

Nutritional Components of Kombucha and Their Health Benefits: A Review Based Study

Noel Salvador Fernandes¹, Dr. Pradyuman Singh Rathore²

¹*Research Scholar, Department of Hospitality Management*

²*Department of Hospitality Management, SJIT University, Jhunjhunu, Rajasthan*

Abstract— A symbiotic culture of bacteria and yeasts is used to ferment sugared tea to create the beverage known as kombucha. Consuming kombucha has been linked to a number of health benefits, including lower blood pressure and cholesterol, a decreased risk of cancer, and enhanced immunological, hepatic, and gastrointestinal systems. The presence of bioactive chemicals that work in concert is thought to be responsible for kombucha's health benefits. Glucuronic acid, yeasts from the species *Saccharomyces*, and bacteria from the genera *Acetobacter* and *Gluconobacter* found in kombucha beverages all help to maintain health. This review addresses the chemical components produced by the fermentation process of kombucha and focusses on recent research on its health benefits. Additionally, a list of kombucha intake contraindications is discussed.

Index Terms— Antioxidant, and Health benefits, Kombucha, Nutritional Components, SCOBY

I. INTRODUCTION

In essence, all foods are functional to a certain extent since they supply the nutrition and energy required to sustain life. There is proof, meanwhile, that there are bioactive dietary ingredients that are not regarded as nutrients but can have positive health impacts (Crowe & Francis et al, 2013). According to Kaur and Singh (2017), functional foods are those that, independent of their nutritional value, have been shown to have positive effects on the body in one or more of its functions, promoting optimal health and well-being.

Because they lower the risk factors that lead to illnesses, many foods have a preventative effect. The term "Shimizu" describes functional foods known as FOSHU (Food for Specified Health Uses), which have been authorised by Japan's Consumer Affairs Agency, a pioneer in the regulation of functional foods. Some of these foods lower the risk of chronic non-communicable diseases, control nutrient absorption, and/or enhance the gut flora (Crowe & Francis, 2013).

According to reports, some dietary components, including polyphenols, oligosaccharides, amino acids, and lactic acid bacteria, may be potential components for the creation of functional meals in the future (Shimizu, 2012). It is necessary to update the bioavailability and effectiveness of these substances to levels that are scientifically possible in normal dietary patterns (Kaur & Singh, 2017). According to Tur and Bibiloni (2016), a product must be a food product, have scientific proof of its benefits, have quantifiable physiological effects, and be consumed regularly as part of a regular diet in order to qualify as a functional food.

1.1 WHAT IS KOMBUCHA

The beverage known as kombucha is made by fermenting tea, primarily black tea (other types, such green and oolong tea, often called blue tea, can be used as a base for its creation), with sugar added as a fermentation substrate. Despite the fact that tea was initially used to make this beverage, there are versions created using infusions such as mint, lemon balm, or jasmine. Customers are more likely to accept the beverage because of its somewhat acidic and mildly carbonated taste. Acetic acid and other organic acids, which are metabolic products of the Symbiotic Culture of Bacteria and Yeast (SCOBY), have antibacterial properties and keep harmful bacteria from contaminating the beverage (Watawana, Jayawardena, Gunawardhana, & Waisundara, 2015).

1.2 MAKING OF KOMBUCHA

Sugared tea is fermented using a SCOBY to create this beverage (Jayabalan, Sathishkumar et al, 2014). It has a somewhat acidic and sweet flavour, and there might be traces of carbon dioxide in it (Nunmer, 2013).

Usually, black, green, or oolong tea is used to make kombucha beverages. It can be made by adding sugar, which will function as a substrate for the bacteria and

yeasts that ferment tea, to 5 g of tea leaves per litre of water. It is sufficient to use about 50 g of sugar per litre of water. The beverage should be near 20°C before adding the SCOBY or a little amount of prepared kombucha. To control the growth of microbes and avoid unintended contamination, it is crucial to make kombucha using sanitised utensils and to work in clean environments (Watawana et al., 2015). Similar to this, it's critical to regulate pH levels during kombucha fermentation, ideally stopping when a pH of 4.2 is reached because excessive acetic acid production could be detrimental (Kovacevic et al., 2014). Additional techniques for ensuring food safety include pasteurising the finished product to stop excessive carbon dioxide and alcohol formation, adding 0.1% potassium sorbate and 0.1% sodium benzoate as food preservatives, and then keeping it chilled (Watawana et al., 2015).

