

# CHAPTER I

## INTRODUCTION

### 1.1 Background

Orange is one of the most popular fruits around the world. It is famous for its sour and tangy flavour. Nevertheless, this fruit also has many health benefits. Orange also has several usages not only as a food source but also as a cooking ingredient.

As a fresh fruit, orange is a quite popular fruit to consume. In the U.S. itself orange is categorized as one of the favourite fresh fruit to consume bellow banana and apple (Pollack et al., 2003). Orange is mostly consumed at home rather than a fast food place, restaurant, school, or any other places (Pollack et al., 2003). It's not surprising since orange juice is a quite popular choice of beverage.

There are many varieties of oranges that bred throughout the decades. Each of them has its own characters and unique. In her journal, Julia F. Morton has included as many as twelve varieties of oranges starting from *Washington Navel*, *Trovita*, *Valencia*, *Lue Gim Gong*, *Rhode Red Valencia*, *Hamlin*, *Homosassa*, *Shamouti*, *Parson Brown*, *Pineapple*, *Queen*, and *Blood Oranges* (Morton, 1987). The colour, size, taste, and thickness of the skin are the main differentiator of the varieties.

Among many varieties of orange, there is a variety called Navel orange. This is probably one of the most popular varieties of orange looking at its availability throughout the seasons. Morton also claimed that "ease of peeling and separation of segments makes this the most popular orange in the world for eating out-of-hand or in salads" (Morton, 1987). Despite, navel orange with its popularity would become a great choice as an ingredient for a cooking condiment.

The usage of orange not only as a food or cooking ingredients. The orange peel has pharmaceutical usage and also used as a perfume agent (Kamaliroosta et al., 2016). The essential oil of the orange is the one that used as a

perfume since it contains many sesquiterpene hydrocarbons or aromatic carbon chains.

The utility of the orange parts in the food industry covers a wide variety of dishes and beverages. The infamous *poulet a l'orange* which the sauce is made from the juice of the orange. The peel is frequently used in marmalade, candy, and even sometimes chocolate praline or even just a compound of chocolate enriched with the orange peel. The orange could also be extracted to be made into an essence which is useful in baking and pastry. Those are the exemplary use of orange in food industry.

The use of fermentation could be tracked back from the very beginning of civilized human existence. The first fermentation occurred because of an incident of a festival done by the Mesopotamian. The festival mentioned was to celebrate the abundance of grape harvesting at the time. The grape was pummeled in a barrel and the juice was left out inside the covered barrel. Thus, the overflowing grape juice was later on naturally fermented and wine is created.

Wine is an example, many fermented drinks therefore also produced after the discovery of fermenting. Beer, whiskey, rum, gin, vodka, tequila and many more are the product of the fermented beverage from *Saccharomyces cerevisiae* (Graeme and Graham, 2016). Although many of them are alcoholic, there are fermented drinks that are less alcoholic or none including apple cider, kombucha, yoghurt, and more.

Cider according to Merriam-Webster is a fermented apple juice often made sparkling by carbonation or fermentation in a sealed container. This beverage contains alcoholic content and sometimes also contains CO<sub>2</sub>. Cider taste could be described as sweet, sour and tangy with a little bit of alcohol touch and sometimes also effervescing flavour. Cider had ever been popular in many continents as an alcoholic beverage. This cider has another use it could be fermented into vinegar.

Though vinegar has a vast use, it was not immensely produced until not later than middle age. The making of the vinegar is known as vinegar fabrication. It's the same concept as secretive recipe-based fermentation, which in 1394 each vinegar maker was required to make a solemn oath for not revealing the

secret of vinegar fabrication. The renaissance era was the gold mine for vinegar fabrication; thus, many macerated kinds of vinegar were produced.

To fabricate vinegar, two steps of fermentation are required during the process. Hence, the first fermentation is alcoholic fermentation. In this step, the fermentation agent is breaking down sugar or carbohydrate into ethanol, CO<sub>2</sub>, and energy it's called glycolysis (Graeme and Graham, 2016). This exact fermentation process can also create an alcoholic beverage.

In his paper, Pasteur mentioned that vinegar was not made by only pure chemical oxidation, but by the agency of minute living 'plant' belonging to a group of *Mycoderma*. The elaboration of vinegar was only understood after Pasteur published his paper in 1864 about acetous fermentation. Pasteur came to notice five criteria for producing vinegar. First one is alcohol, then oxygen, the fermenting agent, the nutrients such as carbohydrate and protein, and the last is the temperature.

