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To study the effect of level of jaggery and sapota pulp on chemical quality of *Kulfi*

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ABSTRACT : The three levels of pulp of sapota 16, 25 and 40 per cent were used with three levels of jaggery *i.e.* 7, 8 and 9 per cent to prepare the *Kulfi*. In conclusion the protein and fat content decreased with increase in levels of jaggery and fruit pulp in end product *i.e. Kulfi* and the non-reducing sugar, reducing sugar, iron, ash, total solids contents ware increased in end product with increase in levels of both *i.e.* jaggery and fruit pulp.

KEY WORDS : Milk, Sapota, Jaggary, *Kulfi*

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INTRODUCTION

At present the dairy industry is actively involved in novel product development. This includes new formulations and imitation product designed to compete with or replace existing products based on their superiority in convenience, cost and quality, so the progress in product development. Fruit milk shake and *Kulfi* are the one of important milk product for value addition. Fruits like sapota (*Chikku*), *Ber*, custard apple pulp are also used in milk shake and *Kulfi*, so milk shake become the name of fruit milk shake and *Kulfi* become frozen dairy dessert.

Kulfi – Indian frozen dairy product is liked most by the consumers as it is quite cheap, palatable and nutritious frozen dairy dessert. It is widely accepted and its demand is increasing day by day next to ice-cream. It is a typical frozen dessert sold by small milk venders, *Halwais*, sweet makers etc., in many parts of our country, especially in summer season. Hence, we can call the *Kulfi* as poor man's ice cream. *Kulfi* manufacturing helps to develop small scale industry and generate sizeable employment and income.

Jaggery nutritious and easily available, Jaggery contains more mineral content such as iron, Ca, Mg, P in comparison with cane sugar and as we know milk is deficit in iron. So, to get the irons level in milk product *i.e.* milk shake and *Kulfi* we chosen the jaggery as a sweetener instead of cane sugar during the study. It also contains reducing sugars including glucose and fructose.

Sapota is a sweet and delicious tropical fruit with plenty of nutritional benefits. It is very rich in dietary fibre, which makes it a good laxative. It also rich in minerals, calcium 28 mg, phosphorus 27 mg, iron 2 mg (Sulladmath and Reddy, 1985). The sweetness of sapota can be related to the simple sugars like fructose and sucrose that make up the fruit and which replenishes and revitalizes our energy instantly. So that nutritious point of view it is proposed to possible to prepare *Kulfi* using sapota.

MATERIAL AND METHODS

The research project was conducted at Rajhans Dairy, Sangamner. The three levels of pulp of sapota, *Ber*, custard apple etc. at 16, 25 and 40 per cent were used with three levels of jaggery *i.e.* 7, 8 and 9 per cent to prepare the sapota *Kulfi*. The samples were analyzed for chemical composition, *viz.*,

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protein, fat, non-reducing sugar, reducing sugar, iron, ash, acidity etc. by using standard procedure as per IS: 1479 (Part II) 1961 and IS: 1224 (Part I) 1977. The results obtained during the investigation were subjected to statistical analysis by using Completely Randomized Design (CRD) as described by Panse and Sukhatme (1985).

