Phytochemical analyses have shown that *M. oleifera* is a rich source of potassium, calcium, phosphorous, iron, vitamins A and D, essential amino acids, as well as known antioxidants, such as  $\beta$ -carotene, vitamin C, and flavonoids (Bennett *et al.*, 2003; Mbikay, 2012). A wide variety of polyphenols and phenolic acids as well as flavonoids, glucosinolates, and possibly alkaloids are believed to be responsible for the effects of the plant (Stohs and Hartman, 2015).



The material and methods adopted during this investigation are reported in this chapter. The sequence of operation designed to conduct the experiment is as mentioned below.

**Experimental site:** Research lab, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad-211007, U.P. (India).

**Procurement of raw materials:**

- a. Milk: It was purchased from AGGIES Dairy, SHUATS, Allahabad.

**Nutritional composition of moringa**

Parameters	Leaf powder
Moisture (%)	7.5
Calories	205
Protein (g)	27.1
Fat (g)	2.3
Carbohydrate (g)	38.3
Fiber (g)	19.2
Minerals (g)	-
Ca (mg)	2,003
Mg (mg)	368
P (mg)	204
K (mg)	1,324
Cu (mg)	0.57
Fe (mg)	28.2
S (mg)	870
Oxalic acid (mg)	1.6 %
Vitamin a-b carotene (mg)	16.3
Vitamin b-Choline (mg)	-
Vitamin b1-thiamine (mg)	2.64
Vitamin b2-riboflavin (mg)	20.5
Vitamin b3-nicotinic acid (mg)	8.2
Vitamin c-ascorbic acid (mg)	17.3
Vitamin e-tocopherol acetate (mg)	113
Arginine (g/16gN)	1.33%
Histidine (g/16gN)	0.61%
Lysine (g/16gN)	1.32%
Tryptophan (g/16gN)	0.43%
Phenylalanine (g/16gN)	1.39%
Methionine (g/16gN)	0.35%
Threonine (g/16gN)	1.19%
Leucine (g/16gN)	1.95%
Isoleucine (g/16gN)	0.83%
Valine (g/16gN)	1.06%

**Source:** From *Moringa oleifera*: Natural Nutrition for the Tropics by Lowell Fuglie

**Materials & Methods**



- b. Moringa leaf powder: Purchased from local market of Allahabad.  
 c. Sugar: Purchased from local market of Allahabad.  
 d. Culture: Purchased from NDRI, Karnal.

**Standardization of milk:** Milk was standardized to 4.5% and 8.5% solid not fat

**Development of product:** One litre of milk was standardized to 4.5% and 8.5 % solid not fat and was converted to Shrikhand as follows. The standardized milk was heated to

63°C for 30 minute, it was then cooled to 25°C. This milk then inoculated by lactic starter culture @ of 2% and then milk was incubated, at 25°C for 10 to 12 hours until a firm coagulum (Dahi) was formed. The Dahi, so formed was broken and transferred to muslin cloth to 16 hours, for the expulsion of whey is called 'chakka' Sugar@ 25%, Moringa leaf powder was mixed chakka, to obtain the final product Shrikhand.

**Sensory evaluation of Shrikhand by using Moringa leaf powder.**

**1. Organoleptic**

- a. Clour & Appearance.
- b. Flavour& Taste
- c. Consistency
- d. Overall acceptability

**2. Microbial analysis of experimental Shrikhand**

- a. SPC
- b. Yeast &Mold
- c. Yeast &Mold

**3. Statistical analysis**

- a. No. of treatments -4
- b. No. of replications -5
- c. Total No. of trials-20