According to local customs, kombucha fermentation takes anywhere from three days to as long as sixty days (Watawana et al., 2015). In order to maximise fermentation time, kombucha is fermented at room temperature. At a concentration of 5–20%, sucrose serves as the primary carbon source and supplies the media and nutrients required for the growth of microorganisms. As a fermentation starter culture, a SCOBY or the liquid that results from a prior fermentation at a 10% concentration can be utilised (Vina, Semjonovs, Linde, & Patetko, 2013).

II. KOMBUCHA'S NUTRITIONAL COMPONENTS

The microorganisms of the symbiotic culture used to ferment kombucha, along with the temperature and duration of fermentation, the amount of sucrose, the type of tea used, and the analysis techniques employed for quantification, all influence the presence and amount of the chemical components.

2.1 VITAMINS

Bauer-Petrovska and Petrushevska-Tozi examined a kombucha beverage made with 70 g of sucrose and 5 g/L of black tea to determine its vitamin content. They discovered that the B vitamins were 74 mg/100 mL of vitamin B1, 52 mg/100 mL of vitamin B6, and 84 mg/100 mL of vitamin B12. According to Malbasa, Lončar, Vitas, and Canadanovic-Brunet, the concentration of vitamin C steadily rose to 28.98 mg/L

on the ninth day of fermentation, while the level of vitamin B2 was 8.3 mg/100 mL.

2.2 MINERALS

Minerals are inorganic substances that are necessary in trace amounts for the body's growth and regular activities as well as for tissue maintenance. The minerals copper, iron, manganese, nickel, and zinc rose as a result of the metabolic activity of kombucha, according to Bauer-Petrovska and Petrushevska-Tozi. Manganese and cobalt had concentrations between 0.462 µg/mL and 0.004 µg/mL, respectively. Moreover, lead traces (0.005 µg/mL) were found. It should be noted that toxic blood lead levels are 20 µg/dL for adults and 10 µg/dL for children, or 0.2 and 0.1 µg/mL, respectively, according to the Agency for Toxic Substances and Disease Registry (ATSDR, 2007). Because of its very lower amounts, kombucha tea poses no risk to health.

2.3 ETHANOL

The last determinant of the kombucha beverage's flavour is its complete chemical makeup, which includes the amount of residual sugar, carbon dioxide, and organic acids. The fermentation period will also affect the flavour. It has been noted that kombucha tea with a higher concentration of acetic acid has a more astringent and acidic flavour, whereas a tea with a higher concentration of gluconic acid has a softer flavour. Therefore, the desired quality of kombucha tea can be achieved by regulating the fermentation conditions (Chen & Liu, 2000).

2.4 ACETIC ACID

When ethanol from sucrose is broken down into glucose and fructose, acetic acid bacteria in kombucha make acetic acid (Spedding, 2015). The chemical substance that gives vinegar its acidic flavour and smell is acetic acid. Acetum, which meaning vinegar in Latin, is whence its name originates (Bramforth, 2014). Acetic acid tends to rise gradually, reaching 11 g/L at 30 days of fermentation, and then fall gradually, reaching 8 g/L at 60 days. This decline results from either the yeast's decreased ethanol metabolism as a result of low pH or its subsequent use as a carbon source by bacteria after the tea's sugars are consumed (Chen & Liu, 2000). Acetic acid production is significantly reduced when an alternative carbon

source, like molasses, is utilised (Jayabalan et al., 2014).

