General Impact Factor (GIF): 0.875
Scientific Journal Impact Factor: 1.205
e- ISSN: 2394-5532
p- ISSN: 2394-823X
International Journal of Applied And Pure Science and Agriculture
www.ijapsa.com

EFFECT OF PROBIOTIC FERMENTATION ON MINERAL CONTENT OF BANANA BASED FOOD MIXTURES

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Abstract

Today, since the development of foods that promote health and wellbeing is the key priority of food industry, attempts have been made to develop probiotic food mixtures containing banana flour, green gram flour, soya flour, tomato, mango and papaya. 25 g of each mixture was mixed with 150 ml of distilled water and adjusted the pH to 4.5 and autoclaved at 121° C (1.5 kg/cm^2) for 15 mts. After cooling, this was inoculated with 300µl (119×10^6 cfu/ml) liquid culture of L.acidophilus (24 hour old culture) and incubated at 37° C for 24 hours. After fermentation it was freeze dried and the samples were analysed for their mineral content viz: calcium, potassium and iron. The unfermented samples served as control. There was no significant difference in the calcium and potassium content of fermented and unfermented samples. There was a significant increase in the iron content of fermented and unfermented food mixtures.

Keywords: Probiotic, L. acidophilus, Calcium, Potassium, Iron

I. INTRODUCTION

The science of human nutrition has moved from a focus on the prevention of nutrient deficiencies to an emphasis on the health maintenance and reduced risk of chronic diseases [1].

Probiotic foods are those foods which contain a live microbiological culture either as a result of fermentation or as an intentional addition to beneficially affect the host by improving the intestinal microbial balance [2]. The beneficial effects of probiotic will depend on a number of factors including the strain chosen, level of consumption, duration and frequency of exposure, and the physiological condition of the individual [3].

Probiotic bacteria break down hydrocarbons which mean the food is being split into its most basic elements. This allows almost total absorption through the digestive system. In this way probiotics dramatically increase overall nutrition and enhance rapid cellular growth and development. Probiotics also produce many important enzymes and increase the availability of vitamins and nutrients, especially vitamin B, vitamin K, lactase, fatty acids and calcium [4].The market for foods that promote health beyond providing basic nutrition is flourishing. Therefore, in the present study, an attempt has been made to develop banana based probiotic fermented food mixtures and to analyse the mineral profile of the developed food mixtures.

II. MATERIALS AND METHODS

A. Collection of raw materials and preparation of food mixtures

Raw banana (Nendran *Musa* AAB) was purchased from the local market. This was peeled, washed, sliced and dried. The dried chips were powdered to a flour of 40 mesh size. This banana flour was used as a source of starch in all food mixtures. The foods selected for developing the probiotically fermented food mixtures were defatted soya flour and green gram flour (as source of protein in the food mixture), mango, papaya and tomato and these foods were purchased from the local market.

In the present study, *L.acidophilus* was used as the probiotic culture for the fermentation of food mixtures. Pure cultures of *L.acidophilus* (MTCC 447) used was obtained from Institute of Microbial Technology (IMTECH), Chandigarh

B. Development of food mixtures

The food mixture was fermented under optimum conditions with a control.

2.1. Autoclaved and fermented food mixture (FFM): The food mixture (25g) was mixed with 150ml water and stirred to obtain uniform slurry. Adjusted the pH to 4.5 and autoclaved at 121° C (1.5 kg/cm^2) for 15 mts. After cooling this was inoculated with 300µl(119×10^6 cfu/ml) liquid culture of *L.acidophilus* (24 hour old culture) and incubated at 37° C for 24 hours. After fermentation it was freeze dried.

2.2. Autoclaved and unfermented food Mixture (UFFM): The food mixture (25g) was mixed with 150ml water and stirred to obtain uniform slurry. Adjusted the pH to 4.5 and autoclaved at 121° C (1.5 kg/cm2) for 15 mts. After cooling it was freeze dried.

C. Mineral content of fermented and unfermented food mixtures

Calcium was estimated by titration method with EDTA [5]. Five ml of diacid extract made upto 100 ml was taken and added 100 ml water, 10 drops of hydroxylamine, 10 drops of triethanol amine and 2.5 ml of NaOH and 10 drops of calcone. Then it was titrated with EDTA till the appearance of permanent blue colour. It was expressed in mg per 100 g of the sample.