**Treatment Combination (In ratio)**

Treatment	Chakka (gm)	Moringa Leaf Powder
T0	100	0
T1	99	1
T2	98	2
T3	97	3

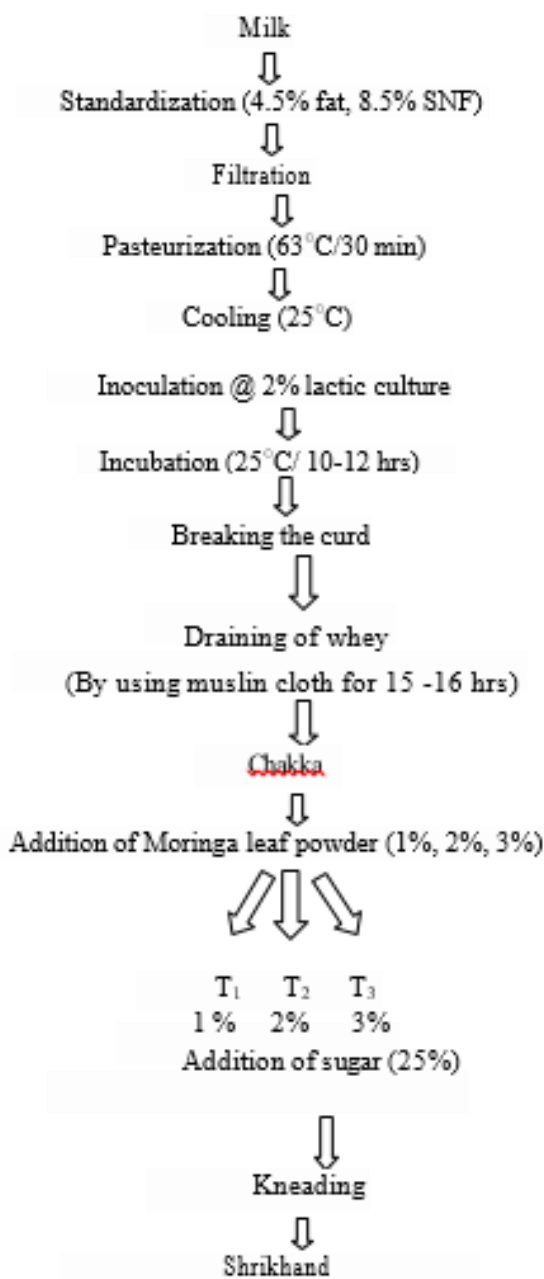
**T0:** T0: The product was prepared by using 100g of chakka.

**T1:** T1: The product was prepared by using 99g of chakka and 1.0% of Moringa leaf powder.

**T2:** T2: The product was prepared by using 98g of chakka and 2% of Moringa leaf powder.

**T3:** T3: The product was prepared by using 97g of chakka and 3% of Moringa leaf powder.

**Flow diagram of preparation of Shrikhand by using Moringa leaf powder**



**Technical Programme**

**Chemical analysis of experimental Shrikhand**

**Carbohydrate Percentage-** Was estimated by using lane and enyon given in IS: 1479 (Part- II) 1961.

**Protein Percentage:** - Nitrogen content was determined by Semimicro-Kjeldhal's method of Manefee and Overmann (1940) as described in IS: 4079 (1967).

**Fat Percentage-** Was estimated by using HCL method as stated in IS: 1224 (Part-I) 1977.

**Ash Percentage-** Was estimated by using Muffle Furnace as described in IS: 1165 (1967).

**Total solid Percentage-** Total solids were determined as per procedure given in IS: 1479 (Part-II) 1961.

**Moisture%-** Was estimated as per the procedure given in IS: 1479 (Part-II) 1961.

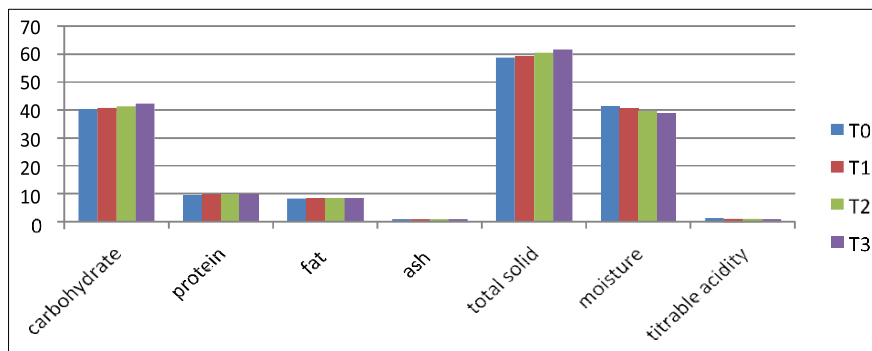
**Acidity Percentage-** Acidity of milk was determined by the procedure given in IS: 1479 (Part-I) 1960.

