



Feasibility of Using Jackfruit Seed Powder as a Substitute of Skimmed Milk Powder for Making Traditional Yoghurt

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ABSTRACT

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This research work was carried out to determine the optimum quantity of jackfruit seeds powder to substitute skimmed milk powder (SMP) for yoghurt preparation. Total six yoghurt samples were prepared where one is control (A) and rest five samples were prepared by mixing different ratios of jackfruit seeds powder and SMP. 0%, 0.75%, 1.5%, 2.25% and 3% of jackfruit seeds powder were mixed with 3%, 2.25%, 1.5%, 0.75% and 0% SMP and designated as B, C, D, E and F respectively. Physical, chemical and microbiological and cost analysis of prepared samples were done. Yoghurt sample (D) showed highest score in total physical test but individual score for body and consistency of sample F is maximum. Solubility % of jackfruit seeds powder were found 10.96. Highest acidity level was found in control yoghurt and highest pH in sample F. Maximum fat content (g/kg) was found in sample F, but utmost protein content was found in sample (B). Total solids, ash and carbohydrate content of sample F were significantly higher ($p < 0.01$) than all other yoghurt samples and control sample showed the lowest content. Microbiological analysis showed total viable count (cfu/g) of control sample (A) is significantly higher ($p < 0.01$) but no significant variation ($p > 0.05$) was found in coliform count (cfu/g). Yeast and mold count of sample F is significantly higher ($p < 0.01$) than all other samples while control sample showed minimal count. Cost analysis showed substitution of jackfruit seeds powder with SMP sharply reduced the production cost. Considering all parameters, it can be concluded that, sample F showed highest content in chemical analysis but this yoghurt samples organoleptic acceptance and microbiological quality is worst. Overall, sample (D) proclaimed best moreover, physical acceptance of this sample is significantly higher ($p < 0.01$) than all other yoghurt samples.

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Introduction

Yoghurt is the oldest popular fermented milk products around the world but familiar in different countries in divergent names. In Indian subcontinent along with Bangladesh traditionally this product is known as dahi, yoghurt or curd. Its unique flavor appeals to many nutritionists to incorporate different inexpensive sources of nutrients to generate diversified taste. Milk is fermented by defined bacterial culture, which modify milk contents technologically and induce characteristics smell, taste, texture, color and flavor (Aswal and Priyadarshi, 2012). Fermentation instigate high therapeutic value to yoghurt (Zare *et al.*, 2012). Specific gravity for milk is 1.032 and yoghurt is 1.040 moreover, water percentage for milk is 87-88% and yoghurt is 85-88% (Linocoln, 1998). Skimmed milk powder (SMP) is

added (3%) during yoghurt production to increase the structure, consistency and specific gravity (Tamime and Robinson, 2007). Williams *et al.* (2004) conducted an experiment to determine the effects of skimmed milk powder on yoghurt texture. They found yoghurt made with SMP enhance the dairy solids and make structure grainy.

Jackfruit trees (*Artocarpus heterophyllus*) belong to the family *Moraceae*, grow abundantly in Bangladesh, India and in many parts of Southeast Asia (Rahman *et al.*, 1999). During summer season this fruit is available in every districts of Bangladesh. Both fruits and seeds having high nutritional value. Jackfruit seeds can characterize as agricultural by-products. A 100 gm of jackfruit seeds, provides 1.5 gm fiber, about 184 calories,

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38 gm carbohydrate, 7 gm protein and 1 gm of fat (Odoemelam, 2005). Fiber helps to lose weight and lowering risk for heart disease, high blood pressure, high cholesterol and constipation. Starch of jackfruit seeds helps to control blood sugar and keep gut healthy (Burkill, 1997). Jackfruit seeds are also abundant in thiamine and riboflavin which acts as an antioxidant. These seeds also a good source of zinc, iron, calcium, copper, potassium and manganese (Umesh *et al.*, 2010). Roasted and dried seeds of jackfruit is grind to make powder that can apply to prepare different functional foods as well as adding agent in yoghurt, candies, fruit-rolls, marmalades and ice cream (Niva, 2007; Narasimham, 1990). Furthermore, this seed contains antimicrobial component that can prevent foodborne illnesses and treat diarrhea (Swami *et al.*, 2012).

