

## Effect Of Green Tea Extract (*Camelia Sinensis*) Reduce Weight in Obesity Male Wistar Rats (*Rattus Norvegicus*)

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### ABSTRACT

This study was to determine the effect of green tea extract (*Camellia sinensis*) in reducing body weight in obese male Wistar rats (*Rattus norvegicus*). Obesity is a condition of excessive accumulation of body fat so that a person's weight is far above normal and can endanger health. There was an effect of giving green tea leaf extract on weight loss in male Wistar rats at doses of 4.5 grams, 5.5 grams, and 6.5 grams before and after being given green tea leaf extract. The quantity of green tea extract of 6.5 grams was significantly lower than the other groups. The ingredients that have the most effect on weight loss are Epigallocatechin-3-gallate, L-theanine, and caffeine. So, it was concluded that green tea could be used to treat overweight and obesity because the content of green tea (*Camellia sinensis*) can reduce body weight and fat levels.

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## 1. INTRODUCTION

Body weight is a volatile anthropometric parameter; body weight develops with age. On the other hand, in abnormal circumstances, there are two possibilities for weight development, which can grow faster or slower than normal. Body weight must always be monitored to provide information that allows preventive nutritional interventions as early as possible to overcome unwanted weight loss or gain trends, such as obesity [1].

The development of the world, which is increasingly advanced and rapidly affects people's lifestyles, one of which has side effects in the form of unhealthy living habits, such as a diet high in fat and sugar, as well as low physical activity, which results in obesity problems. Fat (overweight and obesity) is the accumulation of excess fat in the body's fatty tissue [2]. Having an ideal body is everyone's hope, especially for a woman, but some people have excess bodies or are often called obese or overweight. Obesity (fat) is a scourge that is very feared by some women because a woman if her weight has exceeded the normal limit or weight, will do everything possible to lose weight until she reaches the ideal weight or according to what she wants [3].

Obesity is associated with metabolic disorders such as insulin resistance, inflammation, and hypercoagulability, which can all be understood as consequences of adipose tissue dysfunction. Adipose tissue dysfunction can be seen as a combination of pro-inflammatory changes in adipose tissue and fatty tissue endocrine function. From a health standpoint, obesity is a nutritional disorder caused by consuming more than needed [4]. Obesity is a global health problem. Obesity is overweight or excess weight that exceeds normal body weight. Obesity is related to genetic, metabolic, lifestyle, eating habits, physical activity, sociocultural and economic factors. Obesity occurs due to energy imbalance for a long time. Namely, total energy expenditure is less than energy intake resulting in an accumulation of energy reserves stored in fat, subcutaneous, and visceral.

The incidence of obesity in the world and Indonesia has increased. The increase in the incidence of obesity occurred from 34.5% (2008) to 52.0% (2016) in adults. Based on the results of the 2018 Basic Health Research Ministry of Health of the Republic of Indonesia (RISKESDAS), the prevalence of obesity in Indonesia increased from 19.1% (2007) to 35.4% (2018) for the age group 18 years and over. In the study group of adolescents, it was also reported that obesity was more than 13% (Kemenkes RI, 2019). Obesity increases the risk of non-communicable (degenerative) diseases such

as cardiovascular disease, type 2 diabetes mellitus, osteoarthritis, and cancer (Ratikasari et al., 2020). The risk of the impact of obesity on fertility in men is greater than in women. Other studies have reported that as weight increases, testosterone production decreases [4].

Obesity is no longer just a cosmetic problem but a serious health problem, often accompanied by various complications/comorbidities such as diabetes mellitus, dyslipidemia, hypertension and cardiovascular disease, cholelithiasis, cancer, and respiratory problems. So it can be said that obesity breeds disease (Salomo et al., 2018). The treatment of overweight and obesity has been researched and implemented. This treatment includes lifestyle changes, physical activity, dietary adjustments (diet), drugs, surgery, and alternative therapies in traditional ways, including herbal medicine. Currently, herbal medicine is more in demand by the public because the cost is relatively cheap. This herbal treatment has also been used to treat overweight and obesity, one of which is choosing green tea (*Camellia sinensis*) to reduce body weight and fat levels [5].

