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Quality evaluation and shelf-life study of milk pudding enriched with whey protein isolate and sapota *(Manilkara zapota)* pulp

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Abstract
The experimental pudding was prepared using whole milk, sapota pulp and whey protein isolate with different combination of these ingredients. Sensory evaluation of the 80 prepared experimental sample with different levels of sapota pulp and whey protein isolate was analysed by using 9-point hedonic scales. T6 had the highest flavor and taste score (8.25), which were also the most palatable in respect of body and texture (8.86). A treatment combination control (8.03) was judged to be the most acceptable in terms of colour and look. Analysis of shelf life for days 1, 7, and 14 was done. The absence of yeast and mould in the microbiological test indicates that the experiment was carried out under hygienic settings, and SPC included the largest proportion in T2 and T9 (2.89 cfu/gm). The 7th and 14th days of sapota pudding shelf life were investigated. The price of the product was calculated for various treatment combinations.

Keywords: milk pudding, whey protein isolate, sapota pulp, quality evaluation

Introduction

Pudding is a type of food product that can be used as part of meal like dessert as a savoury dish. Pudding can refer generally to the sweet. Pudding is a dish that is cooked by being boiled or steamed. There are many types of pudding in all over world like bread pudding, bread and butter pudding, chocolate pudding, banana pudding, egg pudding etc (Fischer and Windhab 2011). Milk pudding can be defined as a soft kind of cooked dish, commonly prepared with sugar, milk, fruits and stabilizers. Addition of fruits helps to render good flavour and increases its palatability and nutritive value. The starch used in the pudding formulation has an important role for providing essential properties of the product, imparting body and mouth feel. Pudding is semisolid in form, characterized by a sweet, nutty and pleasant flavour which is highly acceptable to the Indian palate. (Mudgal, 1989) [5].

Sapota is identified as rich sources of antioxidants and copiously used to overcome oxidative stress. The fact behind the health beneficial property of sapota is the large number of nutraceutical phytochemicals that they contain, *viz*., polyphenols, carotenoids, sterols, saponins, terpenes and vitamins. Phytochemical components like phenolics, ascorbic acid and carotenoids may have direct influence over the radical-scavenging potential (MCCARTY 2004) [3]. Sapota fruit has always been reflected as a healthy fruit which could be associated with alleviation of micronutrient malnutrition. Various studies have highlighted the nutrient content of sapota which comprises of proteins, sugars, protein, acids, phenolic compounds (catechins, chlorogenic acid, gallic acid, leucodelphinidin, leucocyanidin, and leucopelargonidin), carotenoids, minerals 10 Sapota 195 (Cu, K, and Fe), and vitamins (A, C, folate, and pantothenic acid). Recently, it was reported that a methanolic extract of sapota fruit inhibits tumor growth (Srivastava *et al*. 2014) [6]. Fruits are identified as rich sources of antioxidants and copiously used to overcome oxidative stress. The fact behind the health-beneficial property of fruits is the large number of nutraceutical phytochemicals that they contain, *viz*., polyphenols, carotenoids, sterols, saponins, terpenes and vitamins (McCarty 2004) [3].

Whey protein isolate (WPI) contains >90% protein on a dry weight basis. Microfiltration is used to remove excess lipid from sweet whey. Whey protein isolate is made from the permeate of the MF process; WPI can also be produced through ion exchange chromatography (Huffman 1996) [2]. Serum proteins (sometimes referred to as native whey protein) are separated by direct filtration of skim milk. Both ceramic and spiral-wound membranes can be used to separate casein and serum proteins with differing efficiencies (Zulewska *et al*., 2009; Beckman *et al*., 2010; Hurt *et al*., 2010; Adams and Barbano, 2013) [7]. Although WPC and WPI may be used in food product applications solely for their high nutritional quality, they are gaining acceptance as functional food ingredients, especially in those applications that require a heat-coagulating, heatgelling protein, as in, for example, restructured meat and bakery products (Morr et.al., 1992) [4]. Whey protein is a complete and rich in amino acid protein. It contains a high profile of essential amino acids and branched chain amino-acids which are important for growth and repair of tissue. Leucine is a key branched chain amino acid (BCAAs) in whey proteins synthesis which plays a role in insulin and glucose metabolism (Castellanos VH, Litchford: 2006) [1].

