The Pharma Innovation Journal 2017; 6(8): 254-258

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating 2017: 5.03
TPI 2017; 6(8): 254-258

www.thepharmajournal.com
Received: 16-06-2017
Accepted: 17-07-2017

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Studies on physiochemical attributes of cereal based fermented functional milk

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Abstract
Malnutrition or malnourishment is the problem which is most prevalent in today's society and causes lot of health problems with undernutrition, extreme starvation might be permanent problems in physical and mental development. Milk is not consumed by many due to many factors like lactose intolerance or due to dislikes, we can supplement milk by cereal based fermented milk product which will be a new nutritious product. Cereal based functional fermented milk fulfils the nutrient requirements of an undernutrition person as it provides proper energy, protein, vitamins and minerals. A research was conducted with a view to develop a healthy nutritious functional cereal-based fermented milk and to study its physiochemical attributes. The research included four treatments having common ingredients like milk (100 ml), whole barley flour (4%), date syrup (10%) and differs in the amount of flax seed powder. (T_1) had 0.5% flax seed powder, (T_2) had 1%, (T_3) had 2% and (T_4) had 3% flax seed powder. The result of physico chemical analysis pertained to the research in T_4 had highest percentage of carbohydrate, protein, fat, moisture, and acidity with 13.57, 5.48, 7.98, 72.95, and 0.68 respectively.

Keywords: Malnutrition, undernutrition, extreme starvation, lactose intolerance, flax seed, date syrup, fermented milk product.

1. Introduction
Milk and milk-derived products have constituted a significant part of the diet of all groups at all ages. Amongst those milk products, fermented milks are of great importance worldwide because of their nutritional, organoleptic and shelf-life properties that are significantly improved when compared with its raw material i.e. milk. Fermented milks are developed as a means of preserving nutrients of milk. Fermented milks including dahi, yogurts are considered as an ideal vehicle for the delivery of many beneficial microorganisms' viz. probiotics and prebiotics in addition to the microflora of human gastrointestinal tract (Gadhiya *et al*., 2015) [6]. Therefore, fermented milk is the most popular group of functional food.

Lactic Acid Bacteria (LAB) have been widely used as starter culture for the manufacturing of various fermented dairy products such as dahi, lassi and whey beverages. LAB and their food products are thought to confer a variety of important nutritional and therapeutic benefits and have many documented health promoting or probiotic effects in humans such as inhibition of pathogenic organism, antimutagenic and reduction of blood cholesterol (Shiby and Mishra, 2013) [12].

Consumption of fermented milks has increased and various popular ingredients of functional significance are being incorporated into cultured dairy products to enhance their market value and thus with specific health benefits (Tamime, 2002) [13]. Fermented milk products have been reported to have therapeutic properties like anti-cholesterolemic and anti-carcinogenic.

The choice of cereal-based substrate for the development of probiotic foods is motivated by increase in consumer vegetarianism, lactose intolerance, cholesterol content, and economic reasons that are associated with dairy products (Prado *et al*., 2008; Gobbetti *et al*., 2010). Cereals also have the potentials to offer consumer prebiotic and whole grain benefits (Lamsal and Faubion 2009). Cereal grains are very good substrates for fermentation. Cereal grains are very good substrates for fermentation globally and the predominant microorganisms are lactic acid, bacteria, and yeasts (Blandino *et al*., 2003; Franz *et al*., 2014) [4]. Cereal grains constitute a major source of dietary nutrients and addition of cereals into milk enriches its mineral value supplementing fibre (Das *et al*., 2012). Fermentation further enhances the nutritive value, palatability and functionality of cereals by reducing the antinutritional factors.