**Result and Discussion**

The present investigation effect on “Effect of Moringa (*Moringa oleifera*) Powder on quality of Shrikhand” was planned and carried out in Warner college of Dairy Technology Department. SHUATS. Allahabad.

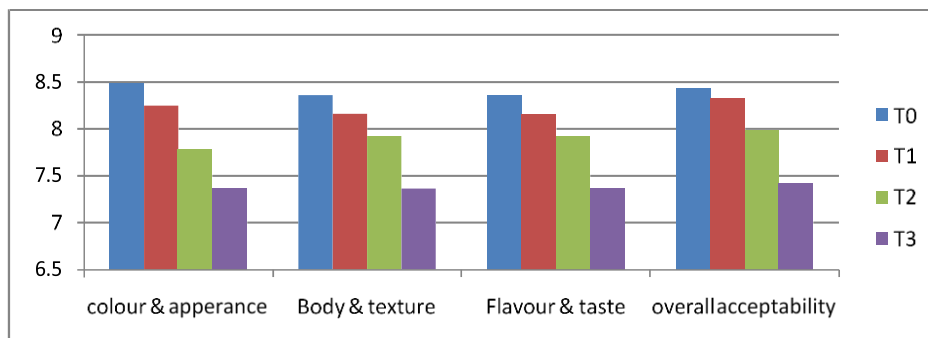
**Table 4.1:** Average data for different parameters of control and experiments (in percent)

Parameters	Treatment				
	T0	T1	T2	T3	S/NS
<b>1. Physic-chemical analysis</b>					
Carbohydrate%	40.17	40.57	41.37	42.13	S
Protein %	9.52	9.62	9.72	9.84	S
Fat %	8.23	8.33	8.41	8.52	S
Ash %	0.88	0.89	0.90	0.91	S
Total Solid %	58.80	59.40	60.40	61.40	S
Moisture %	41.20	40.60	39.60	38.60	S
Titration acidity %	1.16	1.12	0.99	0.92	S



**Table 2:** Organoleptic Scores (9 point hedonic scale)

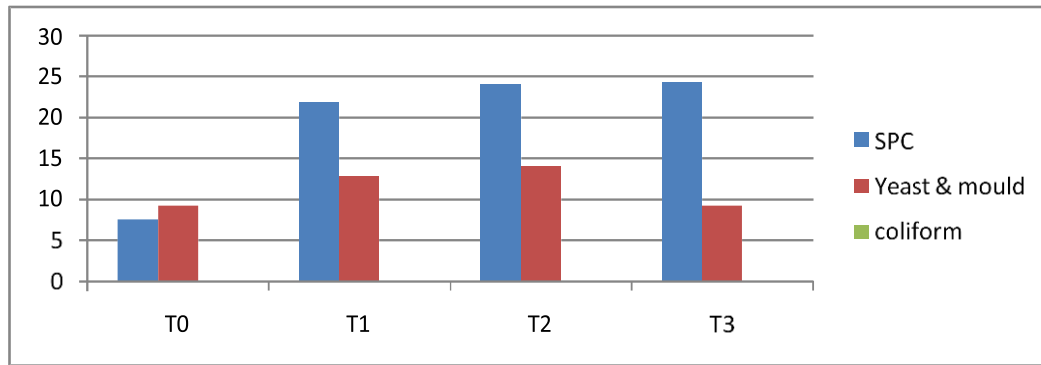
Colour & Appearance	8.48	8.24	7.78	7.36	S
Body & Texture	8.36	8.16	7.92	7.36	S
Flavour & Taste	8.36	8.16	7.92	7.36	S
Overall acceptability	8.42	8.32	7.98	7.42	S



**Fig 2:** Average data for different parameters of control and experiments

**Table 3:** Microbial analysis

SPC (×cfu/ml)	7.60	21.80	24.00	24.20	S
Yeast & Mold	9.20	12.80	14.00	9.20	S
Coliform	Nil	Nil	Nil	Nil	-



**Fig 3:** Average data for different parameters of control and experiments

**Carbohydrate-** The highest mean of carbohydrate percentage was recorded in experimental shriknad sample of T3 (42.13), followed by T2 (41.37), T1 (40.57). And T0 (40.17). The difference in these values of carbohydrate percent was significant.