Therefore, the second step of vinegar fabrication is the process of breaking down ethanol into acetic acid. Alcohol dehydrogenase is an operation by *Acetobacter sp.* to break ethyl alcohol into acetaldehyde. Then, acetaldehyde is processed to form a hydrated aldehyde. Hydrated aldehyde then experiences acetaldehyde dehydrogenase which produces acetic acid (Walke, 1958).

Culinary industry has made vinegar as one of its important cooking ingredients. Used to make sauce such as vinaigrette and sweet and sour sauce. It can also be used as a cake developer where it has to be mixed with baking soda to create gas. Vinegar also used as marinade as its sour property could soften the animal protein. It also used as pickling agent to preserve vegetables.

Hence, the idea of making a double fermentation orange zest vinegar could be quite sensational. By processing the vinegar as explicitly as its former product, could bring a promising result and final product. It could bring more variety of cooking product in the near future and be usable by the gourmet industry or personal use for a better preference.

## **1.2 Reasons of Ingredients Selection**

The main ingredient that is used in this product is orange or to be precise, the orange's zest or peel. The orange will be processed into vinegar featuring its smell and flavour. The remaining part of the orange will be discussed later on in the latter chapter.

The orange is used because of its vogue among the culinary industry. The chef mostly picked orange as one of their components because it's aromatic smell and its kick for freshness. The tanginess and the flavour could never fail to fulfil the palate of the people who like it.

According to Statista, almost 50 million metric tons of orange is produced annually. This number depicts how easy it's to lay hand on the main material of this production. The point is, the scarcity of the material should be no problem and thus the number also shows that the cost might be suppressed further.

Beside its commonness and its gourmet factor, orange also offers many health benefits. It's packed with many good chemical and pharmaceutical goodness for the human body. Those benefits will be discussed in the following sub-chapters.

## **1.3 The Content of Nutrients and Health Benefits**

In this sub-chapter, the topic will be the nutrients of the orange that people adore. This part also introduces the health benefits contained by an orange fruit. Likewise, the prebiotics and probiotics that greatly take role in the process.

The nutrients of an orange probably consist of many healthy compounds. As healthy as it may seems, it also consists of adequate amount of fructose and multiple vitamins for daily necessities. Milind and Dev said in their journal that a single orange provides 12.5% daily need of fiber, which has been shown to reduce high cholesterol levels thereby helping to prevent atherosclerosis (Milind and Dev, 2012). Healthy pharmaceutical effects, high in vitamin and fiber, and consisting of healthy sugar are the main nutritional value of an orange. The table 1. will show more comprehensive value of the nutrition provided by an orange.

Table 1. Nutritional value of a 100gr orange

<b>Elements</b>	<b>Amounts</b>
Energy	192kj
Carbohydrate	11.54gr
Sugar	9.14gr
Fat	210mg
Protein	700mg
Dietary fiber	2.4gr
Thiamine	100µg
Riboflavin	40µg
Niacin	400µg
Pantothenic acid	250µg
Vitamin B6	5µg
Folate	17µg
Vitamin C	45mg
Calcium	43mg
Iron	90µg
Magnesium	10mg
Phosphorous	12mg
Potassium	16.9mg
Zinc	80µg

*Note.* Reprinted [adapted] from “Orange: Range of Benefits,” by Parle Milind and Chaturdevi Dev, 2012, International Research Journal of Pharmacy, pp. 63.

It can't be denied that fruit is an important resource of human's diet and so does orange. Etebu and Nwauzoma said in their article that, the human diet contains important micronutrients namely vitamins C and E, carotenoids and flavonoids, essential for the maintenance of human health (Etebu and Nwauzoma, 2014). The importance of orange is due to the presence of functional food

ingredients and antioxidant nutraceuticals or phytochemicals. As many of us know that antioxidant helps to dispose of free radical of one's body.

