The Pharma Innovation Journal 2018; 7(3): 142-147

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(3): 142-147

www.thepharmajournal.com
Received: 22-01-2018
Accepted: 23-02-2018

Santosh P Shinde
College of Agriculture, Latur, College of Agriculture, Badnapur, Maharashtra, India Sher e Kashmir University of Agriculture and Technology Jammu, Jammu and Kashmir in India

Balasaheb C Andhare
College of Agriculture, Latur, College of Agriculture, Badnapur, Maharashtra, India Sher e Kashmir University of Agriculture and Technology Jammu, Jammu and Kashmir in India

Sahar Masud
College of Agriculture, Latur, College of Agriculture, Badnapur, Maharashtra, India Sher e Kashmir University of Agriculture and Technology Jammu, Jammu and Kashmir in India

Tushar A Maske
College of Agriculture, Latur, College of Agriculture, Badnapur, Maharashtra, India Sher e Kashmir University of Agriculture and Technology Jammu, Jammu and Kashmir in India

Vishal S Dhumal
College of Agriculture, Latur, College of Agriculture, Badnapur, Maharashtra, India Sher e Kashmir University of Agriculture and Technology Jammu, Jammu and Kashmir in India

Correspondence
Santosh P Shinde
College of Agriculture, Latur, College of Agriculture, Badnapur, Maharashtra, India Sher e Kashmir University of Agriculture and Technology Jammu, Jammu and Kashmir in India

Process standardization of low-calories and low-sugar *kalam*

Santosh P Shinde, Balasaheb C Andhare, Sahar Masud, Tushar A Maske and Vishal S Dhumal

Abstract
The low-calories and low-sugar *kalam* was prepared by using maltodextrin, sugar and aspartame in suitable combination after optimization in the laboratory of Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, VNMKV, Parbhani during the year 2016-17. These paper present that the formulation of buffalo milk with 3 percent fat, 1 percent maltodextrin (on the basis of milk) and 10 percent sugar & 0.10 percent aspartame (on the basis of *khoa)* were found suitable for preparation of low-calories and low-sugar *kalam*.

Keywords: Low- calories, low sugar, *Kalam*, Process standardization

Introduction
In India, most of traditional dairy product contains high fat and also high sugar (Pal & Raju, 2007) [5]. *Peda* and *Burfi* are the two major *khoa* based sweets, which are highly popular among Indians, mainly because of their delicious taste and high nutritional value. It has been reported that the quantity of *peda* produced in India exceeds any other indigenous milk based sweet (Mahadevan, 1991) [4]. Fat replacers sometimes referred as fat substitutes or fat replacements are ingredients that mimic some of the roles of fat in food processing. The ideal fat replacer is a safe compound consumed with no health risk. It has all the functional and organoleptic properties of fat (taste and appearance characteristics such as richness, flakiness and sheen) with significantly fewer calories than fat (Hope Warshaw and Marion Franze, 1996) [3]. It can serve as an excellent carrier product for extra nutrient and if enriched or fortified it can satisfy the nutritional needs of the people (Krupa *et al*. 2011). In India, most of traditional dairy food contains high fat and also high sugar (Pal & Raju, 2007) [5].

Kalam: *Kalam* is a popular heat desiccated traditional dairy delicacy of Maharashtra specially Parbhani district in Gangakhed talukas. It is prepared by blending of *khoa* and sugar followed by heat desiccation until characteristic light brown colour appears. It is a nutritive, palatable and a very good source of energy. (Ghorpade, 2011) [2]

Material and Methods
Low-calories and low sugar *kalam* was prepared in the Department of Animal Husbandry & Dairy science, Latur.

Standardization of Milk: The buffalo milk was standardized to 6% fat and the excess fat of buffalo milk was removed by using cream separator.

Artificial sweetener: Artificial sweeteners i.e. Aspartame was purchased from College of Agriculture, Latur.

Sugar: Good quality sugar was obtained from the local market of Latur.

