

HEALTH BENEFITS OF FERMENTED AND FUNCTIONAL FOODS

Yash Kumar and Lokendra Singh²

Department of Physiotherapy, CAEHS, Meerut; 328, Prabhat Nagar, Meerut.

Abstract: Current and prospective benefits of Fermented foods, Prebiotics, Probiotics and Ganoderma foods on human health especially on rejuvenation, immunity enhancement, nutrient supplementation, digestion and progression of some diseases have been discussed and Indian Scenario has been highlighted albeit there is no foolproof conclusive study so far that proves they are an effective cure for diseases except diarrhoea for any reason, including that induced by antibiotics. Notwithstanding, many clinical trials seem to hold promise and prebiotic and probiotic are the byword everywhere, therefore. Judged from the standpoints of longevity, impact on earth, evolutionary success and geographical spread, Yeasts, moulds and lactobacilli, which participate in forming fermented and functional foods are among the top 100 species (C. Lloyd, 2009; Times of India).

Key words: Fermented and Functional food benefits

INTRODUCTION

Ancient people all over the world have been using fermented foods, probiotic and Ganoderma-derived foods since before prechristian period for a variety of purposes including long and youthful life (Kumar, 2009). Antioxidantive benefits of dietary supplementation, diversification and fortification by medicinal herbs and milk based fermented products are already well known (Singh, Kaur & Kumar, 2009). Present communication reports about present status of our knowledge on fermented and functional foods in relation to human health and overall wellbeing. Suffice to say that B12 (produced by fermentation) alone is necessary for the synthesis of RBC, maintenance of the nervous system and growth and development in kids and its deficiency can cause depression, fatigue, constipation, loss of appetite, neuropathy and neurological damage.

FERMENTED FOODS

Fermented foods have been in use in Oceania (eg Poi & sago), Europe (Saurkraut), Middle East (Twshi boza), Africa (millet porridge, hot pepper sauce), East & south Asia (baimig, dalok, jeruk), central Asia (kumis, shubat or camel milk), USA (chocolate), India (Achar, Appam) and Nepal (gundruk, sinki). Fermented foods are foods produced or preserved by yeasts, moulds, bacteria or their combination, thereof under anaerobic condition. For preservation lactic acid is used in saurkraut, dry sausages and yogurt while acetic acid is used in pickling foods to increase their shelf life. Alcohol produced in fermentation is used in alcoholic beverages. Fermented food types may be diverse, such as, 1. bean based 2. grain based 3. vegetable based 4. fruit based 5. honey based 6. dairy based 7. fish based 8. meat based; each exemplified by miso, vodka, mixed pickles, vinegar, mead, shubat, shrimp paste and salami, respectively. Most of the fermented foods are facilitated by fungi. These include, SHOYO, MISO, HAMANATO, KATSUO BUSHI (Japanese Foods) in

which Soybean, Wheat, Koji and Fish are substrates and *Aspergillus oryzae*, *Saccharomyces rouxi* and *A. glaucus* are microbes involved. In China, common fermented foods are SUFU, TAMARI, ANGKAK and LAO CHAO. Substrates of them are soybean and rice which use *Actinomucor elegans*, *Mucor disperrus*, *Aspergillus tamarii*, *Monascus purpurea* and *Rhizopus chinensis*, *Saccharomyces malanga* as fermenting microbes. Indonesians use KETJAP, TEMPEH, ONTJOM and BONG KRED as fermented foods that use Soybean cheese, Peanut and coconut cakes as substrates and *A. oryzae*, *Rhizopus oligosporus*, *Neurospora sitophilla* as fermenting microbes. Nepalese commonly use KINEMA, a Soyabean based fermented food that uses *R. oligosporus* as starter. In Africa & Nigeria, GARI and OGI AGIDI are Cassava and maize based fermented foods that use *Geotrichum candidum* and moulds and bacteria as starters. IDLI and DOSA, the common fermented foods of south Indians are rice and black gram based foods that use yeasts and *Leuconostoc mesenteroides* as fermenters. Details of fungus fermented foods and methods of their preparation have been given by Gupta and Mukerji (2001). Besides, there are a variety of fermentation produced and preserved household foods which upon fortification become value-added eatables in India. The list includes 1. cheese (mixed with palak & Potato-pea) 2. butter (Laced on stuffed parathas) 3. curd 4. buttermilk 5. cereal-based yogurt 6. lassi with dry fruits, 7. dahi fortified with palak, bathua, onions, cucurbits, papaya, jira (all rich in antioxidants) 8. dahi mixed with pieces of apples, oranges, grapes, berries, mangoes (full of antioxidants) 9. Jalebi, imarti, rumali, tandooree roti, which use fermented flour 10. Kadhi 11. Idli 12. Dosa, 13. Dhokla 14. mixed pickles 15. vinegar-dressed lettuce, onion, ber, raddish, papaya, etc (Sugihara, 1985; Steinkraus, 1995; FAO, 2007).