Manufacture of skimmed milk powder in Bangladesh is very limited. SMP contains 0.5% fat, 35.5% protein, 51% Lactose, 8.5% ash and 5% moisture (Patel *et al.*, 2005). Every year huge amount of SMP is being imported from abroad. Maximum time its legal storage period is expired, hence its quality is questionable (Uddin *et al.*, 2011). SMP price varies from BDT 900-1100/kg. High pricing of SMP increases manufacturing cost of yoghurt. Jackfruit seeds powder can use in yoghurt preparation substituting SMP. This seeds high nutritional content enriches yoghurt nutritional values. Besides, binding nature of jackfruit seeds firms the structure of yoghurt (Alzamora *et al.*, 2005). In addition, jackfruit price is very low in Bangladesh. Thus, attempts were made to determine the optimum level of jackfruit seeds powder with SMP for substitution in value added yoghurt production. Moreover, organoleptic, chemical, microbiological status and production cost of the newly developed yoghurt were also assessed.

Materials and Methods

Collection and storage of samples

Jackfruits were purchased from Jaydebpur market, Gazipur of Bangladesh. Commercially available skimmed milk powder (SMP), were bought and stored in the laboratory.

Preparation of jackfruit seeds powder

Seeds were collected from ripened jackfruits. Aril and rind of seeds were removed by sharpen knives. Seeds were washed with water and then sliced. Sliced seeds were primarily dried in hot air oven (GEMMYCO, YCO-N01, Taiwan) at 110 °C for 12 hours. Milling and sieving (125-180 µm) were done before further drying at 60 °C for 6 hours. Finally, jackfruit seeds powder was prepared (Eke-Ejiofor *et al.*, 2014).

Preparation of yoghurt at laboratory

Raw milk was collected from Bangabandhu Sheikh Mujibur Rahman Agricultural University dairy farm. Yoghurt samples were prepared in the laboratory. Milk was boiled, then sugar is added at the rate of 12%. Normally, 3% SMP is used in milk during yoghurt preparation (Tamime and Robinson, 2007; Soukoulis *et al.*, 2007). Different ratios of Jackfruit seeds powder and SMP mixture were added, when temperature was around 40°C. 0%, 0.75%, 1.5%, 2.25% and 3% of jackfruit seeds powder were fortified with 3%, 2.25%, 1.5%, 0.75% and 0% SMP respectively. Hence jackfruit seeds powder replaced 3%, 2.25%, 1.5%, 0.75% and 0% SMP similarly. Control sample were prepared without adding of jackfruit seeds powder and skimmed milk powder. Further, milk is boiled for 10 minutes. Boiled milk, cooled down to near 37°C and inoculated with 2.5% yoghurt starter cultures (Prasad and Singh, 2017). After inoculation, warm milk of 37°C poured into plastic cups and kept in an incubator at 37°C for a period of 5 hours. Titratable acidity of the curd samples were measured to confirm the optimum fermentation of the product. At last, the yoghurt samples were stored in a refrigerator (4°C) for 24h to achieve the final finished product.

Analysis of the samples

The following tests were made on the yoghurt samples, prepared in the laboratory.

Physical tests

This test popularly known as sensory and organoleptic evaluation. It comprises three evaluation variables, smell and taste (50), body and consistency (30) and color and appearance (20). All yoghurt samples were judged by a panel of experts to determine the total physical score.