Bulking agents: High quality bulking agents i.e. Maltodextrin was purchased from College of Agriculture, Latur.

Experiment details and treatment details
1. Optimization of stage of addition of fat replacer on the basis of milk for preparation of low calorie *Kalam*.

2. For optimization of stage of addition of fat replacer, Maltodextrin was tried at 1% level on the basis of milk to prepare low calorie *Khoa* from toned milk.
3. Trials three were conducted to decide the stage of addition of Maltodextrin
    1. At milk stage.
    2. At pat formation stage.
    3. After pat formation stage.

The stage of addition of maltodextrin was selected by comparing with full fat *Khoa*, prepared from 6% fat on the basis of sensory evaluation for next study.

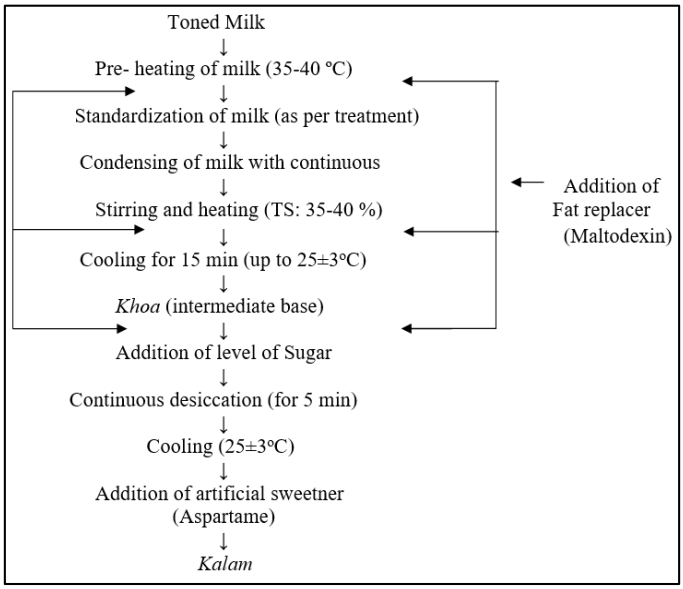
Optimization of levels of Maltodextrin

1. Maltodextrin was tried to prepare low calorie *Khoa*.
2. Levels of Maltodextrin was selected by comparing with full fat *Khoa* on the basis of sensory evaluation.

Sugar replacement in *Kalam*

1. The previously developed low calorie *Khoa* with Maltodextrin was tried for preparation of *Kalam*.
2. Artificial sweetener Aspartame was tried at different levels with sugar. Levels of aspartame and sugar was selected on the basis of sensory evaluation.
3. *Kalam* prepared from low fat *Khoa* using aspartame and sugar was compared with *Kalam* prepared from standardized sugar with full fat *Kalam*.
4. Suitable level of Aspartame and sugar was selected on the basis of sensory evaluation.

Procedure for preparation of *Kalam* by using Artificial sweetener and Fat Replacer Proposed process diagram for the manufacture of *Kalam* added with artificial sweetener and bulking agents from Toned milk



Statistical analysis

All the data were expressed as mean ± standard deviation of mean and was calculated from three independent experiments. One-way analysis of variance (ANOVA) using Completely Randomized Design (CRD) was applied.

Results and Discussion

Fat replacement for preparation of *kalam*

This part of experiment was carried out with an aim to prepare low fat and low calorie *kalam* by reducing the fat content. The traditional *Kalam* contains high amount of fat, which is harmful for the health-conscious peoples. Hence, the attempt was made to prepare low fat *kalam* from buffalo milk. The fat content in buffalo milk was standardized to 3 percent by using Pearson's square formula. *Kalam* prepared from buffalo milk containing 3 percent fat without incorporation of fat replacer was unacceptable in terms of sensory attributes because prepared *kalam* was hard and chewy. So, prepared *kalam* containing 3 percent fat was unsuitable for preparation of *kalam*. Use fat replacers i.e. Maltodextrin was used as fat replacer for preparation of *kalam*. For preparation of *kalam* with help of maltodextrin as fat replacer, the stage of addition was finalized. An experiment was conducted to use Maltodextrin as a fat replacer which being a carbohydrate, (very low in fat) was used for manufacturing low fat and low calorie *kalam*. The various three stages were selected for addition of maltodextrin. 1% maltodextrin on the basis of milk was taken to finalize the stage of addition.