Cereal based functional fermented milk fulfils the nutrient requirements of an undernutrition person as it provides proper energy, protein, vitamins and minerals. The ingredient of the cereal based functional fermented milk includes whole barley flour, flax seed, date syrup and milk which supplements the nutrients required for an undernourished. The barley supplements with protein, dietary fiber, the B vitamins, niacin and several dietary minerals like manganese and phosphorous. Also flax seed provides omega 3 fatty acid which protect against heart disease, lower triglycerides, decreased risk with higher blood levels, inflammation etc. Omega-3 fatty acids are important for normal metabolism. Mammals are unable to synthesize omega-3 fatty acids, but can obtain the shorter-chain omega-3 fatty acid ALA (18 carbons and 3 double bonds) through diet and use it to form the more important long-chain omega-3 fatty acids. It is known that animal food is a good source of omega 3 fatty acids but vegetarian diet lacks.

Material and Methods

The experiment was carried out in the research laboratory of department of Dairy Technology, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad. Milk, Skim milk, Flaxseed powder, Whole Barley Flour, Date Syrup were obtained from the local market of Allahabad. Cultures were procured from Student's Training Dairy SHUATS, Allahabad. *The experimental product was prepared by using toned milk* with fat-3.0% and SNF-8.5%. The milk was homogenised and heated to 90℃ for 2 min. then the milk was cooled at 30-32℃. After cooling, 5% of skim milk powder was added while continuous stirring to increase the SNF to 11%. Barley flour with 4% was then mixed with the milk. After this addition of flax seed powder was done in variation with T_1 having 0.5%, T_2 having 1%, T_3 having 2% and T_4 having 3%. 10% Date syrup is mixed with the ingredients and is properly mixed with an electrical mixer. Finally 2% bacterial culture was added and the mix was then packed in air tight containers/ polystyrene cups which were capped and incubated at 37℃ for 8 hours. The fermented milk product prepared was cooled and stored in refrigerator under 5℃.

The treatment combination used are as follows

T_1- Toned milk- 100ml, Skim milk powder- 5%, Whole barley flour-4%, Date syrup- 10%, Flaxseed powder- 0.5%.
T_2- Toned milk- 100ml, Skim milk powder- 5%, Whole barley flour-4%, Date syrup- 10%, Flaxseed powder-1%.
T_3- Toned milk- 100ml, Skim milk powder- 5%, Whole barley flour-4%, Date syrup- 10%, Flaxseed powder-2%.
T_4- Toned milk- 100ml, Skim milk powder- 5%, Whole barley flour-4%, Date syrup- 10%, Flaxseed powder-3%.

Result and Discussions based fermented milk product. The present investigation was carried out to see the possibility of incorporating barley flour, flax seed powder, and date syrup into the indigenous milk product dahi and the results obtained from the analysis were subjected to physico-chemical characteristics of cereal based fermented milk product.

The average of data obtained on physio-chemical analysis in four replication of cereal based fermented milk product.

Parameter	T_1	T_2	T_3	T_4
Physico-chemical analysis				
Carbohydrates%	9.64	12.30	13.13	13.57
Protein %	4.72	4.90	5.08	5.48
Fat %	5.97	6.62	7.175	7.98
Moisture%	79.66	76.16	74.60	72.95
Total Solid %	20.34	23.83	25.39	27.04
Acidity %	0.82	0.78	0.75	0.68
Ash%	0.50	0.56	0.625	0.68
Firmness	359.21	373.17	453.45	562.65
Cohesiveness	305.94	339.82	459.81	519.91
Consistency	9242.08	9752.14	11488.00	13072.48
Index of Viscosity	535.82	722.79	733.20	741.50

Carbohydrates

The highest average for carbohydrate (13.57) was recorded in T_4 sample containing 3% of flaxseed flour, followed by T_3 (13.13), T_2 (12.30), T_1 (9.64)

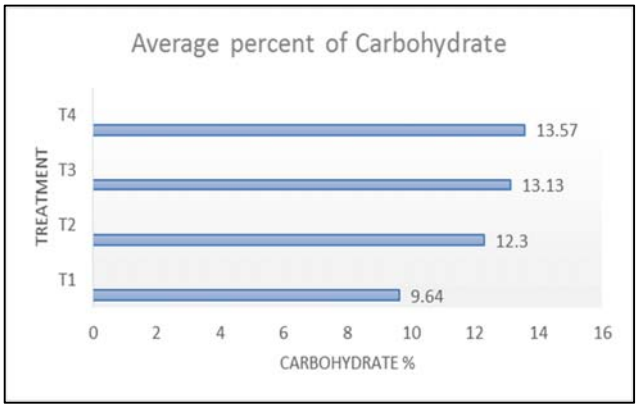

Fig 1: the graph indicating carbohydrate percentage for Carbohydrate of cereal based fermented milk product

Protein:-The highest average for protein (5.48) was recorded in T_4 sample containing 3% of flaxseed flour, followed by T_3 (5.08), T_2 (4.90), T_1 (4.72).