Determination of solubility index

Solubility index is calculated as % of dry solids following the method described by Andersson *et al.*, (2001). Jackfruit seeds powder (0.83 g) was suspended in 10 ml of distilled water and stirred for 30 min. Afterwards, the dispersions were centrifuged at 4000 rpm for 30 min. The supernatants were poured into pre weighed petri dish and the residue was weighed after overnight oven drying at 70°C. Finally, solubility index is calculated using following formula:

$$\text{WSI} = (\text{weight of dissolved solids in supernatant} \times 100) / \text{weight of dry solids}$$

Chemical tests

All yoghurt samples were chemically analyzed in terms of acidity (%), pH, Fat (g/kg), Protein (g/kg), Total solids (g/kg),

Ash (g/kg) and carbohydrate (g/kg). Acidity, Total Solids (TS) and ash content of the yoghurt samples were determined by as per procedure described in AOAC (2005). pH value was measured by digital pH meter (Laboratory Research Grade Two Channel Benchtop pH/mV/ISE Meter- HI5222, USA). Protein and fat content of yoghurt samples were determined by Kjeldahl and Babcock method respectively according to procedure described by Aggarwala and Sharma (1961). Carbohydrate content was calculated by subtracting the sum of fat, protein and ash content from the total solids.

Microbiological Tests

Total viable count (cfu/g), coliform count (cfu/g) and total yeast and mold count (cfu/g) of the yoghurt samples were performed according to the "Standard Methods for the Examination of Dairy Products" American Public Health Association (APHA, 2004).

Statistical analysis

Statistical analysis was performed using SPSS statistical software. All results were described as the mean \pm S.E. For differentiation, one-way analysis of variance (ANOVA) was carried out. Differences were considered to be statistically significant when the p value was less than 0.05 ($P < 0.05$).

Cost analysis

Cost/kg of yoghurt production was calculated in BDT and then compared.

Results and Discussion

Physical parameters

Sample F, showed the lowest score for smell and taste, which was produced by adding 3% jackfruit seeds powder and 0% skimmed milk powder (Table 1). On the other hand, 1.5% jackfruit seeds powder with 1.5% SMP (D) showed the highest score. Jackfruit seeds powder incorporated with 0.75% (C) and 2.25% (E) were lower than Sample D. Yoghurt with 0% jackfruit seeds powder appeared better score than control sample. This result is agree with Dissanayaka *et al.* (2019).

In case of, body and consistency, 3% jackfruit seeds added yoghurt (F) revealed highest result. Control sample showed worst result, as there were no jackfruit seeds and SMP and this result is close to sample B (0% jackfruit seeds). Remya *et al.* (2019) reported both jackfruit juice and seed flour enhance the body and consistency of traditional yoghurt. Here, sample F contained maximum jackfruit seed powder and divulged lofty score. Moreover, as percentage of jackfruit seeds powder were decreased, score for body and consistency of yoghurt sample were decreased respectively (Table 1).

0% jackfruit seed containing yoghurt expressed score only 21.33 ± 0.44 , whereas, simultaneous increasing of jackfruit seed powder soared the value up to 28.43 ± 0.35 . It should be noted that solubility index of jackfruit seeds powder was also determined and found 10.96%, and this value is higher than the findings of Airani (2007), and consistent with Noor *et al.* (2014) but lower than Karadhbajne and Yatin (2014).

Sample F (3% jackfruit seeds powder), revealed the worst score for color and appearance and score for control sample is little bit higher. Inclusion of 1.5% jackfruit seeds powder revealed highest value for color and appearance and this is close to sample C (0.75% jackfruit seeds). 0% and 2.25% mixture of jackfruit seeds powder in yoghurt appeared same result. This result is similar with Ara *et al.*, (2015). All samples varied significantly in terms of smell and taste, body and consistency and color and appearance ($p < 0.01$).

