COMPARATIVE STUDY ON MICROBIAL PURITY OF LOCALLY EXTRACTED PALM KERNEL AND COCONUT OILS

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Abstract— This study was aimed at determining the microbial purity of palm kernel oil and coconut oil extracted locally by evaluating the presence of total aerobic mesophilic bacteria, fungal (mould) and Coliform counts as well as presence of pathogenic bacteria (*E.coli*) if any. This was achieved via serial dilution, pour plate and Most Probable Number (MPN) techniques followed by standard biochemical tests as well as the use of Eosine-Methylene Blue (EMB) for *E.coli* 0157:H7. The oil samples were found to contain few or no colonies of aerobic mesophillic bacteria and fungi. There was no growth of either coliform or pathogenic bacteria detected which make the oils to fall within the minimum acceptable range stipulated by National Agency for Food and Drug Administration Control (NAFDAC) for oils.It is therefore concluded that the oils used in this study are suitable for consumption.

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Index Terms— microbial purity, locally extracted, Palm kernel oil, Coconut oil.

1 INTRODUCTION

Palm kernel oil and coconut oil have similar uses due to their similar composition. Among other oils, palm kernel oil and coconut oil are the only oils that contain lauric acid, known to be an antimicrobial agent. However, the percentage of lauric acid varies from oil to oil. This may be due to the specie of the palm nut (kernel) or the extraction method [1].

Lauric acid plays a key role in the antimicrobial activity of palm kernel oil and coconut oil. Thus, the higher the lauric acid content, the higher the antimicrobial activity [1, 2].

Traditional methods of production are employed for the extraction of palm kernel oil and Coconut oil by individuals. As a result, vegetable oils which include palm kernel oil and coconut oil among others are prone to contamination by microorganisms. These orgarnisms could be found in the environment, raw materials and equipment used for the processing, as well as those used for storage and distribution [3].

Generally, vegetable oils including Palm kernel oil and coconut oil do not exhibit significant microbial activity due to their unsuitability for microbial growth; however there are few exceptions. These microbes are usually introduced into the oils through handling from the manufucturers to the final consumer.

Microorganisms cause chemical changes in oils. These changes lead to deterioration in the quality of their chemical composition. The lipolytic activity of fungi on the triglycerides of the oils and fats may cause rancidity, acidity, bitterness and off flavours. Such activity may occur in seeds or other plant parts from which oils are extracted or derived [3]. The decomposition of glycerides by micro-organisms may be accelerated by the exposure of palm fruit to heat and sunlight [3, 4, 5] and water activity in the palm fruit.

Frying and cooking of the oil reduces the microbial load to the minimum level. Some individuals however consume this product raw. This may result in health problems in such individuals. It is against this background that this research was carried out with the aim of determining the microbiological purity of palm kernel oil and coconut oil locally extracted.

2 MATERIALS AND METHODS

2.0 Materials

- Safety Cabinet (Laminar Flow)
- McCathney Bottles
- Petri – dishes
- Syringes
- Hand Gloves
- Nose Mask

2.1 Collection and Preparation of plant Samples

Half bag of coconut was purchased from Bakin Dogo market, a branch of Kaduna central market. The Coconuts were unshelled at the point of purchase and transported to the laboratory. Palm kernel oil and coconut oil that were used for this study were extracted locally using local extraction method.

2.2 Extraction of Coconut oil

Half bag of coconut was purchased from Bakin Dogo market, a branch of Kaduna central market. The Coconuts were unshelled at the point of purchase and transported to the laboratory. The unshelled nuts were then cut into smaller pieces. This was further crushed in a mortar. After crushing, it was taken to the engine for grinding into liquid form. The mixture was then sieved to separate the liquid from the chaff. The filtrate was allowed to stay overnight for approximately 24 hours. After 24 hours, the filtrate formed a thick layer of fluid

on the surface. This was scooped using a clean spoon into a clean pot. The pot was placed on the stove to boil the milk until the water evaporates and the oil began to form. The oil was then fetched using a flat spoon into a clean bowl immediately as it formed. This process continued until all the oil was extracted.

