Determination of the Efficacy of Cold-Pressed Virgin Coconut Oil in Increasing High Density Lipoprotein and in Reducing Weight, Abdominal Girth Ratio, Low Density Lipoprotein, Total Cholesterol and Triglycerides in Obese and Overweight Individuals (A Pilot Study)

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Abstract

Medium chain triglycerides (MCT) have a slightly lower calorie content compared to other fatty acids and they are more rapidly absorbed and burned as energy, resembling carbohydrate more than fat. Virgin coconut oil is composed predominantly of MCT. The efficacy of administering cold-pressed virgin coconut oil in increasing the high density lipoprotein (HDL) and in reducing the weight, abdominal girth ratio, low density lipoprotein (LDL), total cholesterol and triglycerides in obese and overweight individuals was investigated. Eleven obese and overweight individuals were given 45 ml (3 tablespoons) of cold-pressed virgin coconut oil a day for 6 weeks. The subjects' weight, height, waist circumference and hip circumference were measured at the beginning and at the end of the study. Lipid profile was taken twice, before and after administration of virgin coconut oil. Medical and psychiatric history of the subjects was also taken. Subjects were also provided with a diary so they could record their intake of the test substance. Measurements showed minor changes in the subjects' weight, abdominal girth ratio, total cholesterol, triglycerides, LDL and HDL after the administration of virgin coconut oil. This data led to the conclusion that although there was a trend towards reduction in the subjects' triglycerides and total cholesterol, the differences were not statistically significant. There was also a trend towards increase in HDL, LDL, weight and abdominal girth ratio but was also not statistically significant. Therefore, the null hypothesis, which stated that virgin coconut oil is not effective in increasing the HDL and in reducing the weight, abdominal girth ratio, LDL, total cholesterol and triglycerides in obese and overweight individuals cannot be rejected.

I. Introduction

Virgin Coconut Oil (VCO) is now getting global reputation as the healthiest and most versatile oil in the world. The Philippines is one of the best sources of virgin coconut oil and its popularity in the country is already legendary (1). Coconut oil is unique because it is composed predominantly of Medium-Chain Triglycerides (MCT). The MCT does not elevate LDL, which is known as the bad cholesterol, in our body compared to other polyunsaturated vegetable oils such as canola and sunflower oil, which is widely produced in the West (1). It should also be remembered that the research done on coconut oil that yielded negative findings in the past was the result of one study conducted four decades ago, using hydrogenated oil, which has been altered from its original form, and not virgin oil (2). Modern research shows that MCT help increase metabolism (3).

The advantage of virgin coconut oil in weight management is due primarily to its effect on metabolism. Medium-chain fatty acids found in coconut oil speed up the body's metabolism by burning more calories and promoting weight loss. (4). Recent studies published in journals of nutrition demonstrated that diets containing MCT result in an increase in energy, a rise in metabolism, increase burning of calories, decrease in food consumption and lower body fat mass (3).

Today, people are becoming more aware and conscious of their health. Overweight and obesity has been a problem for many people of all ages. Overweight and obesity are a result of energy imbalance over a long period of time. There are also those who have slow metabolism. Increasing metabolic rate, therefore, provides an increased degree of protection from both degenerative and infectious illnesses (5).

There are a lot of regimens and programs available at present to help reduce weight and lessen the risk of developing such diseases. However, not all can comply with the prescribed programs and not all can give the desired result. In some regimens, although effective in reducing the weight, leave the person weakened because of starvation and lack of nutritional

requirements. Overweight people who are dieting have even slower metabolism. (6). Dieting to become slim by eating less fat or skipping meals simply has not worked (7) because by skipping meals the individual tends to eat more on the next meal. VCO was proposed to help reduce weight without leaving the person friable. It is because the fat in coconut oil is used by the body to produce energy rather than stored as a body fat.