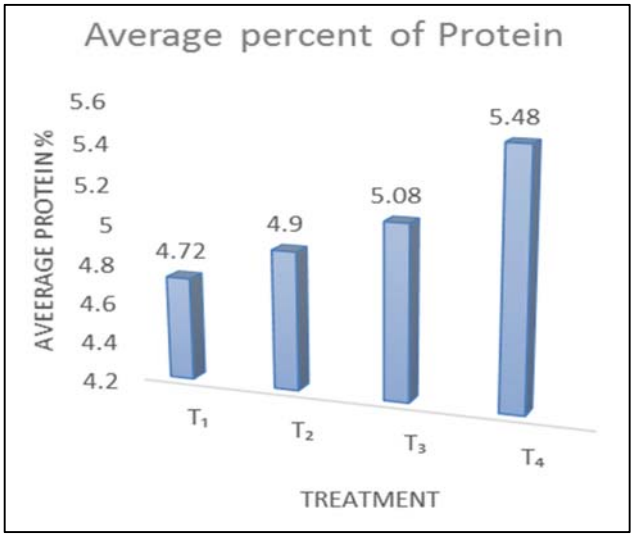

Fig 2: The graph indicating Protein percentage for Protein of cereal based fermented milk product

Fat: The highest average for fat (7.98) was recorded in T_4 sample containing 3% of flaxseed flour, followed by T_3 (7.17), T_2 (6.62), T_1 (5.97).

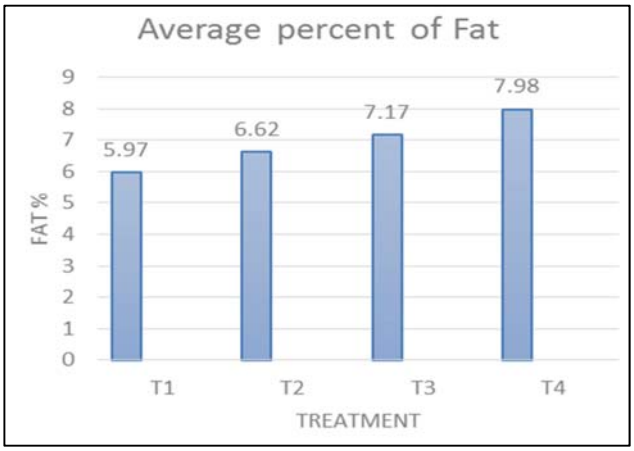

Fig 3: The graph indicating Fat percentage for Fat of cereal based fermented milk products

Moisture

The highest average for moisture (79.66) was recorded in T_1 sample containing 0.5% of flaxseed flour, followed by T_2 (76.16), T_3 (74.60), T_4 (72.95).

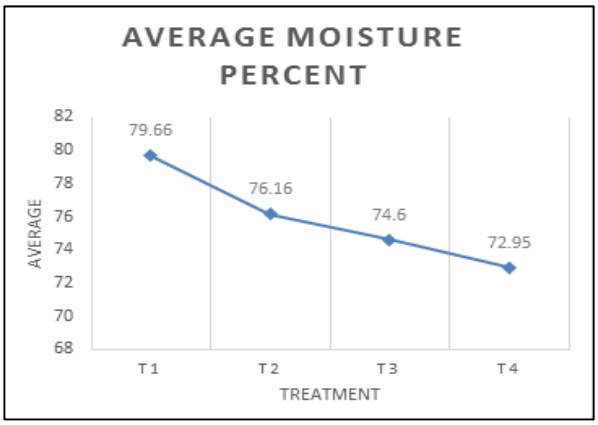

Fig 4: The graph indicating Moisture percentage for Moisture of cereal based fermented milk product

Total Solids

The highest average for total solids (27.04) was recorded in T_4 sample containing 3% of flaxseed flour, followed by T_3 (25.39), T_2 (23.83), T_1 (20.34).

