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Prophylactic and bio-therapeutic benefits of `*ogi*': A lactic acid fermented food

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ABSTRACT: *Ogi* is a popular cereal meal consumed mainly in the western part of Nigeria. Despite its safety and health benefits, its consumption is dwindling. Like other lactic acid fermented foods, *ogi* is a good source of lactic acid bacteria (probiotics). Probiotics have been reported to have some benefit in the prevention and treatment of some diseases such as gastrointestinal disorders including diarrhoea and dysentery. Metabolic disorders such as lactose intolerance, sucrase and maltase deficiencies can also be managed by probiotics. They favorably modulate immunity in some circumstances and have anticarcinogenic effects, regulate hypercholesterolemia. The use of probiotics to recolonize the vagina to prevent sexually transmitted diseases like gonorrhoea, syphilis, candidiasis and HIV has also been documented. These claims provide a strong rationale for increased consumption of *ogi*, particularly among immunocompromised populations such as the elderly or the convalescent. Probiotics enhance the immune response, which would in turn increase resistance to immune-related diseases. *ogi* is very cheap and easy to prepare. If the potential of *ogi* and lactic acid bacteria (LAB) could be adequately utilized it will reduce the pressure on the use antibiotics and hence reduce the rate of bacterial resistance to antibiotics. [Researcher. 2010;2(9):72-77]. (ISSN: 1553-9865).

Key Words: *ogi*, lactic acid bacteria, probiotics, prophylactics, immune system, fermented foods.

INTRODUCTION

Cereals are the main sources of macro- and micronutrients for humans in most African countries (Asiedu *et al*., 1992). They are processed, in West African countries, into a wide range of fermented foods and beverages like *mawe* (Hounhouigan,1994), kenkey (Hahn *et al.,* 1993), *poto-poto* (Vieira-Dalode *et al*., 2007), *ogi* (Odunfa and Adeyele, 1985; Adeyemi and Beckley 1986; Akingbala *et al.,* 1987; Adeyemi, 1988; Johansson *et al.,* 1989; Adewusi *et al.,* 1991), *togwa* (Mugula *et al.,* 2003), *buchera* (Muyanja *et al.,* 2002) *kunu zarki* (Olukoya *et al.,* 1993) and *koko* (Lei and Jakobsen, 2004). These fermented foods serve as infant weaning diet; children's break fast, adult main meals and snacks (Flahar and Leung, 1983; Onilude *et al.,* 1999)

Ogi is the most popular traditional health-sustaining fermented food in Western Nigeria. It is formulated from cereal: White maize *(Zea mays)*, yellow maize (Z. *mays*, yellow variety), red guinea corn *(Sorghum vulgare)*, white guinea corn *(Sorghum bicolor)* and millet *(Pennisetum typhoideum)* but not from rice and wheat (Adebolu *et al.,* 2007). In some communities in southwestern Nigeria, uncooked *ogi* is normally administered to people having running stomach to reduce the frequency of stooling (Aderiye and Laleye, 2003) but the empirical proofs for this claim is lacking. Studies have revealed that *Lactobacillus rhamnosus* and *L. reuteri* could colonize the vagina, kill viruses, and reduce the risk of infections, including bacterial vaginosis (Reid *et al*., 2001a; Cadieux *et al.,* 2002).

The nutritional benefits of *ogi* have been investigated extensively but the therapeutic and preventive effects of *ogi* and LAB, which are responsible for the fermentation and organoleptic quality of *ogi* have been scantily reported. LAB have been implicated in the fermentation of *ogi* and have been frequently isolated (Olukoya *et al.,* 1993). *Lactobacillus* spp., *Pediococcus* spp., *Leuconostoc* spp. and *Weissella* spp. have been reported variuosly (Olukoya *et al.,* 1993; Odunfa and Adeyele, 1985; Johansson *et al.,* 1989; Hounhouigha *et al.,* 1993; Lei and Jakobsen, 2004).

LACTIC ACID BACTERIA (LAB)

Lactic acid bacteria are gram-positive bacteria with cell wall components such as peptidoglycan, polysaccharide, and teichoic acid, all of which have been shown to have immunostimulatory properties (Takahaslii *et al.,* 1993). In addition to cell wall components, immunostimulatory effects were also observed with antigens which originated from the cytoplasms of some strains of LAB.