Indeed, virgin coconut oil is a very interesting topic to study because of the many health benefits and many uses that it provides. The coconuts are de-husked, grated and the fresh coconut meat is cold-pressed and filtered. The process retains the enzymes, lauric acid and all the other immune system building nutrients (8). More research still has to be done regarding the benefits of VCO, which can be very promising. This research can also help in increasing the sales production of coconut oil in other countries since coconut is one of the most important industries in the Philippines.

In the light of the foregoing statements, the researchers aimed to determine the efficacy of administering 45 mL (3 tablespoons) of cold-pressed virgin coconut oil a day for 6 weeks in increasing the high density lipoprotein and in reducing the weight, abdominal girth ratio, low density lipoprotein, total cholesterol and triglycerides in obese and overweight individuals.

II. METHODS

Study Design

This is an experimental study in which subjects were instructed to take three 15-mL of cold pressed VCO (before each meal) per day for 6 weeks. They were given diaries to ensure compliance. They were also advised to maintain their usual diet and their usual activities. Their weight, abdominal girth ratio, total cholesterol, LDL, HDL and triglycerides in obese and overweight individuals were measured before and after administering virgin coconut oil.

Study Population

Twelve overweight and obese individuals were recruited to participate in the study. Since this was a pilot study, only a small number of subjects were recruited for easy monitoring and budget restrictions.

such as diabetes, thyroid problems and hypertension and 2) intake of medications that can alter weight and metabolism, such as diet pills, appetite suppressant, etc.

Methods

The subjects' weight, height, waist circumference and hip circumference were measured at the beginning and at the end of the study. Qualified subjects were provided with virgin coconut oil and 50-mL cups. The subjects were then instructed to take three 15-mL of cold pressed virgin coconut oil (before each meal) per day for 6 weeks. To ensure compliance, subjects were also provided with a diary so they could record their intake of the test substance.

The blood pressure of each subject was measured by one of the researchers. Their lipid profiles were taken at the Asiatic Laboratory. These were taken twice, before and after administration of virgin coconut oil. The medical and psychiatric history of the subjects was also taken in the beginning of the study. This was one way of checking if there were any illnesses or diseases that the subjects might have that the researchers should be aware of. Any condition they have might be exacerbated or triggered by their intake of VCO so these subjects should not be considered anymore as part of the study. Psychiatric history may be necessary in terms of compliance since subjects with psychiatric problems might not take their VCO on schedule or may not even take it at all. Checking the subjects' histories was necessary to avoid liabilities in the study and avoid complications in the subjects.

To eliminate inter-observer errors, only one of the researchers was assigned to measure the following parameters. Measurements were determined according to the following instructions:

Measurement Procedures

A.1 Weight Measurement

The scale used was the stadiometer at the UERMMMC Hospital Blood Bank. It was placed on a hard-floor surface. Heavy garments and footwear were removed. The participant was then instructed to stand in the center of the platform, weight distributed evenly to both feet. The weights were moved until the beam balanced.

back to the height ruler. The back of the head, back, buttocks, calves and heels should be touching the upright ruler with feet together. The top of the ear canal should be level with the inferior margin of the cheekbone. The participant was asked to look straight. The headpiece of the stadiometer or the sliding part of the measuring rod was lowered so that the hair was pressed flat. Height was recorded to the resolution of the height rule (i.e. nearest millimeter/half a centimeter).

A.3 Waist Circumference

Waist circumference was measured at a level midway between the lower rib margin and the iliac crest with the tape all around the body in a horizontal position. Tight clothing, including belts, was loosened and pockets were emptied. Participants were asked to stand with their feet close together and with their weight equally distributed to each leg. They were asked to breathe normally and the reading of the measurement was taken at the end of gentle exhaling. The measuring tape was held firmly, ensuring its horizontal position. The tape was loose enough to allow the observer to place one finger between the tape and the subject's body. Measurements were recorded to the resolution of the tape (nearest millimeter/half centimeters).

