The Effect of Green Coffee Bean Extract in Decreasing Oxidative Stress in Overweight and Obese Patients

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Abstract

The green coffee bean extract supplementary product from *Coffea Arabica* has recently been receiving much attention in the west. This is because it contains substantial amounts of a crucial substance, "chlorogenic acid". This is an antioxidant, and can be used as a dietary supplement for weight loss and reduction of body mass index. If proven to be effective, then use of the extract by overweight and obese patients could reduce chronic oxidative stress and help to prevent various degenerative diseases.

Objective

To study the effects of consuming the green coffee bean extract supplementary and whether it could reduce the oxidative stress in overweight and obese patients and to study the effects of consuming the green coffee bean extract supplementary and whether it could reduce the body mass index in overweight and obese patients.

Method

A prospective, randomized, double blind, experimental clinical trial in forty male and female subjects, aged between 25 and 45, each with a body mass index value of at least 23.00 kg/m^2.They were randomly separated into two groups of twenty, to consume either the green coffee bean extract supplementary or a placebo medication. The dosage level was 200 mg before breakfast and dinner 30 minute, (400 mg each day) for a duration of eight weeks. Measurements were taken of BMI (Bone Mass Index), FORT (Free Oxygen Radical Test), FORD (Free Oxygen Radical Defense test), SBP (Systolic Blood Pressure), DBP (Diastolic Blood Pressure) and PR (Pulse Rate) at both the beginning and the end of the test period.

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Results

It appeared that: 1.The average value of BMI decreased for both groups, but with no statistical significance. 2. The average value of FORT in the green coffee bean extract subjects decreased from 3.47 ± 0.77 to 3.31 ± 0.77,which is of statistical significance ($P = 0.013$, $P < 0.05$). In the placebo group the value increase ($P = 0.435$) was of no statistical significance. 3. The FORD value increased for both groups, but with no statistical significance. 4. The average value of SBP decreased in the green coffee bean extract group, but increased within the placebo group with no statistical significance. 5. The average of value DBP increased for both groups, but with no statistical significance. 6. The average value of PR decreased in the green coffee bean extract group, but increased in the placebo group, although with no statistical significance. The mean differences between the two groups in BMI, FORD, SBP, DBP and PR showed no statistical significance, however the FORT indicator showed a difference from the average value. For the green coffee bean extract group, it was 0.16 ± 0.26, and for the placebo group it was 0.08 ± 0.42. There was a statistical significance here ($P = 0.041$, $P<0.05$).

Conclusion

The green coffee bean extract was effective in reducing oxidative stress in overweight and obese patients, with a statistical significance in comparison to the placebo medication. From the evaluation of the average value of FORT that decreased, the FORD value did not increase, but decreased instead. This was due to overweight and obese patients being in a state of compensated oxidation. As for the capability in reducing the BMI in overweight and obese patients, there was no statistical significant difference between the two groups. The side effects from the caffeine within the green coffee extract were within safety limits. There was no significant change of blood pressure and pulse rate in any of the subjects.
Key words: Green coffee bean extract/ Oxidative stress/ Free radicals/ Antioxidants/ overweight/ obesity

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Introduction

Being overweight and obese is a body condition where excess fat is stored as adipose tissue. The adipose tissue is stored as triglyceride, which also produces many proinflammatory mediators (Alba Fernández-Sánchez et al., 2011). This creates an imbalance between the free radicals and antioxidants in the body, called oxidative stress. This results in the destruction of protein, fat and genetics that occur in the body cells; if oxidative stress became chronic, it may lead to many degenerative diseases, such as diabetes, high blood pressure, heart disease, coronary disease, autoimmune disease, nerve system- related disease and cancer (Morihiro Matsuda et al.,2013)

The solution measures for being overweight and obese are weight control, which requires modifications to lifestyle and eating behavior together with exercise. If this method fails, then it may be necessary to also take medication. Nowadays, there are many types of medicine, some have the effect of suppressing hunger or appetite, which has many side-effects to the mental state. The price range for these is quite high and the majority are imported. Furthermore, there has been the development of dietary supplements that encourage weight loss by reducing the absorption of nutrients; white bean extract, fiber and others (Vinson JA et al. (2009). However, the results of weight loss were not particularly encouraging. Recently the discovery of new dietary supplement has become of interest in western countries, especially the green coffee bean extract, from *Coffea Arabica.* This was found to contain large amounts of the crucial substance, "chlorogenic acid", which is an antioxidant (Shradha Bisht et al., 2010). This can be used as a supplement for weight loss and reduction of BMI (Igho Onakpoya et al., 2011) (Joe A Vinwon et al., 2012).