Optimization of different stages of maltodextrin for preparation of low-calories *kalam*

The effect of stage of addition of maltodextrin@1% on the basis of milk for preparation of low fat *kalam* is given in following table. The matter related to flavour, body and texture, colour and appearance, sweetness and mouthfeel and overall acceptability are discussed in following heads.

Table 1: Sensory attributes of low-calories *kalam* added with maltodextrin at different stage

Stage of addition	Flavour (9)	Body and Texture (9)	Colour and Appearance (9)	Sweetness/ Mouthfeel (9)	Overall Acceptability (36)	Mean
Control *kalam* (6% fat)	9.0	9.0	9.0	9.0	36	9.0
At Milk Stage	9.0	7.5	7.5	8.5	33	8.25
At pat formation stage	9.0	8.5	8.5	8.5	35	8.75
After pat formation stage	9.0	8.0	8.0	8.5	34	8.50

The typical flavour of most desirable quality *kalam* is mild and cooked flavour accompanied by richness and sweetness due to fat and lactose content in milk used for preparation of *kalam*. The desired body and texture is one of the having soft, smooth and very fine grains which are cohesively knit in form of a bolus. The comparison has been made with *kalam* prepared from 6% fat (standardized fat) and *kalam* prepared 3% fat with maltodextrin as fat substitute. The various stages for addition of maltodextrin was experimented to develop low fat *kalam*. The maltodextrin @ 1% on the basis of milk was used.

Effect of stage of addition of maltodextrin on flavour score

For addition of maltodextrin, various stages were tried i.e. milk stage, at pat formation stage and after pat formation stage. From these various stages, the pat formation stage was found most acceptable by sensory evaluation as compared to other stages. The average flavour score *kalam* ranged from 8.5 to 9.0. The maximum flavour score 9.0 (out of 9.0) was obtained from *kalam* samples prepared from full fat *kalam* containing 6% fat. The highest score was obtained amongst these three stages of addition of maltodextrin from milk of 3% fat and incorporating 1% maltodextrin at pat formation stage minimum flavour score 8.5 (out of 9.0) was obtained from *kalam* prepared addition of 1% maltodextrin at milk stage. So, the maximum acceptable flavour score, 8.5 out of 9 was obtained from *kalam* prepared at pat formation stage. The prepared *kalam* was found to have near about flavour score as compared to full fat *kalam*. Addition of maltodextrin at various stages had a significant (P<0.05) effect on flavour score of *kalam*. Maltodextrin was incorporated at milk stage, the body and texture of developed *kalam* was very sticky, uneven and unclean.

Effect of stage of addition of maltodextrin on body and texture score

Body and texture of any food or dairy product plays an important role in sensory evaluation and acceptability of the product. The average body and texture score of *kalam* ranged from 7.5 to 9.0. The maximum body and texture score 9.0 (out of 9.0) was obtained from *kalam* samples prepared from full fat *kalam* containing 6% fat. The highest score was obtained amongst these three stages of addition of maltodextrin from milk of 3% fat and incorporating 1% maltodextrin at pat formation stage. Minimum body and texture score 7.5 (out of 9.0) was obtained from *kalam* prepared with addition of maltodextrin at milk stage. So, the maximum acceptable body and texture score 8.5 (out of 9.0) was obtained from *kalam* prepared at pat formation stage. The prepared *kalam* was found to have near about body and texture score as compared to full fat *kalam*. Addition of maltodextrin at various stages had a significant (P<0.05) effect on body and texture score of *kalam* Maltodextrin was incorporated at milk stage, the body and texture of developed *kalam* was very sticky, uneven and unclean.