Overall, 1.5% jackfruit seeds powder treated yoghurt (D) score was significantly higher than all other yoghurt samples ($p < 0.05$). Except, body and consistency, this sample also proclaimed highest score. Kale *et al.* (2011) described 1-2% jackfruit flour admixing yoghurt is best for consumption. Total organoleptic score for 0.75% (C) and 2.25% (E) jackfruit seeds powder added yoghurt disclosed same result, and 0% Jackfruit seed added yoghurt slightly away from these scores (Table 1). Control and sample F (3% jackfruit seeds powder), showed same result but score for 3% jackfruit seeds incorporated yoghurt divulged worst result, scoring 70.87 ± 7.43 . This result is consistent with Sarkar (2019); Rahman *et al.* (2001). Here, it is cleared that 0.75% to 2.25% incorporation of jackfruit seeds powder increased the physical score, but 3% inclusion plunged the score, even lower than control and SMP added yoghurt and these results coincide with Karam *et al.* (2013).

Chemical parameters

Acidity is defined as percent of lactic acid produced by bacterial culture (Badis *et al.*, 2004). After five hours incubation of the yoghurt samples, control yoghurt expressed highest level of acidity and 3% jackfruit seeds powder treated yoghurt revealed lowest level of acidity. As control sample contained no SMP and jackfruit seeds powder, mesophilic bacteria multiplied rapidly and expressed excessive level acidity (Laiño *et al.*, 2013). Acidity level of sample B (0% jackfruit seeds powder) is slightly lower than control sample. Subsequent incorporation of jackfruit seeds powder in increasing level, lowering the level of acidity (Table 2). The relationship between acidity and pH is reverse and this also absolutely observed in yoghurt samples (Alakali, *et al.*, 2008). The mean pH value for the yoghurt samples

varied from 4.64 to 5.46. Highest pH value was found in sample F (3% jackfruit seeds powder) and lowest in control sample. The mean pH value for sample B, is slightly higher than control sample. Simultaneous addition of jackfruit seeds powder in the yoghurt samples directed to soaring of pH values.

A statistically significant difference ($p < 0.01$) was observed among the fat content of all yoghurt samples. Maximum fat content (g/kg) was found in 3% jackfruit seeds powder treated yoghurt and lowest in sample B, which contained 3% SMP and no amount of jackfruit seeds powder (Table 2). These contents ranged from 46.00 g/kg to 34.67 g/kg and findings is agreed with Mukprasirt and Sajjaanantakul, (2004). 2.25% jackfruit seeds incorporated sample disclosed 43.67 g/kg whereas 1.5% and 0.75% jackfruit seeds powder served sample showed the same amount of fat. Ocloo, *et al.* (2010) described jackfruit seeds flour contained 1.7-2.5% crude fat, and food products fortified with this flour significantly enhance the fat content. Similar results were also outlined by Gupta *et al.* (2011); Noor *et al.* (2014). Control sample expressed 4.0 gm/kg fat above than sample B (0% jackfruit seeds powder).

In case of protein content g/kg, only SMP contained yoghurt proclaimed highest amount and control sample showed lowest amount (Table 2). The mean protein content varied from 41.77 g/kg to 32.88 g/kg. Sánchez-Rivera *et al.* (2015), described both heated and unheated skimmed milk powder contained minimum 34% protein. So, SMP fortification increased the crude protein content in yoghurt. As jackfruit seeds powder percentage was increased, protein content become decreased. However, when SMP percentage become increased, protein content become increased simultaneously. All the samples varied significantly ($p < 0.01$). According to Chowdhury *et al.* (2012) jackfruit seeds powder also contained 17-21% protein. Control sample carried no amount of jackfruit seeds powder and SMP and its value become shallowed than any other yoghurt sample.

