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Nutritive value of fermented traditional foods of India

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Abstract

Fermented foods play an important role in the nutrition of the people in developing countries. Infact fermentation is regarded as one of the oldest ways of food processing and preservation where microbes play a major role in adding nutritive value, flavor, etc. Cereals are rich source of nutrients such as protein, carbohydrate, lipid, fibre, vitamins and minerals, and hence are used as substrates for the production of fermented foods in all parts of the world. Cereals such as wheat, barley, oats, ragi, soya and rice were taken for the preparation of fermented product. Microorganisms, both lactic and non-lactic acid bacteria, ferment the cereals. Among the different fermented samples analyzed, oats have less carbohydrate and rich in fibre, moderate in protein content and soya is rich in protein and ragi is rich in iron, curd doesnot have fibre and rich in lipids, Fermented rice is rich in carbohydrates when compared to other cereals.

INTRODUCTION

The traditional fermented foods contain high nutritive value and developed a diversity of flavours, aromas and textures in food substrates.Fermentation has been used for several thousand years as an effective and low cost means to preserve the quality and safety of foods. Food fermentations involve mixed cultures of microorganisms that grow simultaneously or in succession (Campbell-Platt, 1994). Fermented food products can be grouped into different categories on the basis of the main substrate or raw materials used in the processing such as fermented starchy foods, fermented cereals, alcoholic beverages, fermented legumes and oil seeds, fermented animals proteins e.g. nono and yoghurt. More than anything else, man has known the use of microbes for the preparation of food products for thousands of years and all over the world a wide range of fermented foods and beverages contributed significantly to the diets of many people (Achi, 2005). Microbial colonization has important health implications for humans. But on rare occasions, microbes develop a pathogenic relationship with a host, and illness or death of the host can result. Negative influences on human health by colonizing or invading microbes should not be acute.

Most probiotic foods in the markets worldwide are milk based and very few attempts are made for the development of probiotic foods using other fermentation substrates such as cereals. The development of non-dairy probiotic products is a challenge to the food industry, to utilize the abundant natural resources such as dietary fiber, proteins, energy, minerals and vitamins for producing high quality functional products. Cereals such as malt, rice, corn, wheat, sorghum, milk, oats and soya are used as substrate for lactic acid fermentation based on their availability of nutrients such as carbohydrates, amino acids, peptides, salts, vitamins, minerals, etc.. These nutrients are required for the growth of probiotic microbes. Other than the cereals, brined olives, salted gherkins and sauerkraut have been reported to contain high concentration of *Lactobacilli* (Molin, 2001). This article deals with the biochemical characteristics the nutritive value of the fermented foods.

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MATERIALS AND METHODS

Preparation of fermented foods

Fermented foods are the main source of beneficial microorganisms which can be potentially used as probiotics. So the present investigation was started with the production of fermented products using different food sources such as grains, rice and milk.

Fermented Grains

Lactic acid fermentation of cereals is a long – established processing method in Asia. Cereals such as ragi, wheat, barley, oats and soya were soaked in clean water for 2 days and ground well to make slurry. They were allowed to ferment for 1-3 days at room temperature. Fermented samples were taken for further study (Charalampopoulos et al., 2002).

Fermented Rice

Boiled Rice was taken and it was filled with sterile clean water for 2 days. After 2 days the sample was used for further study.

Fermented Milk

4ml of pre-fermented curd was inoculated as starter culture into 10ml of pasteurized milk. It was incubated at 37°C for 3-4 h, and then taken for further study. The prepared fermented foods were subjected to biochemical analysis to study their nutritive content and microbial load.

Analysis of nutritive content of fermented foods

Cereal grains are rich in protein, starch, dietary fibre and several free sugars, higher content of essential

