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Comparative Study on Cholesterol Content of Olive, Gingili, Palm, Sunflower and Coconut Oil

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ABSTRACT

In the present investigation, an effort was made to find out cholesterol content in five most important edible vegetable oils in Northern Sri Lanka. Quantitative and qualitative analysis performed using standard method revealed varying levels of cholesterol content. Olive oil sample contained significantly ($p<0.05$) lowest cholesterol content which is 100.58±0.43 mg dL^{-1}. Coconut oil has significantly ($p<0.05$) highest (362.84±1.72 mg dL^{-1}) cholesterol content. Values of cholesterol content in different vegetable oil groups were recorded in the following ascending order: olive oil<gingili oil<palm oil<sunflower oil<coconut oil. Mean cholesterol content analyzed for all vegetable oil samples collected from the Northern Sri Lanka are significantly different ($p<0.05$) from each other. It has been concluded that using olive oil and gingili oil in our daily diet in place of other oils can achieve a remarkable degree of protection from cholesterol oriented disease for example heart disease and stroke.

Key words: Olive oil, sesame oil, coconut oil, sunflower oil, palm oil

INTRODUCTION

Vegetable oils namely, gingili oil, sunflower oil, coconut oil, virgin coconut oil, palm oil, olive oil and rice bran oil are lipid materials derived from plant seeds and most representative food in the traditional Sri Lankan diet. Among the vegetable oil groups, gingili oil, sunflower oil, coconut oil and palm oil are most popular in local market of Northern Sri Lanka according to their prices especially due to the free issue offered by Government of Sri Lanka. Usually these edible oils are extracted primarily from seeds of oilseed plants (WADE, 1996).

All vegetable oils contain 100% fat. Based on the previous reports, coconut oil and sunflower oil are representative of saturated, monounsaturated and polyunsaturated fatty acid (Chacko and Rajamohan, 2011). Sunflower oil has high content of oleic acid (Simopoulos, 2010). Gingili oil has one of the lignans with a fused tetrahydrofuran nucleus, namely, sesamin. It is a most intriguing component since it exerts an efficient antioxidant activity (Osawa *et al*., 1985). Olive oil is also a source of at least thirty phenolic compounds (Saija *et al*., 1998), many of which contribute to the resistance of olive oil to oxidative rancidity (Boskov, 1996; Perez-Jimenez *et al*., 2007). Commercial plantation of oil producing palms certainly achieved the widespread interest of people, nowadays. Palm oil is very rich in tocopherols and tocotrienols (Gapor and Ong, 1982).

Cholesterol is a compound involved in the essential functions of the human body. Due to the increasing awareness on the health implications of high cholesterol in the diets, most people now prefer to purchase cholesterol-less vegetable oils (Daksha *et al*., 2010). Plasma cholesterol has been shown to be a major risk factor in the development of atherosclerosis and cardiovascular diseases (Glass and Witztum, 2001). Arteriosclerosis is a complex disease, characterized by severe inflammatory response towards damage of the arterial wall involving several cell types, including platelets. Platelets play a major role in the hemostatic process and in thrombus formation after an endothelial injury (Mackman, 2004). A number of studies have been performed on effect of vegetable oils on human health (Rukmini and Raghuram, 1991; Lichtenstein *et al*., 1994). The present study was carried out to estimate the level of cholesterol in most popular vegetable oil groups in Northern Sri Lanka.

MATERIALS AND METHODS

Sample collection: Samples of five groups of vegetable oil produced from a variety of oil seeds (palm oil, gingili oil, sunflower oil, olive oil and coconut oil) were purchased from various markets in Northern Sri Lanka during June 2011 to December 2011. All chemicals and materials were purchased from standard sources, Sigma chemical company, USA.

Data on utilization of vegetable oil: Information on utilization of the above mentioned vegetable oil groups by the community was gathered from 250 households from northern Sri Lanka during June 2011 to December 2011. From the data gathered the percentage of utilization by the people for each vegetable oil group was computed and plotted as a pie chart.

