Green tea: is it a health drink or just a beverage? An observational study in over weight student volunteers

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ABSTRACT

Objectives: To study the effect of consumption of green tea on Weight, Body Mass Index (BMI) reduction & on Waist Hip Ratio (WHR).
Methods: This was a prospective study involving 30 student volunteers in the age group of 20-23 for a period of 3 months. 2nd Year MBBS students who had given informed consent to undergo this study were selected, after obtaining approval from institutional ethical committee. Basic parameters like weight, height, BMI (Body Mass Index), measurements of waist, hip and Waist Hip Ratio (WHR) were taken. Students were selected based on the inclusion criteria of those who were having BMI more than 23. Freshly prepared green tea (Camellia sinesis), 150 ml, with hot water, was consumed by the volunteers at a fixed time every day for a period of 3 months. At the end of each month all the measurements were repeated. At the end of the project, data was analyzed statistically using t test (Paired).
Results: There was a significant reduction in weight, BMI in volunteers taking green tea. Their alertness, while attending classes, also improved.
Conclusion: This study proved that green tea is indeed an elixir that promotes longevity and wellbeing, qualifying it as a health drink.

Keywords: *Camellia sinesis*, BMI (Body Mass Index), Waist Hip Ratio (WHR)

INTRODUCTION

Millions of people the world over drink tea. Extant studies suggest that green tea (*Camellia sinesis*) is beneficial for health.[1] Green tea is manufactured from unfermented leaves in contrast to oolong tea which is made from partially fermented leaves and black tea which is made from fully fermented leaves. The duration of fermentation reduces the polyphenol content and increases the caffeine content in the final product due to which green tea, of the above three varieties of tea, has the highest content of polyphenol: an antioxidant. Polyphenols in green tea, can neutralize free radicals [2] and may reduce or even help prevent some of the damages caused by free radicals [2]. There is a popular opinion that consumption of green tea helps to reduce weight [3,4]. This study proposed to test this notion by giving green tea to overweight volunteers.
Objectives:
To study the effect of consumption of green tea on Weight &BMI reduction

To study the effect of consumption of green tea on Waist Hip Ratio (WHR)

MATERIALS AND METHODS
This was a prospective study involving 30 overweight volunteers (2nd MBBS students).
Study Design: Thirty 2nd MBBS students who had given informed consent to undergo this study were selected after obtaining approval from ethical committee.
Inclusion &exclusion criteria: Students of age group 17-22 with BMI >23 with other normal health parameters were selected. Older students, pregnant &those with BMI<23 were excluded. Baseline parameters, like weight, height, waist and hip circumference were taken.
Time of consuming green tea: Everyday between 1.45pm and 2pm after lunch, freshly prepared 150ml of green tea (**LIPTON HONEY-LEMON BRAND**) with 5gm sugar was taken by the volunteers under the direct supervision of the investigators for a period of 3 months. On holidays students themselves had to take green tea and the

required green tea sachets were issued. There was no other change in their diet pattern. A register was kept for entering the daily intake of green tea. Since it was involving students, the period of study was kept as 3months so that there would not be any disturbances in their academic activities. All the parameters like weight, height, waist and hip circumference were measured at the end of 4weeks, 8weeks and 12weeks. Statistical analysis of the data was done using student 't' (paired) test.

RESULTS
30 student volunteers with BMI>23 participated in the study. The parameters like Height, Weight, waist circumference, hip circumference, BMI were measured and analyzed using paired t- test. p <0.05 was taken as significant.

Table.1: Height of 30 volunteers.

No.	Day0
1	152
2	176
3	166
4	168
5	161
6	174
7	153
8	154
9	161
10	162.5
11	154
12	156
13	171
14	162
15	167
16	167
17	162.5
18	160
19	159
20	162
21	160
22	161
23	159
24	159
25	160
26	159
27	153
28	158
29	149
30	167

Weight: The difference of weight between 0 week to 4,8,12 was analyzed. The *p*-value for 0-4 week was <0.01, 0-8 week was <0.0001& for 0-12 week was <0.001. (Table.2&3, Fig.1).

Table.2: Day 0 weight before starting green tea &week4,8,12 after taking green tea.