Fig.1 Nutritional content of Ragi

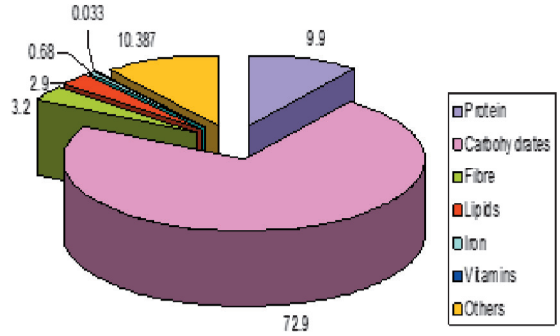


Fig.2 Nutritional content of Wheat

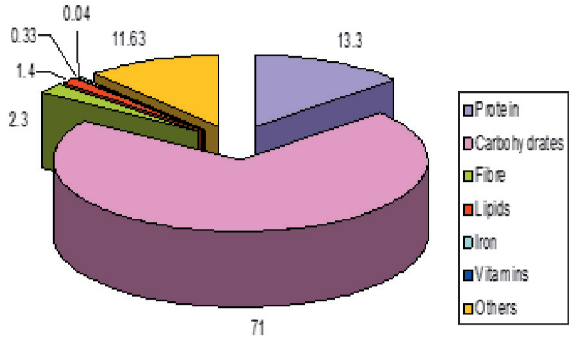


Fig.3 Nutritional content of Barley

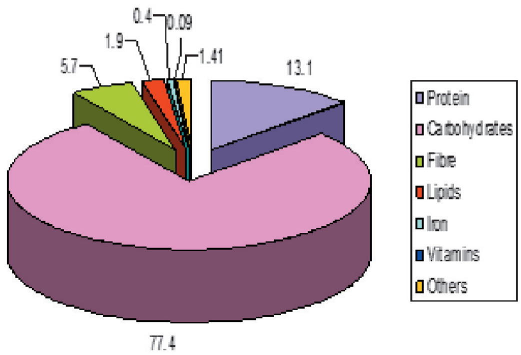


Fig.4 Nutritional content of Oats

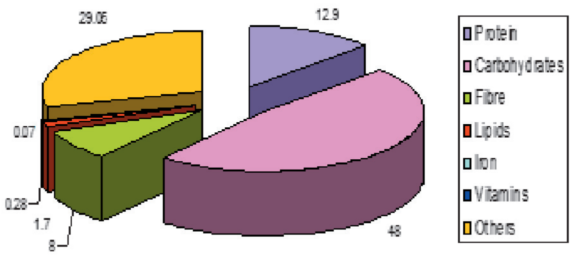


Fig.5 Nutritional content of Soya

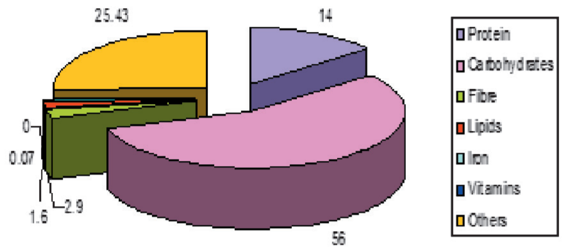


Fig.6 Nutritional content of Rice

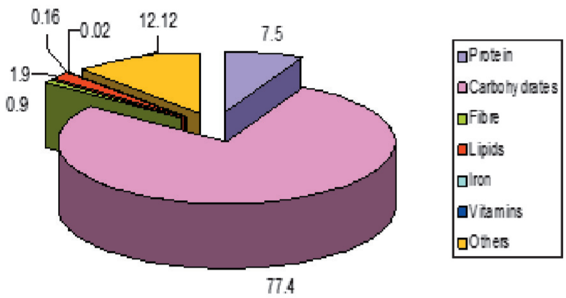
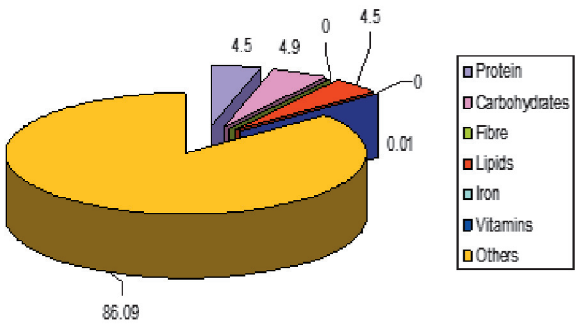


Fig.7 Nutritional content of Curd



vitamins and minerals. The nutrient content of the fermented food sources were analyzed by using the diagnostic kit provided by Agappe diagnostics Limited, Ernakulam, Kerala (India).

Estimation of Protein (Direct Biuret method)

20 µl of the sample was taken and mixed with 1000 µl of working reagent (Potassium iodide 6mM/L, Potassium sodium tartarate 21mM/L, Copper sulphate 6mM/L, Sodium hydroxide 58mM/L) and incubated for 10 minutes at 37ºC. The absorbance of standard (BSA 6gms/dl) and sample were measured against reagent blank at 546nm.

Estimation of Carbohydrate (Glucose Oxidase-Peroxidase method)

10µl of the sample was taken and mixed with 1000µl of glucose oxidase peroxidase reagent (Glucose oxidase 10000U/L, peroxidase >600U/L). It was incubated for 10 minutes at 37ºC. The absorbance of standard (Glucose 100mg/dl) and sample were measured against reagent blank at 505nm.