Determination of cholesterol content: At first, solutions of five different cholesterol concentrations (115.80, 231. 60, 347.40, 463.20 and 579.00 mg dL^{-1}) were prepared by using strong cholesterol standards (Fluka Chemie; Frei). Each solution was treated with ferric chloride, acetic acid mixture and sulphuric acid and the absorbance of each solution was read at 560 nm in UV-Visible spectrophotometer (UVD-3000) (Zlatkis *et al*., 1953). A standard calibration curve was plotted (Fig. 1) and it was fed to the LABOMED, INC software. Cholesterol content of each oil sample was analyzed according to the method of Zlatkis *et al*. (1953). Colour developed was observed and absorbance was read at 560 nm wavelength. Subsequently the concentration of cholesterol was estimated using the attached LABOMED, INC software in the UV-Visible spectrophotometer. Ten replicates were done for each oil sample.

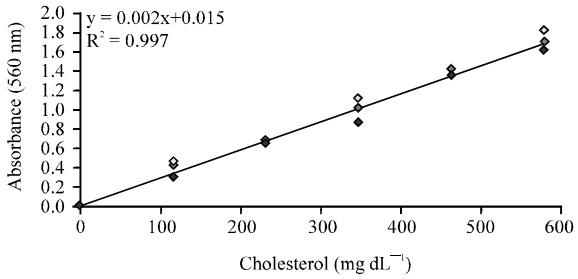

Fig. 1: Standard calibration curve showing absorbance for five different concentrations of cholesterol (Points in different shapes indicate different replicates)

Statistical analysis: The results were presented as mean value±standard deviation. Results were analyzed using STASTICA software. Comparisons between the five groups were performed by one-way ANOVA followed by Duncan's post-hoc multiple comparison tests. Significant difference was defined at $p<0.05$.

RESULTS

The standard calibration curve (Fig. 1) showed a significant increase for the absorbance with the increasing cholesterol concentration. Cholesterol concentrations prepared were 115.8, 231.6, 347.4, 463.2 and 579 mg dL^{-1} and the respective absorbance values for the specified concentrations were 0.398, 0.644, 1.026, 1.342 and 1.695, respectively. The analytical data for cholesterol content of five oil samples from the regional markets are shown in Fig. 2. Out of these, Olive oil sample contained significantly ($p<0.05$) lowest cholesterol content which was 100.58±0.43 mg dL^{-1}. Coconut oil has significantly ($p<0.05$) highest (362.84±1.72 mg dL^{-1}) cholesterol content than the others. Values of cholesterol content in different vegetable oil groups were recorded in the following ascending order: Olive oil<gingili oil<palm oil<sunflower oil<coconut oil. Mean cholesterol content analyzed for all vegetable oil samples collected from the Northern Sri Lanka was significantly different ($p<0.05$) from each other. The probability values obtained from the statistical analysis while comparing the mean cholesterol content are expressed in Table 1.

From the present study it is evident that all vegetable oil samples analyzed contain cholesterol at least to some extent. Coconut oil consists of 3.6 times cholesterol than the olive oil.

The Information gathered from the 250 families revealed, 47.2% people are using palm oil, 26% are using coconut oil, 20% are using gingili oil, 6% are using sun flower oil, 0.8% are using olive oil (Fig. 3).

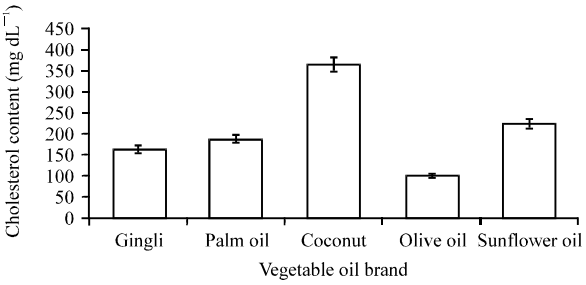

Fig. 2: Mean±standard deviation of cholesterol content (mg dL^{-1}) in different vegetable oil