Effect of stage of addition of maltodextrin on colour and appearance score

Colour and appearance of any food or dairy product plays an important role in sensory evaluation and acceptability of the product. The average colour and appearance score of *kalam* ranged from 7.0 to 9.0. The maximum colour and appearance score 9.0 (out of 9.0) was obtained from *kalam* samples prepared from full fat *kalam* containing 6% fat. The highest score was obtained amongst these three stages of addition of maltodextrin from milk of 3% fat and incorporating 1% maltodextrin at pat formation stage. Minimum colour and appearance score 7.5 (out of 9) was obtained from *kalam* prepared with addition of maltodextrin at milk stage. So, the maximum acceptable colour and appearance score 8.5 (out of 9) was obtained from *kalam* prepared at pat formation stage. The prepared *kalam* was found to have near about colour and appearance score as compared to full fat *kalam*. Addition of maltodextrin at various stages had a significant (P<0.05) effect on colour and appearance score of *kalam*. The colour and appearance of developed *kalam* was very sticky and pronounced moist appearance was observed, when maltodextrin was incorporated at milk stage.

Effect of stage of addition of maltodextrin on sweetness and mouthfeel score

Sweetness and mouthfeel of any food or dairy product plays an important role in sensory evaluation and acceptability of the product. The average sweetness and mouthfeel score of *kalam* ranged from 8.5 to 9.0. The maximum sweetness and mouthfeel score 9.0 (out of 9.0) was obtained from *kalam* samples prepared from full fat *kalam* containing 6% fat. The highest score was obtained amongst these three stages of addition of maltodextrin from milk of 3% fat and incorporating 1% maltodextrin at pat formation stage. Minimum sweetness and mouthfeel score 8.5 (out of 9.0) was obtained from *kalam* prepared with addition of maltodextrin at milk stage. So, the maximum acceptable sweetness and mouthfeel score 8.5 (out of 9.0) was obtained from *kalam* prepared at pat formation stage. The prepared *kalam* was found to have near about sweetness and mouthfeel score as compared to full fat *kalam*. Addition of maltodextrin at various stages had a significant (P<0.05) effect on sweetness and mouthfel score of *kalam*. The sweetness and mouthfeel of developed *kalam* was very sticky and pronounced moist appearance was observed, when maltodextrin was incorporated at milk stage.

Effect of stage of addition of maltodextrin on overall acceptability score

Overall acceptability of any food or dairy product plays an important role in sensory evaluation and acceptability of the product. The average overall acceptability score of *kalam* ranged from 33 to 36. The maximum overall acceptability score 36 (out of 36) was obtained from *kalam* samples prepared from full fat *kalam* containing 6% fat. The highest score was obtained amongst these three stages of addition of maltodextrin from milk of 3% fat and incorporating 1% maltodextrin at pat formation stage. Minimum overall acceptability score 33 (out of 36) was obtained from *kalam* prepared with addition of maltodextrin at milk stage. So, the maximum acceptable overall acceptability score 35 (out of 36) was obtained from *kalam* prepared at pat formation stage. The prepared *kalam* was found to have near about overall acceptability score as compared to full fat *kalam*. Addition of maltodextrin at various stages had a significant (P<0.05) effect on overall acceptability score of *kalam*. The overall acceptability of developed *kalam* was very sticky, uneven and unclean when maltodextrin was incorporated at milk stage.

On the basis of sensory evaluation, addition of bulking agent Maltodextrin for preparation of *kalam* at pat formation stage was finalized for further study.

Optimization of different levels of maltodextrin for preparation of low-calories *kalam*.

The effect of level of addition of maltodextrin@0.5%, 1.0% and 1.5% at pat formation stage on the basis of milk for preparation of *kalam* is given in following table. The matter related to flavour, body and texture, colour and appearance and overall acceptability are discussed in following heads.

