Tocopherols and Phytosterols Content of Coconut Oil Blends Prepared for Coconut Oil Consumers and Non-Coconut Oil Consumers

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Coconut oil has low amounts of phytosterols and tocopherols in it. The blends prepared in this study for coconut oil consumers contain more amounts of tocopherols and phytosterols. This is achieved due to the incorporation of other vegetable oils through blending. The blends prepared for coconut oil consumers are expected to provide the health benefits of tocopherols and phytosterols to coconut oil consumers.

Introduction

Blending of vegetable oils is gaining importance in recent days worldwide. Through blending one can alter nutritional composition of the vegetable oil [1-3]. Tocopherols (Vitamin E) are ubiquitous in vegetable oils and have both anti-oxidant and anti-cancer properties [4]. Vitamin E intake also protects against the parkinsons disease [5]. Phytosterols play a role in lowering total cholesterol and low-density lipoprotein (LDL) cholesterol through blocking the absorption of cholesterol from the digestive tract [6, 7]. Coconut oil has nearly 70% of medium chain fatty acids and only 7% of unsaturated fatty acids and hence is resistant to oxidation. The oil also has very low content of tocopherols and phytosterols in it. On the other hand, vegetable oils like sunflower oil, safflower oil, rice bran oil, soyabean oil, sesame oil, groundnut oil, mustard oil and palm oil have low content of medium chain fatty acids and higher amounts of tocopherols and phytosterols. Through blending it is possible to increase the tocopherols and phytosterols content of coconut oil and to increase the content of medium chain fatty acids in other vegetable oils. When other vegetable oils were blended with coconut oil, the polyunsaturated fatty acid content increased naturally, which is an added advantage [8]. So, to provide the health benefits of tocopherols, phytosterols and polyunsaturated fatty acids to coconut oil consumers and to provide the health benefits of medium chain fatty acids to non-coconut oil consumers, two different kinds of blends were prepared and evaluated [8, 9] for tocopherols and phytosterols levels, and the results are reported here.

Experimental Procedure

Materials

Coconut oil (CNO), refined coconut oil (RCNO), rice bran oil (RBO), soyabean oil (SBO), palm oil (PO), mustard oil (MO), groundnut oil (GNO), sesame oil (SESO), sunflower oil (SFO), and safflower oil (SAFFO) used for blending were

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purchased from the local market of Mysore city.

All the chemicals and solvents used were of analytical grade. Two different types of blends were prepared i. Blends for coconut oil consumers (coconut oil is present in major percentage), ii. Blends for non-coconut oil consumers (Refined coconut oil is present in minor percentage).

Blending of Oil Samples

Blends for coconut oil and non-coconut oil consumers were prepared according to the procedure of Bhatnagar *et al* [8] Coconut oil (20, 50, 80, 80, 50, 50 and 20%) with any one of the following oils, viz., sunflower oil (80 %), rice bran oil (50 %), safflower oil (20 %), groundnut oil (50 %), sesame oil (20 %) and palm oil (50 % and 80 %) (at indicated proportions in brackets) respectively are the different kinds of blends prepared for coconut oil consumers. The refined coconut oil (20%) with any one of the following oils, viz., safflower oil (80%), sunflower oil (80%), Rice bran oil (80%). Soyabean oil (80%), Groundnut oil (80%), Sesame oil (80%), and mustard oil (80%), are the different kinds of blends prepared for non-coconut oil consumers. The blends were prepared in 15kg batches by mixing respective oils in the above ratio by mechanical stirrer [10].

Tocopherols Content Determination

Tocopherols content of the samples was determined by using HPLC according to the AOCS (1998) official methods [11]. A silica column was used with hexane and isopropanol as the mobile phase at 99.5:0.5 (v/v) and a flow rate of 1mL/min. The tocopherols and tocotrienols were quantified and expressed as a-tocopherols equivalents.

Phytosterols Content Determination

Phytosterols content of the starting oils, and the two types of blends were analyzed by the method of Searcy and Bergquist with slight modification [12]. Oil samples were dissolved in HPLC grade chloroform and different aliquots pipetted into test tubes and the test tubes kept under a stream of nitrogen for solvent evaporation. Then 1.5mL of acetic acid-ferric chloride reagent was added. (504 mg of $FeCl_3$ in 1L of Acetic acid). After vortexing for 20 seconds, the contents were incubated for 15 minutes at room temperature (27-30°C). Then 1 mL of concentrated sulphuric acid was added, followed by vortexing for 20 seconds, they were incubated in dark at room temperature for 45 min. After the incubation period, the optical density was measured at 540nm in the spectrophotometer. The total phytosterols concentration in the sample was quantitated from a standard curve generated with standard cholesterol (30–200 µg) as 10% solution in groundnut oil and expressed as total phytosterols.