There are many supplementary products on the market these days. Most people aim for weight loss by suppression of hunger and appetite only. They do not consider the reduction of oxidative stress as well. Therefore, green coffee bean extract can be one of the supplements, which if used among overweight patients to reduce weight could also work as an antioxidant, reducing oxidative stress (Julija Ogrin Papic et al (2012). It could also give overweight and obese patients a better quality of life and inhibit chronic oxidative stress and degenerative diseases.

Objectives of the research

1. To study the effects of consuming green coffee bean extract supplement and whether it could reduce oxidative stress in overweight and obese patients.
2. To study the effects of green coffee bean extract supplement and whether it could reduce the BMI in overweight and obese patients.

Method of study

A prospective, randomized, double blind, experimental clinical trial in forty male and female subjects, aged 25 to 45 were selected, each with a BMI of at least 23 kg/m^2. None had any conditions affecting oxidative stress, such as diabetes, high blood pressure, coronary artery disease, strokes, liver disease, kidney disease, Alzheimer's disease, Parkinson's disease, autoimmune disease, cancers or chronic infections. They were no alcohol consumption, nonsmokers, were not pregnant or breastfeeding, did not have gastritis, and none had taken medicines or supplements affecting weight loss, or supplements with antioxidant properties for the last three months.

The subjects were separated into two groups of twenty individuals each. One group was given green coffee bean extract (GCE) and the other a placebo group (PBC) made from Maltodextrin starch. Dosage was a 200 mg capsule taken twice daily before breakfast and dinner 30 minute for eight weeks. The effects of GCE were compared against PBC, with measurement of BMI (Bone Mass Index), FORT (Free Oxygen Radical Test) (Mahdi O. Garelnabi et al., 2008), FORD (Free Oxygen Radical Defense test) (Maria G. Pavlatou et al. (2009), SBP (Systolic Blood Pressure), DBP (Diastolic Blood Pressure) and PR (Pulse Rate) compared before and after the study.

Statistical analysis of the volunteers' general information was done using descriptive statistics; frequency, percentage, and standard deviation. The comparison of BMI, FORT, FORD, SBP, DBP and PR, both before and after the study for each group, used the Paired T-Test for the comparison of averages' differences setting reliability at 95% ($\alpha = 0.05$).

Results

1. General characteristics of the sample group

There were forty subjects in this research project, 12 males and 28 females. 19 were between 25 and 29 years old, 12 between 30 and 34, 8 between 35 and 39 and 2 between 40 and 44. Their levels of obesity, or BMI values ranged from 5 at obese 1 (23 to 24.99), 13 at obese 2 (25 to 29.99) and 22 with a BMI in excess of 30 kg/m^2.

2. Results of the study

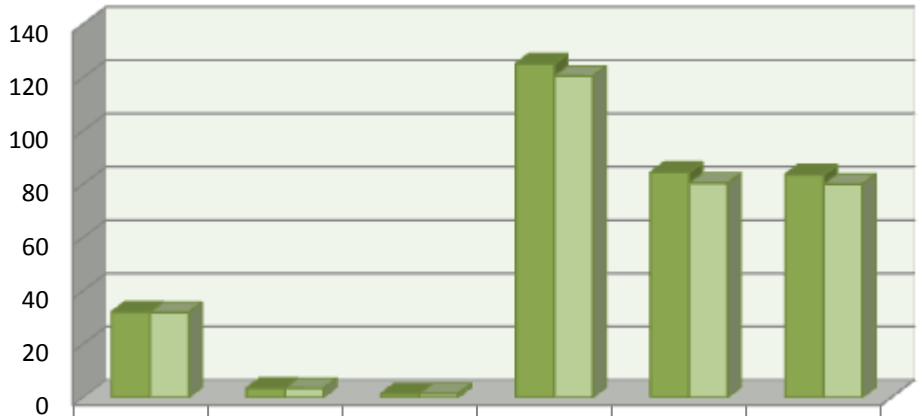
Before the study of both GCE and PCB groups, measurements of the indicators BMI, FORT, FORD, SBP, DBP and PR were taken as a base level. It appeared that both groups had normal distribution and individual indicators showed no significant statistical differences, with reliability of 95% as P = 0.931, 0.839, 0.962, 0.217, 0.166 and 0.286 respectively (see Figure 1).

