**KOMBUCHA AND ITS THERAPEUTIC EFFECTS - A REVIEW**

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ABSTRACT

Kombucha is a beverage made by fermenting sweetened tea (Camellia sinensis) with a culture containing a symbiotic consortium of bacteria and yeasts SCOBY strain. The substrates used in the preparation of the traditional drink, or even others that give the drink an innovative character; chemical and microbiological composition and variations; the characteristics, the possible benefits attributed to the consumption of Kombucha. This paper is focused on the properties of some constituents of Kombucha. The intensive research about the effects of Kombucha Tea on health and its significance are summarized to get a better understanding of the complex mechanisms that support health.

KEYWORDS: Kombucha, SCOBY, Fermentation, Therapeutic effects, Health.

INTRODUCTION

The development and application of technology in contemporary medicine are evidence that people are continuously looking for ways to enhance their general health and well-being. In recent years, scientific societies and public demand have been providing a new definition of beverages. A large amount of information has been published concerning the effects of tea and its major constituents on human health.

Tea was first introduced into European countries from China by Portuguese and Dutch explorers as a medicinal herb. This beverage has been consumed in many countries for a very long time, and today interest is growing because scientific reports indicate that tea could bring benefits for health and may help prevent chronic diseases. (Hollman,et al., 1996). Tea is the second most popular beverage in the world after water (Yang &Wang, 1993).

Kombucha beverage is a naturally fermented beverage that is acquired from sugary tea with a dependent Symbiotic Culture of Bacterium and Yeast (SCOBY) C. (M. Hasler and A. C. Brown,2009) via a fermentation process usually lasting for 7–10 days. Kombucha, one of the popular drinks of recent years, is a fermented product that first became widespread in China, traditionally using black or green tea [Camellia sinensis (L.)] as substrates. When it started to become popular in Japan, it was named "kombucha" and created with the combination of the word "kombu" and "cha", meaning algae and tea, respectively. Kombucha found non-alcoholic and low-alcohol versions (less than 0.5% (v/v) of alcohol) on the market, or even alcoholic versions (Nummer, 2013). Kombucha is commercially sold as a tea-type beverage in markets. (Oz H.S et. al., 2017),

The consortium is a symbiotic system of viable yeasts (such as Saccharomyces cerevisiae, S.ludwigii, S. apiculatus, Schizosaccharomyces pombe, Torulosporadelbrueckii, Brettanomyces bruxellensis, B.lambicus, B. custerii, Candida krusei, C. albicans, Zygosaccharomyces bailii, Z.rouxii, Z. kombuchaensis, Kluyveromyces africanus, Pichia membranaefaciens, P.fermantans, Kloeckeraapiculata, Torulopsis sp., Dekkera sp.) and acetic acid bacteria (Acetobacter xylinum, A.xylinoides, A. ketogenum, A. suboxydans, A. pasteurianus, A. aceti, A. acetiformis, Gluconobacterliquefaciens, G.oxydans, Bacterium gluconicum,) which varies depending on the climatic and geographic conditions (Velic´anskiet al.2013; De Filippiset al. 2018)

Kombucha contains different chemical components such as metallic elements (e.g., Fe, Mn, Ni, Cu, and Zn); carbon dioxide; organic food acids; polyphenols; many water-soluble vitamins like vitamin C; amino acids such as lysine; fiber; sugars; antibiotic substances; different types of vitamin B; hydrolytic enzymes; and ethanol. Several benefits, such as antioxidant activity and anti-inflammatory potential, make Kombucha popular as a functional beverage or food (S. A. Villarreal‐Soto, et al., 2018)

The chemical composition of kombucha varies considering the type of tea used and the conditions during the fermentation. The health benefits of different tea leaves are attributed to their high content of phenolic which has been described as a potent antioxidant. (Cardoso et al. 2020).

Kombucha is potential in improving gut health as a probiotic drink. Probiotics are microorganisms that provide health benefits to the host when given in sufficient concentrations (Bergström, H. 2018).

The use of alternative raw materials (e.g., coffeeberry, leaves, fruits, milk, vegetables, by-products, and wastes) for the fermentation process of Kombucha has been proposed by researchers.

KOMBUCHA AS A PROBIOTIC

Kombucha is a fermented beverage that is popular among traditionally fermented foods (Villarreal-Soto, et al., 2018).A symbiotic relationship between bacteria and yeast, as well as their effect on the humanmicrobiota of kombucha, has to be validated. (Reva et al., 2015)

ANTIDIABETIC

Antioxidant-containing foods have been investigated as protection against diabetic oxidative stress, and it has been reported that some antioxidants play an important role in the mitigation of oxidative stress in diabetes mellitus (B A Nummer,2013)

Kombucha Tea was also found to effectively restore alloxan-induced changes of the parameters related to oxidative stress like lipid peroxidation end products, protein carbonyl content, glutathione content, and antioxidant enzyme activities in the pancreatic, renal, cardiac, and hepatic tissues of diabetic animals (Chakravorty. et al., 2019). The antiglycation activity of KT was also found to increase with fermentation time (Chakravorty et al., 2016).