Health benefits of Fermented foods: Fermented foods serve following purposes: 1. Enrichment of diet through addition of a diversity of flavours, aroma and textures in

food substrates. 2. Preservation of food through lactic acid, acetic acid and alkaline fermentation that increase shelf life of preserved stuffs. 3. Biological enrichment of food substrates with proteins, essential amino acids, vitamins, being nutritious to boot. 4. Fortified fermented foods being rich in glutathione, superoxide dismutase, vitamins C, E, B and Carotenoids detoxify our body and boost our immunity developing potential to fight out diseases. 5. Provide energy, and 6. play immunomodulatory role (Singh, Kaur & Kumar, 2009). According to Debi Hopkins, Fermented foods lower cholesterol, remove phytic acid (that has antinutritive properties) from nonfermented soybeans, Natto soybean dissolves blood clot because it has fibrinolytic nattokinase, sprout milk yogurt which has vitamin K and isoflavones that prevent osteoporosis and breast cancer (www.macula.com Natural Health Newsletter). Lactofermented vegetables proliferate Lactobacilli and enhance digestibility and vitamins levels.

PREBIOTICS

These are high fibre diet foods that are digestible and good to colon health (Gibson Marcel & Roberfroid, 1995). As they are present in large intestine, they should be differentiated from Probiotics which are active in small intestine. Prebiotics are found in plants, saliva and breast milk and consist of oligosaccharides and encourage growth of good bacteria. Psyllium, bran, germinating barley and inulin are rich sources of prebiotics, which are not destroyed when cooked. The prebiotics retard growth of bad bacteria.

Benefits of Prebiotics: 1. Increase calcium absorption 2. increase good colon bacteria 3. enhance immune system 4. reduce triglycerides 5. control appetite 6. reduce colon polyp and cancer 7. improve bowel regulation 8. increase bone density 9. reduce bad colon bacteria 10. reduce flatus smell and 11. control colitis and prevent rectal bleeding.

PROBIOTICS

Probiotics are those non pathogenic, selected, live micro-organisms which when used in adequate amount as dietary supplements or food ingredients confer health benefit on the host by improving the microbial balance of the gut (Fuller 1989; 1992) in addition to their conventional effects. They enhance functionality of fermented foods when selected cultures of them are used. Probiotics can be found in such foods as yogurt, dahi, fermented and unfermented milk, miso, some juices and soya drinks. Different strains and species of lactobacilli and bifidobacteria have been used commercially as probiotics (Kaur et al., 2002) but cultures of yeast and bacteria are also used in some cases. Often used prebiotic cultures include *Lactobacillus rhamnosus*, *L. casei*, *L. johnsonii*, *L. acidophilus*, *L. plantarum*, *L. delbrueckii ssp bulgaris*, *L. Reuteri* : *Lactococcus lactis ssp biovar*

diacetylactis 60, *L. ssp. cremoris* ; *Bifidobacterium bifidis*, *B. longum*, *B. infantis*, *B. breve* ; *Leuconostoc citrovorum*; *Pedococcus sp.* *Saccharomyces cerevisiae* and *Escherichia coli* strains. Antibiotic susceptibility of Common probiotic human faecal species of Lactobacilli, viz., *L. fermentum*, *L. plantarum* and *L. casei* was determined by disc diffusion method using LAPTg agar, MRS agar and MHA by Dhewa et al., (2009). and variable susceptibility to chloramphenicol, erythromycin, ciprofloxacin, kanamycin, gentamycin, streptomycin, pefloxacin, lincomycin, ofloxacin, rifampicin, vancomycin and ampicillin. Resistance to ampicillin suggests that lactobacilli could simultaneously used as a probiotic for diarrheal treatment.

Benefits of Probiotic foods: Although largely improved in humans, so called biotherapeutics of probiotics include 1. resistance to pathogens 2. reduction in blood lipids 3. antitumour properties 4. hormonal regulation 5. immune stimulation 6. alleviation of food allergies and 7 lactose intolerance through gut microflora manipulation (Kapila, Jain, Tada & Sinha, 2006). Some of the health benefits of prebiotics are being highlighted below;

1. Improve intestinal microbial balance inhibiting pathogens and toxins. Chitra N Wendakoon (2000) reported that yogurt can kill ulcer causing *Helicobacter pylori*. According to Alvarez and Oberhelman (2001), Gill & Guarner (2004) Cabana et al. (2006), Doron & Gorbach (2006) and Huebner & Surawicz (2006), probiotics especially dahi is useful in prevention and treatment of gastrointestinal infections like dysentery, diarrhea, irritable syndrome- Crohn's disease, ulcerative colitis and antibiotic triggered diarrhea besides intestinal infection due to *Clostridium difficile*
2. Enhancement of immune function including increase in macrophages and phagocytosis by consumption of *Bifidobacterium lactis* -HNO19 (Arunachalam et al, 2000), *Lactobacillus rhamnosus* (Gill & Rutherford, 2001), *L. casei* (Kato et al., 1983), *Leuconostoc citrovorum* and *Lactococcus lactis* (Singh & Kansal, 2003). Evidence suggests that probiotic microbes exert their immune enhancing effects by augmenting both non specific (e.g. phagocyte function, NK cell activity) and specific (e.g. antibody production, cytokine production, lymphocyte proliferation and delayed type hypersensitivity host immune response). Using *Lactobacillus casei* containing fermented milk, dahi and skim milk in mice system, kapila et al., 2006, observed that *Shigella dysenteriae* colonization in small intestine, liver, and spleen was far less and that *L. casei* induced both specific and non specific immunostimulatory response. In vitro phagocytic and lysosomal enzyme activities conducted in mice fed with *L. acidophilus* and *L. casei* mixed dahi cultures, Jain, Sinha & Yadav (2005) observed increase in peritoneal macrophages and phagocytes, which may reduce the

