

Original Research Article

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Development and Characterization of Herbal Custard

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Herbal Custard is prepared by adding pudina (*Mentha spicata*) paste into fresh toned milk. The physicochemical, microbiological, organoleptic and rheological properties were analyzed to assess the quality of the custard. Physicochemical properties of custard samples including moisture, ash, fat, protein and carbohydrate content were determined for all the samples. In this study, many trials have been made with different proportion of pudina paste *i.e.* 1%, 2%, and 3% using two types of heat treatment *i.e.* oven and microwave. Finally the sensory evaluation of all the products were carried out and according to the panel of judges, overall acceptability of 2% pudina fortified herbal custard (microwave) was found superior in comparison to others ($p < 0.01$). Total Coliform Count and total Yeast and Mold Count of different types of herbal custard samples were determined in 0, 1, 3, 5 and 7 days respectively. The shelf stability of herbal custard gradually increases after 7 days of storage period in terms of total yeast and mold count (CFU/g). It was found that no coliforms were present in any samples during storage. The results of current study demonstrated that the fortification of pudina paste into custard significantly improve the quality characteristics of the final product.

Introduction

In different herbs, a wide variety of active phytochemicals including the flavonoids, terpenoids, lignans, sulfides, polyphenols, carotenoids, coumarins, saponins, plant sterols, curcumins and phthalides have been identified. Mint (*Mentha arvensis*) contain anti-microbial component volatile oil, carvone, limonene, 1, 8-cineole, trans-carveol, linalin, pulegone, menthol, menthene, menthenone. Fortification of herbs have shown in many food products like in ghee, cream, lassi, sandesh, butter milk, flavored milk, whey beverage etc. Peppermint yields 0.1–1% of volatile oil composed primarily of menthol (29–48%), menthone (20–31%),

menthofuran (6.8%) and menthyl acetate (3–10%). Other pharmacologically active ingredients include bitter substances, caffeic acid, flavonoids (12%), polymerized polyphenols (19%), carotenes, tocopherols, betaine, choline and tannins (Sokovic *et al.*, 2009). Measured low to moderate levels of phenolics with antioxidant activity were reported from peppermint (Zheng and Wang, 2001). According to Amr (1990) peppermint contain DPPH (mg AAE/gm) and Phenols (mg GAE/gm) 203.8 and 89.6 respectively. Total polyphenol content of one-milligram pudina extract was equivalent to 500 μ g of gallic acid. Therefore, this potential

bioactivity of pudina extract was associated with its high polyphenolic content (Kumar and Chattopadhyay, 2007). Herbs are used in many domains, including medicine, nutrition, flavouring, beverages, dyeing, repellents, fragrances, cosmetics (Djeridane *et al.*, 2006). Many species have been recognized to have medicinal properties and beneficial impact on health, e.g. antioxidant activity, digestive stimulation action, antiinflammatory, antimicrobial, hypolipidemic, antimutagenic effects and anticarcinogenic potential (Aaby *et al.*, 2004). Crude extracts of herbs and spices, and other plant materials rich in phenolics are of increasing interest in the food industry because they retard oxidative degradation of lipids and thereby improve the quality and nutritional value of food.

Custard is a variety of culinary preparations based on a cooked mixture of milk or cream and egg yolk. Depending on how much egg or thickener is used, custard may vary in consistency from a thin pouring sauce (*crème anglaise*) to a thick pastry cream (French: *crème pâtissière*). Most common custards are used as desserts or dessert sauces and typically include sugar and vanilla. Custard bases may also be used for quiches and other savory foods. Sometimes flour, corn starch, or gelatin is added as in pastry cream or *crème pâtissière*. Cooked (set) custard is a weak gel, viscous and thixotropic; while it does become easier to stir the more it is manipulated, it does not, unlike many other thixotropic liquids, recover its lost viscosity over time (Karla *et al.*, 1996).

In this study an attempt has been made to prepare Herbal Custard using pudina paste (@1%, 2%, 3%) by using oven and microwave treatment. The physicochemical, microbiological, organoleptic and rheological properties were compared to assess the quality of the Custard.