A.4 Hip Circumference

Hip circumference was measured as the maximal circumference over the buttocks. Tight clothing, including belts, was loosened and pockets were emptied. Participants were asked to stand with their feet close together and with their weight equally distributed to each leg. They were asked to breathe normally and the reading of the measurement was taken at the end of gentle exhaling. The measuring tape was held firmly, ensuring its horizontal position. The tape was loose enough to allow the observer to place one finger between the tape and the subject's body. Measurements were recorded to the resolution of the tape (nearest millimeter/ half centimeters).

A. 5 Blood Pressure

Blood pressure was measured four times for each visit. The first blood pressure reading was discarded. The average of 3 subsequent measurements was recorded. Using mercury sphygmomanometer, the blood pressure was taken after resting for 5 minutes.

A. 6 Lipid Profile

Lipid Profile was taken twice, at the beginning and at the end of the study, at the Asiatic Laboratory.

Definition of terms and variables

Overweight – an individual who has a Body Mass Index (BMI) between 23 and 24.9

Obese – an individual who has a BMI of 25 or higher

$$BMI = \frac{\text{Weight in kilograms}}{\text{Height in square meters}}$$

Abdominal Girth Ratio - waist to hip ratio according to the Centers for Disease Control and Prevention (CDC):

For men, a ratio of .90 or less is considered safe.
For women, a ratio of .80 or less is considered safe.
For both men and women, a WHR of 1.0 or higher is considered "at risk" for heart disease and other problems associated with being overweight

Independent variable – cold-pressed virgin coconut oil administration : 45 mL (3 tablespoons) a day for 6 weeks; 15 mL taken before meals

Dependent variable – increase in HDL and reduction in weight, abdominal girth ratio (waist to hip circumference ratio), LDL, total cholesterol and triglycerides

Protocol Ammendments:

Due to some adverse effects experienced by the subjects such as diarrhea, flatulence, bloatedness and excessive sweating, the protocol was adjusted. If a subject experienced diarrhea for 2 days with more than 3 episodes per day, he/she was advised to alter the schedule of taking VCO since most of them complained of having episodes at their workplace or in school. Despite altering the schedule, their intake should still total to 45 ml per day. If diarrhea still persisted, they were advised to take Loperamide with a maximum of 2 doses in the morning. In this way, they were not bothered by having episodes at work or in school. If the above mentioned changes did not work to control diarrhea, they were advised to reduce their daily intake of VCO to 30 ml, to be taken twice a day before meals.

Data Analysis

Paired t test was employed in the analysis of data. Two sets of measurements were collected from each individual on two separate occasions, one at the beginning and one at the end of the study. The differences between the two observations were computed. This then determined if the differences between their measurements before and after taking the virgin coconut oil were significant.

III. RESULTS

After the six-week experiment proper, results showed minor changes in the subjects' weight, abdominal

girth ratio, total cholesterol, HDL, LDL and triglycerides after the administration of virgin coconut oil. There were no significant changes in the daily activities of the subjects, during and after the administration of virgin coconut oil. 50% of the subjects claimed that they missed at least one dosage of VCO during the course of the study. Some of the subjects altered their schedule of taking VCO. For instance, some took 20 ml in the morning and 25 ml in the evening. Although the schedule was different, the total amount taken each day was still 45 mL. Based on a previous study, a subject is considered compliant if he or she has completed 85% of the required dose. In this research, all of the subjects had met the criteria.