Day0	Week 4	Week 8	Week 12
69.1	67.8	66.2	66
80.2	76.7	75.2	78.6
80.1	78.1	78	78.7
84.1	80.9	82.4	82.8
81	81.3	79.8	82.2
85.5	84.5	82.3	84.1
72.2	70.8	70.8	72.1
55.3	54.8	53.8	53.4
72.3	70.7	70	68.8
64	63	61	61.7
52	53.5	52.1	52.2
71.7	71.1	69.2	69.1
74.6	73	72.1	74.2
80	78	76.4	77.8
75.2	71.8	71	73.8
79.4	77.7	78.1	78.1
70.5	70.5	66	66
61.6	61.6	59.5	58.5
63.2	61.5	62.8	59.8
79.2	77.3	78	74.9
68.4	67.4	61.9	61.9
67.6	65.8	64.7	62.3
60.3	59.8	59.7	59.7
62.4	60.7	59.9	58.8
65.5	62.5	61.6	59.3
68.2	65.6	63.5	63.5
55.7	55.7	56.5	56.5
60.5	60.5	55.7	55.7
53	53	48.7	48.7
89	89	81.5	81.5

Table.3: The difference of weight between 0 week to 4,8,12 *P* value is found to be significant <0.05in all cases

Values	0 to4 weeks	0 to8 weeks	0 to12 weeks
Mean	1.24	2.78	2.703333333
S.D.	1.20590501	1.88540675	2.19017923
P	0.0000022	0.00000000331	0.000000101
S.E.	0.220167	0.344226	0.39987

Body mass Index (BMI): The difference of BMI between 0 week to 4,8,12 showed significant *p*-value < 0.05 in all the cases (Table.4, Fig.2) The *p*-value for 0-4 week was <0.001, 0-8 week was <0.00001& 0-12 week was <0.001.

**Table.4: The difference of BMI between 0 week to 4,8,12
P value is found to be significant <0.05in all cases**

Values	0 to4 weeks	0 to8 weeks	0 to12 weeks
Mean	0.533343437	1.12566982	1.113440855
S.D.	0.399757309	0.67750097	0.834199275
P	0.0000000238	0.000000000268	0.0000000236
S.E.	0.072985365	0.12369419	0.152303253

Waist Circumference: In the case of waist circumference the *p*-value for 0-4 week <0.01, 0-8 week was <0.01 & 0-12 week was <0.01(Table.5, Fig.3).

Table.5: The difference of waist circumference between 0 week to 4,8,12 *P* value is found to be significant <0.05in all cases

Values	0 to4 weeks	0 to8 weeks	0 to12 weeks
Mean	2.04	2.316667	2.99
S.D.	4.514314	6.342907	6.379079
p	0.009703	0.009703	0.007836
S.E.	0.824197	1.158051	1.164655

Hip Circumference: In the case of hip circumference the *p*-value for 0-4 week was <0.01. 0-8 week was <0.01 & 0-12 week was <0.01(Table.6, Fig.4).

Table.6: The difference of hip circumference between 0 week to 4,8,12 *P* value is found to be significant <0.05in all cases

Values	0 to4 weeks	0 to8 weeks	0 to12 weeks
Mean	1.883333	2.323333	2.296667
S.D.	2.839631	3.631062	3.594007
p	0.000537	0.000753	0.000762
S.E.	0.518443	0.662938	0.656173

Waist Hip Ratio (WHR) However, when the difference of WHR between 0 week to 4,8,12 and 4 to 8weeks were analyzed, *p*-value was > 0.05 in all cases (Table.7, Fig.5).

Table.7: The difference of waist hip ratio between 0 week to 4,8,12 *P* value is found to be significant >0.05in all cases

Values	0 to4 weeks	0 to8 weeks	0 to12 weeks
Mean	0.004563346	0.044991578	0.021882677
S.D.	0.053608703	0.209418107	0.074731982
p	0.322263823	0.246731504	0.059795864
S.E.	0.009787565	0.03823434	0.013644131