After the duration of the eight week, the average value of BMI (Mean ± SD) in the GCE group had changed from 32.12 ± 4.93 to 32.10 ± 4.84. For the PCB group the value had changed from 31.95 ± 7.50 to 31.84 ± 7.39. The average value of both group decreased, although with no statistical significance. The P value was 0.986 and 0.443 respectively (see Figure 2). The FORT average value (Mean ± SD) in the GCE group decreased from 3.47 ± 0.77 to 3.31 ± 0.77 with statistical significances (P = 0.013, P < 0.05). The PCB group value increased from 3.42 ± 0.63 to 3.50 ± 0.60, but with no statistical significance, P = 0.435 (see Figure 3). The average value of FORD (Mean ± SD) in the GCE groups decreased from 1.46 ± 0.45 to 1.41 ± 0.17. For the PCB group, the value decreased from 1.45 ± 0.41 to 1.44 ± 0.26. Average values for both groups decreased, but with no statistical significance and P value of 0.630 and 0.896 respectively (see Figure 4).

The evaluation of the side-effects between the two groups was measured. The average of the SBP (Mean ± SD) in the GCE group decreased slightly from 125.35 ± 12.93 to 125.10 ± 14.17. With the PCB group it increased from 120.55±10.52 to 122.60 ± 9.65. There was no statistical significance, with P value at 0.921 and 0.267 respectively (see Figure 5). The average values of DBP (Mean ± SD) in the GCE group increased from 84.50 ± 9.87 to 85.30 ± 8.92. The PCB group increased from 80.35 ± 8.68 to 81.75 ± 7.71. There was no statistical significance,

with P value at 0.665 and 0.515 respectively (see Figure 6). The average value of PR (Mean ± SD) in the GCE group decreased from 83.45 ± 10.37 to 82.45 ± 10.49. The PCB group increased from 80.00 ± 10.93 to 82.45 ± 8.32. Again, there was no statistical significance with P value of 0.619 and 0.254 respectively (see Figure 7). The mean differences of the two groups within the indicators BMI, FORD, SBP, DBP and PR showed no statistical significance, but the FORT indicator showed a mean difference in the GCE group of 0.16 ± 0.26, and in the PCB group as 0.08 ± 0.42; this held a statistical significance ($P = 0.041$, $P < 0.05$) (see Figure 8).

Figure 1: The various indicators of the GCE & PCB groups before the study



	BMI(kg/m²)	FORT(μmol/IH2O2)	FORD(mmol/l Trolox)	SBP(mmHg)	DBP(mmHg)	PR(/min)
GCE(n=20)	32.12	3.47	1.46	125.2	84.5	83.65
PCB(n=20)	31.95	3.42	1.45	120.55	80.35	80