	Pre-intervention (n=11)	Post-intervention (n=11)	Net change	p
Weight in kg	76.21	76.55	+ 3.71	NS
Abdominal girth ratio	0.99	1.00	+ 0.16	NS

Table1. The mean weight and the mean abdominal girth ratio before and after administration of VCO

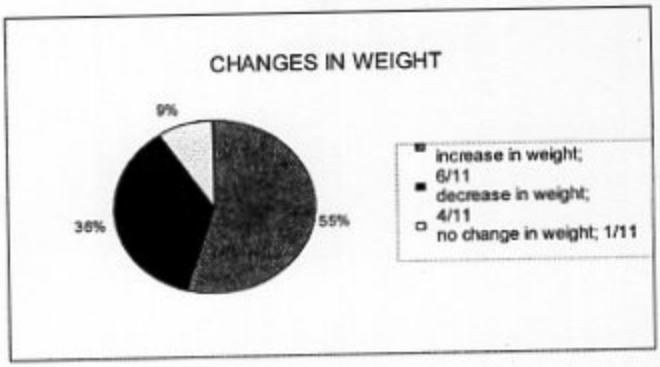


Figure1. Distribution of subjects according to weight changes after the administration of virgin coconut oil.

Figure 1 shows the differences in weight after VCO administration. Among the subjects, 10 out of 11 were obese. 6 out of 11 gained weight, 4 had weight loss and 1 subject had no change at all. The weight gain or the weight loss was approximately 2 kilograms for each subject. From table 1, it can be deduced that although there is a trend towards weight gain, it was not statistically significant (t = 0.34). Some subjects claimed to the usual. Some subjects, on the other hand, reported increased appetite.

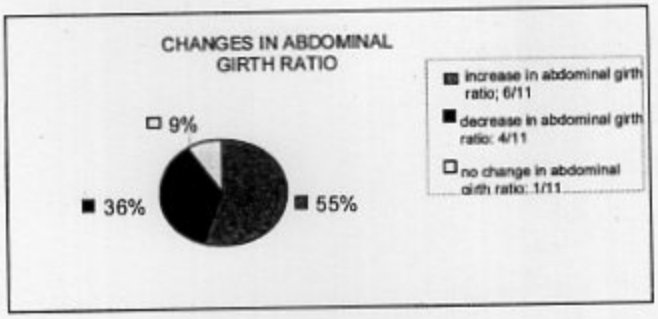
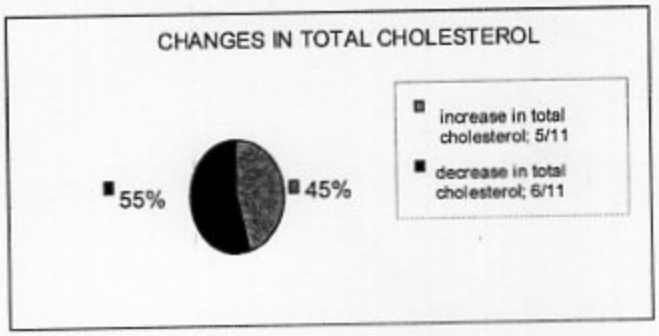


Figure 2. Distribution of subjects according to changes in abdominal girth ratio after the administration of virgin coconut oil.

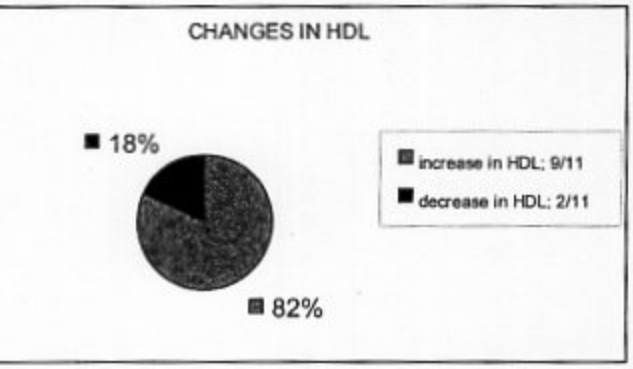
Figure 2 presents the changes in the abdominal girth ratio after VCO administration. 6 out of 11 subjects had an increase of less than a centimeter in their abdominal girth ratio, 4 subjects lost less than a centimeter and 1 subject had no change at all. The 4 subjects who reported loss of appetite during the first few weeks of VCO intake were the ones who had a decrease in abdominal girth ratio. Table 1 showed that there was no statistically significant change (t = 1.39) in the abdominal girth ratio after VCO administration.