Table 2: Sensory attributes of low-calories *kalam* added with maltodextrin at different level

Level of Addition of Maltodextrin	Flavour (9)	Body and Texture (9)	Colour and Appearance (9)	Sweetness/ Mouthfeel (9)	Overall acceptability (36)	Mean
Control *Kalam* (6%)	9.0	9.0	9.0	9.0	36	9.0
Maltodextrin 0.5%	8.5	8.0	8.0	8.0	34	8.25
Maltodextrin 1%	8.5	8.5	8.5	8.0	35	8.75
Maltodextrin 1.5%	8.5	7.5	7.5	8.0	33	8.50

The typical flavour of most desirable quality *kalam* is mild and cooked flavour accompanied by richness and sweetness due to fat and lactose content in milk used for preparation of *kalam*. The desired body and texture is one of the having soft, smooth and very fine grains which cohesively knit in form of a bolus. The comparison has been made with *kalam* prepared from 6 percent fat (standardized fat) and *kalam* prepared from 3 percent fat with maltodextrin as fat substitute. The various levels of maltodextrin were experimented to develop low fat *kalam*. The maltodextrin @ 0.5%, 1% and 1.5% on the basis of milk was used to prepare low calorie *kalam.*

Effect of level of maltodextrin on flavour score

For addition of maltodextrin, various levels were tried i.e. maltodextrin 0.5%, 1% and 1.5% on the basis of milk was used to prepare low calorie *kalam* at pat formation stage. From these various levels, the addition of 1% maltodextrin at pat formation stage was found to be the most acceptable by sensory evaluation as compared to other levels of maltodextrin. The average flavour score of *kalam* ranged from 8.5 to 9.0. The maximum flavour score 9.0 (out of 9.0) was obtained from *kalam* samples prepared from full fat *kalam* containing 6 percent fat. The highest score was obtained amongst these three levels of addition of maltodextrin from milk of 3 percent fat and incorporating 1 percent maltodextrin at pat formation stage. Minimum flavour score 8.5 (out of 9.0) was obtained from *kalam* prepared with addition of 1.5% maltodextrin at pat formation stage. So, the maximum acceptable flavour score 8.5 (out of 9.0) was obtained from *kalam* prepared with addition of 1% maltodextrin at pat formation stage. The prepared *kalam* was found to have near about flavour score as compared to full fat *kalam*. Addition of maltodextrin at various levels had a significant (P<0.05) effect on flavour score of *kalam.*

Effect of level of maltodextrin on body and texture score

The average body and texture score of *kalam* ranged from 8.0 to 8.5. The maximum body and texture score 9.0 (out of 9.0) was obtained from *kalam* samples prepared from full fat *kalam* containing 6% fat. The highest body and texture score was obtained amongst these three levels of addition of maltodextrin from milk of 3% fat and incorporating 1% maltodextrin at pat formation stage. Minimum body and texture score 7.5 (out of 9.0) was obtained from *kalam*prepared with addition of 1.5% maltodextrin at pat formation stage. So, the maximum acceptable body and texture score 8.5 (out of 9) was obtained from *kalam* prepared with addition of 1% maltodextrin at pat formation stage. The prepared *kalam* was found to have near about body and texture score as compared to full fat *kalam*. Addition of maltodextrin at various levels had a significant (P<0.05) effect on body and texture score of *kalam*.