Tea (*Camellia sinensis*) is the second most consumed beverage globally and has been used as medicine for centuries. Consumption of green tea is prevalent in Asian countries such as Indonesia because it is associated with its benefits as an anti-inflammatory, antiproliferative, and potential for weight loss [6]. Green tea is very beneficial for health, so green tea is included in dietary supplements and serves as a drink [7]. Green tea is natural because it does not undergo a fermentation process, so the substances in green tea have not experienced a change process. In addition, tea is also straightforward to find and is commonly used as a daily drink. The most important content of green tea is *epigallocatechin-3-gallate* (EGCG), a bioactive ingredient that suppresses the pathogenicity of several chronic diseases, especially cardiovascular disease. Green tea also has pharmacological effects, including weight loss, lowering cholesterol, triglycerides, and blood glucose [8], can prevent dental caries, and antimutagenic and antibacterial [5]. Green tea has also been recommended as a source of antioxidants which have functions including the potential as antimutagenic and anticarcinogenic, controlling weight, providing anti-hypertensive effects and the risk of cardiovascular disease, maintaining oral health, protecting against Ultraviolet rays, and preventing intestinal infections [7].

Several studies on the use of green tea in weight loss have been conducted. One study concluded that giving green tea leaf extract (*Camellia sinensis*) had an effect on weight loss in white male Wistar rats with (*Rattus norvegicus*) strain before being given green tea leaf extract and after being given green tea leaf extract and after being given green tea leaf extract tea leaves [5]. Another study concluded that green tea extract could reduce total cholesterol levels in alloxan-induced diabetic Wistar rats with a perfect dose of 400 mg/kg BW, almost equivalent to the drug simvastatin and close to the normal value of total cholesterol levels [9].

The results of in-vivo studies on experimental animals show that green tea affects weight loss and adipose tissue weight. One mechanism of weight loss through green tea consumption is increasing lipid absorption. Green tea extract and tea catechins also increase fecal lipid concentrations in high-fat/induced rats. The results of in-vitro studies also show anti-obesity effects by inhibiting adipocyte proliferation and differentiation and reducing the absorption of fat and carbohydrates by inhibiting various related enzymes [10].

Several previous studies have shown that green tea is effective in losing weight both in-vitro and in-vivo in experimental animals and humans. This motivated researchers to examine the benefits of green tea more deeply by conducting pure empirical research in the laboratory on the effect of green tea extract in reducing body weight in obese male Wistar rats (Lee Index > 300). Based on the description of the background above, the formulation of the problem in this study was whether the administration of green tea extract (*Camellia sinensis*) had an effect on weight loss in male Wistar rats (*Rattus norvegicus*) who were obese.

## 2. METHOD

This research is a type of laboratory experimental research or true experiment. The research design used a post-test with a control group design to analyze the effect of giving green tea extract (*Camellia sinensis*) in reducing body weight in obese male Wistar rats (*Rattus norvegicus*). Research

variables are everything that will become the object of research observation [11]. The variables in this study consist of independent variables and dependent variables.

The sample is part of the number and characteristics of the population [12]. The samples in this study were adult male white rats (*Rattus norvegicus*) Wistar strain weighing 160-200 grams, aged 2-3 months and healthy, characterized by active movements and no physical defects. The number of white rats used in this study was 20 and considered to be a large sample which was divided into four groups with five rats in each group, namely group A was given 4.56 g of green tea extract (dose I), group B was given 5.5 g of green tea extract (dose II), group D was given 6.5 g of green tea extract (dose III), and the control group was only assigned standard feed and distilled water. Determination of the number of animals follows the "reduction" point, namely minimizing the number of animals used in research without reducing the validity of the results, by the "3R Principles" (Replacement, Reduction, and Refinement), which researchers must adhere to in-vivo research [13].

### Test Animal Acclimatization

Acclimatization is an adjustment (self) to a new climate, environment, conditions, or atmosphere. Before being given treatment, all white rats were first adapted to the Animal House laboratory for one week. The white rat is adapted to a new place of residence, environment, food, and drink. Rats were given food and drink according to their needs (*ad libitum*).