	Pre-intervention (n=11)	Post-intervention (n=11)	Net change	p
Total cholesterol	4.48	4.53	+ 0.47	NS
HDL	1.29	1.30	+ 0.16	NS
LDL	2.66	2.73	+ 0.84	NS
Triglycerides	1.25	1.13	- 1.25	NS

Table2. The mean total cholesterol, HDL, LDL and triglycerides before and afteradministration of VCO

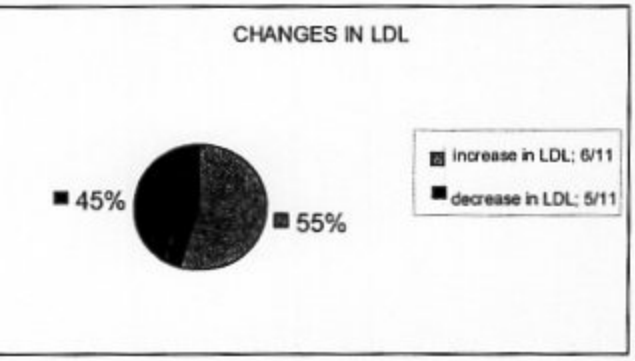


heir total cholesterol levels, which was among the main bjectives in this research. Although the differences nay be less than 1 mmol/L, this may indicate that even n the short span of time that the subjects took VCO, heir cholesterol somehow decreased. There is a trend owards the decrease in total cholesterol levels, however, fter analysis using t-test, it was not found to be tatistically significant (t=0.310).



igure 4. Distribution of subjects according to hanges in HDL-C levels after the administration f virgin coconut oil.

This figure shows the differences in the HDL evels of the subjects after VCO administration. There s a slight increase in 9 out of 11 subjects of approximately ess than 0.1 mmol/L and 2 subjects had a decrease of .11 and 0.16. The data indicates that VCO can increase good" cholesterol levels and may be of benefit to health. Iowever, the t-test value for HDL is 0.824 indicating nat the increase in HDL is not statistically significant.



igure 5. Distribution of subjects according to hanges in LDL-C levels after the administration f virgin coconut oil.

which denoted that there is no significant difference between these values.

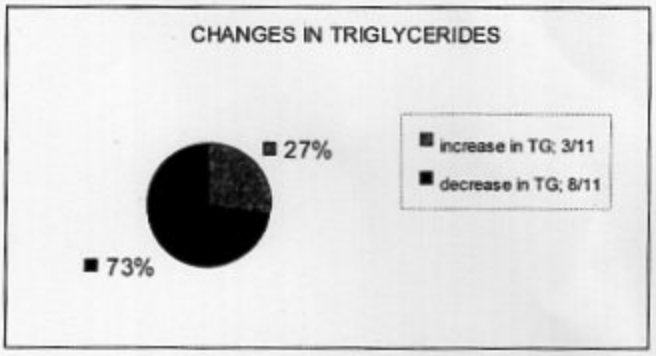


Figure 6. Distribution of subjects according to changes in Triglyceride levels after the administration of virgin coconut oil.

Among the subjects, 8 out of 11 showed a decrease in triglyceride levels. There is a trend towards reduction in the triglycerides of the patients but the computed value for the t-test showed that the decrease in triglyceride levels is not statistically significant (t=-1.092).

In summary, there were no statistically significant changes in the parameters measured over the past six weeks. The change in weight was not considered significant since other studies defined significant weight loss as 5% loss of weight within one month. Each subject had different experiences during the course of the study. They were instructed not to make any lifestyle changes to determine the effect of VCO alone on the measured parameters. 4 out of the 11 subjects had diarrhea with 2-3 episodes per day. One of them took 2 tablets of Loperamide due to persistence of diarrhea which occurred 6-7 times a day. The medication relieved the symptom and no drug was taken after that. Flatulence, abdominal bloating and excessive sweating were also among the other symptoms the subjects experienced during the course of the study. All these symptoms resolved spontaneously.

