FERMENTATION ENHANCED NUTRITIONAL QUALITY OF FOOD- A REVIEW

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ABSTRACT

Among the earliest processed food products, fermented foods are those ingested by humans. Through fermentation techniques different semi-digested and reactive meals can sometimes be converted into functional foods which have a beneficial effect on health. Generally, fermentation helps to eliminate numerous unwanted microbes and toxins from food particles while also introducing helpful microbes to help with digestion, these bacteria also help to develop new enzymes. Fermentation also enhances the quality of different food products such as soybeans, dairy products, cereals, etc. by including their nutritional status. Thereby quality of functional foods can be increased through fermentation which generally improves the GI Tract health, acts as immune system enhancer, improving the bio-availability of nutrients, lowering the lactose intolerance habitat, reducing the appearance of allergic symptoms in susceptible persons and also sometimes decreasing the risk of certain diseases including cancer. Basically fermented foods contain probiotic organisms which may be the probable agents to enhance the health benefits of individuals. In this article, emphasis has been given to the beneficial effect of fermented foods on the general health of the human being.

Keywords: Probiotic, Mycotoxin, Lactose intolerance, Biofortification, Anti-carcinogenic effect.

INTRODUCTION

Since the dawn of civilization, the human diet, fermented foods have had a major role, which manufactured, consumed, and utilized by people (Maria et al., 2017). Various bacteria and their enzymes cause vital and beneficial changes in the food particles through the fermentation technique. Based on the main metabolites and microorganisms involved, food fermentation processes can be categorized using lactic acid bacteria (LAB) from genera like *Leuconostoc*, *Lactobacillus*, and *Streptococcus*. Various vulnerable organic substrates are ingested by microorganisms as part of their metabolic processes, resulting in fermentation. The eventual return of chemical components to the soil and air is both of them are necessary for survival or existence on this earth, and the destruction of natural materials depends on such interactions. Today, the term "Fermentation" refers that the aerobic or anaerobic breakdown of carbohydrates and carbohydrate-like compounds. In the presence of probiotic microbes, the phrase "Fermented Foods" denotes a special class of food products characterized by the breakdown of different carbohydrates; however, glucose is not always the sole component affected (Potter and Hotchkiss, 2006). The majority of fermented foods contain a complex blend of proteins, lipids, carbohydrates, and other components that are altered either concurrently or gradually by a range of bacteria and their enzymes. Thus, it can be implied that the process of fermentation has a number of crucial implications in addition to its preservation and variety-creating functions. In particular, acids and alcohols are suppressive to general harmful microorganisms that may wind up in meals. For instance, *Clostridium botulinum* cannot develop and manufacture toxins at pH levels lower than 4.6. When bacteria ferment dietary components, they produce energy and expand their population.

ROLE OF FERMENTED FOOD PRODUCTS

Health Beneficial Effects – Probiotics

The term probiotics are used to refer to the living microbes which have a positive impact on the host body's health. Dairy products are the most popular probiotic carriers since they serve as the essential starter organisms in fermented foods. Intolerance to lactose, infections of the urinary tract in women, inflammation of the digestive tract, diarrhea in children, traveler's diarrhea, diarrhea caused by antibiotics, Irritable Bowel Syndrome (IBS), Helicobacter pylori gastritis, and CRC or Colorectal Cancer, are all examples of inflammatory bowel conditions. The health advantages of probiotics are illustrated by their effects on immune function, infant health, atopic illness, and atopic dermatitis (Heller and Clin, 2001).

Alleviation of lactose intolerance

Lactase deficiency, or milk sugar, is a common problem in lactase-deficient people across the world. Consuming lactose can result in diarrhea, bloating, stomach pain, and flatulence in those who don't produce adequate milk inside the intestine (Panesar et al., 2006). Lactose digestion is aided by milk-containing *L. acidophilus* cells in such people. It has been demonstrated that many lactose intolerant people can consume fermented dairy products like cheese, yogurt, curd,

kefir, etc. having lower effects compared to the same quantity of non-fermented counterparts.