LAB cell walls contain the main immunomodulatory component (Rook, 1989). Their cell wall is composed mainly of peptidoglycan (30-70% of the total cell wall), polysaccharide, and

teichoic acid. Peptidoglycans are glycopeptides released from the bacterial cell wall by bacteriolytic enzymes, such as lysozyme. Lysozyme, which is secreted into the intestine from paneth cells (Peeters and Vantrappen, 1975), can release peptidoglycan and muramyldipeptide (MDP), a lower-molecular-weight product of peptidoglycan. Peptidoglycans are known to have adjuvant effects on immune response (Adams, 1981*).* Binding sites for peptidoglycans were identified on lymphocytes and macrophages (Dziarski, 1991). Lactic acid bacteria which are very sensitive to lysozyme digestion may liberate peptidoglycan in the intestine and induce adjuvant activity at the mucosal surface (Link-Amster *et al.*, 1994).

Lactobacillus and *Bifidobacterium* species and a few other bacteria that are associated with *ogi* have been found to be safe for human use and are termed 'probiotics'. Probiotic is derived from the Greek word `biotikos' which is literarily translated as 'for life'. Probiotics are live microorganisms which when administered in adequate amounts confer a health benefit to the host (Anukam *et al.*, 2004). Recent studies indicate that some strains can regulate the virulence of pathogens. Probiotic organisms have been propagated and developed in capsules for vaginal instillation and for oral intake (Ohhira, 2005). The purpose is to recolonize with organisms that appear to help protect it against microbes that could cause infection.

LAB AS PROBIOTICS

Probiotics are non-pathogenic organisms which are used to inhibit the growth of potential pathogens either directly through the colonization of the host's body or indirectly through the production of secondary metabolites that are harmful to the pathogens (Onarhein and Raa, 1990). Accordimg to Fuller (1989), the attributes of good probiotic include the following:

- Ability to exert a beneficial effect on the host
- Non-pathogenic and non-toxigenic
- Viability of the cells
- Ability to survive in the gut environment
- Adherence to the intestines
- Ability to remain viable for a very long period

Lactic acid-producing probiotic microorganisms play a role of tremendous importance in the maintenance of human health. The probiotic concept was born in the early 20th century by the Russian scientist Éllie Metchnikoff, known as the father of modern immunology and received the Nobel Prize in 1908. Dr. Metchnikoff proposed that the health, wellbeing and longevity of Balkan populations were attributable to their consumption of large quantities of fermented milk that contains beneficial microorganisms that belong to the genus *Lactobacillus* (Doyle *et al.,* 2001). Many investigators have reported the therapeutic effects of different strains of LAB. Lactic acid bacteria can be administered parenterally, orally and through urinogenital routes and, in all the cases, strengthen nonspecific immunity (Gerritse *et al.,* 1990; Frenades and Shahani, 1990; Anukam *et al.*, 2004).

THERAPEUTIC EFFECTS OF LAB

Dead bacteria were reported to be generally less efficient as antigens than are live bacteria because dead bacteria are rapidly dislodged from the mucosa (Pierce *et al.,* 1987; Bernet *et al.,* 1994). Some studies, however, showed no difference in immunogenicity between viable and nonviable bacteria (Hatcher, 1993).

The potential therapeutic effects of LAB and *ogi*, including their immunostimulatory effect, are due primarily to changes in the gastrointestinal (GI) microflora to suppress the growth of pathogens. Increase in population of LAB in the intestinal or vagina reduces the cause of bacterial vaginosis, which is a major risk factor for the contraction of HIV (Reid, 2002a). It also reduces the occurrence of gonorrhoea, chlamydia, and other sexually transmitted diseases (Reid *et al.,* 2001b) and diarrhoea (Kollaritsch *et al.,* 1989; Adebolu *et al.,* 2007). Yeast infections, constipation, and a number of other intestinal discomforts can be suppressed by LAB colonization (Fernandes *et al.,* 1987). Agerholm-Larsen *et al.* (2000) and Aderiye *et al.* (2007) also reported that consumption of LAB likewise wreduces the amount of low-density lipid in the serum and incidence of cardiovascular diseases.