2.5 GLUCORONIC ACID

GlcUA is a crucial auxiliary on liver activities since it can bind with toxin molecules to promote their removal from the body, which contributes to xenobiotic liver detoxification. It also contributes to the removal of endobiotics. Bilirubin is one of these endobiotics, and GlcUA (via glucuronidation) inhibits the harmful effects of this pigment and obstructs the inhibition of numerous enzymes involved in the metabolism of proteins and carbohydrates. According to Vřna, Linde, Patetko, and Semjonovs (2013), a high level of bilirubin in urine is a sign of damage somewhere in the glucuronidation pathway because the majority of bilirubin is eliminated by bile and only a small amount of conjugated bilirubin is eliminated through urine.

2.6 POLYPHENOLS

Polyphenol activity, compounds created during fermentation, and the combined action of the many compounds in the tea are the primary causes of the protective impact of kombucha beverages (Jayabalan, Subathradevi, Marimuthu, Sathishkumar, & Swaminathan, 2008). Over the course of fermentation, the total polyphenol content of kombucha tea increases linearly (Chu & Chen, 2006). For instance, the tea contains a significant amount of both epicatechin (EC) and epigallocatechin (EGC) (Manach et al., 2004). According to Jayabalan, Marimuthu, and Swaminathan (2007), kombucha prepared with green tea had a greater level of EC (~150%) on day 12 of fermentation, while kombucha made with black tea had a higher level of EGC (~115%) on the same day.

III. KOMBUCHA'S HEALTH BENEFITS

Studies and personal accounts from people who have drank this beverage attest to its positive health effects. Aloulou et al. (2012) assessed the suppression of the intestinal epithelium-secreted α -amylase enzyme, which is essential for the digestion of carbohydrates, in diabetic rats that were given 5 mL/kg of kombucha or black tea every day for 30 days. The rats were induced with aloxan. According to the findings, rats that drank kombucha had a greater suppression of the α -amylase enzyme in their plasma and pancreas, as

well as postprandial hyperglycemia, than rats that drank black tea. Enzymatic alterations in the pancreas and plasma were assessed in addition to abnormalities of glucose metabolism.

Another study by Kabiri, Setorki, and Ahangar (2013) provides additional scientific backing. It examines the preventive effects of kombucha beverages and silymarin, or milk thistle, in rats whose livers have been damaged by thioacetamide (a toxin linked to hepatic fibrosis). 36 rats were split up into 6 groups for the study, with group 1 serving as the control group. Rats that received thioacetamide injections were included in group 2; rats that received thioacetamide injections and subsequently received kombucha treatment (50 mL/during 3 weeks) were included in group 3; rats that received kombucha treatment (50 mL/during 3 weeks) and subsequently received thioacetamide injections; rats that received thioacetamide injections and silymarin treatment (200 mg/kg during 3 weeks) were included in group 5; and rats that received thioacetamide injections and kombucha (50 mL/per rat) and silymarin treatment (400 mg/kg) were included in group 6.

The findings demonstrated a higher cytotoxic effect of kombucha elaborated with green tea. On the cell lines A549 and Hep-2, 50% inhibition was achieved at doses ranging from 200 to 250 μ g/mL. However, the black tea-based kombucha beverage exhibited moderate cytotoxic action; it only affected Hep-2 cell lines and required higher doses (386 μ g/mL) to prevent 50% of cellular development than green tea-based kombucha.

IV. CONCLUSION

Bioactive substances including glucuronic acid and polyphenols can be found in kombucha beverages. The synergistic action of these ingredients is responsible for the positive effects of kombucha intake, which makes it a beverage with potential health benefits (when prepared under correct sterile circumstances). Its polyphenol content, which slows the oxidation of LDL, controls cholesterol metabolism, and avoids high blood pressure by encouraging smooth muscle relaxation, makes it clear that consuming it can help prevent the development of CVDs. One of its primary constituents, GlcUA, contributes to endobiotic removal and xenobiotic liver detoxification, potentially improving liver functioning. It should be noted that the scoby and

elaboration techniques will affect the concentration of the drink's active ingredients. Some contraindications have been recorded, therefore the health consequences on humans under controlled research are justified.

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