Determination of Quality of Coconut Oil Manufactured in Ampara District with Selected Quality Parameters

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Abstract- *Coconut oil, commonly used edible oil in Sri Lanka, has number of health benefits such as cholesterol-lowering effects, reduced risk of cardiovascular diseases, weight loss, improved cognitive functions, and antimicrobial activity. Demand for coconut oil rapidly increases. Coconut oil is produced on small to large scale. In Ampara district, there are numerous small-scale traditional coconut oil producers that produce oils that lack of proper knowledge and scientific practices. This study is designed to compare selected quality parameters of coconut oil produced locally with SLS standards (SLS 32:2017). Oil samples were collected from Addalaichenai, Akkaraipattu and Pottuvil. The free fatty acid (FFA), moisture, and peroxide value (PV) were determined using standard methods. The results obtained were the mean values for free fatty acid, moisture, and peroxide value ranged from 1.069±0.15 to 1.1402±0.38 mg NaOH/g oil, 0.3486±0.00 to 1.7920±1.49 % and 1.0913±0.47 to 1.8836±0.55 meq /kg respectively. All three samples had higher moisture and free fatty acid content than the standard value (0.4 and 0.8) respectively, and lower peroxide value (>3). A significant difference was observed in peroxide value, which was lower than the SLS value, whereas the moisture content and free fatty acid value were not found to be significantly differ across all areas. The local manufacturers must improve their oil processing scientifically and hygienically, so as to improve the quality on par with the SLS standards and to provide quality oil to the consumers. However, modern scientific manufacturing methods should be introduced by the local manufacturer.*

Keywords: Coconut oil, quality parameters, SLS standard, Ampara district

I. INTRODUCTION

Coconut oil is obtained by crushing copra, the dried kernel of the coconut fruit (*Cocos nucifera L.*). It is one of the most important coconut base products. Freshly harvested coconut flesh contains 34 % oil, 50 % moisture, 7.3 % carbohydrate, 2.2 % ash and 3.5 % protein (Kumar *et al*, 2019), and dried kernel has 60-65 % oil, has a natural sweet coconut taste, and contains 92 % saturated fatty acids (Krishna *et al*, 2010). The world produced nearly 62.45 million metric tons (MMT) of coconuts in 2018 (FOA, 2018). In 2019, Sri Lanka's coconut production was estimated to be 3,085.6 million nuts. Coconut oil production increased by 309.2 % to 44,648 MT (Annual report of Central bank of Sri Lanka, 2019). Coconut oil has a lot of health benefits, including lowering cholesterol, weight loss, reducing the risk of cardiovascular disease, improved cognitive functions, antimicrobial activity, and others (Lima & block, 2019). Demand for coconut oil rapidly increases among peoples due to its health benefits, growing commercial value and widespread use in cooking (Lima & block 2019). As a result, it is manufactured in Sri Lanka as cottage, micro, small and mid-size enterprises (SMEs) and large industries, as well as it provides a good income to households. Therefore, numerous cottage level traditional coconut industries, manufacture oils lack of proper knowledge and understanding on the quality parameters of coconuts oils for unscriptural financial benefits in Ampara districts, which may pave the way for causing health hazards for the consumers. Hence, the evaluation on the quality parameters of locally manufactured coconut oils has become indispensable due to the negative health concern faced by the general public. Therefore, the present study is designed to determine the quality parameters of locally manufactured coconut oil and compared with the requirements of the SLS 32:2017 to measure the gap between the degree of quality of locally manufactured coconut oil and the requirements prescribed in the SLS 32:2017 standards.

II. LITERATURE REVIEW

In 2020, the total global production of edible-grade coconut oil was 3.57 MMT (Statista, 2021). Philippines, Indonesia, and India were the top three producers (FAO, 2012). Around the world,

54 % of the coconut oil sold is used for cooking, while the remaining 46 % is used for other purposes (Krishna, 2012). In Sri Lanka, coconut production was estimated to be 3,085.6 million nuts in 2019, representing a 17.6 % increase over 2018. Coconut oil production increased by 309.2 % to 44,648 MT in 2019, while virgin coconut oil production climbed by 2.8% to 12,725 MT. As a result, oil imports dropped from 217,730 MT in 2018 to 155,997 MT in 2019 (Annual report of Central bank of Sri Lanka, 2019). Coconut oil is the fat obtained from the kernel of coconut palm. Refined coconut oil (RCO) is made from dried coconut, while the future unrefined oil is made by washing, bleaching, and deodorizing mature fresh coconut in industrial scale production (Gunston, 2002). Coconut oil contains fatty acids, which has been shown to protect against not only cardiovascular disease, but also a variety of chronic health issues such as diabetes and cancer, as well as to prevent and even treat infectious diseases. However, due to a general prejudice against saturated fats, data on coconut oil has been buried in medical journals without interruption (Boateng *et al*, 2016).

III. PROBLEM STATEMENT

Coconut oil has high demand among consumers as it is commonly used for cooking purpose. It is manufactured in Sri Lanka by micro, SMEs, and large industries. It is also produced by cottage industry, which provides a good source of income for households. There are numerous small-scale traditional coconut oil manufacturing industries in Ampara districts which produce oils lack of scientific knowledge and understanding on the overall quality parameters of coconut oils. However, unless coconut oil is processed based on the scientific and good sanitary practice, the quality parameters of oils produced may not meet the required degree of quality and safety standards and may be unsafe for human consumption. Therefore, the present study aims to determine the quality parameters of locally manufactured coconut oil and compare them to the requirements prescribed in SLS 32:2017 requirements.

