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THE PHYSICAL AND SENSORY CHARACTERISTICS OF MARGARINE PRODUCED FROM CANNABIS OIL-PALM OIL BLENDS

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ABSTRACT

Margarine was produced from blends of cannabis oil-palm oil to investigate if the product will be accepted. The samples obtained were (100% Palm oil, 100% Marijuana oil, 70% Palm oil and 30% marijuana oil, 70% Marijuana oil and 30% Palm oil and 50% Palm oil and 50% Marijuana oil. The produced Margarine samples were stored at an ambient temperature,

INTRODUCTION

Margarine can be defined as a stable emulsion (water-in-oil type), consisting mainly of vegetable oil and water (Lounis et al., 2018). It is a fatty food resembling butter in appearance, character, and composition, holding the continuous phase and dispersed phase by the emulsifier under specific conditions (Saadi et al., 2012). It is by composition a stable water-in-oil emulsion or plastic water-in-fat emulsion in which water droplets are kept separated by the fat crystal (Aini & Miskandar, 2007).

Historically, margarine, a fat-based food product, was formulated in the 19th century as a substitute for butter due to the inability of the lower social classes to afford butter of dairy origin. (Lounis et al., 2018). Apart from cooking and making bakery products, margarine is essential in the lipid industry (Nguyen et al., 2019). Margarine and shortening with various melting ranges for bakery

and its physical properties were investigated with the standard method, while its sensory properties were conducted using a 9-point hedonic scale. The physical result ranged for moisture (%); from 38.0-42.0, Viscosity (centipoise); 2.9 -8.2, and the Specific gravity from 73.6 to 74.8; all for Samples AOA, AOB, AOC, AOD and AOE, respectively. The result from the sensory analysis revealed that most samples for taste were significantly different at p<0.05. It was concluded that margarine could be produced replacing palm oil with only 50% cannabis oil. The production of margarine using the two oil blends should be granted the proper ethical approval for enabling the volunteering panelists to taste the products.

Keywords; *Margarine, Cannabis oil and Palm oil.*

products are produced from vegetable oils. (Adhikari et al., 2010) The shortening is a simple fat blend with a range of classifications that depends on humans' usefulness (Li et al., 2018).

Although the raw material for the original margarine formulation was animal fat, shortages in beef fat supply and advances in plant material hydrogenation led to its replacement by hydrogenated vegetable oils (List, 2012). Producing trans-free margarine fat analogues should also be encouraged (Pande et al., 2013). Palm oil may consist of vegetable oil and water, possibly with milk. It also contains emulsifiers, flavours, colouring, preservatives (pH correction, antioxidants), vitamins. Commercial margarine fats are mainly prepared from vegetable oils through the process of partial hydrogenation to improve physicochemical properties (Lounis et al., 2018)

Oil palm is a versatile crop, with palm oil and other derivatives used to cook and make margarine, detergents, and cosmetics. (Purnomo et al., 2020). Margarine made from refined, bleached, and de- odorized palm oil at different emulsion temperatures showed no significant difference in their consistency, polymorphic behaviour, and solid fat content (SFC) during storage. (Miskandar et al., 2002). Palm oil and tri- palmitin (PPP) 's crystalizing behavior in the margarine system depends on its

agglomeration of higher melting points (Yoshioka, 2007). Palm stearin is the most solid fraction of palm oil; content ranges from 49 to 68% and oleic content from 24 to 34% (Pande et al., 2010). This may call binding with another during margarine manufacturing. Soft margarine and spreads proved relatively easy to reformulate to zero trans by using hydrogenated and liquid oil components. However, stick products have proven more challenging to reformulate because more solid fat is required for baking applications and storage considerations at ambient temperatures. (List, 2012). Cannabis oil is edible and more nutritious than Palm oil (Nussain, 1995) Hempseed oil is a rich source of linoleic (n- 6) and a-linolenic (n-3) fatty acids (FA). It contains tocopherols, an anti-oxidants and a polyunsaturated FA (PUFA) with anti-inflammatory, antithrombotic, antiarrhythmic and hypolipidemic properties (Latif, & Anwar, 2009). However, the National Drug Law Enforcement Agency (NDLEA) destroyed about a million acres of cannabis farmland with over for the years 1994- 2001. In the recent times, the country had recorded more waste in billions of Naira dure to destruction of marijuana (Obahopo 2020; Osayande, 2021; Oladapo, 2021). Up till now, there has been no study on its alternative use to mitigate the continuous mass destruction to reduce dependence on raw materials of some foods and feeds. For this reason, it is important to study its potential in making safe food products. This study assessed the physical and sensory characteristics of cannabis-palm oil blend margarine.

