AN OVERVIEW OF EFFECTIVENESS PLANT-BASED SHORTENING IN SUBSTITUTING LARD PROPERTIES TOWARDS BAKERY PRODUCTS

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Abstract: Animal-based fat like lard is a fatty substance known for imparting a flavourful, yeasty aroma and the perfect soft texture towards bakery products like cakes, pastries, and bread. The prohibition under religious restriction in using lard and high saturated fat content drove the usage of modified vegetable oils in the bakery industry. However, legislative limitations and health considerations of the trans-fat produced from modified vegetable oil causes abundant research on reduction of trans fat content in modified vegetable oils are conducted. Hence, this review aims to distinguish modification processes of vegetable-based fats and oils besides to study the simplest and economical vegetable-based fats and oils blends in replacing physicochemical and mechanical properties of lard and its effectiveness on bakery products. Several findings reported that the vegetable-based fat and oil blends displayed both β' and β- form polymorphs comparable to the polymorphic behaviour of lard. In addition, previous studies found similar consistency of vegetable-based fat and oil blends to lard in the range of 319.20 to 326.26 g/cm^2 that yields a satisfactory plastic and spreadable. Subsequently, the vegetable-based fats and oil blends in substituting lard properties have been successfully proven by uniform thickness and width cookies produced by the lard and the blends. Despite the emerging trends of the modified vegetable fats and oil blends used in bakery products that possess a better reduction of trans-fat and saturated fat, conducting further investigation on the limitation of using them commercially in the food industry should be considered since these involve potential public health impact.

Keywords: Lard, modification vegetable oils, shortenings, bakery products

1. Introduction

Food preparation widely used animal-based fats and vegetable oils not only for cooking, grilling and baking but also as food dressing to enhance the flavour of food and meet people's palatability. One of the versatile uses of fats and oils is for bakery products. Several previous studies stated that butter and lard was the most well-known animal-based fat used in baking applications as they produce baked goods with flavourful impact (Culetu et al., 2021). Earlier studies proposed that the lard has a higher smoke point around 182˚C to 204˚C than butter at about 176˚C although butter had a higher amount of saturated fats (Marcus, 2013). Interestingly, the lard has the richest cis-oleic acid proportion although it derived from animal origin causes it was more favourable to be used (Culetu et al., 2021). However, the religious prohibition causes the substitution of lard by modified vegetable-based fats and oils for baking applications was considered. Nevertheless, the modification process of vegetables-based fats and oils need to be concerned since the process develops formation of trans fat which will cause severe health problems (Chavasit et al., 2019).

Besides, the encouragement in eliminating industrially-produced trans-fat by the World Health Organizations (WHO) drove abundant research on reducing trans-fat in several modification methods of vegetable-based fats and oils in the food industry. Hence, this review aims to distinguish the modification methods of vegetable-based fats and oils besides to study the simplest yet economical vegetable-based fat and oil blends in replacing the physicochemical and mechanical properties of lard and its effectiveness on the quality of bakery products.

2. Discussion

2.1. Modification methods of vegetable oils

There are several modification methods of vegetable oils that have applied in the food industry; hydrogenation, interesterification and blending. However, the trans isomer of unsaturated fatty acids produced from modified vegetable oils by partial hydrogenation process led to several adverse health effects causes a several study conducted for reducing the trans-fat in hydrogenation process including the inclusion of anti-isomerization effect during the process (Guo et al., 2021). Meanwhile, interesterification consists of either chemical or enzymatic methods that have a wide range of application and do not generate trans-fat but the stability of catalysts is poor and high cost are required (Gupta, 2017). Hence, this review focussed on the blending method as it was the simplest yet specifically developed for desired oxidative, textural and physical properties of fat-based products (Kittipongpittaya et al., 2020).

2.2. Physicochemical and mechanical properties of vegetable-based oil and fat blends

Several studies have shown that physicochemical properties of different proportions of various blending vegetable oils and fats have compatibility with the lard properties (Noor et al., 2017a; Noorzyanna et al., 2017; N. A. Yanty et al., 2018). The fatty acid composition exhibits high content of oleic acid > palmitic acid > linoleic acid > stearic acid while triacylglycerol composition exhibits high content of POO (dioleoyl-palmitoyl-glycerol) > POL (palmitoyl- linoleoyl-oleoyl glycerol) > PPO (dipalmitoyl-3-oleoyl glycerol) > StPO (palmitoyl- oleoylstearoyl glycerol). The solid fat content (SFC) of the blends showed to have similar range with lard but they have different temperature as the SFC becomes 0%, the high melting transition formed for the vegetable blends is higher when comparing to lard as the three blends consists of palm oil and its fraction, palm stearin. Lastly, the polymorphism behaviour of the vegetable blends displayed to have both β' and β-form polymorphs comparable to lard.

A study of different proportions of vegetable blends showed a similar consistency to lard in the range of 319.20 to 326.26 g/cm2 in which the range value yields a satisfactory plastic and spreadable (N. A. M. Yanty et al., 2017). Besides, the similar study showed a compatibility in hardness and compression force between lard and the blends due to the increment of solid fat content in every blend contribute a well structural stronger network.

2.3. Effect of vegetable oil and fat blends on the quality of bakery products

The hardness of the dough cookies and baked cookies made from several vegetable oil and fat blends showed a correspondence with the lard (Manaf et al., 2019; Noor et al., 2017b). These are because the distribution of trisaturated and monounsaturated in the vegetable blends and lard

affects the solid fat content profile and develops a link between dough hardness and the cookies hardness. Besides, the similar studies also revealed that the cookies made with lard had thickness at ranging from 9.42 to 13.94 mm and width at ranging from 72.95 66.37 mm respectively which has been concluded to be similar to both vegetable blends due to a similar solidification behaviour between the blends and lard at specific range of temperature.

3. Conclusion

In conclusion, the difference of modification methods of vegetable oils has been distinguished, the compatibility of different vegetable blends in substituting lard properties and its effect towards the quality of bakery products have been synthesized. As a recommendation, a further investigation on the limitation of using them commercially in the food industry should be considered since these involve potential public health impact.

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