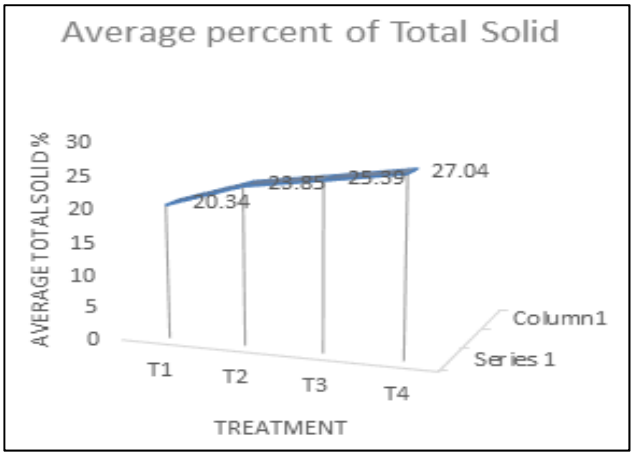

Fig 5: The graph indicating Total Solids percentage for Total Solids of cereal based fermented milk product

Acidity

The highest average for acidity (0.82) was recorded in T_1 sample containing 0.5% of flaxseed flour, followed by T_2 (0.78), T_3 (0.75), T_4 (0.68).

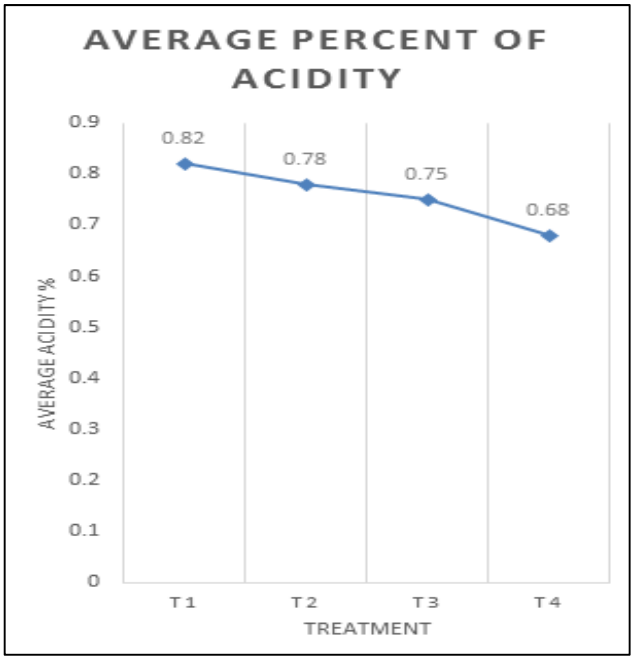

Fig 6: The graph indicating Acidity percentage for Acidity of cereal based fermented milk product

Ash

The highest average for Ash (0.68) was recorded in T_4 sample containing 0.5% of flaxseed flour, followed by T_3 (0.62), T_2 (0.56), T_1 (0.50).