Estimation of Fibre (AOAC Method, 1985)

To 1 gm of sample, 40ml of MES tris was added. To that 50 µl of α-amylase was added, mixed and placed in a hot water bath at a temperature of 95-100ºC for 35 minutes. Then the beaker was cooled to 60ºC, to that 100µl of protease solution was added and incubated at 60ºC for 30 minutes. Then 5ml of 0.56N HCl and 200µl of amyloglucosidase solutions were added to it. It was incubated at 60ºC for 30 minutes. The samples were allowed to get precipitated at room temperatures for 60 minutes. Tar crucible was taken and 0.1 mg of celite was added. Crucible was placed on the glass beaker, and the precipitate was mixed with 75% ethanol and poured onto the crucible. Suction was applied to extract the liquid, The crucible was dried at 103°C in a hot air oven for 10-15 minutes and then the crucible was cooled for 1 hr. Then the weight of the crucible was determined.

Estimation of Lipids s(Cholesterol oxidase Peroxidase method)

10µl of the sample was taken and mixed with 1000µl of test reagent (Cholesterol esterase >180U/L, Cholesterol oxidase > 200U/L, peroxidase >1000U/L). It was incubated for 5 minutes at 37ºC. Then the absorbance was measured at 505nm.

Estimation of Iron (Cromazurol method)

100µl of the sample was taken and mixed with 2.5ml of reagent A (Acetate buffer 0.2M/L, CTMA bromide 0.7mM/L, Cromazurol B 2mM/L). It was incubated for 10 minutes at 37ºC. Then the absorbance was measured at 630nm.

Estimation of Vitamin B (ELISA Method)

Microtitre plate was coated with anti-vitamin B. 50µl of the standard and sample was added into the appropriate wells. To that 50µl of vitamin B12 peroxidase conjugate was added. The plate was covered and incubated for 60 minutes at room temperature. Then the plates were washed thrice with wash buffer (PBS + Tween 20) and 100µl of substrate solution (Tetra methyl benzidine) was added. Plates were incubated further in dark for 20 minutes. After the development of blue colour, the reaction was stopped with 100µl of the stop solution (0.5M H2SO4). Then the absorbance was read at 450nm using ELISA reader.

RESULTS AND DISCUSSION

Fermented foods

In the present investigation, fermented grains such as ragi, wheat, barley, oats, soya, watery rice and curd were used. As grains are rich source of nutrients such protein, carbohydrate, lipid, fibre, vitamins and minerals, they favour the multiplication or growth of microbes. So in order to isolate more number of beneficial microorganisms such as bacteria and fungi, fermented foods were taken as the substrates for the primary isolation. The prepared fermented foods were subjected to biochemical analysis.

Nutritive content of fermented foods

The nutritive content of the various fermented foods that were analysed are given in Table 1. The relative proportions of the various nutrients (viz., proteins, carbohydrates, fibre, lipids, iron and vitamins) in each type of food are given as pie charts (Fig.1-7). The nutrient content in cereals infact increases due to fermentation. Nanson and Fields (1984) have reported the improvement in the concentration of amino acids during the fermentation of meal. In another study Akobunde (1981) recorded that riboflavin and niacin increased with the fermentation of maize dough. Similarly Hamad and Fields (1979) stated that fermentation significantly improved the percentage of proteins and amino acids in maize, millet, sorghum rice and other cereals, which has also been supported by Padhye and Salunkhe (1979). The level of iron doubled when dehulled flour was fermented (Svanberg and Svanberg, 1988).The growth of microorganisms in cereals could be attributed to rich source of nutrients. Basic fermentation involves the enzymatic activities of *Lactobacillus*, *Pediococcus*, yeast and molds. However, the metabolic activities of these organisms result in the production of organic acids such as lactic acid, acetic acid, butyric acid, and propionic acid. All these could be contributed to the safety as well as the acceptable flavor of the foods, which has also been supported by Mensah *et al.* (1983).

Table 1. Nutritive Analysis of Fermented Food

S.No.	Nutrients analysed	Name of the fermented food						
		Ragi	Wheat	Barley	Oats	Soya	Rice	Curd
1.	Protein (g/dl)	9.9	13.3s	13.1	12.9	14.0	7.5	4.5
2.	Carbohydrates (g/dl)	72.9	71.0	77.4	48.0	56.0	77.4	4.9
3.	Fibre (g/dl)	3.2	2.3	5.7	8.0	2.9	0.9	Nil
4.	Lipids (g/dl)	2.9	1.4	1.9	1.7	1.60	1.9	4.5
5.	Iron (mg/dl)	0.68	0.33	0.4	0.28	0.07	0.16	0.01
6.	Vitamins (mg/dl)	0.033	0.04	0.09	0.07	Nil	0.02	Nil

CONCLUSION

Cereals such as wheat, barley, oats, ragi, soya and rice were taken for the preparation of fermented product.It plays an important role in the nutrition of the people in developing countries. Possible application of cereals or cereal constituents in functional food formulations as fermentable substrates for the growth of probiotic microorganisms especially *Lactobacillus* and *Bifidobacteria* has been reported by Charampoulous*et al.* (2002). Hence it is concluded that fermented foods are rich source of nutrition.

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