DISCUSSION

Green tea taken daily for a period of 3 months showed significant reduction in weight in overweight students (Table.2 &3, Fig.1) ($p< 0.05$). The result of our study is similar to the study done at Canada which evaluated the ability of green tea preparations to help with weight loss that included 14 RCTs. Those in the green tea group lost an average 0.2 to 3.5 kg more than those in the control group over 12 weeks.[4] A study at Geneva, described oral administration of the green tea extract stimulated thermogenesis and fat oxidation and thus has the potential to influence body weight and body composition via changes in both energy expenditure and substrate utilization. [5] In most studies, the weight loss was not statistically significant. However, in the instant study, when the difference of weight between 0 week to 4,8,12 was

analyzed, there was significant *p*-value for 0-4 week (<0.01), 0-8 week (<0.0001) & for 0-12 week (<0.001). An overview of the epidemiological reports; Does Green Tea Help to Fight against Obesity? done in Saudi Arabia revealed the consumption of green tea or its catechins helps in significant reduction of body mass index (BMI), body weight and body fat by increasing postprandial thermo genesis and fat oxidation.[6] In our study too, the difference of BMI between 0 week to 4,8,12 showed significant *p*- value < 0.05 in all the cases (Table.4, Fig.2) The *p*-value for 0-4 week BMI (<0.001), 0-8 week (<0.00001) & for 0-12 week (<0.001).

In Biosciences University of Mauritius an experimental group consumed 3 cups of green tea daily for 14 weeks followed by a 2-week washout period. The control group followed a water regimen. Green tea suppressed waist-hip ratio of women from a significant increase. [7] However, in our study when the difference of WHR between 0 week to 4,8,12 was analyzed, *p*-value was found to be not significant > 0.05 in all cases (Table.7, Fig.5). This could have been achieved probably if the green tea intake had been continued for a few more months. These studies showed the overall beneficial effects of green tea in obese individuals [8,9] like significant reduction in weight, BMI, waist circumference, hip circumference. However, further research is required to concretely establish the exact magnitude of health benefits and to prescribe the exact quantum of green tea to be consumed to achieve optimum results as well as to elucidate the mechanism of action.[10] Further, to gain better understanding of the interaction of green tea with endogenous systems as well as other exogenous factors, there is a need for evolving better methods which are more specific and sensitive along with more representative models and more accurate predictive bio markers. The encouraging results demonstrated in the instant study offer a ray of hope to obese individuals to bring their BMI to normal level by consumption of green tea over a short period of time.

CONCLUSION
The instant study show statistically significant drop in BMI before and after green tea in overweight volunteers.
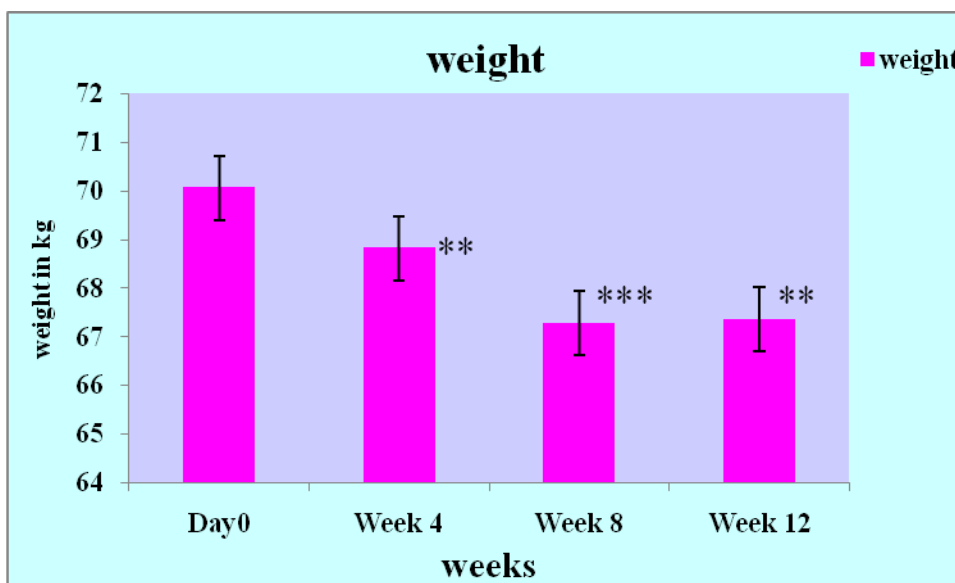