Boosting the immune system

The human body is protected by the immune system from a variety of unpleasant environmental agents as well as infectious agents. The innate and acquired components of immunity are conceptually separated into two functional groups. Both components involve a variety of blood-borne elements (antigen, antibody, and hormones) including lymphocytes. Secondary plant metabolites, such as polyphenols derived from processed meals, may also contribute to the advantages.

Intestinal pH balance

Colons have a slightly acidic pH, which prevents or gets rid of potentially pathogenic microorganisms. When heterotrophic microorganisms are prevalent in the colon in large numbers, they can cause bad breath (foul smelling) and other health-related problems. Lactobacilli bacteria make lactic acids, as well as a huge number of other helpful microbes including yeasts which generate acids and also help to maintain a healthy level of pH in the large intestine (Lopez *et al*., 2002).

Protection against infection

Diarrhea and other GI Tract diseases are brought on by a change in the intestinal microbiota carried by an invading bacterium. Viable lactic acid bacteria may prevent infection by limiting its colonization, as well as the consequent multiplication of pathogens found in food, hence avoiding contamination (Gandhi. D.N., 2000).

Anti-carcinogenic effect

Fermented foods have been shown to be beneficial as they help in healing some malignancies. It has been proved that in animal experiments lactic acid bacteria have an anti-carcinogenic impact by either preventing cancer initiation or suppressing cancer that has already started. In mice, yogurt and milk fermented with *L. acidophilus* were found to exhibit anti-carcinogenic properties (Hosono *et al*., 1986).

Lowering of serum cholesterol

According to reports, fermented foods have a hypocholesterolemic impact. It is thought that consuming significant amounts of fermented milk provides components that inhibit cholesterol production. The capacity of *L. acidophilus* to reduce serum cholesterol levels has been discovered (Grunewald, 1992).

Role of Nutrition Enhancement – Preservation

All through the beginning of human history, fermentation has been employed to preserve food (Parvez *et al*., 2006). Certain foods become more digestible through fermentation, and in the case of cassava fermentation, the toxicity of the substrate is reduced. Fermentation also lengthens a food's shelf life and improves its microbiological safety.

Flavor enhancement

The smell and flavor of the food are improved during fermentation, making it more enticing. Fermented meals are more well-liked by consumers than unfermented foods, due to such organoleptic qualities (Blandino *et al*., 2003).

Enhancement of Nutritive Values

Compared to non-fermented meals,

fermented foods may be higher in nutrients. Both catabolic and anabolic microorganisms synthesize several complex vitamins and other growth regulators by dissolving more complex organic compounds. The second important way that fermented foods can boost nutrition is by releasing nutrients that have been bound to plant cells and tissues via inedible substances (Mokoena *et al*., 2005).

Reduction of mycotoxin's harmful effects

Secondary metabolites known as mycotoxins are produced by fungi, primarily those belonging to the family *Fusarium*, *Penicillium,* and *Aspergillus*. These poisons can contaminate agricultural products, food, and animal feed causing a multitude of illnesses in both humans and animals (Hjortmo et al., 2008).

Folate Biofortification

Folates play a crucial role in cellular metabolism including proliferation as cofactors necessary for the synthesis of nucleotides. The folate biosynthesis pathway is present in some species of bacteria, yeast, and plants that are found in fermented foods. However, because humans are unable to synthesize folate, they must obtain it through diet (Gregory. J.F., 1989). *S. cerevisiae* produces large quantities of folate per weight and it is a good nutrition source of local folate (Patring et al.,2005).

FERMENTED FOOD GROUPS

Fermented milk and milk products

The majority of milk-based fermented foods are produced using lactic acid bacteria (LAB) fermentation, which is primarily done to retain the nutritional value of the finished product and increase shelf life. A few of the advantageous effects on human health include altering the gut microbiota, preventing and treating IBD or Inflammatory Bowel Disease (Saez-Lara *et al*., 2015), as well as having hypocholesterolemic and anti-carcinogenic properties (Kapila *et al*., 2007), are some of the positive effects on human health.