Results and Discussion

Blends of coconut oil with other vegetable oils have been prepared as per the PFA specification for Blended Edible Vegetable oils [13], Rule A.17.24 which means an admixture of any two edible vegetable oils where the proportion by weight of any edible vegetable oil used in the admixture is not less than 20 per cent. The individual oils in the blend shall conform to the respective standards prescribed by these rules. The blends are clear, free from rancidity, suspended or insoluble matter or any other foreign matter, separated water, and added colouring matter, flavouring substance, mineral oil, hydrocyanic acid, castor oil and tricresyl phosphate.

In India the daily intake of fat per person is 20g/day. Coconut oil 20g contains 0.34 and 17.4mg % of tocopherols and phytosterols. Similarly refined coconut oil contains 0.44 and 17.4mg% of tocopherol and phytosterols. But the daily recommended intake of tocopherols and phytosterols are 15mg and 1500-3000 mg%. It is not possible to meet the daily recommended intake of tocoperols and phytosterols through the consumption of coconut oil and refined coconut oil alone and there is a need for an alternative approach such as through blending to increase the levels of these natural antioxidant. Unrefined coconut oil was used for the blends prepared for coconut oil consumers. Whereas refined coconut oil was used for the blends prepared for non-coconut oil consumers.

Tocopherols Content

The daily recommended allowance of tocopherols is 15 mg / day / person [14]. Coconut oil has the least tocopherols content of 1.7 mg %. The tocopherols content of the starting oils ranged from 1.7 to 153.3 mg % (Table 1). Soyabean and palm oil had the highest tocopherols content of 153.3 mg % and 96.1 mg % respectively among the oils studied.

Table 1. Total tocopherols and phytosterols content of the starting oils used for blending

Sl. no	Oil samples	Total Tocopherols (mg%) For 100 g of oil	Total Tocopherols (mg%) For 20 g of oil	Total Phytosterols (mg%) For 100 g of oil	Total Phytosterols (mg%) For 20 g of oil
1	CNO	1.7 ± 0.1	0.3	87 ± 17.6	17.4
2	RCNO	2.2 ± 0.3	0.4	87 ± 17.6	17.4
3	SFO	64.7 ± 2.0	12.9	425 ± 35.3	85.0
4	GNO	57.1 ± 1.0	11.4	290 ± 14.1	58.0
5	SESO	57.5 ± 3.0	11.5	390 ± 14.1	78.0
6	SAFFO	52.2 ± 3.4	10.4	425 ± 35.3	85.0
7	MO	66.4 ± 0.6	13.2	312 ± 17.6	62.4
8	PO	96.1 ± 2.5	19.2	180 ± 17.6	36.0
9	RBO	70.9 ± 4.5	14.1	390 ± 14.1	78.0
10	SBO	153.3 ± 3.8	30.6	460 ± 17.6	92.0

CNO - Coconut oil, RCNO - Refined coconut oil, SFO - Sunflower oil, GNO - Groundnut oil, SESO - Sesame oil, SAFFO - Safflower oil, MO - Mustrad oil, PO - Palm oil, RBO - Rice bran oil, SBO - Soyabean oil

for coconut oil consumers, the blends prepared for non-coconut oil consumers had still higher amount of tocopherols. This is because 80% of the other vegetable oil was blended with 20% of coconut oil. Blending of other vegetable oils with coconut oil increased the tocopherols content of coconut oil blends targeted for coconut oil consumers. Apart from that they also get the health benefits of medium chain fatty acids.

When the blends prepared for coconut oil consumers were analyzed for tocopherols content, it ranged from 11.7 - 96.5 mg % (Table 2). The increase in tocopherols content is due to the blending of other vegetable oils with coconut oil. The increase in tocopherols content will depend upon the percentage of other vegetable oil used for blending with coconut oil. They also impart the health benefits of polyunsaturated fatty acids to coconut oil consumers.

Table 2. Total tocopherols and phytosterols content of blends prepared for coconut oil consumers

Sl. no.	Blends	Total Tocopherols (mg %) For 100 g of oil	Total Tocopherols (mg %) For 20 g of oil	Total phytosterols (mg %) For 100 g of oil	Total phytosterols (mg %) For 20 g of oil
1	100% CNO	1.7 ± 0.2	0.3	87 ± 17.6	17.4
2	20% CNO + 80% SFO	56.2 ± 0.6	11.2	375 ± 35.3	75.0
3	50% CNO + 50% RBO	55.5 ± 0.4	11.1	240 ± 14.1	48.0
4	80% CNO + 20% SAFFO	15.8 ± 0.3	3.1	165 ± 14.1	33.0
5	80% CNO + 20% SESO	11.1 ± 0.3	2.2	167 ± 10.6	33.4
6	50% CNO + 50% GNO	47.9 ± 0.4	9.5	190 ± 14.1	38.0
7	50% CNO + 50% PO	24.3 ± 0.6	4.8	170 ± 7.07	34.0
8	20% CNO + 80% PO	96.5 ± 0.7	19.3	165 ± 14.1	33.0