Materials and Methods

Raw material

Toned milk, sugar, custard powder, pudina leaves were bought from local market of Sodepur.

Preparation of herb paste

The pudina leaves were washed thoroughly; roots were removed by using a sharp knife and chopped, grinded and stored in refrigerated condition.

Preparation of herbal custard in oven

Fresh milk was taken and boiled in a saucepan over medium heat. Then custard powder was mixed with small amount of milk (@5% w/v). The mixture was added in the saucepan and stirred continuously. Sugar was added as milk starts to thicken (@10% w/v). Then the mixture was boiled and when it reaches its correct consistency it was removed from heat and pudina paste was added (@1%, 2%, 3% w/v). Then the product was cooled for half an hour. After cooling the final product was packaged and stored in refrigerator

Preparation of herbal custard in microwave

Fresh milk was taken in a microwave bowl and boiled for 6min at 800W. Then custard powder was mixed with small amount of milk (@5% w/v). Then the mixture was added in the bowl and stirred for 1min. Sugar was added as milk starts to thicken (@10% w/v). Then the mixture was boiled for 4 min at 800 W and after the end of boiling pudina paste was added (@1%, 2%, 3%w/v). Then it was mixed well and cooled for half an hour. After cooling the final product was packaged and stored in refrigerator

Methodology

The rheological flow properties of shear-thinning materials are most commonly described by a two parameter power law model of the form (Jumah *et al.*, 2001).

$$\tau = m\dot{\gamma}^n$$

Where, τ is the shear stress, $\dot{\gamma}$ is the shear rate; m is the flow consistency index and n is the flow behavior index. This power-law model is used in this study to describe the behavior of the custard batter. The value of n is less than one for pseudo plastic material.

Total polyphenol content was measured at 765nm by Folin-Ciocalteu reagent (McDonald *et al.*, 2001) and expressed in terms of Gallic acid equivalent (GAE).

Custard incorporated with pudina paste (1%, 2% and 3%) were coded with different numbers and submitted to sensory evaluation by ten member of trained panelists of the department on a 9-point hedonic scale (BIS, 1971). Chemical analysis was done according the method described by AOAC (1999). The data was statistically analyzed using statistical tool ANOVA described by Snedecor and Cochran (1967).

Results and Discussion

Comparison of sensory quality of different types of herbal custard

The sensory score and comparison for the parameters of different types of herbal custard (oven) are given in table 1 and figure 1(a). Average overall acceptability score of prepared custard samples were found to be 7.87, 8.37 and 7.75 respectively. Highest score was recorded for sample OC2. The samples had significant influence ($p < 0.01$) on appearance, color, flavor, body and texture whereas no significant difference was

observed ($p > 0.01$) in mouth feelness and overall acceptance.

In case of herbal custard (microwave) samples showed significant influence ($p < 0.01$) on appearance, color and body and texture and no significant difference was observed ($p > 0.01$) on flavor, mouth feelness and overall acceptability (Table 2 and Fig. 1b). Average overall acceptability score of prepared custard (microwave) samples were found to be 7.2, 8.5, 7.7 and MC2 scored highest overall acceptability among all varieties of custard (both oven and microwave treated).

Semi-solid fat-containing foods such as custards, mayonnaises and sauces are appreciated by consumers because of their creamy mouth feel. This sensory attribute is difficult to describe and is known to be multidimensional. It was demonstrated that creamy mouth feel in custards can be predicted reasonably well from rheological measurements too (Jellema *et al.*, 2005).

Comparison of rheological quality of different types of herbal custard

Textural characteristics of pudina paste fortified custard samples were analyzed. The results are shown in Fig. 2a-2d by plotting shear stress vs. shear rate and viscosity vs. shear rate. According to the textural analysis, the values of m and n resulting from the fit of the power law model for different samples can be found in table 3. The values of n in all herbal custard (oven) samples are less than 1. Therefore it is evident that all samples show pseudo-plastic behavior. The results are comparable with the findings of Jellema *et al.*, (2005) and Dutta *et al.*, (2016).