The estimation of potassium was done using a flame photometer [6]. One gram of the digested solution was made up to 25 ml and read directly in a flame photometer. The potassium content was expressed in mg per 100 gm of the sample.

Iron was estimated by Atomic Absorption Sectrophotometric method using the diacid extract prepared from the sample [7].

III. RESULTS AND DISCUSSION

The foods selected for developing the probiotically fermented food mixtures were banana flour, defatted soya flour, green gram flour ripe mango, papaya and tomato. Fourteen food mixtures with various combinations were prepared and presented in Table1. All the food mixtures contained 60-70 percent banana as the major constituent and 20 percent of either defatted soya flour or green gram flour. Fruit pulps viz mango, papaya and tomato either singly or in combination were present in 10 – 20 per cent levels.

Table 1. Food combinations in the fourteen food mixtures

Food mixtures (Treatments)	Combinations (percent)
T_1	B-70, DS-20, M-10
T_2	B-60, DS-20, P-20
T_3	B-60, DS-20, T-20
T_4	B-70, GG-20, M-10
T_5	B-70, GG-20, P-10
T_6	B-60, GG-20, T-20
T_7	B-60, DS-20, M-10, P-10
T_8	B-60, DS-20, M-10, T-10
T_9	B-70, DS-,20, P-5, T-5
T_{10}	B-60, GG-20, M-10, P-10
T_{11}	B-70, GG-20, M-5, T-5
T_{12}	B-60, GG-20, P-10, T-10
T_{13}	B-70, DS-20, M-3.34, P-3.34, T-3.34
T_{14}	B-70, GG-20, M-3.34, P-3.34, T-3.34

B- Banana, DS- Defatted soya flour, GG- Green gram flour, M- Mango, T-Tomato, P-Papaya

Mineral content in fermented and unfermented food mixtures

There was a significant difference in the calcium content of FFM As revealed in Table 2. T_3 had the highest calcium content of 69.70 mg/100g whereas T_{10} and T_{12} showed the least calcium content of 43.82 mg/100g. High potassium content was observed in all FFM which varied from 304.67 mg in T_2 to 492.67 mg/100g in T_6 and T_{10} and the difference in the potassium content observed in FFM were significant. Iron content of FFM ranged from 6.04mg in T_5 to 6.99mg/ 100 g in T_1 and the difference in iron content was also found to be significant

Table 2. Calcium, potassium and iron in fermented food mixtures (mg/100g)

Treatments	Calcium	Potassium	Iron
T_1	67.77^{j}	305.33^{h}	6.99^{a}
T_2	67.31^{de}	304.67^{i}	6.33^{e}
T_3	69.70^{a}	396.67^{d}	6.79^{c}
T_4	43.92^{i}	483.00^{j}	6.32^{e}
T_5	44.71^{g}	468.00^{k}	6.04^{h}
T_6	46.90^{f}	492.67^{a}	6.13^{g}
T_7	68.25^{b}	307.33^{g}	6.13^{g}
T_8	66.94^{e}	313.67^{f}	6.26^{f}
T_9	69.12^{a}	306.00^{e}	6.24^{f}
T_{10}	43.82^{j}	492.67^{a}	6.72^{a}
T_{11}	44.22^{h}	486.00^{b}	6.85^{b}
T_{12}	43.82^{j}	482.00^{c}	6.66^{d}
T_{13}	67.41^{cd}	317.00^{e}	6.97^{a}
T_{14}	45.00^{g}	487.00^{b}	6.28^{f}

Values are mean of three independent determinations
Values with same superscript do not have significant difference
DMRT column wise comparison

Table 3. Calcium, potassium and iron in unfermented food mixtures (mg/100g)

Treatments	Calcium	Potassium	Iron
T_1	67.693 [d]	304.333 [h]	6.90 [a]
T_2	67.283 [e]	308.333 [g]	6.32 [d]
T_3	69.233 [b]	393.333 [e]	6.77 [b]
T_4	43.697 [j]	484.667 [b]	6.23 [e]
T_5	44.640 [g]	468.000 [d]	6.04 [g]
T_6	46.570 [a]	497.333 [a]	6.15 [f]
T_7	67.400 [e]	307.000 [a]	6.17 [f]
T_8	66.550 [a]	313.000 [f]	6.26 [e]
T_9	68.843 [a]	312.667 [f]	6.21 [e]
T_{10}	44.277 [h]	495.000 [a]	6.73 [a]
T_{11}	43.887 [i]	486.333 [b]	6.74 [b]
T_{12}	43.360 [k]	481.333 [c]	6.62 [c]
T_{13}	66.817 [a]	316.000 [e]	6.85 [a]
T_{14}	45.037 [a]	487.000 [b]	6.23 [e]