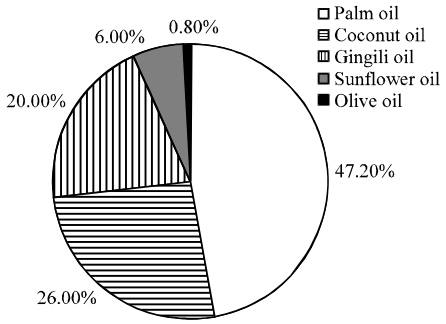

Fig. 3: Percentage of people utilizing vegetable oil in Northern Sri Lanka

Table 1: Probability values showing marked significant differences between vegetable oils

	Gingili	Palm	Coconut	Olive	Sun flower
Gingili	--	0.000149	0.000055	0.000149	0.000066
Palm	--	--	0.000066	0.000066	0.000149
Coconut	--	--	--	0.000032	0.000149
Olive	--	--	--	--	0.000055
Sun flower	--	--	--	--	--

Duncan test; All values expressed above are less than 0.05 and therefore illustrate significant differences

DISCUSSION

People consume different varieties of vegetable oils directly or as their food ingredients. From the present study it is evident that the vegetable oils had different cholesterol levels. In an earlier study, Okpuzor *et al.* (2009) reported that olive oil has the lowest amount of cholesterol content. They recorded varying cholesterol content in sesame oil, sunflower oil and olive oil which are 1.20±0, 0.562±0.263 and 0.421±0.029 mg mL^{-1}, respectively, by the method of Ojiako and Akubugwo (1997) in Nigeria. But in the present study the values obtained for Sesame oil, Sunflower oil and Olive oil are 163.16±0.63, 223.86±0.71 and 100.586±0.43 mg dL^{-1}, respectively. The values obtained in the present investigations are higher than the earlier reported values. Lee *et al.* (2000). Specified that consumption of tomato products with olive oil increases the antioxidant activity of plasma whereas the sunflower oil does not. Previous studies described the beneficial properties of olive oil; it has also been recorded that the consumption of olive oil has dramatically been increased in European countries (Psaltopoulou *et al.*, 2004).

Sesame has long been used extensively as a traditional healthy food in our country. However, no attention has been directed to the physiologically active components in this seed. Sesame has been considered to elicit medicinal value for the prevention of various regressive diseases such as atherosclerosis, hypertension and aging in the Oriental countries for thousands of years (Hirose *et al.*, 1991).

Sesamin reduced the concentration of serum and liver cholesterol significantly irrespective of the presence or absence of cholesterol in the diet. The effect of sesamin on the lymphatic absorption of cholesterol was followed for 24 h after intragastric administration of a fat emulsion in rats by Hirose *et al.* (1991). They found that sesamin decreased the absorption of exogenous cholesterol significantly.

From an experimental study, Broitman *et al.* (1977) and Zulet *et al.* (1999) reported that the polyunsaturated fat in safflower oil promoted the decrease in serum cholesterol levels in rats whereas the rats fed with diets containing cholesterol plus saturated fat in 20% of coconut oil, elevated the serum cholesterol and promoted vascular lipidosis.

The American Heart Association recommends avoiding the use of coconut oil for cooking as it contains 85 to 90% saturated fat which is generally regarded as bad while paying attention to heart disease (Fogli-Cawley *et al.*, 2006). Researchers found number of deaths was three times higher in Singapore than Hong Kong because coconut and palm oil consumption was higher in Singapore (Anonymous, 2008).

Cholesterol, a lipid, plays a vital role in the physiological regulation of membrane fluidity and proper functioning of cells. It is also a major precursor in the production of bile acids, steroid hormones as well as vitamin D. Cholesterol found in the cell membrane of all cells, has been of great medical importance in recent years, because its high level in the body has been associated with coronary heart diseases (CHDs) (Laker, 2003).

Rural people living in Sri Lanka used to consume coconut oil for the preparation of their diets in the past decades. However, they gained some awareness and using palm oil in their diet at present. This is one good indication for better human health in our country.

CONCLUSION

The findings of the present study express that, using Olive oil and sesame oil in our daily diet in place of other oils can achieve a remarkable degree of protection from cholesterol oriented disease for example heart disease and stroke.

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