Whereas the n value in all types of herbal custard (microwave) samples are greater than 1 which indicates dilatant fluid characteristic. Longrée *et al.*, (1966) reported that fluid

properties of custard were affected by the types of ingredients used and types of heat treatment given. Systems containing milk, egg and starch were non-Newtonian and time dependent. During shearing viscosity losses,

increased as rate of shear increased, and were not recovered upon resting. When the system was overheated, protein-starch aggregates which produced crossed hysteresis loops.

Table.1 Sensory quality of different types of Herbal Custard (Oven) with Anova analysis

Parameters	OC1 (avg. ± s.d)	OC2 (avg. ±s.d)	OC3 (avg. ± s.d)	Level of Significance
Appearance	7.75±0.46	7.87±0.64	7.87±0.64	**
Color	7.63±0.52	8.13±0.64	8.25±0.46	**
flavor	7.25±0.88	8.5±0.53	7.37±0.74	**
Body and texture	7.75±0.46	8.5±0.53	7.37±0.74	**
Mouth feelness	7.87±0.64	8.25±0.70	7.75±0.88	NS
Overall acceptance	7.87±0.64	8.37±0.52	7.75±0.70	NS

** Significant at p< 0.01

(avg ± s.d) = Average ± Standard Deviation, n=10

OC1 = 1% Pudina custard, OC2= 2% Pudina Custard, OC3 = 3% Pudina Custard

Table.2 Sensory quality of different types of Herbal Custard (Microwave) with Anova analysis

Parameters	MC1 (avg. ± s.d)	MC2 (avg. ± s.d)	MC3 (avg. ± sd)	Level of Significance
Appearance	7±0.48	7±0.59	7.7±0.6	**
Color	7±0.49	8±0.61	8.2±0.41	**
Flavor	6.25±0.78	8.3±0.5	7.7±0.68	NS
Body and texture	7.7±0.42	8.1±0.47	7±0.72	**
Mouth feelness	7.8±0.63	8.2±0.69	7.5±0.8	NS
Overall acceptance	7.2±0.55	8.5±0.5	7.7±0.69	NS

** Significant at p< 0.01

(avg ± s.d) = Average ± Standard Deviation, n=10

MC1 = 1% Pudina custard, MC2= 2% Pudina Custard, MC3 = 3% Pudina Custard.

Table.3 Fluid flow behavior of different types of herbal custard

Sample	<i>n</i>	<i>m</i>
OC1	0.33	37.67
OC2	0.28	67.17
OC3	0.26	86.87
MC1	1.702	0.6
MC2	1.765	0.45
MC3	1.787	0.37

Herbal Custard (Oven): OC1 = 1% Pudina, OC2= 2% Pudina, OC3 = 3% Pudina.

Herbal Custard (Microwave): MC1 = 1% Pudina, MC2= 2% Pudina, MC3 = 3% Pudina.

m= flow consistency index; *n*= flow behavior index

Table.4 Chemical analysis of different types of herbal custard

Sample Name	Ash (%)	Moisture (%)	Fat (%)	Protein (%)	Carbohydrate (%)
Control	0.9	91.4	4.5	4.4	23
OC1	0.8	94.8	4.4	4.41	22.4
OC2	0.6	95	4.4	4.42	22.4
OC3	0.4	95.5	4.3	4.45	22.3
MC1	0.8	91.6	4.5	4.4	23
MC2	0.6	91.8	4.4	4.4	22.5
MC3	0.4	92	4.3	4.35	22.4

Herbal Custard (Oven): OC1 = 1% Pudina, OC2= 2% Pudina, OC3 = 3% Pudina.

Herbal Custard (Microwave): MC1 = 1% Pudina, MC2= 2% Pudina, MC3 = 3% Pudina.