CNO - Coconut oil, SFO - Sunflower oil, RBO - Rice bran oil, SAFFO - Safflower oil, SESO - Sesame oil, GNO - Groundnut oil, PO - Palm oil

The tocopherols content of blends prepared for coconut oil consumers for 20g of fat in mg% were coconut–sunflower 11.2; coconut-rice bran 11.1; coconut-safflower 3.1; coconut-sesame 2.2; coconut-groundnut 9.5; coconut-palm 4.8, and 19.3. Among the blends the coconut-palm oil blend provides tocopherols more than the daily recommended quantity, whereas the blend of coconut-sunflower and coconut-rice bran oil provides tocopoherols very much near to the daily recommended level. Consumption of coconut oil alone therefore, may not provide natural antioxidants such as tocopherols in recommended levels to the consumer. Hence, consumption of coconut oil blends may provide health benefits.

The tocopherols content of the refined coconut oil was 2.2 mg %. The tocopherols content of the blends prepared for non-coconut oil consumers ranged from 45.1 to 103.5 mg % (Table 3). When compared with the blends prepared for coconut oil consumers, the blends prepared for non-coconut oil consumers had still higher amount of tocopherols. This is because 80% of the other vegetable oil was blended with 20% of coconut oil. Blending of other vegetable oils with coconut oil increased the tocopherols content of coconut oil blends targeted for coconut oil consumers. Apart from that they also get the health benefits of medium chain fatty acids.

The tocopherols content of blends prepared for non-coconut oil consumers for 20g of fat in mg% were refined coconut–safflower 9.2; refined coconut-sunflower 9.4; refined coconut-rice bran 14.2; refined coconut-soyabean 20.7; refined coconut-groundnut 9.5; refined coconut-sesame 9.0; refined coconut-mustard 9.8. Among the

Table 3. Total tocopherols and phytosterols content of blends prepared for non-coconut oil consumers

Sl. no.	Blends	Total Tocopherols (mg %) For 100 g of oil	Total Tocopherols (mg %) For 20 g of oil	Total Phytosterols (mg %) For 100 g of oil	Total Phytosterols (mg %) For 20 g of oil
1	100% RCNO	2.2 ± 0.2	0.4	87 ± 17.6	17.4
2	20% RCNO + 80% SAFFO	46.2 ± 0.6	9.2	410 ± 17.6	82.0
3	20% RCNO + 80% SFO	47.2 ± 0.5	9.4	340 ± 14.1	68.0
4	20% RCNO + 80% RBO	71.4 ± 0.9	14..2	310 ± 17.6	62.0
5	20% RCNO + 80% SBO	103.5 ± 0.8	20.7	425 ± 35.3	85.0
6	20% RCNO + 80% GNO	47.9 ± 0.2	9.5	190 ± 14.1	38.0
7	20% RCNO + 80% SESO	45.1 ± 0.68	9.0	312 ± 17.6	62.4
8	20% RCNO + 80% MO	49.4 ± 0.48	9.8	260 ± 17.6	52.0

RCNO - Refined Coconut oil, SAFFO - Safflower oil, SFO - Sunflower oil, RBO - Rice bran oil, SBO - Soyabean oil, GNO - Groundnut oil, SESO - Sesame oil, MO - Mustard oil

blends the coconut-soyabean blend provides tocopherols more than the daily recommended quantity, whereas the coconut-rice bran provide 14.2 mg% of tocopherols.

Phytosterols Content

In India the daily intake of fat is 20g/day/person. 20g of coconut oil and refined coconut oil contains 17.4 and 17.4 mg% of phytosterols. But the daily recommended intake of phytosterols is 1,500 - 3000 mg/day for cholesterol lowering effects [15]. The phytosterols content of the starting oils ranged from 87-460 mg % (Table 1). Coconut oil has phytosterols content of 87 mg %. Soyabean, rice bran, sesame, safflower, and sunflower oils naturally have high amount of phytosterols content, which ranged from 390 to 460 mg %.

The phytosterols content of the blends prepared for coconut oil consumers ranged from 165 to 375 mg % (Table 2) which is 2-5 times higher than for coconut oil alone. The increase in phytosterols content is due to blending of other vegetable oils with coconut oil. The increase in phytosterols content will also depend upon the percentage of other vegetable oil used for blending with coconut oil.