However, excessive free radicals may bring forth more problems than it means, it's called oxidative stress. In his article, McCord mentions, oxidative stress is now thought to make a significant contribution to all inflammatory diseases (arthritis, vasculitis, glomerulonephritis, lupus erythematosus, adult respiratory distress syndrome), ischemic diseases (heart disease, stroke, intestinal ischemia), hemochromatosis, acquired immunodeficiency syndrome (AIDS), emphysema, organ transplantation, gastric ulcers, hypertension and preeclampsia, neurologic diseases (multiple sclerosis, Alzheimer's disease, Parkinson disease, amyotrophic lateral sclerosis, muscular dystrophy), alcoholism, smoking-related diseases, and many others (McCord, 2000). In an article written by Selvaraj and Sarathchandra mentioned that antioxidant could help with protection against heart disease, protection against cancer, boost immunity, and fight aging (Selvaraj and Sarathchandra, 2018). Even though free radical may be seen as a bad influence, it's still needed by the body. McCord shows an example in his article that people now believe that the superoxide radical plays additional constructive roles that may be more subtle in nature. Certain types of cells are able to escape from the restraints under certain circumstances. For example, fibroblasts are able to proliferate to form scar tissue that is necessary for wound closure and healing. Lymphocytes capable of producing needed antibodies are able to proliferate to create a clone of such cells when appropriately stimulated. In both cases, it appears that superoxide may serve as the signal to override the postmitotic constraints, and both cases may have evolved as secondary responses to the oxidative nature of the primitive immune system's superoxide-generating machinery (McCord, 2000). To simplify it, the free radical is essential in the immune system of the human body to help the blood cell to eliminates the threat of unfamiliar cell that penetrates the body. Therefore, a balanced amount of the antioxidant and free radical is needed to ensure the continuity of living in a healthy demeanour.

Vitamins C is one of the most common antioxidants could be found in an orange. The vitamin C contents in orange provide 116% of the human's daily

need. The vitamin C is necessary as the immune system booster of human which is good for preventing cold, cough, and recurrent ear infections (Milind and Dev, 2012).

Flavonoids have a big share in part of orange's antioxidants even though not as much as vitamin C. Flavonoids is divided into eight subgroups flavones, flavonols, isoflavones, chalcones, anthocyanins, flavanones, isoflavonoids, and neoflavonoids (Panche et al., 2016). The flavonoids have many effects including reducing the effect of sporadic diseases.

Recent studies have researched in fact that flavonoids could act as anti-inflammatory activity. In the journal, Panche et al. mentioned that flavonoids could reduce the inflammation symptom occurred by pushing the body to produce prostaglandins in which suppressed the inflammation (Panche et al., 2016). The flavonoids produced an enzyme called COX that recently studied to be used as an anti-inflammatory inhibitor.

Vitamin C, carotenoids (a kind of vitamin A), and Flavonoids in orange could help with lowering the cholesterol thus prevent cardiovascular diseases. Limonene and polymethoxylated flavones (PMFs) are two compounds that proven to help to lower the cholesterol more effective than the prescript drugs (Milind and Dev, 2012). PMFs could be found in the peels of the orange, so feels free to consume more orange zest in the daily consumption.

Another effect that brought forth by the PMFs and limonene is anti-carcinogenic property. As known, carcinogenic has a characteristic of nurturing cancer cell or as a substance that could trigger the developing of the cancer cell. Limonene, one of the main constituents of orange, reduces the risk of mouth, skin, lung, breast, stomach, and colon cancer (Milind and Dev, 2012). While PMFs, shown strong anti-proliferative against cancer cell. In addition, the beta-cryptoxanthin (a kind of carotenoid found in orange) could also help reduce the risk of lung cancer.

The use of orange juice is also beneficial for human health. With a low pH number, orange juice could prevent calcium oxalate to form thus help to

reduce the risk of kidney stones from developing. The orange juice could also help reduce an infection possibility by *Helicobacter pylori* which cause ulcers.

The peel of an orange is also useful in treating several diseases. The oil contained in the peel is proven to calm anxiousness while used as aromatherapy (Milind and Dev, 2012). Whereas the peel has an anti-bacterial characteristic where the fresh peel could be used to treat acne by rubbing a fresh peel on it. The ability of the orange peel to eliminate bacteria is inseparable with limonene constituents in orange.

Vinrange is an orange zest cider vinegar. Thus, offer few a little health benefit. Just like apple cider vinegar, orange zest cider vinegar may offer to the benefits of a candida cleanse and lowering blood pressure. Although, no research has been conducted to detect any substance or compound inside this new product that could be proven to has the same effect as apple cider vinegar.

Candida cleanse is one of the health benefits that is not preferred by people because it means a person must consume the vinegar directly. Bad breath, low energy level, digestive strain, and urinary tract infections could be caused by candida and yeast infections. Marion suggests that this kind of vinegar contains healthy 'good' bacteria, also known as probiotics that help to kill off candida, allowing the consumer to put those symptoms to rest (Marion, no year).

Lowering blood pressure is the next benefit that will be discussed. The shifting of diet into a higher sodium food may be the trouble of the century. More and more of food are processed with high sodium intake in it. Marion in his article mentions that research has proven that acetic acid contained in the vinegar has an antihypertensive effect, which means it counteracts the high blood pressure.