Fig.1 (a) Sensory evaluation of Herbal Custard (Oven); **(b)** Sensory evaluation of Herbal Custard (Microwave)

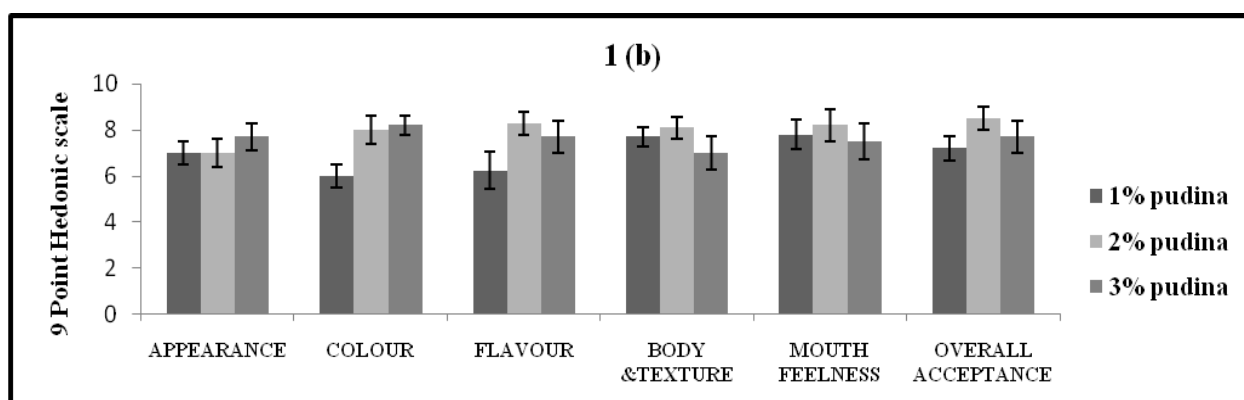
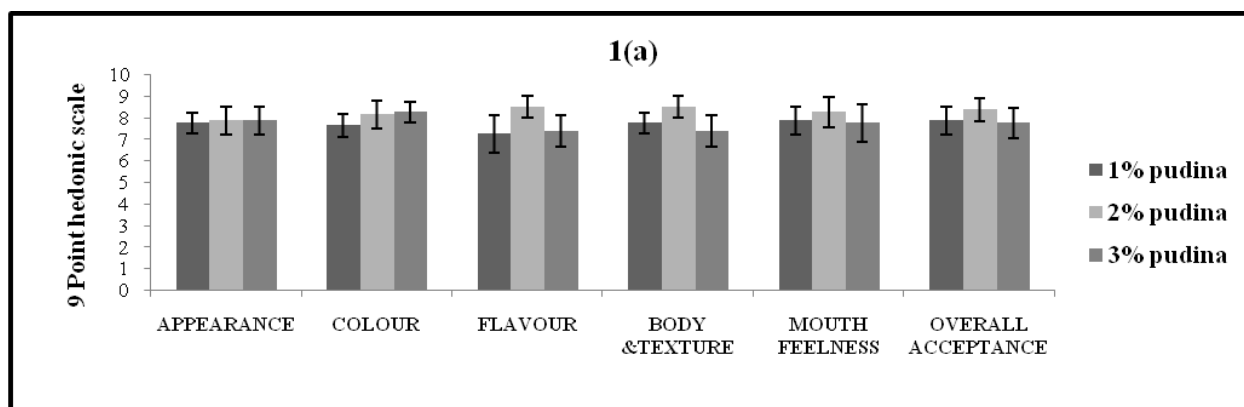
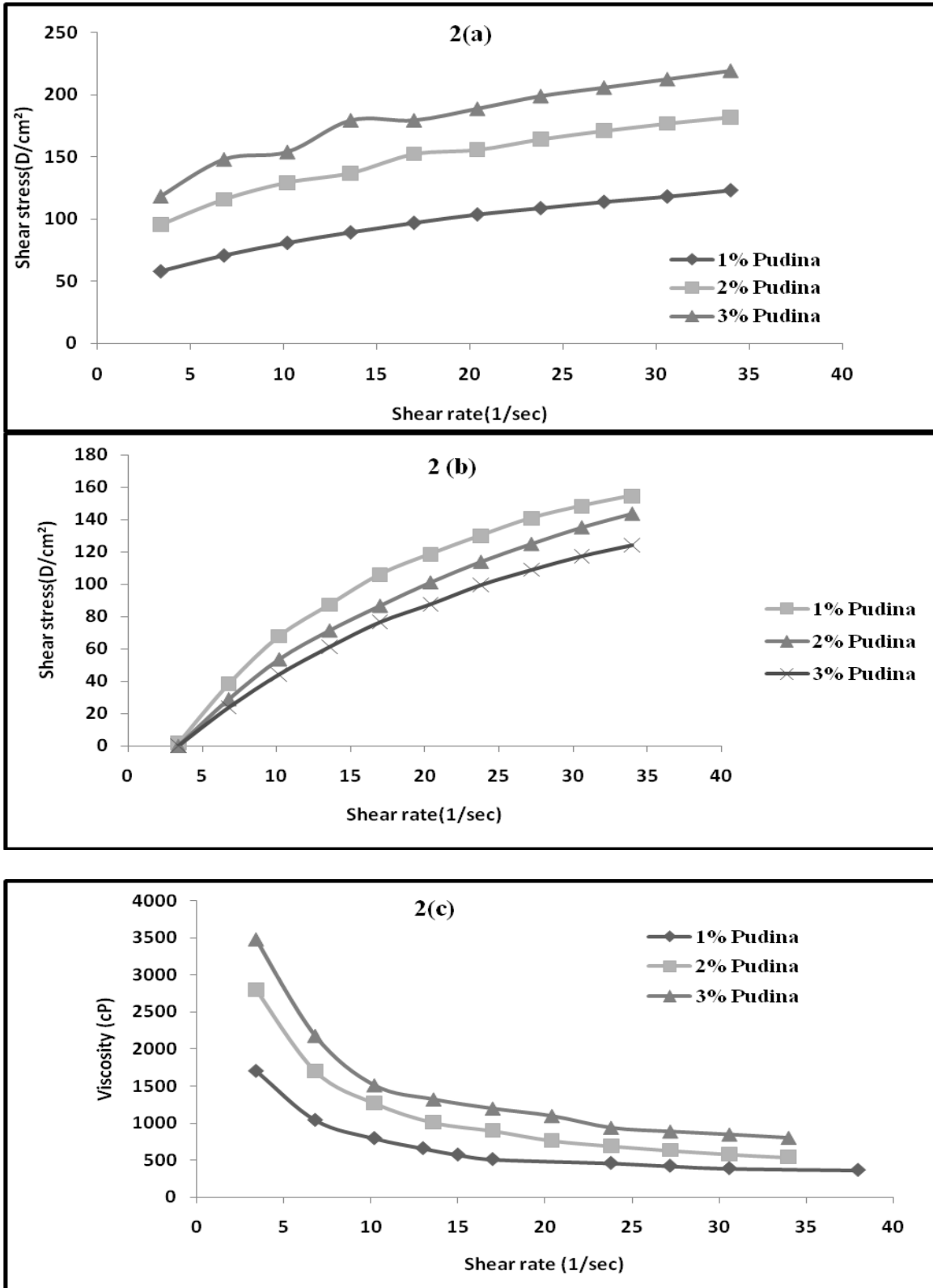