Effect of levels of addition of maltodextrin on colour and appearance score

The maximum colour and appearance score 9.0 (out of 9.0) was obtained from *kalam* samples prepared from full fat *kalam* containing 6 percent fat. The highest score was obtained amongst these three levels of addition of maltodextrin from milk of 3 percent fat and incorporating 1 percent maltodextrin at pat formation stage. Minimum colour and appearance score 8.5 (out of 9.0) was obtained from *kalam* prepared with addition of 1.5 percent maltodextrin at pat formation stage. So, the maximum acceptable colour and appearance score 8.5 (out of 9.0) was obtained from addition 1 percent maltodextrin at pat formation stage. The prepared *kalam* was found to have near about colour and appearance score as compared to full fat *kalam*. Addition of maltodextrin at various levels had a significant (P<0.05) effect on colour and appearance score of *kalam.*

Effect of levels of addition of maltodextrin on sweetness and mouthfeel score

The maximum sweetness and mouthfeel score 9.0 (out of 9.0) was obtained from *kalam* samples prepared from full fat *kalam* containing 6 percent fat. The highest score was obtained amongst these three levels of addition of maltodextrin from milk of 3 percent fat and incorporating 1 percent maltodextrin at pat formation stage. Minimum Sweetness and mouthfeel score 8.5 (out of 9.0) was obtained from *kalam* prepared with addition of 1.5 percent maltodextrin at pat formation stage. So, the maximum acceptable Sweetness and mouthfeel score 8.5 (out of 9.0) was obtained from addition 1 percent maltodextrin at pat formation stage. The prepared *kalam* was found to have near about Sweetness and mouthfeel score as compared to full fat *kalam*. Addition of maltodextrin at various levels had a significant (P<0.05) effect on Sweetness and mouthfeel score of *kalam*.

Effect of level of maltodextrin on overall acceptability score

Overall acceptability of any food or dairy product plays an important role in sensory evaluation and acceptability of the product. The average overall acceptability score of *kalam* ranged from 33 to 36. The maximum overall acceptability score 36 (out of 36) was obtained from *kalam* samples prepared from full fat *kalam* containing 6 percent fat. The highest score was obtained amongst these three stages of addition of maltodextrin from milk of 3 percent fat and incorporating 1 percent maltodextrin at pat formation stage. Minimum overall acceptability score 33 (out of 36) was

obtained from *kalam* prepared with addition of 1.5 percent maltodextrin at pat formation stage. So, the maximum acceptable overall acceptability score 35 (out of 36) was obtained from *kalam* prepared from addition of 1 percent maltodextrin at pat formation stage. The prepared *kalam* was found to have near about overall acceptability score as compared to full fat *kalam*. Addition of maltodextrin at various levels had a significant (P<0.05) effect on overall acceptability score of *kalam*. On the basis of sensory evaluation, addition of bulking agent Maltodextrin @1% for preparation of *kalam* at pat formation stage was finalized for further study.

Optimization of sugar and aspartame levels in the preparation of kalam

The effect of addition of sugar and aspartame for preparation of *Kalam* is given in following table. The matter related to flavour, body and texture, colour and appearance and overall acceptability are discussed in following heads.

Table 3: Effect of different levels of Aspartame on the sensory attributes of low-calories and low-sugar *kalam*

Addition of sugar and aspartame	Flavour (9)	Body and Texture (9)	Colour and Appearance (9)	Sweetness/ Mouthfeel (9)	Overall Acceptability (36)	Mean
30% sugar + 0% Aspartame	9.0	9.0	9.0	9.0	36	9.0
20% sugar + 0.05% Aspartame	9.0	8.5	8.5	8.5	34.5	8.63
10% sugar + 0.10% Aspartame	9.0	8.5	8.5	8.0	34.0	8.50
0% sugar + 0.15% Aspartame	9.0	7.5	8.0	7.5	32.0	8.00

