

Chapter 1

Introduction

1.1 Background

One of the most popular breakfasts for kids and adults is chocolate spread. It is usually eaten with bread, and pastries, or can be used as fillings. A complex multiphase system of solid-oil suspensions which is chocolate spread is made up of a dispersion phase comprising cocoa powder, sugar, fat, milk, and emulsifiers (Paz-Yépez et al., 2019). Unlike the common chocolate bar which uses cocoa butter as a fat ingredient, chocolate spreads are made with the addition of vegetable oil, commonly palm oil. Palm Oil is the most consumed and is used for food applications such as cooking, margarine, spreads, confectionery fats, ice cream, and emulsifiers. A tropical perennial crop called palm oil is grown primarily for its vegetable oil, which is made up of both crude palm oil and palm kernel oil.

Palm kernel oil (PKO) is produced from the kernel while palm oil is derived from the mesocarp (Thomas, 2016). Moreover, palm kernel oil contains highly saturated fatty acids and is semi-crystalline at room temperature. It is the most widely utilized material because they are available and inexpensive (Manzocco et al., 2014). Nevertheless, palm oil offers attractive economic rewards to the oil palm industry and emerging nations. On the other hand, the growth of the plantations has significantly and widely increased the burden on the ecosystems (Austin et al., 2017). Such growth has been shown to have harmful environmental effects, such as air pollution, greenhouse gas emissions, and a reduction in biodiversity (Meijaard et al., 2020). Therefore, virgin coconut oil (VCO) can be an alternative solution to avoid these conditions and drawbacks.

Virgin coconut oil (VCO) is produced from the dried kernel or the flesh of the coconut. It can be produced mechanically or naturally, with or without the use of heat, from the young and mature kernel of the coconut, without changing the oil composition. Virgin coconut oil may be used for a variety of food and non-edible uses due to its chemical components. Medium-chain fatty acid oils are

rapidly absorbed by the body as energy sources due to their low molecular weight, which prevents them from being stored as fat in adipose tissue.

VCO that is extracted at a low temperature has a pleasant and slightly delicate flavor that may be preserved. A procedure can prevent the loss of micro-components such as provitamin A, vitamin E, and polyphenols (Rukmini et al., 2011). Therefore, in this research, lab-made VCO is produced by the chilling-thawing treatment. The chilling-thawing method is preferable because it provides a higher yield, no chemical addition, and is less expensive. Also, the virgin coconut oil is not heated over 40°C in this process, which prevents heat from reducing the antioxidant qualities of the oil (Ng et al., 2021). Moreover, chilling-thawing has higher oil recovery followed by fermentation and enzymatic methods (Mansor et al., 2012).

Vegetable oil in a chocolate spread is the liquid fraction that can improve the spreadability of the chocolate spread (Hasibuan et al., 2022). However, the chocolate spread that is made with different types of oil may have different spreadability due to their lipid profile. The fatty acids present in triglycerides have a significant impact on the characteristics of the oil and are a factor in determining its chemical qualities. According to several findings about chocolate spread manufacture, chocolate spread production needs to include heating and mixing processes to homogenize all the ingredients (Kumar, 2014; Bascuas et al., 2021; Fayaz et al., 2017). A significant degree of lipid degradation and nutritional loss results at high temperatures. Moreover, during storage at various temperatures, the compositions of the fatty acids and amino acids dramatically altered (Liu et al., 2019). Hence, the lipid properties of chocolate spreads are investigated in this research.

The lipid properties, such as iodine value, peroxide value, and free fatty acid content influence the quality of the chocolate spread. Therefore, the type of oil used in chocolate spread needs to be considered. The iodine value is used to check the unsaturated fat content of the samples, while the peroxide value is determined to check the rancidity. The amount of free fatty acids in samples is frequently used as a general indicator of their quality and edibility (Amira et al., 2014). Moreover, the lipid properties of palm kernel oil and virgin coconut oil are also different because of

their fatty acid composition. However, there is still a gap in findings about the replacement of palm kernel oil with virgin coconut oil in chocolate spread, especially the lipid properties of it. Therefore, the focus of this research is on the oil incorporation into the chocolate spread. The samples are going to be evaluated by determining the lipid properties such as free fatty acid (FFA), iodine value (IV), and peroxide value (PV).

1.2 Scope of Study

The scope of this research includes:

1. The lab-made VCO is produced using a chilling-thawing treatment in the i3L laboratory.
2. The chocolate spread is produced using different types of oils which are lab-made VCO, commercial VCO, and commercial PKO.
3. The free fatty acid, iodine value, and peroxide value of the chocolate spread formulated with alternative vegetable oil sources such as commercial PKO, commercial VCO, and lab-made VCO are analyzed and compared.

1.3 Objective

The objective of this research is as follow:

1. Evaluate the effect of different alternative vegetable oil sources (commercial PKO, commercial VCO, and lab-made VCO) on the lipid properties of chocolate spread.

1.4 Hypothesis

The hypotheses for the objectives are the following:

1. Free Fatty Acid Content

H0: There is no significant difference in free fatty acid content between chocolate spread formulated with commercial PKO, commercial VCO, and lab-made VCO.

H1: There is a significant difference in free fatty acid content between chocolate spread formulated with commercial PKO, commercial VCO, and lab-made VCO.

2. Iodine Value

H0: There is no significant difference in iodine value between chocolate spread formulated with commercial PKO, commercial VCO, and lab-made VCO.

H1: There is a significant difference in iodine value between chocolate spread formulated with commercial PKO, commercial VCO, and lab-made VCO.

3. Peroxide Value

H0: There is no significant difference in peroxide value between chocolate spread formulated with commercial PKO, commercial VCO, and lab-made VCO.

H1: There is a significant difference in peroxide value between chocolate spread formulated with commercial PKO, commercial VCO, and lab-made VCO.

1.5 Research Question

Based on the background, the research questions were devised:

1. How are the free fatty acid contents of chocolate spread formulated with alternative vegetable oil sources such as commercial PKO, commercial VCO, and lab-made VCO?
2. How are the iodine values of chocolate spread formulated with alternative vegetable oil sources such as commercial PKO, commercial VCO, and lab-made VCO?
3. How are the peroxide values of chocolate spread formulated with alternative vegetable oil sources such as commercial PKO, commercial VCO, and lab-made VCO?