Fig.2 Comparative Rheological study of Herbal Custard; [2(a) and 2(c)= Herbal Custard (Oven); 2(b) and 2(d)= Herbal Custard (Microwave)]



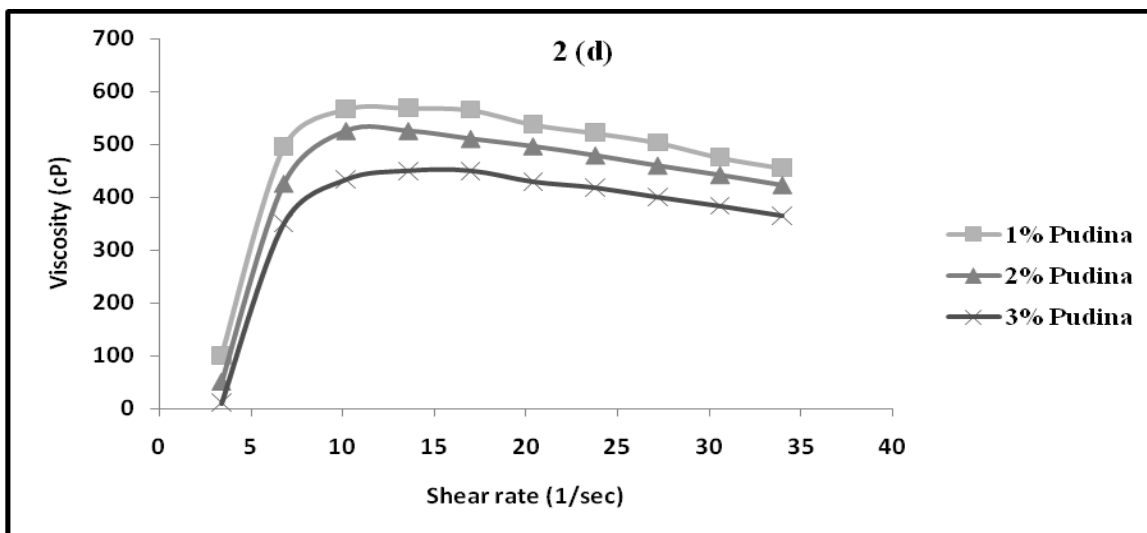


Table.5 Microbial analysis of herbal custard

Yeast and mold count (CFU/g)	Control	OC1	OC2	OC3	MC1	MC2	MC3
0 day	0	0	0	0	0	0	0
1 day	0	0	0	0	0	0	0
3 day	0	1	1	1	0	0	0
5 day	1	2	3	3	1	1	2
7 day	5	3	4	4	2	2	3
Coliform	NIL	NIL	NIL	NIL	NIL	NIL	NIL

Herbal Custard (Oven): OC1 = 1% Pudina, OC2= 2% Pudina, OC3 = 3% Pudina.

Herbal Custard (Microwave): MC1 = 1% Pudina, MC2= 2% Pudina, MC3 = 3% Pudina

Chemical qualities of different types of herbal custard

The results of the proximate composition of different types of herbal custard are shown in table 4. Moisture, protein, fat, carbohydrate and ash content were analyzed for their chemical qualities. Sensorically best samples OC2 and MC2 were comparable in respect to ash, fat, protein and carbohydrate content. But OC2 contains higher amount of moisture (95%) in respect to MC2 (92.8%) may be due to the varying exposure to heat treatment.

Microbiological qualities of different types of herbal custard

Microbiological characteristics are indicators of safety, quality and shelf life of food sample. Total Coliform Count and Total Yeast and Mold Count of different types of herbal custard samples were determined in 0, 1, 3, 5 and 7 days respectively. Results obtained are shown in table 5. Higher amount of total Yeast and mold count (CFU/g) was recorded in both herbal custard (oven) and herbal custard (microwave) on 5th day of

storage and the lowest value was recorded for control sample (Table 5). Higher organism count in herbal custard compared to control may be attributed due to the increased level of pudina paste addition in custard. The shelf stability of herbal custard gradually increases after 7 days storage period compared with control in terms of total yeast and mold count (CFU/g). No coliforms were present in any samples during storage. It is evident that the result occurs due to antimicrobial activity of pudina against enteric pathogens, yeast and mold (Ozcan and Erkmn, 2001).

In conclusion, the new type of pudina paste fortified herbal custard with acceptable physicochemical, organoleptic, microbiological and textural qualities is produced. Both oven and microwave processed herbal custard lies within the acceptable range of all parameters. This new product will help food industries to enrich the production of commercial custard with enhanced health beneficial properties and increased consumer acceptance.

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