Figure 2: The average values of BMI before and after the study

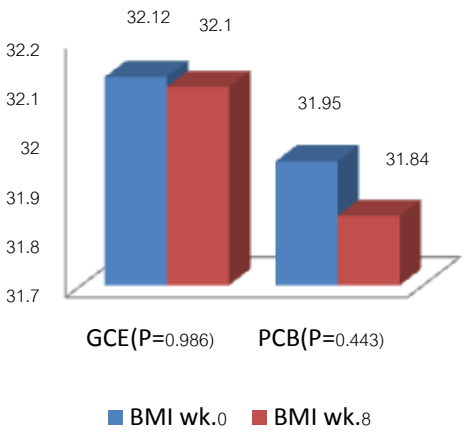


Figure 3: The average values of FORT before and after the study

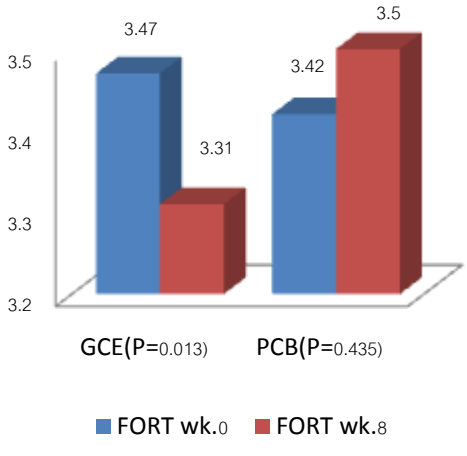


Figure 4: The average values of FORD before and after study

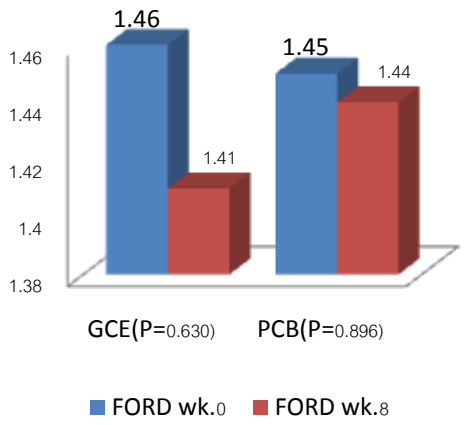


Figure 5: The average value of SBP before and after study

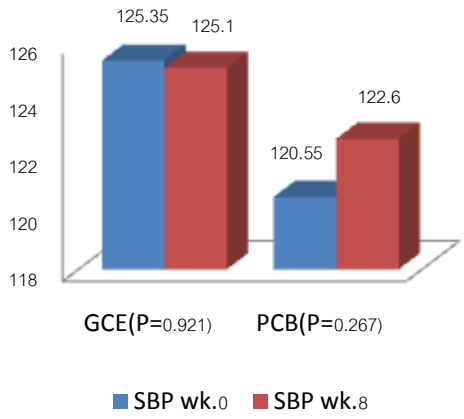


Figure 6: The average values of DBP before and after then study

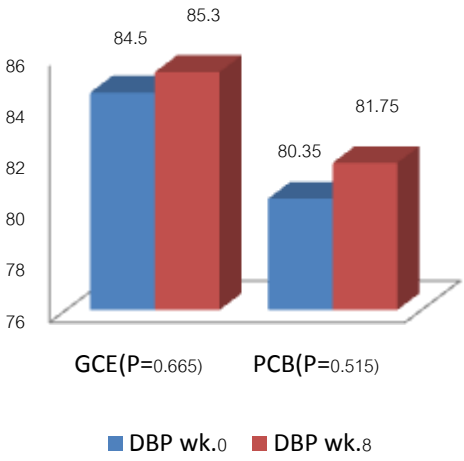


Figure 7: The average values of PR before and after the study

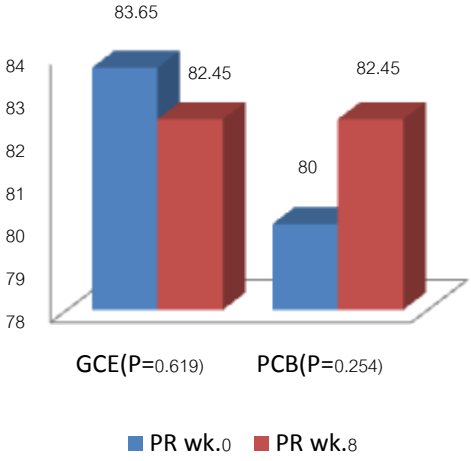
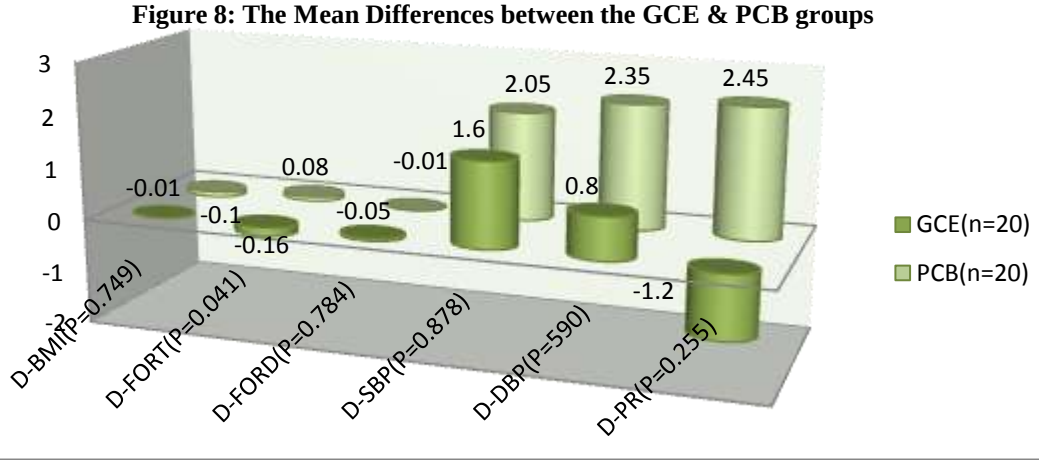