The sensory evaluation of any dairy or food products subjectively measures the impression of human senses. It is well recognized that sensory evaluation is very important tool in determining the acceptability of new food or dairy products. Sugar is a major constituent of traditional *Kalam* as well as the developed low-calories and low-sugar *Kalam*. Sugar replacement by alternative artificial sweetener, thus requires addition of appropriate levels of sugar and artificial sweetener. Aspartame was used along with sugar to provide the sweetness in developed *Kalam*. The *kalam* was prepared by using 1 percent maltodextrin on the basis of milk as bulking agent. The developed *kalam* was used for preparation of *Kalam* on the basis of sensory evaluation. On the sensory evaluation, the *Kalam* prepared from 10 percent sugar and 0.10 percent Aspartame on the basis of *kalam* was selected for physico-chemical study. The superior results were obtained from Control sample containing 30 percent sugar and 0 percent Aspartame. As the level of sugar decreased as well as level of artificial sweetener aspartame increased the flavour, body and texture, colour and appearance and overall acceptability scores decreased significantly. But the maximum acceptable score was obtained by addition of 10 percent sugar and 0.10 percent aspartame to replace the sugar by 60 percent as compared to control *Kalam* samples. On the sensory evaluation addition of 10 percent sugar and 0.10 percent aspartame on the basis of *kalam* was finalized

Effect of sugar and aspartame on flavour score

The average flavour score of *Kalam* ranged from 8.5 to 9.0. The maximum flavour score 9.0 (out of 9.0) was obtained from *Kalam* samples prepared from combinations of 30 percent sugar and 0 percent Aspartame. Minimum flavour score 8.5 (out of 9.0) was obtained from *Kalam* prepared with combinations of 0 percent sugar and 0.15 percent Aspartame. So, the maximum acceptable flavour score 8.5 (out of 9) was obtained from *Kalam* prepared from 10 percent sugar and 0.10 percent aspartame combination on the basis of *kalam*. The developed *Kalam* was found to have equal sweetness to that of control samples containing 30 percent sugar. As level of sugar decreased and level of aspartame increased the flavour score of *Kalam* decreased significantly (P<0.05). Addition of sugar and aspartame for preparation of experimented *Kalam* had highly significant effect on flavour scores of developed *Kalam*.

Effect of sugar and aspartame on body and texture score

Body and texture of any food or dairy product plays an important role in sensory evaluation and acceptability of the product. The average flavour score of *Kalam* ranged from 8.0 to 8.5. The maximum body and texture score 9.0 (out of 9.0) was obtained from *Kalam* samples prepared from combinations of 30 percent sugar and 0 percent Aspartame. Minimum body and texture score 7.5 (out of 9.0) was obtained from *Kalam* prepared with combinations of 0 percent sugar and 0.15 percent Aspartame. So, the maximum acceptable body and texture score 8.5 (out of 9.0) was obtained from *Kalam* prepared from 10 percent sugar and 0.10 percent aspartame combination on the basis of *kalam*.As level of sugar decreased and level of aspartame increased the body and texturescore of *Kalam* decreased significantly (P<0.05). Addition of sugar and aspartame for preparation of experimented *Kalam* had highly significant effect on body and texturescores of developed *Kalam*.

Effect of sugar and aspartame on colour and appearance score: Colour and appearanceof any food or dairy product plays an important role in sensory evaluation and acceptability of the product. The average colour and appearance score of *Kalam* ranged from 8.0 to 9.0. The maximum colour and appearancescore 9.0 (out of 9) was obtained from *Kalam* samples prepared from combinations of 30 percent sugar and 0 percent Aspartame. Minimum colour and appearancescore 8.0 (out of 9.0) was obtained from *Kalam* prepared with combinations of 0 percent sugar and 0.15 percent Aspartame. So, the maximum acceptable colour and appearancescore 8.0 (out of 9.0) was obtained from *Kalam* prepared from 10 percent sugar and 0.10 percent aspartame combination on the basis of *kalam*. As level of sugar decreased and level of aspartame increased, the colour and appearancescore of *Kalam* decreased significantly (P<0.05). Addition of sugar and aspartame for preparation of experimented *Kalam* had highly significant effect on colour and appearance scores of developed *Kalam*.