### Making Green Tea Extract

Green tea leaves are cleaned of dirt and washed with running water until clean and drained. After being drained, the green tea leaves are cut into pieces and dried using an oven at a temperature of 50-60 Celsius. After drying, the green tea leaves are blended to make *Simplicia* (powder). Green tea extract is prepared using the maceration method by soaking betel leaves in a maceration vessel separately and then adding 90% methanol solution until the leaves are completely submerged. The maceration vessel was tightly closed and allowed to stand for  $\pm 5$  days while stirring once a day. The results were filtered and repeated three times, then accommodated in a bottle to be further concentrated using a rotary evaporator until a thick methanol extract was obtained. The extract obtained was then evaporated using a rotary evaporator at 70 Celsius. This process aims to evaporate the methanol to get a thick section from green tea. In the study, the solvent used was 95% ethanol; the advantage of using ethanol as a solvent is that the resulting extract is more specific and can last a long time because, besides being a solvent, ethanol also functions as a preservative.

### Obesity Treatment in Experimental Animals

Each rat was given feed or food containing high fat, such as fried nuggets, french fries, sausages, cereal, fried noodles, and egg yolks at a dose of 5 mg/200-gram body weight/day using a sonde for 14 days until the rats became obese. Measurement of rat obesity using the Lee index:

$$\text{Lee Index} = \frac{1}{3} \sqrt{\frac{\text{body weight (gram)} \times 1000}{\text{nasoanal length (cm)}}}$$

Nasoanal length is the length of the body from nose to anus. Mice can be said to be obese if the value of Lee's obesity index is  $> 300$ .

### Green Tea Extract Giving Schedule

After being given high-fat feed for 14 days and the experimental animals were declared obese with a Lee index  $> 300$ , the following day, green tea extract was given to the treatment group, and they continued to be given food (but only regular feed) for each rat in all groups, as follows:

- Control group (K): given feed and distilled water.
- Treatment group 1 (P1): was given feed and green tea extract through a gastric tube or a feeding tube as much as 4.5 grams (dose I) once a day in the morning for 28 (4 weeks).
- Treatment group 2 (P2): was given feed and green tea extract through a gastric tube or a feeding tube as much as 5.5 grams (dose II) once a day in the morning for 28 (4 weeks).
- Treatment group 3 (P3): was given feed and green tea extract through a gastric tube or a feeding tube as much as 6.5 grams (dose III) once a day in the morning for 28 (4 weeks).

The rats' body weight was measured two times, namely before treatment (after being given high-fat feed or food for 14 days) and after treatment (29th day after being given green tea extract for

28 days or four weeks). Furthermore, the weight loss of the mice was calculated by calculating the difference in the weight of the mice after and before being given treatment (giving green tea extract).

The research data were analyzed using the data normality test using the Shapiro-Wilk test ( $p > 0.05$ ). The Way ANOVA test was conducted to test the significant effectiveness between the trial groups ( $p < 0.05$ ) [14]. To analyze which treatment group was the most effective among the experimental groups, a Post Hoc Test was carried out using the LSD technique.

### 3. RESULTS AND DISCUSSION

Research on the content and phytochemical tests of green tea leaf extract was carried out in the laboratory. The sample used is green tea leaf extract from the Sidamanik tea plantation, Simalungun Regency. The results of the phytochemical test of green tea leaf extract can be seen in the following table:

**Table.1** Green Tea Leaf Phytochemical Test Results

Phytochemical Test	Condition of Green Tea	
	Fresh	Extract
Terpenoid	Pink (+1)	Dark red (+3)
Steroids	Dark green (+4)	Blackish green (+4)
Mayer's alkaloids	No residue (-)	Residue (+1)
Dragendorf alkaloids	No residue (-)	Residue (+1)
Phenolic	Red (+3)	Dark red (+4)
Flavonoids	Pink (+1)	Red (+2)
Saponins	Foaming (+4)	Foaming (+1)

Note: (-): no content, (+1): weak content, (+2): medium content, (+3): strong content, (+4): powerful content.

This study found that the most secondary metabolites in the green tea leaf extract test samples were the steroid and phenolic groups, where extreme levels were obtained (+4). The phenolic group has several derivatives, one of which is the flavonoid. Flavonoids are divided into several components; one is catechin which is useful as a strong antioxidant and contributes to reducing the risk of cardiovascular disease, hypercholesterolemia, Parkinson's, and Alzheimer's. It has an antihypertensive effect and controls weight.

In addition, the flavonoid group in the extract samples also showed increased levels compared to the fresh ones. This is because the methanol solvent has polar properties during the maceration process. These opposite properties attract more secondary metabolites with opposite properties, such as phenolics and flavonoids.