2.3 Extraction of Palm Kernel Oil

The Palm Kernel nut was bought from the market and cracked to obtain the nut. The nut was heated for some time and thereafter crushed using pestle and mortar. The crushed nuts were further crushed using grinding stone to obtain finer particles or paste. This was then transferred to the pot containing little amount of water and placed on the fire. After heating for some time, the water evaporated and the oil began to form. The oil was scooped into a clean container as it formed.

2.4 Media preparations

Saboraud's Dextrose Agar (SDA) was prepared according to the manufacturer's instruction. This was used to determine fungal contamination of the oil samples.

Nutrient Agar (NA) was prepared according to manufacturer's instruction. This was used to determine the presence of total aerobic mesophyllic bacteria in the oil samples.

Eosine- Methylene Blue(**EMB)** Agar was prepared according to manufacturer's instruction. This was used to determine the presence of faecal contamination of the oil sample.

Eosine- methylene blue 0157:H7 was prepared according to manufacturer's instruction. This was used to determine the presence of pathogenic bacteria (*E. coli*) in the oil sample.

For each of the above prepared media the corresponding broths were prepared [Saboraud- Dextrose Broth (SDB), Nutrient broth (NB), Eosine- Methylene Broth (EMB) and Eosine- Methylic Broth]. From the prepared broth serial dilution of the oil samples was carried out from 10^{-1}, 10^{-2} and 10^{-3}. This was carried out on Mccathney bottles containing 9mls of various broths. 1ml of the oil was transferred into 9mls of the various broths, from which 0.5ml was transferred into the corresponding plates.

All these processes were carried out in a safety cabinet (laminar flow) to avoid external contamination. The plates were then incubated at 37^{o}c for 7 days for maximum growth of organism if any.

3 RESULTS

The results of purity test of the oils showed that both palm kernel oil and coconut oil that were extracted in the laboratory had low bacterial and fungal counts but no coliform or pathogenic bacteria isolated.

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Table 1: Purity Test Result of Both Palm Kernel Oil and Coco-

nut Oil Extracted in the Laboratory

Key: PKO – Palm Kernel Oil

	Nutrient Agar(NA)			Saboraud Dextrose Agar (SDA)			Eosine-Methylene Blue(EMB) Agar			Eosine-Methylene Blue(EMB) 0157:H7		
	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}
PKO	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10$	$<1x10^1$	Nil	Nil	Nil	Nil	Nil	Nil
CNO	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10^1$	Nil	Nil	Nil	Nil	Nil	Nil

CNO – Coconut oil

The results of purity test of the oils showed that palm kernel oil that were extracted by local extractors had low bacterial and fungal counts but no coliform or pathogenic bacteria isolated.

Table 2: Purity Test Result of Palm Kernel Oil Extracted by some Local Extractors.

Key: PKO 1 – palm kernel oil, 1

	Nutrient Agar(NA)			Saboraud Dextrose Agar (SDA)			Eosine-Methylene Blue(EMB) Agar			Eosine-Methylene Blue(EMB) 0157:H7		
	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}
Pko1	$3x10^1$	$<1x10^1$	$<1x10^1$	$6x10^1$	$<1x10^1$	$<1x10^1$	Nil	Nil	Nil	Nil	Nil	Nil
Pko2	$1x10^1$	$<1x10^1$	$<1x10^1$	$1x10^1$	$1x10^1$	$<1x10^1$	Nil	Nil	Nil	Nil	Nil	Nil
Pko3	$<1x10^1$	$<1x10$	$<1x10^1$	$1x10^1$	$<1x10^1$	$<1x10^1$	Nil	Nil	Nil	Nil	Nil	Nil

PKO 2 – palm kernel oil, 2
PKO 3 – palm kernel oil, 3

The results of purity test of the oils showed that coconut oil that were extracted by local extractors had low bacterial and fungal counts but no coliform or pathogenic bacteria isolated.

Table 3: Purity Test Result of Coconut Oil Extracted by Some Local Extractors.