Materials and Methods

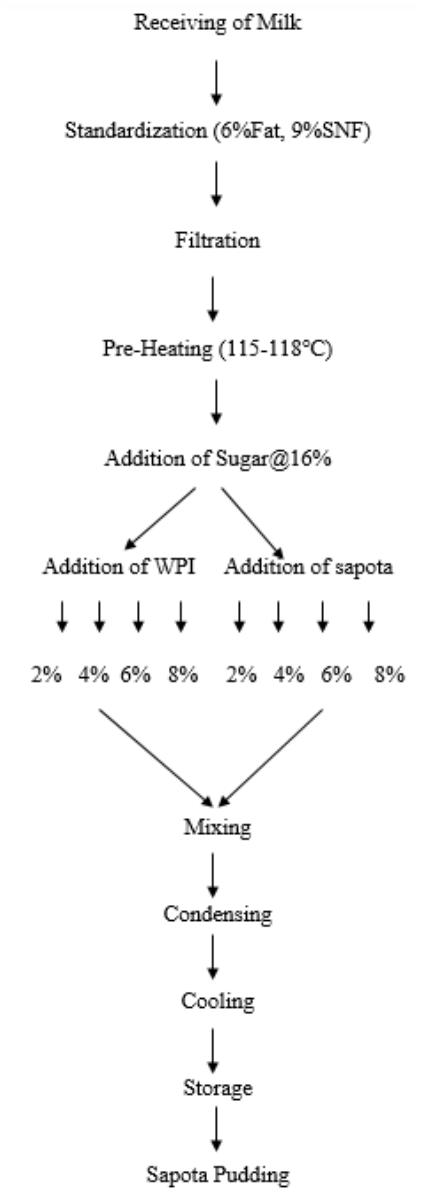
The study was carried out at Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology, and Sciences, Prayagraj (Allahabad), Uttar Pradesh, Department of Dairy Technology (India).

Treatments Combinations

T_O = Whole milk + Sugar (Normal Milk Pudding)
T_1 = Whole milk+Sugar+2%WPI+2%SAPOTA
T_2 = Whole milk+Sugar+2%WPI+4%SAPOTA
T_3 = Whole milk+Sugar+2%WPI+6%SAPOTA
T_4 = Whole milk+Sugar+2%WPI+2%SAPOTA
T_5 = Whole milk+Sugar+4%WPI+2%SAPOTA
T_6 = Whole milk+Sugar+4%WPI+4%SAPOTA
T_7 = Whole milk+Sugar+4%WPI+6%SAPOTA
T_8 = Whole milk+Sugar+4%WPI+8%SAPOTA
T_9 = Whole milk+Sugar+6%WPI+2%SAPOTA
T_{10} = Whole milk+Sugar+6%WPI+4%SAPOTA
T_{11}= Whole milk+Sugar+6%WPI+6%SAPOTA
T_{12}= Whole milk+Sugar+6%WPI+8%SAPOTA
T_{13} = Whole milk+Sugar+8%WPI+2%SAPOTA
T_{14} = Whole milk+Sugar+8%WPI+4%SAPOTA
T_{15} = Whole milk+Sugar+8%WPI+6%SAPOTA
T_{16} = Whole milk+Sugar+8%WPI+8% SAPOTA
*WPI=Whey Protein Isolate

Manufacturing of Milk Pudding

Process flowchart for preparation of milk pudding enriched with sapota pulp and whey protein isolate



Results and Discussions

The work was done in the laboratories of department of Dairy Technology, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P., India.

1. Quality evaluation of prepared milk pudding

Table 1. Table showing the organoleptic evaluation of final developed product pudding

Treatment	Colour and Appearance	Taste and Flavour	Body and Texture	Overall Acceptability
T1	6.76	6.7	6.84	6.748
T2	6.47	7	6.9	7
T3	7.2	7.25	7.35	7.3
T4	6.86	6.444	6.64	6.38
T5	6.74	6.95	6.54	6.95
T6	8.03	8.25	8.86	8.65
T7	7.38	7.46	7.26	7.55
T8	7.2	7.35	7.65	7.57
T9	6.76	6.85	6.65	6.556
T10	6.84	7.1	6.95	7
T11	7.08	7.25	6.85	7.2
T12	6.74	6.84	6.55	6.65
T13	6.46	7.1	6.15	6.35
T14	7.08	6.87	6.69	7.1
T15	7.25	7	6.86	7
T16	6.95	6.95	6.668	6.85
F test	S	S	S	S
S. Ed. (±)	0.048	0.045	0.57	0.76
C.D.(P=0.05)	0.096	0.090	0.114	0.153

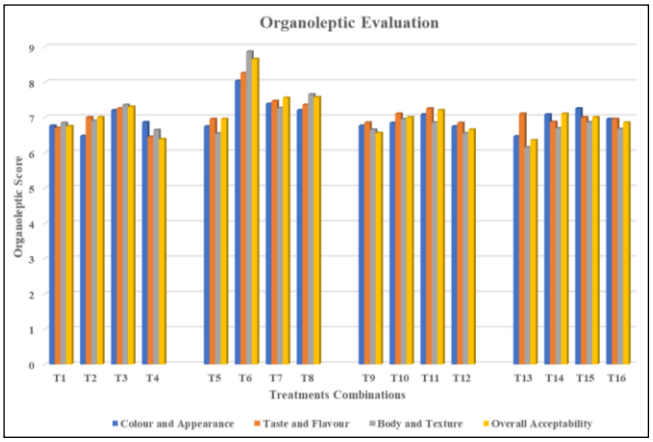


Fig 1: Graphical representation of Organoleptic Evaluation of milk pudding

The mean value of organoleptic evaluation of different treatments of milk pudding was showed in figure no 1. The colour and appearance of treatment T6 which mainly contains 4% sapota pulp, 4% whey isolate, 12 % sugar, 80% of milk is recorded to be the highest value of colour and appearance which is 8.03 (T6). The least colour and appearance value is recorded in Treatment T13. The mean value of body and texture of different treatments. Treatment T6 which mainly contains 4% sapota pulp, 4% whey isolate, 12 % sugar, 80% of milk is recorded to be the highest value of body and texture which is 8.86 (T6). The least body and texture value is recorded in Treatment T13.