**Figure.1** Phytochemical Test and Results of Green Tea Leaf Extract

The saponin group consists of two compounds, namely Tea Saponins (TS-1 and TS2), which can produce antioxidant and anti-inflammatory effects. Saponins also have antimicrobial effects. The terpenoid group also experienced an increase in levels in the test samples carried out. Terpenoids can prevent cancer; Terpenoids are also useful as antioxidants and anti-inflammatories. Based on the results obtained, it is known that tea leaves contain the compound EGCG (*epigallocatechin gallate*).

**Table 2.** Initial Conditions for Each Mice Experiment

Sample	Weight (g)				Abdominal Circumference (cm)				Length (cm)			
	K	P1	P2	P3	K	P1	P2	P3	K	P1	P2	P3
1	155	152	150	151	10,2	10,2	10	10,0	15,0	15,0	15,0	15,0
2	150	174	152	153	10,0	10,7	10,2	10,1	15,0	15,8	15,0	15,0
3	152	160	160	156	10,2	10,5	10,5	10,3	15,0	15,5	15,5	15,0
4	154	155	155	150	10,3	10,2	10,3	10,0	15,1	15,0	15,2	15,0
5	151	154	154	157	10,0	10,1	10,2	10,3	15,0	15,0	15,0	15,2
<b>(Mean)</b>	<b>152,4</b>	<b>159</b>	<b>154,2</b>	<b>153,4</b>	<b>10,14</b>	<b>10,34</b>	<b>10,24</b>	<b>10,14</b>	<b>15,02</b>	<b>15,26</b>	<b>15,14</b>	<b>15,04</b>

Table 2 describes the conditions of each male rat that will be observed in the study. Each treatment, K, P1, P2, and P3, had five rats that were used as experimental samples. The K group is the control group which will only be given standard feed and distilled water. Group P1 was given green tea extract 4.5 gr (dose I), group P2 was given green tea extract 5.5 gr (dose II), and Group P3 was given green tea extract 6.5 gr (dose III). Based on the table above, the mean weight of the heaviest rat samples was in group P1, which was 159 grams. Meanwhile, the lightest average weight in group K was 152.4 grams.

After being treated with feeding for 14 days and then weighing, there was an increase in body weight for each treatment, as follows:

**Table 3.** Results of Mice Samples After 14 Days

Sample	Weight (g)				Abdominal Circumference (cm)				Length (cm)			
	K	P1	P2	P3	K	P1	P2	P3	K	P1	P2	P3
1	182	231	212	228	17,0	14,0	13,3	14,0	18,0	15,5	16,0	16,2
2	180	222	241	231	17,0	13,5	14,5	14,2	18,0	16,3	16,5	16,2
3	181	223	232	240	16,8	13,5	14,0	15,0	17,5	16,3	16,3	17,0
4	188	250	230	219	17,5	15,5	14,2	13,0	18,2	17,5	16,0	16,0
5	185	247	229	223	17,0	15,0	14,1	13,8	18,0	17,0	16,2	16,2
<b>(Mean)</b>	<b>183,2</b>	<b>234,6</b>	<b>228,8</b>	<b>228,2</b>	<b>17,06</b>	<b>14,3</b>	<b>14,02</b>	<b>14,0</b>	<b>17,94</b>	<b>16,52</b>	<b>16,2</b>	<b>16,32</b>

Table 3 obtained data showing an average increase after being fed according to the treatment of each group, where there is an increase in the group's average weight, namely: Control group (K): from 152.4 grams to 183.2 grams. Group P1: from 159 grams to 234.6 grams. Group P2: from 154.2 grams to 228.8 grams, and Group P3: from 153.4 grams to 228.2 grams.

**Table 4.** Mice Body Weight (Treatment Group)

Sample (Treatment)	Weight P1 (gram)		Weight P2 (gram)		Weight P3 (gram)		
	Before	After	Before	After	Before	After	
1		231	225	212	196	228	184
2		222	214	241	225	231	186
3		223	215	232	215	240	190
4		250	240	230	213	219	178
5		247	239	229	210	223	181
<b>Mean</b>		<b>234,6</b>	<b>226,6</b>	<b>228,8</b>	<b>211,8</b>	<b>228,2</b>	<b>183,8</b>
<b>SD</b>		<b>13,202</b>	<b>12,542</b>	<b>10,521</b>	<b>10,474</b>	<b>8,044</b>	<b>4,604</b>