Key: CNO 1 – Coconut oil, 1

	Nutrient Agar(NA)			Saboraud Dextrose Agar (SDA)			Eosine-Methylene Blue(EMB) Agar			Eosine-Methylene Blue(EMB) 0157:H7		
	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}	10^{-1}	10^{-2}	10^{-3}
CNo1	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10^1$	Nil	Nil	Nil	Nil	Nil	Nil
CNo2	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10$	$<1x10^1$	$<1x10^1$	Nil	Nil	Nil	Nil	Nil	Nil
CNo3	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10^1$	$<1x10^1$	Nil	Nil	Nil	Nil	Nil	Nil

CNO 2 – Coconut oil, 2
CNO 3 – Coconut oil, 3

Four different media were prepared and used to determine the purity of the oils. Nutrient Agar (N.A) was used to determine

the presence of total aerobic mesophyllic bacteria. Saboraud Dextrose Agar (SDA) was used to determine fungal contamination of the oil sample. Eosine-Methylene Blue (EMB) Agar was used to dictate the presence of faecal contamination of the oil sample. Eosine-Methylene Blue (EMB) 0157:H7 was used to determine the presence of pathogenic bacteria (*E.coli*) in the oil samples. The results revealed that the oil samples are free from any form of contamination and safe for consumption.

As demonstrated in this document, the numbering for sections upper case Arabic numerals, then upper case Arabic numerals, separated by periods. Initial paragraphs after the section title are not indented. Only the initial, introductory paragraph has a drop cap.

4 DICUSSION

The bacterial load of Palm Kernel oil and Coconut oil samples obtained from the eight samples used for this study fall within the minimum acceptable microbiological level required by the National Agency for Food and Drug Administration Control (NAFDAC), which stipulated that the maximum allowable number of organism in a sample unit of oil should not be more than two with acceptable microbiological level of 10^4/ml. [3, 6]. Generally vegetable oils do not exhibit significant microbial activity due to their unsuitability for microbial growth; however, there are few exceptions. These microbes are usually introduced into the oils if there is faulty handling from the manufacturers to the final consumers. Microorganisms that invade food product have been known to cause diseases especially in humans [5].

In this study, four different media were prepared and used for the microbial purity test of the oils. We examined these oils for presence of total aerobic mesophyllic bacteria. Aerobic mesophyllic bacteria are rigid cell vibroid to helical polar flagella organism. They are harmless sapropyhte and occur in fresh water [which may be a source of contamination during the processing of the oil] and marine environment. Only a few exceptions are parasitic and can be pathogenic for humans and animals. The pathogenic aerobic mesophyllic bacteria have been shown to cause diarrhea in humans [7]. The oils (both PKO and CCNO) were free from these organisms.

Secondly, we demonstrated the absence of fungal contamination of the oils. Moulds (fungi) are multicellular eukaryotic organisms with many destructive structurer features. They are also responsible for bthe decomposition of many materials synthesizing and excreting large quantity of enzymes into the surrounding environment [7]. The oils were free from fungal contamination.

Thirdly, we demonstrated the absence of faecal contamination. Coliforms are about by faecal contamination, hence serving as a good index of possible food contamination [8, 9]. Coliforms such as *E.coli* have been shown to cause gastroenteritis while others cause urinary tract infection. This organism have simple nutritional requirement and can survive in non- aquatic environment.

As earlier stated vegetable oils do not exhibit significant microbial growth; however a few exceptions were encountered in this study although they did not exceed the safety limit. Thus the result of the study showed negative presence of *E.coli* and Coliform. Similar studies were carried out by [4, 5 and 9].

5 CONCLUSION

The absence of microbial growth in the oil could be attributed to their claim of possesing antimicrobial properties which may have inhibited the growth of microbes (bacteria and fungi) if any. Some of the oils showed growth of one or very few colonies which are negligible as they cannot cause any public health problem because of their limited number. The oil samples bought from local extractors showed minimal contamination which may be due to exposure to the environment (open air) during sales. However, the microbial growth did not exceed the safety limit. Therefore it can be concluded that both Palm Kernel oil and Coconut oil used for this study are safe for consumption.

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