Figure.1 Mean Weight and SEM of 30 volunteers before and after intake of green tea.
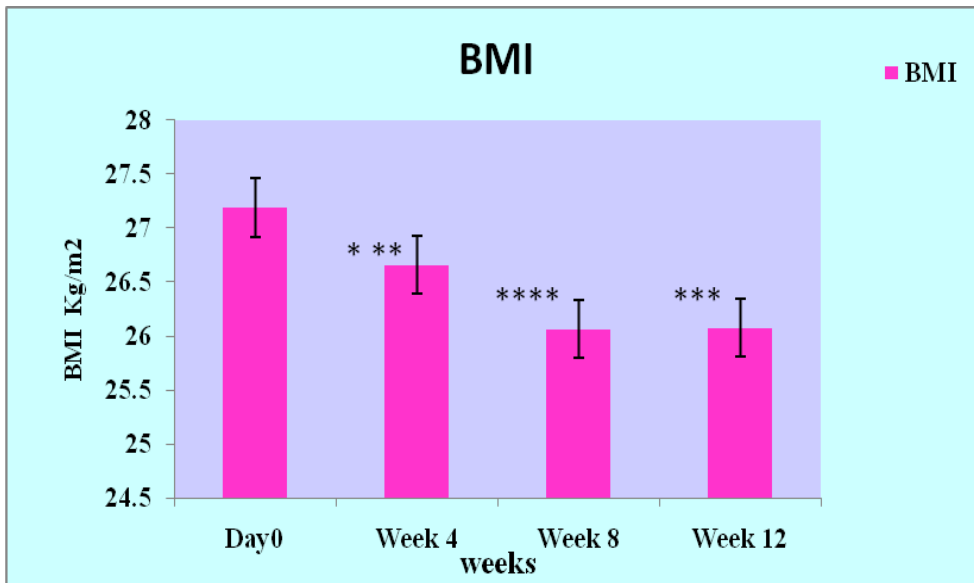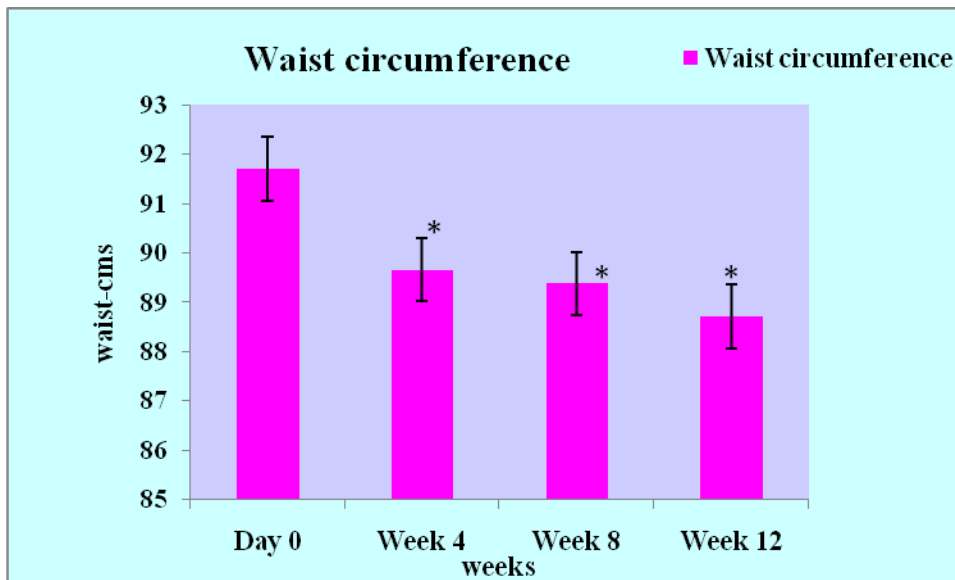*p* **value for 0-4wks is<0.001*, 0-8wks<0.00001***,0-12wks<0.0001**.**

Figure.2   Mean BMI and SEM of 30 volunteers before and after intake of green tea.
p* value for 0-4wks is<0.0001, 0-8wks<0.00001****,0-12wks<0.0001****