Effect of sugar and aspartame on sweetness and mouthfeel score

Sweetness and mouthfeelof any food or dairy product plays an important role in sensory evaluation and acceptability of the product. The average sweetness and mouthfeel score of *Kalam* ranged from 7.5 to 9.0. The maximum sweetness and mouthfeel score 9.0 (out of 9) was obtained from *Kalam* samples prepared from combinations of 30 percent sugar and 0 percent Aspartame. Minimum sweetness and mouthfeel score 7.5 (out of 9.0) was obtained from *Kalam* prepared with combinations of 0 percent sugar and 0.15 percent Aspartame. So, the maximum acceptable sweetness and mouthfeel score 8.5 (out of 9.0) was obtained from *Kalam* prepared from 10 percent sugar and 0.10 percent aspartame combination on the basis of *kalam*.As level of sugar decreased and level of aspartame increased, the sweetness and mouthfeelscore of *Kalam* decreased significantly (P<0.05). Addition of sugar and aspartame for preparation of experimented *Kalam* had highly significant effect on sweetness and mouthfeel and appearance scores of developed *Kalam*.

Effect of sugar and aspartame on overall acceptability score

Overall acceptability of any food or dairy product plays an important role in sensory evaluation and acceptability of the product. The average overall acceptability score of *Kalam* ranged from 33.5 to 36 (out of 36). The maximum overall acceptability score 36 (out of 36) was obtained from *Kalam* samples prepared from combinations of 30 percent sugar and 0 percent aspartame. Minimum overall acceptability score 32 (out of 36) was obtained from *Kalam* prepared with combinations of 0 percent sugar and 0.15 percent aspartame. So, the maximum acceptable overall acceptability score 34.5 (out of 36) was obtained from *Kalam* prepared from 10 percent sugar and 0.10 percent aspartame combination on the basis of *kalam*. As level of sugar decreased and level of aspartame increased, the overall acceptability score of *Kalam* decreased significantly (P<0.05). Addition of sugar and aspartame for preparation of experimented *Kalam* had highly significant effect on Overall acceptability scores of developed *Kalam*.

Conclusion

Preliminary trials were conducted with an intention to select the stage and level fat and sugar replacers, bulking agent and high synthetic sweetener, which could produce *kalam* having sensorial and textural properties as close as possible to that of conventional product. Addition of maltodextrin was tried at three different stages viz., at milking stage, at pat formation stage and after pat formation stage. *Kalam* added with maltodextrin at pat formation stage was liked most by the judges than the other two stages. Three different levels maltodextrin viz., 0.5%, 1% and 1.5% were added. Among them *kalam* added with 1% maltodextrin obtained highest total sensory score. For sugar replacement using the high synthetic sweetener i.e. aspartame was tried for their suitability to manufacture low-calories and low-sugar *kalam*. *Kalam* made using polydextrose resulted in coarse grains and rough texture. Among, maltodextrin and aspartame that were tried at three different level viz., 0.5%, 1%, 1.5% and 0.05%, 0.10%, 0.15, respectively. Maltodextrin added @ 1% and aspartame added @ 0.10% scored highest total sensory score.

References

1. Aneja RP, Mathur BN, Chandan RC, Banerjee AK. Desiccated Milk Based Products in `Technology of Indian Milk Products. 2002; 122-125.
2. Ghorpade S, Patil S, Adangale S, Lokhande A. Quality Apprehension of Kalam Compared with Pedha. Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231-6345, 2011.
3. Hope Warshaw and Marion Franze: Fat Replacers - Their Use in Foods and Role in Diabetes Medical Nutrition Therapy, Diabetes Care **19** (11). (1996)
4. Mahadevan, A. P.: Nutritive value of traditional milk products of India: Indian Dairyman. 1991; **43**:95-101.
5. Pal D, Raju PN. Indian traditional dairy products-an overview. In: Souvenir of the traditional conference on traditional dairy foods, 2007, 1-17.
6. Palit, Pal D. Studies on mechanized production and shelf life extension of burfi", Indian J. Dairy Sci. 2005; 8(1):12-16.
7. Patil GR: Research and Product development needs of dairy sector. Indian Dairyman. 2003; 55(3):56-62.