Koumiss

A fermented drink originally produce from mare's milk (unpasteurized). The most significant microorganisms in Koumiss are the lactic acid bacteria, which change lactose to lactic acid, and also sugar is converted to ethyl alcohol and CO_2 by the yeast and other most important microorganisms present in Koumiss. It goes through two major fermentation - fermentation through alcohol and fermentation of lactic acid (Chen *et al*., 2010), which give it a unique sour, alcoholic flavor.

Cheese

Cheese is a high calorie, high fat, high protein, high calcium, and high vitamin-B containing fermented dairy food that is normally of good quality. For making cheese, casein is broken down using a starter culture, milk, rennet, peptidases, and proteases from secondary micro flora. These bioactive compounds are then used in a number of biological processes (Lopez-Exposito *et al*., 2017).Cheese's ability to treat and prevent disease is mostly due to its vitamin and mineral richness as well as its bioactive peptides (Hur et al., 2016).

Sauerkraut

The most well-known and oldest Chinese fermented vegetable is Sauerkraut. Sauerkraut is made through

spontaneous fermentation, which causes several microbiological, metabolic, as well as physiological changes that may alter the integrity and the end product's quality (Beganovic *et al*., 2011). Sauerkraut contains yeast and fungus alongside lactic acid bacteria. Due to its concentrations of vitamins C and B, minerals including iron, calcium, potassium, phosphorus, and phenolic compounds, Sauerkraut has a number of health benefits.

Kefir

Kefir is a traditional fermented milk beverage having a creamy texture, sour, acidic flavor, and a hint of alcohol. It originated in the Caucasus and is produced from the fermentation (acid-alcoholic) of milk by bacteria present in this fermented food. Kefir has gained popularity in recent years due to its appealing organoleptic qualities as well as anti-carcinogenic, hypo-cholesterolemic, anti- hypertensive, anti-mutagenic, anti-inflammatory, anti-diabetic, anti-bacterial, anti-oxidant, and also probiotic benefits (Ahmed *et al*., 2013).

DISCUSSION

People must be educated about the importance of fermented foods for ensuring their safety and security. The importance of protection can't be overstated. To supplement the overall advantages of fermented foods, personal hygiene should be performed. The fact that many fermented food products are produced under subpar conditions, causing poor quality, as well as limited shelf life is the main barrier to the growth of these products in undeveloped countries (Achi et al., 2005). The lack of appeal in food product presentation and advertising, as well as the fact that the procedures are frequently difficult and drawn out, are further problems. The technology has to be developed through study in order to realize its potential for product safety and nutritional benefits. The challenge is to make sure technology is used to give these products value, such as a longer shelf- life, better flavor, and enticing packaging and labeling. Due to the low survival rates reported in these products, it is ineffective to preserve LAB probiotic organisms in ancient ferments. In addition to their technological functions, LAB and yeasts are used in the preparation of foods and beverages for humans that have a variety of positive effects on health and well-being.

CONCLUSION

Foods that have undergone fermentation have a great deal of promise to improve nutrition, reduce disease risk, and overall health. There are generally eight justifications for the health benefits of fermented foods: Fermented foods have many health benefits, including the following: a) Fermented foods restore the proper balance of gut bacteria, b) they aid in digestion, c) they help in the absorption of nutrients, d) they are high in enzymes when eaten raw, e) fermented foods significantly boost vitamin content, f) they also help in the preservation of nutrients, g) fermented foods enhance flavor, and h) they are inexpensive. Technological developments in the manufacturing of fermented foods have led to a variety of products that satisfy the tastes of many different ethnic groups.

FUTURE SCOPE

Fermentation technology is the utilization of microorganisms and enzymes to create compounds for the food, chemical, pharmaceutical, and energy industries. The

efficiency and product range of fermentation can be further improved, and it can even be used to produce novel food products from non-food biomass. Bacteria and yeast break down carbohydrates during fermentation. Consuming foods having fermented enhances food preservation while also boosting the probiotics, or good bacteria, in the human digestive system.

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