The phytosterols content of blends prepared for coconut oil consumers for 20g of fat in mg% were coconut–sunflower 75.0; coconut-rice bran 48.0; coconut-safflower 33.0; coconut-sesame 33.4; coconut-groundnut 38.0; coconut-palm 34.0 and 33.0. Among the blends the coconut-sunflower oil blend had the highest content of phytosterols and still this is only 2% of the recommended daily intake of 3000mg/day/person.

The phytosterols content of the blends prepared for non-coconut oil consumers ranged from 190 to 425 mg % (Table 3) which is 20% less than for the individual oils. Refined coconut oil had phytosterols content of 87 mg %. When compared to the blends prepared for coconut oil consumers, the blends prepared for non-coconut oil consumers have more amount of phytosterols content. The reason is that more percentage of other vegetable oils and less percentage of coconut oil was used for blending. For non-coconut oil consumers blending had increased the medium chain fatty acids content. The phytosterols and tocopherols content decreased to a smaller extent (compared to blends for coconut oil consumers) in the starting vegetable oils, after blending with refined coconut oil.

The phytosterols content of blends prepared for non-coconut oil consumers for 20g of fat in mg% were refined coconut–safflower 82.0; refined coconut- sunflower 68.0; refined coconut-rice bran 62.0; refined coconut-soyabean 85.0; refined coconut-groundnut 38.0; refined coconut-sesame 62.4; refined coconut-mustard 52.0. Among the blends the coconut-soyabean blend provides highest quantity of phytosterols.

The increase in tocopherols and phytosterols content was due to blending of other vegetable oil with coconut oil and refined coconut oil. The blends prepared for non-coconut oil consumers will have two health benefits. First one is the increase in tocopherols and phytosterols content and the second one is the health benefits of poly unsaturated fatty acids. This is due to blending of other vegetable oil with coconut oil. Similarly the blends prepared for non-coconut oil consumers will have the health benefits of medium chain fatty acids. This is due to incorporation of refined coconut oil with other vegetable oils.

Conclusion

Coconut oil has low amounts of phytosterols and tocopherols in it. The blends prepared in this study for coconut oil consumers contain more amounts of tocopherols and phytosterols in it. This is achieved due to the incorporation of other vegetable oils through blending. The blends prepared for coconut oil consumers are expected to provide the health benefits of tocopherols and phytosterols to coconut oil consumers. Naturally, vegetable oils like soyabean, rice bran, sunflower, safflower, palm, mustard, sesame and groundnut have fewer amounts of medium chain fatty acids. The blends prepared for non-coconut oil consumers also contain high amounts of tocopherols and phytosterols in it along with medium chain fatty acids form coconut oil incorporation. Thus, the blends prepared may provide the health benefits of medium chain fatty acids along with tocopherols and phytosterols to non-coconut oil consumers.

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EAT SMART - Coconut's healthy side

Awareness is the first step to better health. Eating a healthy diet has always been wise. But can oils in foods be helpful? The answer is yes; food cooked in coconut oil stays fresh longer and promotes nutrient absorption. Coconut as a whole plays a very important part in our lives. Coconut oil has been used by many nations in the Pacific. They cook with it, moisturise their skin and hair with it, eat the flesh practically on a daily basis. Coconut oil is the product that should be on your shelf forever.

Ironically many people are apprehensive about using coconut oil. They worry that it is a saturated fat, which is bad for health. However, remember there are good saturated fats as well. Fats are classified into three categories: short-, medium- or long-chain based on the number of carbon molecules they contain. On an average, around two-thirds of the saturated fat in coconut oil consists of medium-chain fatty acids. Scientists say that whenever we consume long-chain fatty acids, bile salts in the small intestine emulsify them before they can be absorbed into our body. Short - and medium-chain fatty acids in coconut oil and coconut milk pass directly through the portal vein to the liver and eventually they are instantaneously obtainable by the body. Most of the saturated fat in coconut oil is easily digestible and renewable into quick energy.

Lowers cholerstrol

Coconut oil is safe to use, as it does not turn to fat in your body. It is helpful in burning fat and regaining energy. It does not increase the cholesterol level and actually helps lower it. Coconut is highly nutritious and rich in fibre, vitamins, and minerals. It is classified as a "functional food" because it provides many health benefits beyond its nutritional content. Coconut oil is of immense importance whether it is taken as a supplement, used as cooking oil, or applied directly to the skin.It has proven beneficial in strengthening the immune system, improving digestion and preventing premature aging of the skin. Coconut oil in food adds rich aroma to the cuisine.

Dr. RUPALI DUTTA, New Delhi-based Dietician

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