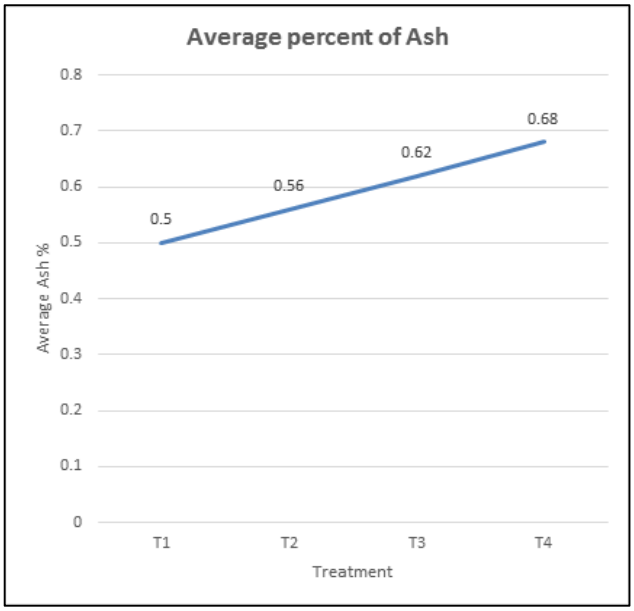

Fig 7: The graph indicating Ash percentage for Ash of cereal based fermented milk product

Firmness

The highest average for firmness (562.65) was recorded in T_4 sample containing 3% of flaxseed flour, followed by T_3 (453.45), T_2 (373.17), T_1 (359.21)

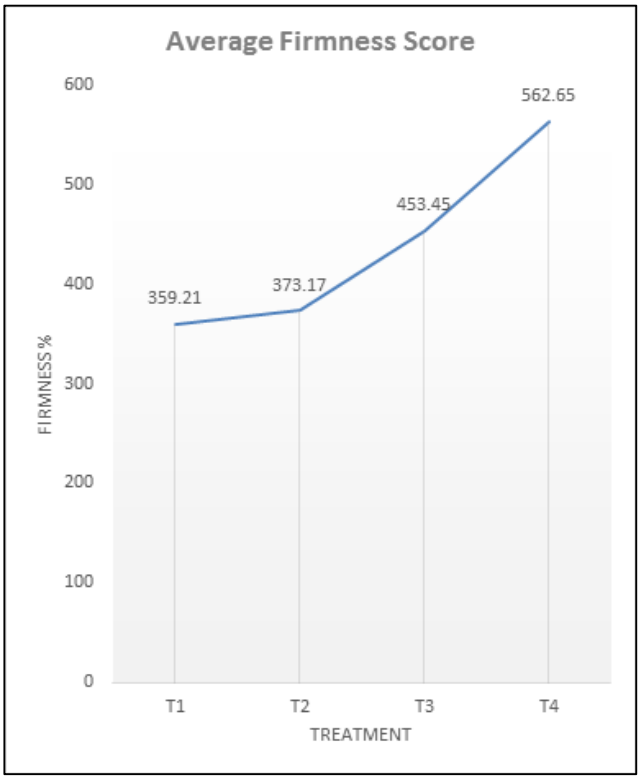

Fig 8: The graph indicating Firmness score for cereal based fermented milk product

Cohesiveness

The highest average for cohesiveness (519.91) was recorded in T_4 sample containing 3% of flaxseed flour, followed by T_3 (459.81), T_2 (339.82), T_1 (305.94).

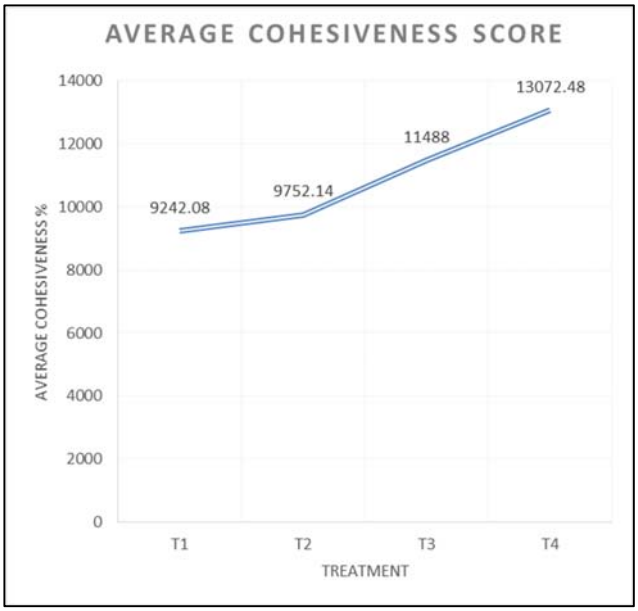

Fig 9: The graph indicating Cohesiveness of cereal based fermented milk product

Consistency

The highest average for consistency (13072.48) was recorded in T_4 sample containing 3% of flaxseed flour, followed by T_3 (11488.00), T_2 (9752.14), T_1 (9242.08).