Figure.3 Mean waist circumference and SEM of 30 volunteers before and after green tea.
p* value for 0-4wks is<0.01*,0-8wks<0.01*,0-12wks<0.01
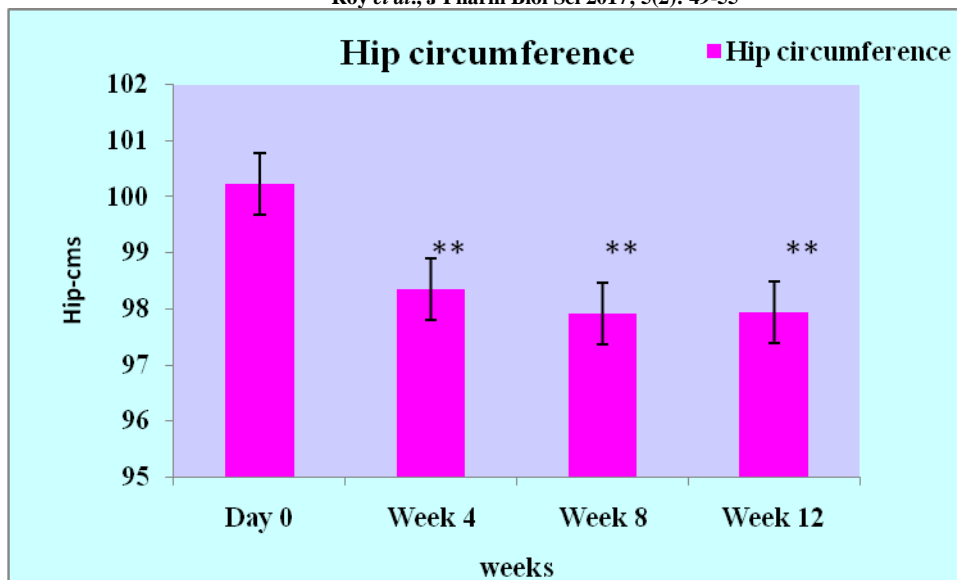
Figure.4 Mean Hip circumference and SEM of 30 volunteers before and after intake of green tea.
p* value for 0-4wks is<0.001**, 0-8wks<0.001**, 0-12wks<0.001*
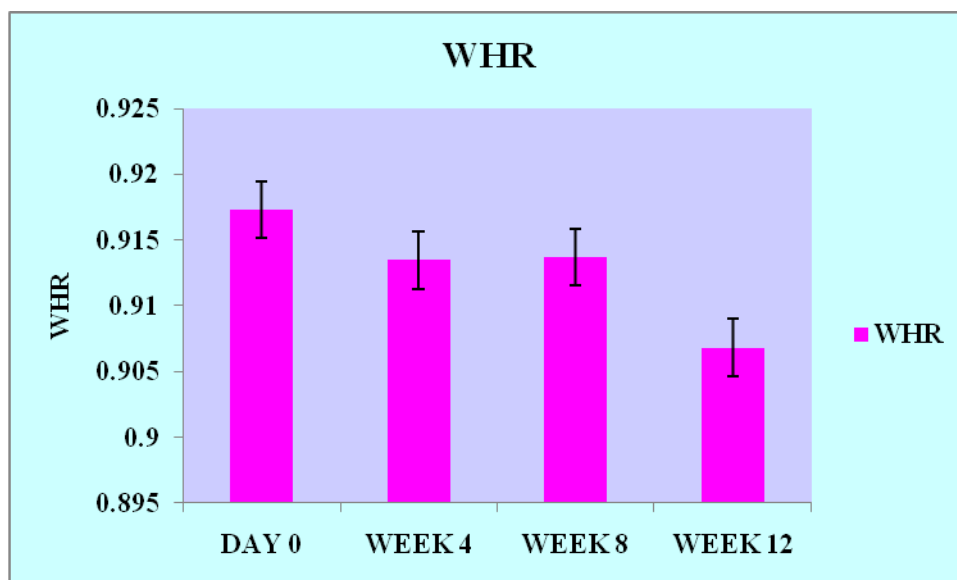

Figure.5   Mean Waist Hip Ratio and SEM of 30 volunteers before and after intake of green tea.
***p* value for 0-4wks is>0.05, 0-8wks>0.05, 0-12wks>0.05**

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