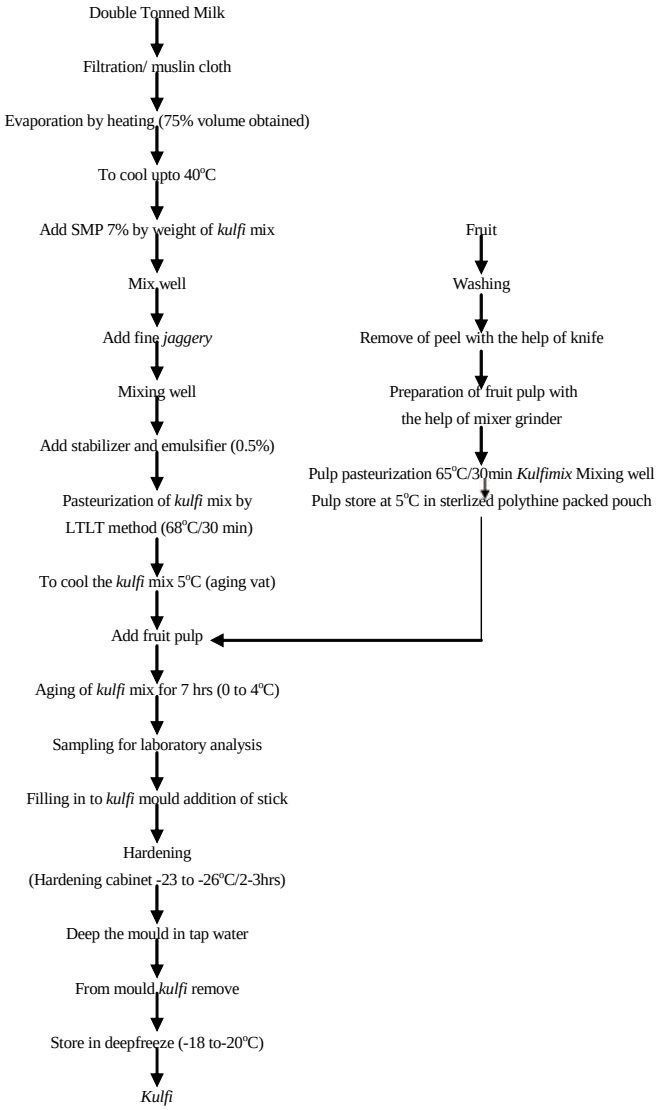

Fig. A : Flow diagram procedure of *Kulfi*

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Effect of level of jaggery on chemical quality of sapota *Kulfi* :

Effect of level of jaggery on chemical quality of sapota *Kulfi* prepared with 16 per cent pulp was studied and presented in Table 1. The protein contents for levels of jaggery *i.e.* 7, 8 and 9 were significantly (P<0.05) decreased to 5.23, 5.19, 5.16; fat significantly (P<0.05) decreased to 1.45, 1.44, 1.42; non-reducing sugar significantly (P<0.05) increased to 12.10, 13.00, 13.90; reducing sugar significantly (P<0.05) increased to 5.61, 5.66, 5.70; iron significantly (P<0.05) increased to 1.07, 1.17, 1.26 (mg/100g); ash significantly (P<0.05) increased to 0.53, 0.58, 0.61; total solids significantly (P<0.05) increased to 26.36, 27.19, 27.98 and acidity was also (P<0.05) increased to 0.24, 0.25, 0.26 per cent, respectively but non-significant.

The protein and fat content decreased with increase in levels of jaggery. Initially protein and fat content was 5.23, 1.45 per cent, respectively, which was then decreased to 5.16, 1.42 per cent, respectively. Protein and fat content of *Kulfi* prepared with 16 per cent pulp significantly (P<0.05) affected with different level of jaggery. It was seen that with the increase in jaggery level there was decrease in the protein and fat level. The reason might be due to jaggery constituent protein and fat in negligible quantity, therefore, as jaggery level increased the protein and fat level decreased significantly in the end product. The non-reducing sugar, reducing sugar, iron, ash, total solids content increased with increase in levels of jaggery, because jaggery (Singh, 1998 and Rao *et al.*, 2007) have all these constitute.

Present observations on particular inline with Taware (2000), Hanwate (2003) and Rupnar (2006). Singh (1998) Reported that chemical composition of jaggery in percentage of sucrose (65-85 %), reducing sugars (10-15 %), total minerals (0.6-0.1 %), calcium (8.0 mg), phosphorus (4.0 mg), iron (11 mg), moisture (3-10 g) and energy (383 Kcal).

Effect of level of jaggery on chemical quality of sapota *Kulfi* :

Effect of level of jaggery on chemical quality of sapota *Kulfi* prepared with 25 per cent pulp was studied and presented in Table 2. The protein contents for levels of jaggery *i.e.* 7, 8 and 9 were significantly (P<0.05) decreased to 4.88, 4.84,4.80; fat significantly (P<0.05) decreased to 1.27, 1.24, 1.22; non-reducing sugar significantly (P<0.05) increased to 14.20, 15.06, 16.00; reducing sugar significantly (P<0.05) increased to 6.29, 6.33, 6.38; iron significantly (P<0.05) increased to 1.25, 1.36, 1.45 (mg/100g); ash significantly (P<0.05) increased to 0.69, 0.75, 0.80; total solids significantly (P<0.05) increased to 25.53, 28.22, 29.11 and acidity was also (P<0.05) increased to 0.25, 0.26, 0.27 per cent, respectively but non-significant.

The protein and fat content decreased with increase in levels of jaggery. Initially protein and fat content was 4.88, 1.27 per cent, respectively, which was then decreased to 4.80, 1.22 per cent, respectively. Protein and fat content of *Kulfi* prepared with 25 per cent pulp significantly (P<0.05) affected with different level of jaggery. It was seen that with the increase in jaggery level there was decrease in the protein and fat level. The reason might be due to jaggery constituent protein and fat in negligible quantity, therefore, as jaggery level increased the

protein and fat level decreased significantly in the end product. The non-reducing sugar, reducing sugar, iron, ash, total solids content increased with increase in levels of jaggery, because jaggery (Singh, 1998 and Rao *et al.*, 2007) have all these constitute. Present observations on particular inline with Taware (2000), Hanwate (2003) and Rupnar (2006).