Total solids (TS) content is the total residue left after absolute evaporation of water from milk (Bassbasi *et al.*, 2014). The mean TS content of the yoghurt samples varied significantly from 241.89 to 290.15 g/kg ($p < 0.01$). Highest TS content was found in 3% jackfruit seeds powder served yoghurt and lowest in control sample (Table 2). Samples contained only SMP and no jackfruit seeds, TS content is slightly higher than control sample. While inclusion of jackfruit seeds powder is increased TS content also become increased (Table 2). This result is consistent with Lai *et al.* (2017); Dey *et al.* (2014). 0.75% jackfruit seeds powder treated yoghurt revealed TS content 268.64 g/kg, simultaneously 1.5%, 2.25% and 3%

jackfruit seeds powder fortified yoghurt showed 273.03, 281.29 and 290.15 g/kg. There is a close relation between TS and Ash content (Yazici and Akgun, 2004). The mean ash content of the yoghurt samples ranged from 6.80 to 11.18 g/kg (Table 2). While jackfruit seeds powder inclusion level is increased ash content is also increased (Sarkar, 2019; Qureshi *et al.*, 2017). 0% jackfruit seeds powder incorporated sample expressed ash content 6.80 g/kg, while 3% jackfruit seeds powder incorporated showed 11.18 g/kg. Control sample indicated lowest ash content, even its value is lower than 0% jackfruit seeds treated yoghurt.

Carbohydrate content includes raw milk lactose, SMP lactose, added sugar (sucrose) and carbohydrate content of jackfruit seeds powder. Here, significant variation was found among all the samples ($p < 0.01$). 3% jackfruit seeds powder treated yoghurt disclosed maximum amount of carbohydrate content (198.10 g/kg), on the other hand, control sample disclosed lowest amount of carbohydrate content (163.55 g/kg). 0% jackfruit seeds powder treated yoghurts carbohydrate content is slightly higher than control yoghurt (Table 2). As the inclusion of jackfruit seeds powder is increased carbohydrate content also increased respectively. These findings are similar with the work of Noor *et al.* (2014).

Microbiological parameters

Table 3, revealed that, total viable bacterial counts were highest in control sample, which was 68.33×10^5 cfu/g, and lowest in sample F, which was 20.00×10^5 cfu/g. 0% jackfruit seeds powder treated sample total viable count (TVC) were lower than control sample. Control sample bacterial load is similar with the work of Olorunnisomo *et al.* (2015), and sample F finding is alike to Rahman *et al.* (2001); Hatijah *et al.* (2019). While, jackfruit seeds powder level was increased, total viable load was decreased (Vahedi *et al.*, 2008). 3% jackfruit seeds powder treated sample showed TVC were 20.00×10^5 cfu/g, contrarily, 0% jackfruit seeds powder revealed 46.67×10^5 cfu/g and this result is alike to Oladipo *et al.*, (2014). Total viable count among all the samples assorted significantly ($p < 0.01$).

The mean coliform count of the yoghurt sample ranged from 2.67 to 4.33 cfu/g (Table 3). Highest number of coliform were found in 3% jackfruit seeds powder served sample. 2.25% jackfruit seeds powder incorporated sample disclosed 4.0 cfu/g, whereas 0% jackfruit seeds powder treated showed 3.33 cfu/g. Both control, 0.75% and 1.5% jackfruit seeds fortified sample divulged same number of coliform/g and these findings are consistent to Sarmini *et al.* (2012). Statistical analysis showed that there were no significant differences between the coliform counts of the yoghurt samples ($p > 0.05$).

Table 1. Physical quality of yoghurt samples, treated with different level of jackfruit seeds powder

Parameters	A	B	C	D	E	F	LSD	LS
Smell and taste (50)	38.83 ^e ±0.60	41.00 ^d ±0.58	45.27 ^b ±0.38	47.27 ^a ±0.50	43.50 ^c ±0.76	33.40 ^f ±0.32	1.19	**
Body and consistency (30)	19.27 ^f ±0.64	21.33 ^e ±0.44	22.47 ^d ±0.29	25.17 ^c ±0.27	26.63 ^b ±0.45	28.43 ^a ±0.35	0.92	**
Color and appearance (20)	13.30 ^d ±0.71	14.60 ^c ±0.31	17.17 ^b ±0.44	18.57 ^a ±0.30	14.73 ^e ±0.47	9.03 ^e ±0.23	0.95	**
Total (100)	71.40 ^b ±7.71	76.93 ^{ab} ±7.92	84.90 ^a ±8.62	91.00 ^a ±8.68	84.87 ^a ±8.35	70.87 ^b ±7.43	17.72	*