Prior to the study, 10 out of the 11 subjects were obese based on the values specified by the Asia Pacific Guidelines wherein obesity means having a body mass index of more than 25 and overweight means a BMI between 23 – 24.9. After the study, only 9 out of the 11 subjects were considered obese. This result was not significant enough to conclude that VCO had an effect in lowering BMI values.

V. Discussion

In a study conducted at the Coconut Research enter in the Philippines, it showed that VCO helps lower holesterol levels through stimulating metabolism thus romoting weight loss. (1) In this study, however, the esults were not that significant since in comparing the MI values of the subjects before and after the dministration of VCO, there were only very slightly ecreases over the past 6 weeks of VCO intake.

The abdominal girth ratio is the waist to hip ratio WHR) and it usually determines if the body type of the person is apple or pear-shaped. Those with apple – shaped bodies have fats stored around the middle of the trunk and these are the people who are at high risk for heart diseases and diabetes compared with those with pear – shaped, whose fats are concentrated around the hips. According to one of the studies at the Center for Disease Control and Prevention, the abdominal girth ratio that is considered safe for men is 0.90 or less and that for women is 0.80 or less. For both men and women, a WHR of 1.0 or higher is considered a risk factor for heart disease and other problems associated with overweight. In a study done by the FNRI-DOH-HDL STUDY GROUP in 1998, among the regions of the Philippines, National Capital Region recorded the highest prevalence rate of android obesity and high degree of risk for being overweight and obese. In addition, Filipino obese adults manifest the "apple-shaped" type of obesity.

In a study done by Nevin and Rajamohan on the beneficial effects of virgin coconut oil on lipid parameters and in vitro LDL oxidation, VCO reduced total cholesterol, triglycerides, phospholipids, LDL and VLDL cholesterol levels and increased HDL cholesterol in serum and tissues. (13) The polyphenol component of VCO was found to be capable of preventing in vitro LDL oxidation with reduced carbonyl formation. In other studies, researchers are more interested in the balance of LDL and HDL. There are certain foods that lower total cholesterol by lowering LDL cholesterol while at the same time raising HDL levels. VCO increases HDL cholesterol while lowering LDL so even if total cholesterol may increase, the ratio between LDL and HDL is still favorable. (14)

In other studies concerning weight loss, lifestyle modification was needed to obtain satisfactory results. Participants in these studies made adjustments to their current lifestyles such as lowering alcohol consumption, cessation of smoking, exercise and changes in their diet. In this study, however, the subjects were not advised to make changes. They were instructed to continue what they usually do everyday to ensure that any changes in the measured parameters would be due solely to the use of VCO.

The efficacy of VCO administration was not fully observed in the study in terms of the obtained results. Although there were some subjects that showed some reductions in their weight, abdominal girth and lipid profiles after study, the differences were not significant enough. Therefore, the null hypothesis in this study which states that VCO is not efficacious in reducing weight, abdominal girth and lipid profiles cannot be rejected.

Limitations

The limitations of the study included small sample size. The small sample size also contributed to the narrow coverage of age which only limited our study to cover a portion of what was truly intended for our study. Another factor was the duration of the study. 6 weeks may not have been enough to get the significant results. Lastly, the differences in metabolic rates in each individual vary.

Recommendations

Larger sample size should be taken into account to get more accurate results. With greater sample size, the VCO's effect in different age groups could be studied. The duration of the research should also be longer to see the true effects of VCO in a subject's body. More laboratory examinations (complete blood count, fasting blood sugar) and a thorough physical examination should also be done for us to better understand the effects of virgin coconut oil. Closer monitoring is highly recommended.

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