Figure 8: The Mean Differences between the GCE & PCB groups



Discussion

From the study of Systematic Review and Meta-Analysis (Igho Onakpoya et al., 2011), there was a statistically significant difference of average values in the bodyweight in the GCE group compared to PCB (Mean difference: - 2.47 Kg; 95%CI: -4.23, -0.72). However, it seems that the research quality was inadequate. A later study (Joe A Vinwon et al., 2012) experimented on sixteen volunteers with BMI of 25 to 30 kg/m^2. They were given GCE for twelve weeks at

700 to 1050 mg per day in comparison to PCB. The average BMI decreased (-2.92 ± 0.85 kg/m^2) with a statistical significance. These results are inconsistent with the current research. Results here showed that the average value of the GCE group (-0.01± 1.01 kg/m^2) was in contrast with the PCB group (-0.10 ± 0.62 kg/m^2) with P = 0.749 with no statistical significance. The average values of SBP, DBP and PR were all consistent with the previous study and there were no significantly different values. Therefore, the caffeine in the green coffee bean extract did not have any impact on blood pressure and pulse rate. It is therefore safe to consume this supplement.

The ability of GCE to reduce oxidative stress from the evaluation of the FORT and FORD values has never previously been studied. Within the GCE group, the average value of FORT decreased from 3.47 ± 0.77 to 3.31 ± 0.77. This was considered to be of significance. For the PCB group, the average value of FORD did not decrease, but in fact increased. The difference between the FORD average values in the GCE group was -0.16 ± 0.26, and for the PCB group it was 0.08 ± 0.42. The difference was of significance (P=0.041, P<0.05). However, the average value of FORT that decreased in the GCE group was in the range of a high oxidative stress (3.04 - 4.56 mmol/H_2O_2). It was still within the normal range of lower than 2.36 mmol/H_2O_2. Thus, the GCE dose of 400 mg per day, for the duration of eight weeks, was genuinely capable of bringing down the oxidative stress. However, to reduce the FORT value to the normal range may require many factors that need further study, such as to increase the amount of GCE and to lengthen the duration of the trial.

The average value of FORD, which was predicted to increase after GCE provision actually decreased for both groups, and the difference values of the averages of both groups were not of significance. This may be because the overweight and obese patients had high oxidative stress. The antioxidant from the GCE that entered into the body was used to manage the large amount of free radicals, and as such the FORD value was not high enough. This demonstrated that the body was in a condition of compensate oxidative stress, because there was still a large lack of antioxidants, although not sufficient to create oxidation balance. The researcher believes that if the patients could reduce their level of oxidation stress until the FORT value was in a normal range, then this would allow the FORD value to increase.

Conclusion

The green coffee bean extract has been proven to be effective in reducing oxidative stress in overweight and obese patients significantly. As for use in the reduction of BMI, the differences in the decreased average values were not of significance. The research team believed this was because the amount of green coffee bean extract used was too little, coupled with the rather short study duration time, as well as the issue of obesity that involves various factors, such as genetics, diet, and exercise. As for the side-effect of caffeine in green coffee bean extract, there were no significant changes in blood pressure and pulse rate. Thus, it can be concluded that green coffee bean extract is safe to be taken as an antioxidant for reducing oxidative stress. It will allow overweight and obese patients to enjoy a better quality of life and avoid escalation into chronic oxidative stress, which may lead to other degenerative diseases.

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