IV. MATERIALS AND METHODS

A. Sample collection

Three different samples of coconut oil ($1m^3$) produced from copra were collected in a clean container from three—different coconut oil manufacturers in Ampara district namely Akkaraipattu,Addalaichechenai, and Pottuvil. The collected samples were kept at room temperature in the laboratory without direct exposure to sunlight for further analysis. Then five replicates were performed from each sample.

B. Analysis of quality parameters

The peroxide value, moisture content and free fatty acid content were determined among the quality parameters. The oven drying method was applied to determine the moisture contents as described in AOAC 925.10 (1990). The free fatty acid contents were determined according to the method prescribed in AOAC (940.28) while the peroxide value was determined according to the method prescribed in the AOAC 965.33 (2000).

C. Statistical analysis

The data were analysed using t-tests with 95% confidence level. All the tests were done by using SPSS (SPSS.25 windows, 2017)

V. RESULTS AND DISCUSSION

The results obtained from the analyses on moisture content, free fatty acid value and peroxide value are shown in Tables 1.

Table 1: Results of quality parameters of coconut oil

Oil samples	Quality parameters		
	Moisture content (%)	Free fatty acid value (mg NaOH/g oil)	Peroxide Value (meq /kg)
Akkaraipattu	1.39288 ± 0.95^{a}	1.1402 ± 0.38^{a}	1.5768 ± 0.38^{ab}
Addalaichchenai	1.7920 ± 1.49^{a}	1.1382 ± 0.38^{a}	1.8836 ± 0.55^{b}
Pottuvil	0.3486 ± 0.00^{a}	1.069 ± 0.15^{a}	1.0913 ± 0.47^{a}
SLS Standard for coconut oil	Maximum 0.4^{a}	Maximum 0.8^{a}	Maximum 3.00^{c}

Means ± Standard Deviation (SD) within the same column with different superscripts are significantly different at $p<0.05$

D. Determination of Moisture content

The moisture and volatile matters are the most important determinants of oil quality (Choe and Min, 2006). Keeping the moisture content low is preferable which extends the shelf life by preventing oxidation and rancidity processes. When fats and oils are exposed to high moisture levels, they deteriorate due to hydrolytic rancidity (Raghavendra and Raghavarao, 2011; Oseni, 2017). The moisture contents of the oils collected from Akkaraipattu, Addalaichenai and Pottuvil were found to be non-significant ($p > 0.05$) with the comparison to the requirements prescribed in SLS (32:2017) standard. The moisture contents of oil from Akkaraipattu and Addalaichenai were higher than 50 % within the recommended range of 0.4 % in SLS standard. The high moisture content shown in Addalaichenai sample was due to a limited drying periods/process. However, the improper drying process will cause water residual in oil. The moisture content of the sample collected from Pottuvil was found to be less than 0.4 % of the SLS standard value. A low moisture content is essential for a long storage life (Kumar, 2018).

E. Determination of Free fatty acid value

The free fatty acid content of coconut oils is an indicator of hydrolytic rancidity, which causes an unpleasant flavour and aroma to the oil. The action of lipase or moisture is the primary cause of hydrolytic rancidity (Osawa *et al*, 2007). Free fatty acids are present in oil or fat, and their concentration will increase during processing and storage (Darko, 2014). The presence of free fat is commonly used as an initial indicator of oil damage (Darko, 2014). The mean free fatty acids (FFA) contents of all three samples were found to be almost same, indicating free fatty acids values that were higher than the standard value and found to be non-insignificant ($p > 0.05$) in all three locations, indicating moderate quality. It has been shown that the free fatty acid content of coconut oil varies with copra processing and storage time (Darko, 2014).

F. Determination of Peroxide value

Peroxide value is the most important to determine the degree of spoilage of oil or fat. When unsaturated fatty acids bind oxygen to their double bonds, peroxide is formed. Oxygen can oxidize unsaturated fatty acid oils, resulting in the formation of peroxide (Natalia *et al*, 2019). The high peroxide level indicates that the oil has been oxidized and is on the

verge of becoming rancid (Natalia *et al*, 2019). Oxidation of some fatty acids, especially unsaturated fatty acids, may lead to high peroxide numbers (Natalia *et al*, 2019). Low oxidation is defined as a peroxide value between 1 and 5 meq/kg, moderate oxidation is defined as a value between 5 and 10 meq/kg, and high oxidation is defined as a value greater than 10 meq/kg (Moigradean *et al*, 2012). However, SLSI standard limits the peroxide value of coconut oils in general to a maximum of 3 meq/kg (Moigradean *et al*, 2012). The peroxide values of coconut oil, as well as the number of unsaturated fatty acids, were taken into account in this present study. If low amount of peroxide produced during the process, cause the higher quality oil production, as the amount of peroxide in the oil would quickly become rancid if the amount of peroxide increased (Natalia *et al*, 2019). The results in this study shows that all three samples vary significantly to SLS (32:2017) limit and show adequate peroxide levels that are lower than the SLS standard maximum level of 3 meq/kg, indicating that they safe to human consumption.

VI. CONCLUSION

According to the findings of this present study, all three samples were found to be of satisfies the Sri Lanka Standards (SLS) requirement in terms of peroxide value; however, due to the moisture content and free fatty acid value, they failed to meet the requirement of SLS standard. The oil sample collected from Pottuvil is moderately higher in quality in terms of all three quality parameters. Therefore, local manufacturers have to improve their coconut oil processing so as to improve the quality of coconut oil and to provide quality oil to consumers to prevent any possible health hazards.

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