Effect of level of jaggery on chemical quality of sapota *Kulfi* :

Effect of level of jaggery on chemical quality of sapota *Kulfi* prepared with 40 per cent pulp was studied and presented in Table 3. The protein contents for levels of jaggery *i.e.* 7, 8 and 9 were significantly (P<0.05) decreased to 4.29, 4.25, 4.21; fat significantly (P<0.05) decreased to 0.96, 0.93, 0.91; non-reducing sugar significantly (P<0.05) increased to 17.30, 18.00, 19.12; reducing sugar significantly (P<0.05) increased to 6.70, 6.74, 6.78; iron significantly (P<0.05) increased to 1.53, 1.64, 1.76 (mg/100g); ash significantly (P<0.05) increased to 0.89, 0.92, 0.98; total solids significantly (P<0.05) increased to 29.05, 29.54, 30.10 and acidity was also (P<0.05) increased to 0.26, 0.26, 0.27 per cent, respectively but non-significant.

The protein and fat content decreased with increase in levels of jaggery. Initially protein and fat content was 4.29, 0.96

Table 1 : Effect of level of jaggery on chemical quality of sapota *Kulfi* (Mean of three replication)

Chemical constituents	Level of jaggery (%)			S.E.	C.D.	Results
	7	8	9			
Protein (%)	5.23	5.19	5.16	0.02	0.06	Sig.
Fat (%)	1.45	1.44	1.42	0.01	0.02	Sig.
Non-reducing sugar (%)	12.10	13.00	13.90	0.52	1.43	Sig.
Reducing sugar (%)	5.61	5.66	5.70	0.03	0.07	Sig.
Iron (mg/100g)	1.07	1.17	1.26	0.05	0.15	Sig.
Ash (%)	0.53	0.58	0.61	0.02	0.06	Sig.
Total solids (%)	26.36	27.19	27.98	0.47	1.29	Sig.
Acidity (%)	0.24	0.25	0.26	0.01	0.02	NS

16 per cent pulp common for all jaggery level.
C.D. (P=0.05) Sig. : Significant, NS : Non-significant

Table 2 : Effect of level of jaggery on chemical quality of sapota *Kulfi* (Mean of three replication)

Chemical constituents	Level of jaggery (%)			S.E.	C.D.	Results
	7	8	9			
Protein (%)	4.88	4.84	4.80	0.02	0.06	Sig.
Fat (%)	1.27	1.24	1.22	0.01	0.04	Sig.
Non-reducing sugar (%)	14.20	15.06	16.00	0.52	1.43	Sig.
Reducing sugar (%)	6.29	6.33	6.38	0.03	0.07	Sig.
Iron (mg/100g)	1.25	1.36	1.45	0.06	0.16	Sig.
Ash (%)	0.69	0.75	0.80	0.03	0.09	Sig.
Total solids (%)	27.53	28.22	29.11	0.46	1.26	Sig.
Acidity (%)	0.25	0.26	0.27	0.01	0.02	NS

25 per cent pulp common for all *jaggery* level,
C.D. (P=0.05) Sig.: Significant, NS: Non-significant

Table 3 : Effect of level of jaggery on chemical quality of sapota *Kulfi* (Mean of three replication)

Chemical constituents	Level of jaggery (%)			S.E.	C.D.	Results
	7	8	9			
Protein (%)	4.29	4.25	4.21	0.02	0.06	Sig.
Fat (%)	0.96	0.93	0.91	0.01	0.04	Sig.
Non-reducing sugar (%)	17.30	18.00	19.12	0.53	1.46	Sig.
Reducing sugar (%)	6.70	6.74	6.78	0.02	0.06	Sig.
Iron (mg/100g)	1.53	1.64	1.76	0.07	0.18	Sig.
Ash (%)	0.89	0.92	0.98	0.03	0.07	Sig.
Total solids (%)	29.05	29.54	30.10	0.30	0.84	Sig.
Acidity (%)	0.26	0.26	0.27	0.003	0.01	NS

40 per cent pulp common for all jaggery level.
C.D. (P=0.05) Sig. : Significant, NS : Non-significant

per cent, respectively, which was then decreased to 4.21, 0.91 per cent, respectively. Protein and fat content of *Kulfi* prepared with 40 per cent pulp significantly (P<0.05) affected with different level of jaggery. It was seen that with the increase in jaggery level there was decrease in the protein and fat level. The reason might be due to jaggery constituent protein and fat in negligible quantity, therefore, as jaggery level increased the protein and fat level decreased significantly in the end product. The non-reducing sugar, reducing sugar, iron, ash, total solids content increased with increase in levels of jaggery, because jaggery (Singh, 1998 and Rao *et al.*, 2007) have all these constitute. Present observations on particular inline with Taware (2000), Hanwate (2003) and Rupnar (2006).