Materials and methods

Material and Equipment

MATERIALS

The palm oil and other food ingredients such as skimmed milk, citric acid, banana scotch flavour, B-carotene, salt, monoglyceride emulsifier were purchased at Ekeonunwa market in Owerri, Imo State in Nigeria, while marijuana was bought from England. Some of the equipment used in the work/ research was obtained from the food technology laboratory in Federal Polytechnic Nekede, Owerri, Imo state.

The materials used for this production were obtained from different sources, palm oil and marijuana oil (skimmed milk, lemon juice,

butterscotch, xanthan gum, turmeric, salt, and the juice material were all purchased at industrial cluster Nekede, Owerri, Imo State.
The Palm oil, Skimmed milk, Lemon juice, Butter, scotch, Turmeric, Salt, Marijuana oil, Xanthan gum (emulsifying agent) were purchased in Owerri, Nigeria.
The Marijuana oil (Olio di Canapa) was sources from Nuova Parafarmacia Centrale Srl Is Located at via Casale Sant'angelo 2, Salerno in Italy. The reagents used were Potassium iodine, Chloroform, Phenolphthalein, Diethyl ether, Ethanol, Acetic acid, Hydrochloric acid, Carbon tetrachloride.

Equipment

All equipment and apparatus used in this research were sourced from the quality control laboratory of the department of food technology in Federal Polytechnic Nekede, Owerri. The equipment includes; weighing balance, oven, Beaker, Volumetric flask, Conical flask, Measuring cylinder. Pipette, Retort stand, Evaporating dish, Density bottle, Water bath, Petri dish.

MARGARINE PRODUCTION

Margarine was prepared by substituting the palm oil with marijuana oil in the ratios of 70:30, 50:50, 100:0. 100:0 (Marijuana oil) 50:50 (Marijuana oil/palm oil) 70:30 (Palm oil/marijuana oil) 100:0 (Palm oil) 70:30 (Marijuana oil/Palm oil)
The palm oil was first thermostatically bleached at 220^{o}C then connected to the pot containing the palm oil to regulate the steaming of the palm oil. Palm oil has resulted in controlling the temperature of the oil. After the palm oil was completely bleached, the ingredients were mixed with skimmed milk, butterscotch, turmeric, salt, marijuana oil, lemon juice. The 2g of skimmed milk was measured and poured into a bow, two spoons of palm oil were poured into the skimmed milk, and it was stirred for 10minutes afterwards, a drop of butterscotch was added for flavour, then a pinch of salt has also added half spoon of turmeric was added for colour, xanthan gum (emulsifier) was added, two spoons of lemon juice was added. The marijuana oil was added and stirred for about 20 minutes

to form margarine. Fully automatic control for minimal cost and efforts provides less effluent load, highly efficient and simple production process—advanced and updated palm oil production equipment for high-quality oil. The whole physical and chemical oil refining process will ensure all the processes are included, such as degumming, deacidification, bleaching, deodorization and fractionation and more.
The preparation of the margarine was produced in different ratios 100:0 marijuana oil, 50:50 marijuana and palm oil, 100:0 palm oil, 70:0 palm oil and marijuana oil, 70:30 marijuana oil and palm oil.