Values are mean of three independent determinations
Values with same superscript do not have significant difference
DMRT column wise comparison

A significant difference in the calcium content of UFFM was noted, which ranged between 43.36 mg/100g in T_{12} and 69.23mg/100g in T_3. Potassium content ranged between 304.33mg/100g in T_1 and 497.33mg/100g in T_6 and the difference was significant. Iron content also showed a significant difference which ranged from 6.04mg/100g in T_5 to 6.90 mg/100g in T_1. Thus a significant variation was observed in the mineral content of UFFM.

FFM and UFFM were statistically compared for their calcium, potassium and iron by applying independent sample't' test and is presented in Table 4.

Table 4. Calcium, potassium and iron in fermented and unfermented food mixtures

Methods	Calcium(mg)	Potassium(mg)	Iron(mg)
FFM	56.35	403.00	6.481
UFFM	56.09	403.81	6.445
Mean difference	0.257	-0.809	0.036
t value	0.100	-0.043	1.957
Significance	0.921	0.966	.0001
	NS	NS	S

There was no significant difference in the calcium and potassium content of fermented and unfermented samples. There was a significant increase in the iron content of FFM than UFFM. A similar result was reported regarding the mineral content in fermented foods [8] in which Rice-dehulled blackgram blends were developed and fermented with whey at 35 °C for 18 h and did not significantly change the total amount of calcium, phosphorus, and iron present in the blends. On the other hand, the HCl-extractability of calcium, phosphorus, and iron was enhanced considerably after whey incorporation and fermentation of cereal-legume blends.

Reduction in antinutrients due to fermentation may increase the bioavailability of various minerals but there need not be any change in the total mineral content in fermented foods [9].

IV. Conclusion

Fermentation has been used for centuries as means of improving the keeping quality of foods. Microorganism by virtue of their metabolic activities, contribute to the development of sensory, shelf life and nutritional qualities of food. In the present study, the calcium, potassium and iron content of the fermented food mixtures ranged between 43.82 to 69.70 mg/100g, 304.67 to 492.67 mg/100 g and 6.04 to 6.99mg /100g respectively. There was no significant difference in the calcium and potassium content of fermented and unfermented samples. There was a significant increase in the iron content of fermented and unfermented samples.

V. Acknowledgement

The support from Department of Biotechnology (DBT), New Delhi is acknowledged.

BIBLIOGRAPHY

[1] Institute of Medicine. 1998. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes: Proposed Definition and Plan for Review of Dietary Antioxidants and Related Compounds. National Academy Press, Washington DC, 545p.
[2] Mark, W. 2002. Food and Nutrition.[on line]. Healthy eating club, Australlia. Available:http://healthyeatingclub.com/info/articles/func foods/probiotics.htm. [20 June 2009].
[3] Koop, H.L. 2001. Prophylactic and therapectic uses of probiotics. *J. Am. Dietetic Assoc.*, **56:** 98-104
[4] Khetarpaul, N. 2005. *Food microbiology*. Daya publication house, Delhi, 469p.
[5] Page, A.L. 1982. *Methods of Soil Analysis*. Part II. American Society of Agronomists, Washington, D.C., 334p.
[6] Jackson, M.L. 1973. *Soil Chemical Analysis*. Prentice Hall of India Pvt. Ltd., New Delhi, 299p.
[7] Perkin-Elmer. 1982. *Analytical Methods for Atomic Absorption Spectrophotometry*. Perkin-Elmer Corporation, USA, 114p.
[8] Sharma, A. and Khetarpaul, N. 1997. Effect of fermentation on phytic acid content and *invitro* digestibility of starch and protein of rice –black gram dhal-whey blends. *J. Fd Sci. Technol.*, **34:** 20-23.
[9] Jood , S. and Khetarpaul, N. 2005. Improving nutritional quality of course cereals through probiotic fermentation. *Pro Fd Ind*., **23:** 17-25.