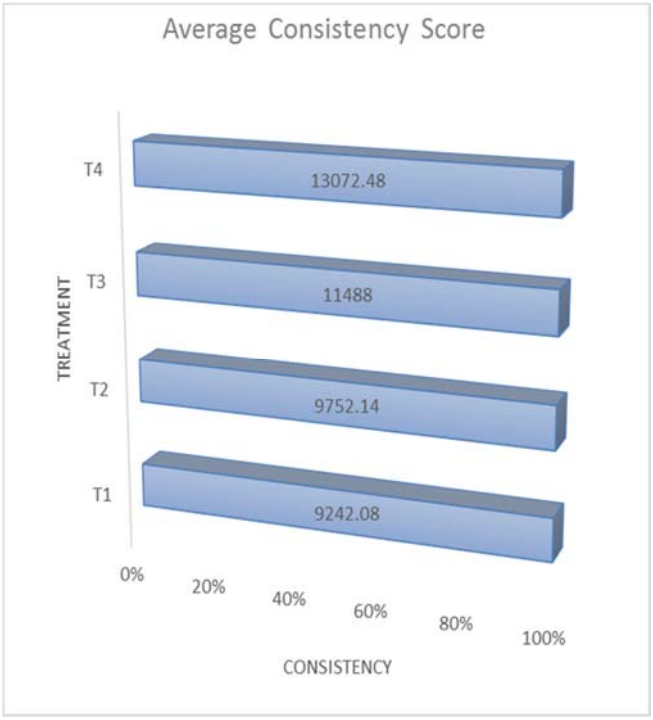

Fig 10: The graph indicating consistency score of cereal based fermented milk product

Index of Viscosity

The highest average for index of viscosity (741.50) was recorded in T_4 sample containing 3% of flaxseed flour, followed by T_3 (733.20), T_2 (722.79), T_1 (535.82).

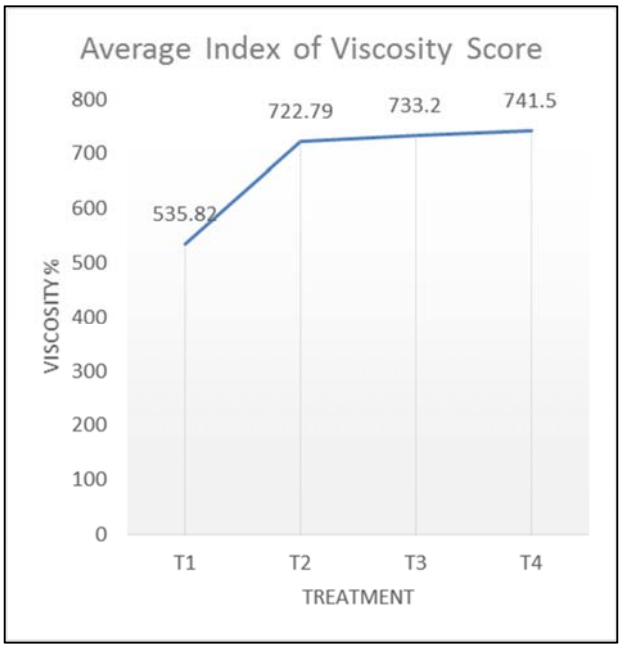

Fig 11: The graph indicating Index of Viscosity for cereal based fermented milk product

Conclusion

The sample prepared of different treatments were analysed for carbohydrate%, protein%, fat%, moisture%, total solids, acidity%, ash% along with the physical analysis including firmness, cohesiveness, consistency and index of variance and it was found that there is significant increase in T_4 regarding

all the parameters. It may be concluded from this that T_4 is more nutritious when compared with other treatments. This shows that the product developed can be supplemented for malnourished and diabetic patient.

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