** = Significant at 1% level, * = Significant at 5% level, NS=Non significant, LS= Level of significance, LSD = Least Significant Difference, ^{abcdef}=means with the different superscripts differed significantly within the same row. Where, A= Control, B= 0% Jackfruit seeds Powder + 3% SMP, C= 0.75% Jackfruit seeds Powder + 2.25% SMP, D= 1.5 % Jackfruit seeds Powder + 1.5 % SMP, E= 2.25% Jackfruit seeds Powder + 0.75% SMP, F= 3% Jackfruit seeds Powder + 0% SMP

Table 2. Chemical analysis of yoghurt samples, treated with different level of jackfruit seeds powder

Parameters	A	B	C	D	E	F	LSD	LS
Acidity (%)	0.99 ^a ±0.01	0.95 ^b ±0.00	0.82 ^c ±0.01	0.79 ^d ±0.01	0.72 ^e ±0.01	0.67 ^f ±0.01	0.02	**
pH	4.64 ^f ±0.03	4.74 ^e ±0.02	4.90 ^d ±0.02	5.08 ^c ±0.03	5.24 ^b ±0.03	5.46 ^a ±0.02	0.05	**
Fat (g/kg)	38.67 ^d ±0.67	34.67 ^e ±0.33	41.33 ^c ±0.33	41.67 ^c ±0.33	43.67 ^b ±0.33	46.00 ^a ±0.58	0.98	**
Protein (g/kg)	32.88 ^f ±0.28	41.77 ^a ±0.15	40.20 ^b ±0.12	39.62 ^c ±0.19	37.32 ^d ±0.31	34.87 ^e ±0.23	0.49	**
TS (g/kg)	241.89 ^f ±0.93	253.00 ^e ±2.46	268.64 ^d ±1.63	273.03 ^c ±3.46	281.29 ^b ±1.44	290.15 ^a ±0.52	4.34	**
Ash (g/kg)	6.80 ^e ±0.20	7.66 ^d ±0.18	8.96 ^c ±0.03	10.12 ^b ±0.13	11.00 ^a ±0.11	11.18 ^a ±0.09	0.30	**
Carbohydrate (g/kg)	163.55 ^f ±0.24	168.90 ^e ±0.81	178.15 ^d ±0.18	181.62 ^c ±0.34	189.29 ^b ±0.42	198.10 ^a ±0.71	2.01	**

** = Significant at 1% level, * = Significant at 5% level, NS=Non significant, LS= Level of significance, LSD = Least Significant Difference, ^{abcdef}=means with the different superscripts differed significantly within the same row. Where, A= Control, B= 0% Jackfruit seeds Powder + 3% SMP, C= 0.75% Jackfruit seeds Powder + 2.25% SMP, D= 1.5 % Jackfruit seeds Powder + 1.5 % SMP, E= 2.25% Jackfruit seeds Powder + 0.75% SMP, F= 3% Jackfruit seeds Powder + 0% SMP

Table 3. Microbiological quality of yoghurt samples, treated with different level of jackfruit seeds powder

Parameters	A	B	C	D	E	F	LSD	LS
Total Viable Count (cfu/ml), (×10 ⁵)	68.33 ^a ±2.40	46.67 ^b ±1.45	39.33 ^c ±0.88	32.00 ^d ±1.53	25.67 ^e ±1.86	20.00 ^f ±1.53	3.64	**
Coliform (cfu/ml)	2.67±1.45	3.33±1.76	2.67±1.45	2.67±1.45	4.00±2.08	4.33±2.19	3.83	NS
Total Yeast and Mold (cfu/ml)	30.33 ^d ±0.88	37.00 ^c ±1.53	44.00 ^b ±2.65	42.67 ^b ±0.33	62.00 ^a ±1.00	62.33 ^a ±4.26	4.82	**