Effect of level of pulp on chemical quality of sapota *Kulfi* :

Effect of level of pulp on chemical quality of sapota *Kulfi* prepared with 7 per cent jaggery was studied and presented in Table 4. The protein content for levels of pulp *i.e.* 16, 25 and 40 were significantly (P<0.05) decreased to 5.23, 4.88, 4.29; fat significantly (P<0.05) decreased to 1.45, 1.27, 0.96; non-reducing sugar significantly (P<0.05) increased to 12.10, 14.20, 17.30; reducing sugar significantly (P<0.05) increased to 5.61, 6.29,

Table 4 : Effect of level of pulp on chemical quality of sapota *Kulfi* (Mean of three replication)

Chemical constituents	Level of jaggery (%)			S.E.	C.D.	Results
	16	25	40			
Protein (%)	5.23	4.88	4.29	0.27	0.76	Sig.
Fat (%)	1.45	1.27	0.96	0.14	0.39	Sig.
Non-reducing sugar (%)	12.10	14.20	17.30	1.51	4.16	Sig.
Reducing sugar (%)	5.61	6.29	6.70	0.32	0.88	Sig.
Iron (mg/100g)	1.07	1.25	1.53	0.13	0.37	Sig.
Ash (%)	0.53	0.69	0.89	0.10	0.29	Sig.
Total solids (%)	26.36	27.53	29.05	0.78	2.14	Sig.
Acidity (%)	0.24	0.25	0.26	0.006	0.02	NS

7 per cent pulp common for all jaggery level.
C.D. (P=0.05) Sig. : Significant, NS : Non-significant

Table 5 : Effect of level of pulp on chemical quality of sapota *Kulfi* (Mean of three replication)

Chemical constituents	Level of jaggery (%)			S.E.	C.D.	Results
	16	25	40			
Protein (%)	5.19	4.84	4.25	0.27	0.76	Sig.
Fat (%)	1.44	1.24	0.93	0.15	0.41	Sig.
Non-reducing sugar (%)	13.00	15.06	18.00	1.45	3.99	Sig.
Reducing sugar (%)	5.66	6.33	6.74	0.32	0.87	Sig.
Iron (mg/100g)	1.17	1.36	1.64	0.14	0.38	Sig.
Ash (%)	0.58	0.75	0.92	0.10	0.27	Sig.
Total solids (%)	27.19	28.22	29.54	0.68	1.87	Sig.
Acidity (%)	0.25	0.26	0.26	0.003	0.01	NS

8 per cent pulp common for all jaggery level.
C.D. (P=0.05) Sig. : Significant, NS : Non-significant

Table 6 : Effect of level of pulp on chemical quality of sapota *Kulfi* (Mean of three replication)

Chemical constituents	Level of jaggery (%)			S.E.	C.D.	Results
	16	25	40			
Protein (%)	5.16	4.80	4.21	0.28	0.76	Sig.
Fat (%)	1.42	1.22	0.91	0.15	0.41	Sig.
Non-reducing sugar (%)	13.90	16.00	19.12	1.52	4.18	Sig.
Reducing sugar (%)	5.70	6.38	6.78	0.32	0.87	Sig.
Iron (mg/100g)	1.26	1.45	1.76	0.15	0.40	Sig.
Ash (%)	0.61	0.80	0.98	0.11	0.29	Sig.
Total solids (%)	27.98	29.11	30.10	0.61	1.69	Sig.
Acidity (%)	0.26	0.27	0.27	0.003	0.01	NS

9 per cent pulp common for all jaggery level.
C.D. (P=0.05) Sig. : Significant, NS : Non-significant

6.70; iron significantly (P<0.05) increased to 1.07, 1.25, 1.53 (mg/100g); ash significantly (P<0.05) increased to 0.53, 0.69, 89; total solids significantly (P<0.05) increased to 26.36, 27.53, 29.05 and acidity was also (P<0.05) increased to 0.24, 0.25, 0.26 per cent, respectively but non-significant.