**Protein-** The highest mean of protein percentage was recorded in experimental shriknad sample of T3 (9.84), followed by T2 (9.72), T1 (9.62). And T0 (9, 52). The difference in these values of protein percent was significant.

**Fat-** The highest mean of fat percentage was recorded in experimental shriknad sample of T3 (8.52), followed by T2 (8.41), T1 (8.33). And T0 (8.23). The difference in these values of fat percent was significant.

**Ash-** The highest mean of ash percentage was recorded in experimental shriknad sample of T3 (0.91), followed by T2 (0.90), T1 (0.89). And T0 (0.88). The difference in these values of ash percent was significant.

**Total solid-** The highest mean of total solid percentage was recorded in experimental shriknad sample of T3 (61.40), followed by T2 (60.40), T1 (59.40). And T0 (58.80). The difference in these values of total solid percent was significant.

**Moisture-** The highest mean of moisture percentage was recorded in experimental shriknad sample of T3 (41.20), followed by 21 (40.60), T1 (39.60). And T0 (38.60). The difference in these values of moisture percent was significant.

**Acidity-** The highest mean of acidity percentage was recorded in experimental shriknad sample of T0 (1.16), followed by T1 (1.12), T2 (0.99). And T3 (0.92). The difference in these values of acidity percent was significant.

**Colour & Appearance-** The highest mean of colour & appearance score recorded in the control and experimental shriknad sample of T3 (8.48), followed by T2 (8.24), T1 (7.78). And T0 (7.36). The difference in these values colour & appearance was significant.

**Body & Texture-** The highest mean of Body & texture score recorded in the control and experimental shriknad sample of T3 (8.36), followed by T2 (8.16), T1 (7.92). And T0 (7.36). The difference in these values Body & texture was significant.

**Flavour & Taste-** The highest mean of Flavour & taste score recorded in the control and experimental shriknad sample

of T3 (8.36), followed by T2 (8.16), T1 (7.92). And T0 (7.36). The difference in these values Flavour & taste was significant.

**Overall acceptability-**The highest mean of the Overall acceptability was recorded in the control and experimental shriknad sample of T3 (8.42), followed by T2 (8.32), T1 (7.98). And T3 (7.42). The difference in these values Overall acceptability was significant.

**SPC-**The highest mean of SPC recorded in the supplemented shriknad of T3 (24.20), followed by T2 (24.00), T1 (21.80). And T0 (7.60). The difference in these values SPC was significant.

**Yeast & Mould-**The highest mean of Yeast & Mould recorded in the supplemented shriknad of T3 (14.00), followed by T2 (12.80), T1 (9.20). And T0 (9.20). The difference in these values Yeast & Mould was significant.

**Coliform-**The coliform count in control and experimental sample were found to be absent.

### Conclusion

It may be concluded that the Experimental Shrikhand can be successfully prepared by using Standard milk with addition of Moringa leaf powder. It was found that the Experimental Shrikhand in treatment T1 was best in organoleptic characteristics and received highest score in organoleptic (colour & appearance, body & texture, flavour & taste, overall acceptability). Shrikhand made with Standard milk sample of sample of treatment T0 was best in chemical characteristics (max. Protein fat, moisture, acidity) and T1 was best in characteristics (T.S, carbohydrate, ash) and T3 is best in microbial characteristics (SPC & Yeast & Mould). The cost of preparation of Shrikhand with addition of Moringa leaf powder T2 was found to be Rs 132.4, 142.3, 152.2 per kg in T1, T2, & T3 respectively. The experimental shriknad are costly than the control Shrikhand. But due to therapeutic value there is a great market potential lies in the developed products.

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