** = Significant at 1% level, * = Significant at 5% level, NS=Non significant, LS= Level of significance, LSD = Least Significant Difference, ^{abcdef}=means with the different superscripts differed significantly within the same row. Where, A= Control, B= 0% Jackfruit seeds Powder + 3% SMP, C= 0.75% Jackfruit seeds Powder + 2.25% SMP, D= 1.5 % Jackfruit seeds Powder + 1.5 % SMP, E= 2.25% Jackfruit seeds Powder + 0.75% SMP, F= 3% Jackfruit seeds Powder + 0% SMP

Table 4. Cost for per kg of yoghurt production

Items	A	B	C	D	E	F
Milk (BDT)	50.00	50.00	50.00	50.00	50.00	50.00
Sugar (BDT)	8.40	8.40	8.40	8.40	8.40	8.40
SMP (BDT)	0.00	24.00	18.00	12.00	6.00	0.00
Jackfruit seeds powder (BDT)	0.00	0.00	0.15	0.30	0.45	0.60
Starter culture (BDT)	4.20	4.20	4.20	4.20	4.20	4.20
Overhead cost (cup, labor, accessories, etc.) (BDT)	10.00	10.00	10.00	10.00	10.00	10.00
Total cost (BDT/KG Yoghurt)	72.6	96.6	90.75	84.9	79.05	73.2

Where, BDT= Bangladeshi Taka, A= Control, B= 0% Jackfruit seeds Powder + 3% SMP, C= 0.75% Jackfruit seeds Powder + 2.25% SMP, D= 1.5 % Jackfruit seeds Powder + 1.5 % SMP, E= 2.25% Jackfruit seeds Powder + 0.75% SMP, F= 3% Jackfruit seeds Powder + 0% SMP

Total yeast and mold of the yoghurt samples significantly varied from 62.33 to 30.33 cfu/g (p<0.01). Similar result is described by El Bakri and El Zubeir (2009). Highest number of yeast and mold were found in 3% jackfruit seeds powder treated yoghurt and lowest in control sample. 2.25% jackfruit seeds powder served sample total yeast and mold counts were very closed to 3% jackfruit seeds powder mixed yoghurt (Table 3). 0.75% jackfruit seeds assorted sample showed total yeast and mold number 44.0 cfu/g and this number is closed to 1.5% jackfruit seeds powder mixed yoghurt. These findings are alike to De Silva and Rathnayaka (2014). The

mean yeast and mold of 0% jackfruit seeds powder treated sample were 37.0 cfu/g.

Cost analysis

Control sample showed lowest cost for per kg of yoghurt production, whereas sample B proclaimed maximum cost for per kg of yoghurt production and it is 132% more than sample F (Table 4). 3% jackfruit seeds powder treated yoghurt cost/kg is slightly higher than control sample. Here it cleared that substitution of jackfruit seeds powder with SMP precipitously shrunk the cost/kg of yoghurt production.

Conclusion

Jackfruit seeds powder can be fortified with skimmed milk powder (SMP) in yoghurt preparation, but cannot be replaced totally. 1.5% jackfruit seeds powder with 1.5% SMP showed best result on every aspect in yoghurt preparation. Thus, SMP can be replaced with jackfruit seeds powder at 1.5% level in yoghurt preparation. Furthermore, while amount of jackfruit seeds powder was soared, fat content (g/kg) become surged but protein content (g/kg) declined vice versa. Cost analysis also indicated substitution of jackfruit seeds powder with SMP acutely lessen the manufacturing cost.

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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