The protein and fat content decreased with increase in levels of pulp. Initially protein and fat content was 5.23, 1.45 per cent, respectively, which was then decreased to 4.29, 0.96, per cent, respectively. Protein and fat content of *Kulfi* prepared with 7 per cent jaggery significantly (P<0.05) affected with different level of pulp. It was seen that with the increase in pulp level there was decrease in the protein and fat level. The reason might be due to pulp constituent protein and fat minute per cent, therefore, as pulp level increased the protein and fat level decreased significantly in the end product. The non-reducing sugar, reducing sugar, iron, ash, total solids content increased with increase in levels of pulp, because sapota pulp (Sulladmath and Reddy, 1985 and Kulkarni *et al.*, 2007) have all these constitute.

The present investigation collaborates with that of Kedar (1972), Kolpe (1995), Kshirsagar (1996), Gaikwad (2000), Taware (2000), Pawar (2001), Patil (2008), Kamble *et al.* (2010), Manjula *et al.* (2012), Bisla *et al.* (2012), Sakhale *et al.* (2012), Nalkar (2012) and Arya *et al*. (2013).

Effect of level of pulp on chemical quality of sapota *Kulfi* :

Effect of level of pulp on chemical quality of sapota *Kulfi* prepared with 8 per cent jaggery was studied and presented in Table 5. The protein content for levels of pulp *i.e.* 16, 25 and 40 were significantly (P<0.05) decreased to 5.19, 4.84, 4.25; fat significantly (P<0.05) decreased to 1.44, 1.24, 0.93; non-reducing sugar significantly (P<0.05) increased to 13.00, 15.06, 18.00; reducing sugar significantly (P<0.05) increased to 5.66, 6.33, 6.74; iron significantly (P<0.05) increased to 1.17, 1.36, 1.64 (mg/100g); ash significantly (P<0.05) increased to 0.58, 0.75, 0.92; total solids significantly (P<0.05) increased to 27.19, 28.22, 29.54 and acidity was also (P<0.05) increased to 0.25, 0.26, 0.26 per cent, respectively but not significant.

The protein and fat content decreased with increase in levels of pulp. Initially protein and fat content was 5.19, 1.44 per cent, respectively, which was then decreased to 4.25, 0.93 per cent, respectively. Protein and fat content of *Kulfi* prepared with 8 per cent jaggery significantly (P<0.05) affected with different level of pulp. It was seen that with the increase in pulp level there was decrease in the protein and fat level. The reason might be due to pulp constituent protein and fat minute per cent therefore as pulp level increased the protein and fat level decreased significantly in the end product. The non-reducing sugar, reducing sugar, iron, ash, total solids content increased with increase in levels of pulp, because sapota pulp (Sulladmath and Reddy, 1985 and Kulkarni *et al.*, 2007) have all these constitute.

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Effect of level of pulp on chemical quality of sapota *Kulfi* :

Effect of level of pulp on chemical quality of sapota *Kulfi* prepared with 9 per cent jaggery was studied and presented in Table 6. The protein content for levels of pulp *i.e.* 16, 25 and 40 were significantly (P<0.05) decreased to 5.16, 4.80, 4.21; fat significantly (P<0.05) decreased to 1.42, 1.22, 0.91; non-reducing sugar significantly (P<0.05) increased to 13.90, 16.00, 19.12; reducing sugar significantly (P<0.05) increased to 5.70, 6.38, 6.78; iron significantly (P<0.05) increased to 1.26, 1.45, 1.76 (mg/100g); ash significantly (P<0.05) increased to 0.61, 0.80, 0.98; total solids significantly (P<0.05) increased to 27.98, 29.11, 30.10 and acidity was also non-significantly (P<0.05) increased to 0.26, 0.27, 0.27 per cent, respectively but non-significant.

The protein and fat content decreased with increase in levels of pulp. Initially protein and fat content was 5.16, 1.42 per cent, respectively, which was then decreased to 4.21, 0.91, per cent, respectively. Protein and fat content of *Kulfi* prepared with 9 per cent jaggery significantly (P<0.05) affected with different level of pulp. It was seen that with the increase in pulp level there was decrease in the protein and fat level. The reason might be due to pulp constituent protein and fat minute per cent, therefore, as pulp level increased the protein and fat level decreased significantly in the end product. The non-reducing sugar, reducing sugar, iron, ash, total solids content increased with increase in levels of pulp, because sapota pulp (Sulladmath and Reddy, 1985 and Kulkarni *et al.*, 2007) have all these constitute.

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