DETERMINATION OF PHYSICAL CHARACTERISTICS

MOISTURE CONTENT

Moisture content was carried out using the method Zlatanos et al. (2006). The dishes were washed thoroughly and dried in the oven, and then placed inside the desiccators to cool. The dishes were labelled and weighed. The samples were mixed thoroughly, and 5g of the samples were weighed. The samples were placed in the oven at 100°C-120°C for 1hour 30minutes. The samples were cooled in the desiccator for 30minutes, the dry weight of the sample plus dishes was recorded. The moisture content were calculated as;

$$\% \text{ moisture} = \frac{W_2 - W_3}{W_2 - W_1} \times \frac{100}{1}$$

Where: W1 = initial weight of empty dish, W2 = weight of dishes + food sample before drying, W3 = final weight of dishes + food ample after drying. To calculate for % total solid = % total solids (dry matter) = 100 - %moisture. Five different empty Petridish were weighed.
2g of each sample were poured into the five-petri dish, then it was taken into the oven and dried at 130°C for two and half hours, then it was allowed to cool, after which it was reweighed.

SPECIFIC GRAVITY/DENSITY

Specific gravity is the ratio of the density of a substance to the density of reference substances; equivalently, it is the ratio of the mass of a substance to the mass of a reference substance of a given volume. The most common method used in the laboratories for the specific gravity of

oil was be determined by using a bottle called SPECIFIC GRAVITY BOTTLE (George, 2016).

The procedure is described below 50ml of pycnometer bottle was washed with detergent and water, dried and weighed. The bottle was filled with water and weighed. The was dried, and the oil was filled and weighed.

Calculation

The equation of specific gravity is

$$\text{Specific gravity} = \frac{\text{density of the sample}}{\text{Density of water}}$$

$$\text{Density} = \frac{\text{weight of oil}}{\text{Volume of oil}}$$

VISCOSITY

Viscosity was determined using the modified method Denin-Djurdjevic et al., (2002). A clean dried viscometer with a flow time above 20 seconds from the margarine to be tested was selected. The sample was filtered through a sintered glass (fine screen) to eliminate dost and other solid material in the margarine sample.

The viscosity meter was charged with the sample by inverting the tube thinner arm into the liquid sample, and suction force was drawn up to the upper timing mark of the viscometer, after which the instrument was tuned to its normal vertical position. The viscometer was placed into a holder and inserted into a constant temperature bath at 28°C and allowed approximately ten (10) minutes for the samples to come to the bath temperature at 28°C. The suction force was then applied to the thinner arm to draw the sample slightly above the upper timing Mar. The afflux times by timing the flow of the sample as flow freely from the upper timing marker to lower mark was recorded.

DETERMINATION OF REFRACTIVE INDEX

Using a modified method of Ariponnammal (2012), the refractive index determined by first cleaning of the refractometer. Then, the prism assembly was opened, the lens tissues were removed. The prism was inspected for cleanliness.

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It was then cleaned with water. The refractometer was reset with a light compensator (water at 20°C). The sample was smeared on the lower prism using a pipette, and the prism was closed. The illuminator was moved upwards, and the adjustment control was turned until the lower field got dark and the upper field light. The Focus was placed on the crosshairs by moving the eyepiece. The dispersion correction wheel was turned until the minimum colour was seen, then the lamp was adjusted for a maximum contract when it was necessary, the adjustment control was turned to adjust the sharp dividing lines to precisely intersect with crosshairs, then the contact switch at the left of the instrument was pressed, reading the top scale, estimating the 4^{th} decimal places. Then the temperature reading was taken from the thermometer. After the experiment, the prism was cleaned by wiping off the sample with lens tissues and was cleaned with methanol. The instrument was turned off.
The formula for determining refractive index is **n = c/v**
where n = index of refraction, **C** = velocity of light in vacuum, **V** = velocity of light in the medium.

SENSORY ANALYSIS

A 10 members panellist were selected from the department of food technology federal polytechnic Nekede Owerri for the sensory evaluation, and the study was carried out under the food processing workshop in the morning hours of 10 am. The laboratory was quiet without noise and interruption, and the panellists were separately seated; each provided a glass of clean water to rinse their mouths between the five evaluation samples of 2mins intervals. The samples were presented in plastic plates and were evaluated for colour, texture (feel), odour and General acceptability using a 9-point hedonic scale. (AOAC 2000).