**Table 5.** Weight Development of Control Mice

Repetition Treatment	Sample	Weight (gram) by Week				
		I	II	III	IV	V
Control (K)	1	155	182	240	270	283
	2	150	180	220	268	280
	3	152	181	221	262	270
	4	154	188	240	280	285
	5	151	185	237	275	281
	<b>TOTAL</b>	<b>762</b>	<b>916</b>	<b>1158</b>	<b>1355</b>	<b>1399</b>
	<b>MEAN</b>	<b>152,4</b>	<b>183,2</b>	<b>231,6</b>	<b>271</b>	<b>279,8</b>

In Table 4, it was found that the body weight of male white Wistar rats (*Rattus norvegicus*) in each treatment group showed that after being given a high-fat diet but not given green tea extract (*Camellia sinensis*), the average body weight of the rats was: P1 is 234.6±13.202, P2 is 228.8±10.521,

and P3 is  $228.2 \pm 8.044$ . Meanwhile, after being given a high-fat diet and green tea extract, the average body weight of the rats, namely: P1 was  $226.6 \pm 12.542$ , P2 was  $211.8 \pm 10.474$ , and P3 was  $183.8 \pm 4.604$ .

It can be concluded that weight gain occurred significantly from week I to week V in all groups studied. However, the control group was not given high-fat feed. Then there was gradual weight loss from Week II to Week V for the treatment groups P1, P2, and P3. A significant decrease occurred in the P3 treatment group, which was still fed (ordinary) and received green tea extract through a gastric tube or feeding as much as 6.5 grams (dose III) daily in the morning. Meanwhile, the control group K continued to experience weight gain from observations made week to week (week I to week V).

**Table 6.** Shapiro-Wilk Normality Test

Group	Shapiro-Wilk			
	Statistic	df	Sig.	
Weight	Control Group	0,808	5	0,094
	Treatment 1	0,859	5	0,225
	Treatment 2	0,916	5	0,504
	Treatment 3	0,986	5	0,966

The significance value (p) in the Shapiro-Wilk Test is the value that exceeds the standard margin of  $p > 0.05$ , which is 0.094 for Group K, 0.225 for Group P1, 0.504 for Group P2, and 0.966 for Group P3. So based on the normality test of Shapiro-Wilk, the data is normally distributed.

**Table 7.** Results of Test of Homogeneity of Variances ANOVA

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Weight	Based on Mean	1.325	3	16	.301
	Based on Median	.601	3	16	.624
	Based on Median and with adjusted df	.601	3	12.017	.627
	Based on trimmed mean	1.286	3	16	.313

**Table 8.** ANOVA Test Results

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1536.573	3	512.191	9.389	.001
Within Groups	872.836	16	54.552		
Total	2409.410	19			

The Test of Homogeneity of Variances obtained data from the test results showing that the significance value (p-value) was 0.301, so the ANOVA test was valid for testing the variance relationships. It can also be concluded that because the significance probability value is more than 0.05, the weight of the control and treatment groups comes from populations with the same variance, or the four groups are homogeneous. From Table 8, a test was carried out to see if there was a difference in body weight from the four groups carried out in research or observation. Based on the data in the table in the "Sig" column. The p-value (p-value) is 0.001. Thus, at the significance level = 0.05,  $H_0$  is rejected (Ghozali, 2018), so the conclusion is that there is a significant difference in the average (mean) body weight based on the four groups.

**Table 9.** Bonferroni's Post Hoc Test

Test Method	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
BONFERRONI	Control Group	Treatment 1	4,47200	4,67129	1,000	-9,5808	18,5248
		Treatment 2	12,63200	4,67129	0,094	-1,4208	26,6848
		Treatment 3	23.03200*	4,67129	0,001	8,9792	37,0848

	3					
	Control	-4,47200	4,67129	1,000	-	9,5808
	Group				18,5248	
Treatment	Treatment	8,16000	4,67129	0,599	-5,8928	22,2128
1	2					
	Treatment	18.56000*	4,67129	0,007	4,5072	32,6128
	3					
	Control	-12,63200	4,67129	0,094	-	1,4208
	Group				26,6848	
Treatment	Treatment	-8,16000	4,67129	0,599	-	5,8928
2	1				22,2128	
	Treatment	10,40000	4,67129	0,244	-3,6528	24,4528
	3					
	Control	-23.03200*	4,67129	0,001	-	-8,9792
	Group				37,0848	
Treatment	Treatment	-18.56000*	4,67129	0,007	-	-4,5072
3	1				32,6128	
	Treatment	-10,40000	4,67129	0,244	-	3,6528
	2				24,4528	

\*. The mean difference is significant at the 0.05 level.