role of medicine in human lives. In skim milk cultures containing *Lactococcus lactis* and *Lactobacillus acidophilus* cultures fed to mice, symbiotic effect and increase in B- galactodidase activity was observed by Yadav, Jain & Sinha (2006; 2007).

3. Effect of Dahi on progression of diabetes and on blood glucose, insulin and lipid profile by consumption of *Lactobacillus acidophilus*, *L. casei* and *Lactococcus lactis* (Yadav, Jain & Sinha, 2005 & 2006, a, b).
4. Prevention of Eczema, Atopic dermatitis, prevention and treatment of pouchitis after colon surgery, tooth decay and periodontal diseases and hypnoses (Vanderhoof & young, 2004; Huebner & Surwicz, 2006; Gill & Guarner, 2004; Doron & Gorbach, 2006; Cabana *et al.*, 2006).
5. Prevention of vaginal yeast infection by Lactobacilli (Redondo- Lopez *et al.*, 1990).
6. Lowering of plasma and organ lipids and decrease in the progression of Atherosclerosis (Chawla & Kansal, 1984; Agarwal & Kansal, 1997).
7. Hypocholesterolemia effect of milk (Richardson, 1978).
8. Nutritional advantage of probiotic foods- antioxidants, bioactive isoflavone and Bacteriocin production (Markau & Rualt, 2002; Yadav, Jain & Teotia, 2004; Grajek *et al.*, 2005; Rukhana *et al.*, 2005; Gautam & Sharma, 2006).

Harmful effects of overgrowth of Fermenting Microbes: 1. Gas and bloating may be side effects of probiotics. 2. Overgrowth of fermenting bacteria and moulds in our system can cause Crohn disease, Ankylosing spondylitis and Candidiasis.

Some of the commercial probiotic foods: 1. Dr. Ohira probiotics 12 plus contain 10 lactobacilli and 2 bifidobacteria 2. Wakunajas probiotics 3. complete probiotics- Mercola 4 NDRI probiotics- Dahi and probiotic icecreams 5. LB17, which are live probiotics produced from 70 natural and organic ingredients using 17 strains of lactic acid bacteria as starter. Seaweed- kombu, focus, brown algae; Mushrooms- shiitake, maitake and *Agaricus brazeimurill*; Vegetables- kale, cabbage, broccoli, komatsuna; Herb-ginseng; Grains and Cereals- soybean, unpolished rice and cultivated and wild Fruits- apples, oranges, berries, lemon, persimmon etc are fermented to produce LB17 that stay alive for 3 years at room temperature and are encapsulated with a vegetable gel cap (Perilla oil, high in omega 3 fatty acids. Used by Raw food Practitioners, LB17 is very useful to lactose intolerant and milk protein sensitive individuals.

Mechanism/ functions of probiotics: 1. Compete for nutrients 2. compete for space 3. produce Vitamin K and B1, B3, B6, B12 4. Increase Natural killer cells 5. Reduce constipation 6. Produce inhibitory substances.

GANODERMA AND ITS HEALTH EFFECTS: This unfermented functional food is a natural solution to a number of modern health problems. It has 200-400 nutraceuticals like polysaccharide- beta-D-Glucan; Ganodermic acids-BDFHKRSTY; organic Germanium; Adenosine triterpenes; Ganodermediol; Alkaloids; Antioxidants; protein Ungzhi 8 and plant sterols, which improve pancreatic function, protect skin degeneration; reduce fatigue; fortify digestive system; boost immunity and body function; inhibit platelet aggregation, increase lymphocytes, decrease CD 8 counts; elevate plasma insulin levels, liver protease, SGOT, SGPT and bilirubin and are antiinflammatory and antiallergic. Ganoderma has natural healing ability, counters oxidants, stops acid reflex, good for behavioural disorders and cleansing and Adaptogen can remedy alcoholism, insomnia, allergy, mumps, paralysis, tiredness, sterility and rheumatism, diabetes and psoriasis as per claims of Chinese and other medical practitioners and Ganoderma food and coffee producers. Ganotherapy uses Ganoderma lucidum mushroom that is easily tissue cultured. Commercial products include DXN Ganoderma products; Bueraco Reale and Vaxa product adaptogen (www.magicmushroom.com.au).

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