The mean value of taste and flavour of different treatments. Treatment T6 which mainly contains 4% sapota pulp, 4%

whey isolate, 12 % sugar, 80% of milk is recorded to be the highest value of taste and flavour which is 8.25 (T6). The least taste and flavour value is recorded in Treatment T4. The mean value of overall acceptability of different treatments. Treatment T6 which mainly contains 4% sapota pulp, 4% whey isolate, 12 % sugar, 80% of milk is recorded to be the highest value of overall acceptability which is 8.65 (T6).

The least overall acceptability value is recorded in Treatment T13.

2. Shelf-life study of the milk pudding

Table 2: Table showing the shelf-life study of final developed product pudding

Treatments	Standard Plate Count (10^5 cfu/g)			Yeast and Mold Count (10^2 cfu/g)			Coliform Count (per gram)		
	0 Days	7 Days	14 Days	0 Days	7 Days	14 Days	0 Days	7 Days	14 Days
T_1	2.84	3.33	4.23	NIL	2.62	3.54	NIL	NIL	NIL
T_2	2.89	3.33	4.23	NIL	2.62	3.44	NIL	NIL	NIL
T_3	2.84	3.34	4.34	NIL	2.63	3.77	NIL	NIL	NIL
T_4	2.82	3.33	4.23	NIL	2.64	3.56	NIL	NIL	NIL
T_5	2.82	3.32	4.44	NIL	2.63	3.76	NIL	NIL	NIL
T_6	2.80	3.33	4.46	NIL	2.64	3.75	NIL	NIL	NIL
T_7	2.84	3.32	4.34	NIL	2.64	3.44	NIL	NIL	NIL
T_8	2.82	3.31	4.23	NIL	2.62	3.54	NIL	NIL	NIL
T_9	2.89	3.33	4.23	NIL	2.63	3.26	NIL	NIL	NIL
T_{10}	2.86	3.32	4.34	NIL	2.63	3.46	NIL	NIL	NIL
T_{11}	2.84	3.33	4.23	NIL	2.64	3.55	NIL	NIL	NIL
T_{12}	2.82	3.32	4.44	NIL	2.63	3.56	NIL	NIL	NIL
T_{13}	2.81	3.32	4.23	NIL	2.62	3.76	NIL	NIL	NIL
T_{14}	2.82	3.32	4.44	NIL	2.63	3.75	NIL	NIL	NIL
T_{15}	2.81	3.33	4.46	NIL	2.62	3.44	NIL	NIL	NIL
T_{16}	2.83	3.32	4.34	NIL	2.64	3.54	NIL	NIL	NIL

The table No. 2 was showing the shelf-life study of final developed product pudding in 7 days of time interval for 14 days at room temperature. In this period were complete analyzed the microbial study of standard plate count (10^5cfu/gm), yeast and mold count (10^2cfu/gm) as well as coliform count (cfu/gm).

Standard plate count of pudding was showed that the day by day increases the number of colonies from 0 days to 14 days. On 0 days the highest SPC value of sample T2 and T9 (10^5cfu/gm) and the lowest value of SPC value in treatment T6 (10^5cfu/gm). The SPC of overall acceptability high score sample it was selected from panel members treatment No. T6 was 2.80 (10^5cfu/gm). On 7th days the value of SPC in the treatment of S6 was 3.33 (10^5cfu/gm) and on 14th day the value of SPC in the treatment of S6 was 4.46 (10^5cfu/gm). In the yeast and mould count of pudding was showed that the day by day increases the number of colonies from 0 days to 14 days. On 0 days the yeast and mould count were showed nil and the on-7th days the value of yeast and mould count in selected sample was in the treatment of S6 was 2.64 (10^2cfu/gm) and the highest yeast and mould count on 7th days was 2.64 (10^2cfu/gm) in treatments of T4, T6, T7, T11 and T16 respectively. On 14th day the value of yeast and mould in the treatment of S6 was 3.75 (10^2cfu/gm). The highest yeast and mould count on 14th days was 3.77 (10^2cfu/gm) in treatments of T3. In the study of coliform count (cfu/gm) showed that the no growth of coliform in any treatments from 0 days to 14 days the result was showed that the nil.

Conclusion

The microbiological and shelf-life study of products was concluded that the no harmful change up to 14 days at 5^0C temperature. In that no any growth of coliform colonies and minor changes in standard plate count colony as well as yeast and mould count.

Sensory evaluation showed that there is a definite potential for pudding prepared enriched with sapota and whey protein isolate as new product in the market place, as they compare favorably with simple pdding on the market.

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