HEPATOPROTECTIVE

Hepatoprotection is the ability to prevent damage occurring to the liver by toxic substances. Studies on cell lines and animal models show the hepatoprotective activity of KT against various environmental pollutants and toxins such as carbon tetrachloride cadmium chloride, TBHP (tertiary butyl hydroperoxide), trichloroethylene, acetaminophen, aflatoxin B1 (Jayabalanet al., 2010), and paracetamol (Pauline et al., 2001). Kombucha Tea can ameliorate the toxic effects of these liver toxicants efficiently. The enzymes, bacterial acids, and other secondary metabolites produced by the microbes during the fermentation of Kombucha have displayed the ability to detoxify the body (Dufresne and Farnworth, 2000). Studies have reported that the detoxifying ability of Kombucha Tea is mainly attributed to the presence of glucuronic acid which can bind to the toxins in the liver and encourage them to flush out of the body (Nguyen et al., 2014).

ANTIBACTERIAL

Kombucha Tea has been considered as a potential antimicrobial source and its inhibitory activity against different pathogenic microorganisms has been studied by many researchers. Studies showed greater antimicrobial activity against Gram-positive organisms like Staphylococcus aureus, and Bacillus cereus and Gram-negative organisms like Escherichia coli, Salmonella choleraesuis serotype typhimurium, and Agrobacterium tumefaciens.

Kombu Tea prepared from fermenting both green and black teas for 21 days showed antimicrobial efficacy against various human pathogenic microorganisms such as the Gram-positiveStaphylococcus epidermidis, S. aureus, Micrococcus luteus, and Listeria monocytogenes and Gram-negative E. coli, P. aeruginosa, S. Typhimurium (LT2), and KT from green tea exerted most antimicrobial potential (Chou et.al., 1999).

ANTIFUNGAL

Sreeramuluet al., (2000, 2001) reported inhibitory activity of KT prepared from black tea against Candida albicans but not against Z. bailii. The 21-day fermented KT from both green and black teas inhibited the growth of C. albicans, Candida tropicalis, Candida parapsilosis, Candida glabrata, Candida dubliniensis, and Candida sakeexcepting Candida krusei (Chou et.al., 1999).

ANTIINFLAMMATORY

KT prepared from fermenting black tea was found to possess significant activity against oxidative stress induced by chromate (VI) treatment in male Sprague–Dawley albino rats. Dawley albino rats by decreasing lipid peroxidation (MDA levels) and DNA damage, increasing the levels of antioxidant enzymes associated with an increase in reduced glutathione and glutathione peroxidase activity (Dipti et al., 2003). KT from black tea also showed protective activity against trichloroethylene-induced nephrotoxicity in male albino rats (Gharib, 2009). The anti-inflammatory activity of KT is mainly attributed to its various phenolic compounds and flavonoids (Banerjee et al., 2010; Tamer et al., 2021).

ANTICANCER

KT has been claimed to possess anticancer activity for many years based on personal observations and testimonials. A recent study also showed that lyophilized extract of KT prepared from fermenting black tea decreased significantly the survival of prostate cancer cell line PC-3 by downregulating the expression of angiogenesis stimulators like cyclooxygenase-2, matrix metalloproteinase, endothelial growth factor, interleukin-8, and human inducible factor-1α. (E. Zubaidah, et . al., 2019). Therefore, KT can alter the expression of different angiogenic stimulators, resulting in the inhibition of angiogenesis (Srihari et al., 2013). The presence of a variety of compounds such as polyphenols, glucuronic acid, gluconic acid, lactic acid, vitamins like (vitamin C), and d-saccharic acid-1,4-lactone (DSL) might contribute to the anticancer properties of KT. (Sinir, G. Ö., et. al.,2019).

OTHER THERAPEUTIC PROPERTIES

Apart from the above-mentioned health benefits of KT, the fermented beverage is also known to possess other therapeutic activities. The beverage has been reported to possess antistress activity (Pauline et al., 2001). KT was also found to have a hypocholesterolaemic effect, as evident from its capability in lowering the total cholesterol and low-density lipoprotein (LDL) cholesterol in high-cholesterol fed mice (Yang et al., 2009). KT could inhibit pancreatic alpha-amylase in the small intestine, it helps in starch digestion and net absorption of glucose Significantly all these pieces of evidence supported the health-promoting properties of KT and established it as a functional food (Chakravorty,et. al.,2019).

Conclusion

Kombucha has received more recognition across the globe due to its health benefits, which may be easily acquired on the market or homemade. Different tea sugar concentrations, SCOBY strains, and a range of temperatures and weather patterns can be used to make the beverage, resulting in Kombucha with a variety of properties. Kombucha Tea procedure differences suggest the chemical and microbial makeup, determining the beverage's useful characteristics. No systematic human trials employing Kombucha tea have been done, according to the literature. The establishment of this beverage as a functional food may require further study in this area. Although there are a few safety concerns, the safe manufacturing and consumption of this beverage can support its claim to be a carbonated beverage substitute.

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