MECHANISMS OF ACTION OF LAB

There are several common mechanisms of how lactic-acid producing probiotics are capable of supporting human health. They assist in breaking down lactose either by direct utilization or indirectly via secretion of additional lactase. This makes lactose-metabolizing probiotics especially attractive for those individuals who may experience various manifestations of lactose intolerance (Hitchins and McDonough, 1989).

Another mechanism includes antagonism between probiotic flora and medically significant pathogens. The competitors are normally waded away by such factors as

- lowering pH,
- releasing bacteriocins,
- competing for nutrients,
- making intestine less hospitable for undesirable bacteria and fungi
- inhibiting the growth and adhesion of pathogens to colonic mucosa
- production of hydrogen peroxide
- production of biosurfactants, and
- modulating the host's immune response.

(Gorbach *et al.,* 1987; Brink *et al.,* 1994; Cats *et al.,* 2003).

The ability of certain probiotics to bind with bile acids and thus influence lipid absorption from the gut plays an important role in maintaining healthy cholesterol metabolism. This phenomenon has been confirmed in numerous well-executed clinical trials (Agerholm-Larsen *et al.,* 2000; Aderiye *et al.,* 2007).

Lactic acid bacteria generate short-chain fatty acids such as acetic, propionic and butyric acids which are utilized as a direct energy source for the host (Gibson and Fuller, 2000). These fatty acids are considered to contribute significantly to the maintenance of the integrity of the colonic mucosa and its barrier function (Johansson *et al.,* 1989).

The inhibitory mechanisms of LAB against disease-causing bacteria are due primarily to the second metabolites of lactic acid fermentation-organic acid (Kim 1988; Fernandes and Shahani, 1990). Another health effect of probiotics is related to the function of the immune system. The GIT tract is infiltrated by immuno-competent cells. They constantly scan intestinal content for antigens and get exposure to molecules that influence the immune system status. The constant exchange between immune system and gastrointestinal flora is essential for proper immune function at large (Gill and Rutherfurd, 2001).

PROPHYLACTIC EFFECTS OF LAB

The health benefits of *ogi* are due primarily to the ability of LAB to survive in the human GIT. LAB commonly used for *ogi* production like other strains could survive in the stomach and they are found in the faeces (Alm and Pettersson, 1980; Robins-Browne *et al.,* 1981).

Lactic acid bacteria can inhibit the growth of transplantable and chemically induced tumors in animals. Consumption of lactic acid fermented products has been reported to protect against breast cancer (Le *et al.,* 1986). Animal studies showed that LAB exerts anticarcinogenic effects (Goldin and Gorbach 1980; Reddy *et al.,* 1983; Shackelford *et al.,* 1983; Hitchins and McDonough, 1989). Diet-induced microflora amendment may retard the development of colon cancer (Hitchins and McDonough, 1989).

The anticarcinogenic properties of LAB are as a result of its ability to reduce nitrite concentrations, thereby eliminating the substrate for the formation of carcinogenic compounds and nitrosamines (Dodds and Collins-Thompson, 1984; Tsuru *et al.,* 1988). A second possible mechanism involves LAB cellular uptake of mutagenic compounds, such as nitrite, in the gastrointestinal tract, thereby reducing the potential conversion of the compounds to carcinogenic compounds, nitrosamines (Fernandes *et al.,* 1987). The third potential mechanism involves suppression of tumors by enhancement of immune response (Friend and Shahani, 1984).

CONCLUSION

Ogi is a food and not a regulated pharmaceutical and, owing to variation in production methods and substrates, its probiotic content may show a flunctuation in quantity but not in quality. The direct application of the product (*ogi*) may not enjoy wide acceptability, larger and controlled studies are needed to further evaluate their reliability and claimed efficacy. Major food companies are actively pursuing the development of probiotic-containing functional yoghurt products (Mattila-Sandholm, 1999). Probiotics from *ogi* have not been harvested and packaged. Being a non-dairy product, its probiotics will enjoy more global acceptance than yoghurt's, especially among the vegetarians.

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