9 = Like extremely, 8 = liver very much, 7 = Like moderately, 6 = Like slightly, 5 = Neither like or Dislike, 4 = Dislike slightly, 3 = Dislike moderately, 2 = Dislike very much, 1 = Dislike extremely

RESULTS

Table 1: Physical property of palm oil- marijuana oil blended margarine

PROPERTIES	AOA	BOB	COC	DOD	EOE
Refractive index	1.465	1.464	1.468	1.467	1.466
Moisture (%)	4.623	6.667	2.086	5.084	5.804
Viscosity	6.5	8.2	4.8	2.9	6.2

Keys
AOA = 100% Palm oil
BOB = 100% Marijuana oil
COC = 70% Palm oil and 30% Marijuana oil
DOD = 70% Marijuana oil and 30% Palm oil
EOE = 50% Marijuana oil and 50% Palm oil

Discussion

The moisture content of the margarine were 42.0, 45.0, 37.0, 38.0 for samples AOA, AOB, AOC, AOD, AOE. Moisture content level decreased with the increase in the level of the "palm oil" sample, which can be compared (Capitani et al., 2017; Windt et al., 2021)

From table 1, the Viscosity (in centipoise) at 25°C showed; 6.5, 8.2, 4.8, 2.9, and 6.2; for Samples AOA, AOB, AOC, AOD and AOE, respectively. The sample AOA and DOD that is 100% marijuana oil and 50% marijuana oil with 50% palm oil respectively decreased in the Viscosity. This could be as a result of an increase in temperature associated with a heat applied on the palm oil during steaming as it has the possibility of breaking its bonds (Aini & Miskandar, 2007). Hence, resulting to a possible less make up with palm oil for the less viscosity cannabis oil that was dominant at 70%.

The specific gravity of the samples ranges from 74.1, 74.1, 74.8, 73.6, respectively, from table 1. The decrease in the density of the substances could result from a loss in moisture in the palm oil, which resulted in the reduction of the volume and mass of the marijuana oil.

TABLE 2: Mean Sensory Scores of palm oil- marijuana oil blended margarine

Parameter	AOA	AOB	AOC	AOD	AOE
Texture	6.1^{a}	6.4^{b}	7.0^{c}	7.3^{d}	6.7^{e}
Colour	5.5^{a}	5.6^{a}	6.3^{b}	7.8^{c}	7.0^{bc}
Odor	6.6^{a}	7.2^{c}	6.1^{b}	7.2^{c}	6.1^{b}
General Acceptability	5.6^{a}	5.8^{a}	6.4^{b}	7.1^{c}	7.3^{c}

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Figures with the same subscript show no significant difference (p> 0.05) level of confidence, while the mean with different subscript is significantly different.

Keys
AOA = 100% Palm oil
BOB = 100% Marijuana oil
COC = 70% Palm oil and 30% Marijuana oil
DOD = 70% Marijuana oil and 30% Palm oil
EOE = 50% Marijuana oil and 50% Palm oil

The sample BOB was more accepted in terms of taste from the sensory evaluation sample, followed by sample EOE also in taste. In terms of color, sample EOE was more accepted, and there was no significant difference in all the samples in color.
Sample BOB and DOD were the most accepted in odors followed by sample AOA, but the least accepted samples were COC and EOE with no significant difference. BOB was more accepted in the General acceptability sample, followed by sample EOE. This agrees with a similar trend by Toma et al. (2020) for a margarine blends from Sunflower and Coconut Oil.

Conclusions

This study was conducted to determine the chemical and physical rheological properties of five different margarine samples produced using marijuana oil and palm oil. The most preferred sample was pure 100% palm oil. Furthermore, palm oil can withstand high temperatures than marijuana oil. Only 30% Marijuana oil can be added to 50% Palm oil Margarine. Therefore, it is recommended that the study be repeated with valid ethical approval in order to subjected the margarine products to testing using human taste buds.

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