CHAPTER I
INTRODUCTION

1.1 Background

Antioxidant is a compound that has radical scavenging properties, in particular reactive oxygen species (ROS). Accumulation of ROS can induce oxidative stress in the body which will damage the cells and result in the occurrence of certain diseases including neurodegenerative diseases such as Parkinson or Alzheimer, obesity, and atherosclerosis (Amarasinghe *et al*., 2018). Moreover, increase in reactive oxygen species can be caused by personal lifestyle such as unhealthy diet, no physical exercise, exposed pollution, and stress. Antioxidant is easily accessible in natural plant sources including tea, coffee, vegetables, herbs, and fruits (Jakubczyk *et al*., 2020).

Kombucha is a fermented drink with antioxidant properties since it is high in phenolic content. As the fermentation proceeds, the phenolic content keeps increasing hence improves the antioxidant activity. Phenolic compounds are essential for human health to help eliminating peroxide anions, radicals (lipid or hydroxyl), and reactive oxygen species (Jakubczyk *et al*., 2020). The concentration of phenolic compounds is roughly about 30% ($^{w}/_{w}$) of the dry mass of the ingredients (Kaewkod *et al*., 2019). Generally, the fermentation is done within 7-14 days at 20-30ºC and as it progresses the flavour changes into a mild vinegar-like taste from acceptable fruity, sparkling, and sour flavour. Due to its acceptable flavour and health benefits, kombucha is preferred by many consumers (Amarasinghe *et al*., 2017; Nurhayati *et al*., 2020). Other than antioxidant,

kombucha also believed to possess anti-bacterial, anti-diabetic, improve immune system, encourage toxin release of the liver, and lower cholesterol level (Jakubczyk *et al*., 2020). The antioxidant properties of kombucha are affected by the duration of fermentation process, temperature, sucrose concentration, raw material quality (generally tea), and the microbial involves in the fermentation (Gaggia *et al*., 2018).

Generally, kombucha is made from the tea derived from the plant *Camellia sinensis* and can be used in the form of green tea or black tea. Among other medicinal plants, tea is known to have the most abundant sources of flavonoids including catechin, epigallocatechin, epicatechin, and epigallocatechin gallate (EGCG) which possess health benefits (Hosseini *et al*., 2015). Generally, tea can be classified based on its degree of fermentation including green tea which not fermented, black tea which is fully fermented, and oolong tea which is partially fermented. There is also white tea which comes from the bud of tea leaves, doesn't undergo any processing, only dried (Purwanti *et al*., 2019).

Nowadays, people have other alternative to make kombucha, one of them is using cascara which is a coffee cherry skin that generally consumed in a form of herbal beverage and beneficial due to its caffeine, polyphenol, bioethanol, antioxidant, and antimicrobial properties. From the coffee processing, cascara has the largest portion of waste and reached 286.515 tons in 2017. So far, cascara is only used as fertilizer and animal feed and the unutilized coffee skin are piling up causing bad smell near the production area (Nurhayati *et al*., 2020).

Other than cascara, herbal tea also widely utilized to make kombucha. It has similar appearance and brewed the same way as tea, however it is not originated

from *Camellia sinensis* plants. It also has potential health benefits including improve immune system, prevent chronic disease, and improve digestive function (Amanto *et al.,* 2019). Some examples are herbal tea made from soursop leave, this plant is famous as herbal medicine since it contains active compound known as Annonaceous acetogenin which is a polyketides having potential as chemotherapy agent and anti-cancer (Lienggonegoro and Kharirie, 2020). Other than that, ashitaba leaf contains xantoangelol which is an active compound that can detain the growth of tumour by slowing down the DNA synthesis in the tumour cell, some research also found that xantoangelol can cure neuroblastoma or nerve cancer and leukimia (Wayan and Made, 2015). Moringa leaf is widely used since it is high in antioxidant and potassium content which are beneficial to treat cancer. Antioxidant compound can prevent the growth of cancel cell while potassium can get rid of the cancer cell. Other than that, amino acid compound in moringa leaf can improve immune system (Berawi *et al*., 2019). Some research also found the potential of cherry leaf to treat gout arthritis which is a diseases signifies by joint veins. The anti-inflammatory properties in cherry leaf can inhibit the occurrence of inflammation in joint areas thereby reduce the pain (Ilkafah, 2018). These prove that some herbal leaves are potential to be used in food and beverage industry. This literature review compared the antioxidant activity and chemical properties of kombucha made from tea leaves (green tea, black tea, white tea, and oolong tea), herbal tea (soursop, ashitaba, moringa, and cherry), and cascara. By using those ingredients to make kombucha can be potential functional beverages in the food industry.

1.2 Research Problem

Kombucha is a probiotic drink obtained from a fermentation of substrate and SCOBY that possess many health benefits. As the fermentation process continue, the phenolic content keeps on increasing which contributes to antioxidant properties. Due to its health benefits and acceptable flavour, kombucha is a popular herbal beverage nowadays. However, its availability in the food industry is still not much compared to other beverages. Generally, kombucha is made from tea of *Camellia sinensis*. Similar to tea, cascara and herbal teas also possess good antioxidant properties since they both are rich in phenolic compound dominated by chlorogenic acid. In response to this, making kombucha from various teas including herbal tea, tea, and cascara is a good potential due to its nutritional health effect and can expand the availability of kombucha in the market of food industry. Other than that, herbal teas and cascara are expected to increase the effectiveness of kombucha as traditional medicine since it is cheap and easy to make. This also can increase the utilization of materials from the environment that is easy to find and practical during processing. However, there is no literature review that compares the chemical and antioxidant activity of kombucha made from tea, herbal tea, and cascara.

1.3 Objectives

The objectives of this literature review were:

1. To compare and analyse the pH of kombucha made from tea and herbal tea.

2. To compare, analyse, and determine the highest antioxidant activity of kombucha made from various tea processing including white tea, green tea, black tea, and oolong tea.
3. To compare, analyse, and obtain the highest total phenolic content of kombucha made from tea and herbal tea.
4. To compare, analyse, and obtain the highest antioxidant activity of kombucha made from tea and herbal tea.