From the results of the previous ANOVA test, data was obtained that the test results showed that  $H_0$  was rejected (there was a difference), so a further test (Post Hoc Test) was needed. The follow-up test (Post Hoc Test) will be carried out to see which groups are different. Further test results with the Bonferroni Post Hoc Test showed that the groups that showed differences in average body weight of male white Wistar rats (*Rattus norvegicus*), which were marked with an asterisk "\*" were the Control Group (K) and the Treatment Group-1 (P1) and Treatment Group-1 (P1) with Treatment Group-3 (P3).

Based on the results of research conducted in each group, it was found that there was an effect of green tea leaf extract (*Camellia sinensis*) on weight loss in male Wistar rats (*Rattus norvegicus*) in the treatment group where the most significant weight loss in obese experimental rats was found in Treatment Group-3 (P3), namely the group that was given feed and green tea leaf extract as much as 6.5 g (dose III), so it can be concluded that the results of this study are in line with previous studies.

The research and trials in the control and treatment groups showed that green tea leaf extract administration accelerated weight loss in male Wistar rats. Although the average weight loss of each treatment group was not significantly different, the administration of each dose of green tea extract, namely 4.5 grams, 5.5 grams, and 6.5 grams in each treatment group, showed an average difference in weight. From the onset of obesity (Week II) to the end of the study (Week V). The results of this study provide further information on findings from previous studies regarding the effect of green tea extract on weight loss in obese male Wistar rats, where a dose comparison was also carried out to see which reduction was more significant after being given to fat male Wistar rats.

There is an effect of giving green tea leaf extract (*Camellia sinensis*) on weight loss in male Wistar rats (*Rattus norvegicus*) before being given green tea leaf extract and after being given green tea leaf extract. The content in green tea obtained from this study are Terpenoids, Steroids, and Phenolics. However, the ingredients most affecting weight loss are Epigallocatechin-3-gallate, L-theanine, and caffeine. Green tea has many components, such as catechins, caffeine, theanine, and vitamins. Catechins are present in green tea from 15% to 20% by weight. Green tea catechins have a hypocholesterolemic effect and suppress intestinal absorption of cholesterol. In addition, it was reported that epigallocatechin gallate (EGCG), a type of catechin, has an inhibitory effect on acetyl-CoA carboxylase which is important for in vitro fatty acid biosynthesis and an anti-obesity effect at high doses in rats—following research conducted by Thielecke, which stated that a very beneficial effect of green tea is its catechins, especially epigallocatechin-3-gallate (EGCG) [15].

It has been widely stated/demonstrated that caffeine decreases food intake and increases thermogenesis and that the thermogenic effect promotes weight loss. In addition, it was clarified that

Theanine (*A-glutamylethylamide*) is the main amino acid characteristic of green tea and has physiological effects such as relaxing activity, activation of dopamine metabolism, and release in the brain. In addition, it is reported that theanine suppresses excitation by caffeine. This is in line with Rahmanisa's research, which said that there are three main components of green tea, namely *epigallocatechin gallate* (EGCG), caffeine, and L-theanine, which are the main secret of green tea in losing weight [16].

#### 4. CONCLUSION

Based on the results of the research that It has been widely stated/demonstrated that caffeine decreases food intake and increases thermogenesis and that the thermogenic effect promotes weight loss. In addition, it was clarified that Theanine (*A-glutamylethylamide*) is the main amino acid characteristic of green tea and has physiological effects such as relaxing activity, activation of dopamine metabolism, and release in the brain. In addition, it is reported that theanine suppresses excitation by caffeine. The average weight loss of each treatment group was similar. Still, the administration of each green tea extract dose of 4.5 grams, 5.5 grams, and 6.5 grams in each treatment group showed an average difference in body weight from the onset of obesity. (Week II) until the end of the study (Week V). The dose of green tea extract was 6.5 grams (Group treatment-3) experienced a more significant decrease than the other groups.

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