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## The Activity of Epigallocatechin-3-Gallate (EGCG) Extract Against Weight Loss in Obesity

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### Abstract

Obesity is overweight exceeding normal body weight. Excessive body weight would make individuals comorbid. Weight loss can be achieved with diet, exercise and medication. Purpose of research was effect of Epigallocatechin-3 gallate (EGCG) on weight loss.

Experimental study was a pre and post-test research design. The population were obese women in Mojokerto with a sample size of 125 respondents selected by random sampling. Instrument used weight scales. Intervention was giving EGCG extract in green tea as much as 2 grams two times a day in the morning with low-carb diet and before bedtime containing 625 mg daily.

Research results used a paired sample T-test and showed mean pre-test weight is 72.56, 72.048 post-test on 7 days and 70.552 post-test weight 14 days. P value = 0.000 <  $\alpha$  (0.05) which means that there is an effect of EGCG extract (Epigallocatechin-3-gallate) on body weight change in obese women. The value of the correlation coefficient is 0.999.

There is an average difference in weight loss on days 7 and 14. EGCG can help lose weight. EGCG inhibits the activity of digestive enzymes, emulsifies fat in the stomach and duodenum, as well as stimulates thermogenesis and body fat oxidation resulting in weight loss.

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### Introduction

Obesity is one of the most common health problems in the community. Obesity is related to genetic factors, metabolic living habits, eating habits, physical activity, sociocultural and economic factors<sup>1</sup>. Obesity is a health problem not only in developed countries, but also in developing countries<sup>2</sup>.

Even in countries with the prevalence of fewer nutrients. The incidence of obesity is still quite high such as in some Asian countries and sub-Saharan Africa<sup>3</sup>. Globally the prevalence of

obesity in women with age >18 years worldwide is 30.2%. Indonesia is one of the Southeast Asian States having an obesity prevalence rate of 21.8%<sup>4</sup>. The prevalence of obesity in East Java in women aged >18 is 21.9%. Data of Mojokerto District health service obesity in 2016 amounted to 18.93%. Based on preliminary study results in Mojokerto on 12 January, 2020, there were four women having obesity and one woman with normal body weight. The average respondent said they could not control the meal. Factors affecting obesity include genetic, environmental, psychosocial, health, drug, progression, and physical activity<sup>4</sup>. Being overweight or obese is a risk factor for serious diseases such as type 2 diabetes mellitus, respiratory diseases, cardiovascular disease, hypertension, orthopedic problems, including lower back pain, and aggravated osteoarthritis<sup>5</sup>. Efforts to suppress prevalence of obesity are, among others, lifestyle modification, behavioral therapy, consumption of drugs, and surgery with various side effects. It

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triggers experts to seek complementary medicine and alternatives in weight change. One of the alternative therapies often studied is consuming green tea (EGCG), especially in the Asian continent<sup>6</sup>.

Tea is the second most drink consumed in the world after water, which is about two-third of the world's population<sup>7</sup>. Consumption of tea has begun to be part of the lifestyle of Indonesian society, along with the level of understanding and awareness about the back to nature movement as well as the tendency of people to consume food or drink substitutes as a balanced diet rich in fats, cholesterol, and low fiber. One of them is green tea<sup>8</sup>. Based on the results of the study, catechins, which are polyphenols, are known to be effective at lowering the risk of cardiovascular disease, diabetes, assisting weight loss, and as anti-inflammatory, antiviral and antibacterial<sup>9</sup>.

The highest catechin content, (-)-Epigallocatechin-3-gallate (EGCG), is found to be strongly associated with a reduced risk of metabolic diseases<sup>10</sup>.

The mechanism of action of EGCG in the body as an anti-obesity agent is catechins in the tea which play a role in the activity of digestive enzymes (lipase, protease, amylase), inhibit the emulsification of fats in the stomach and duodenum, and can stimulate thermogenesis and body fat oxidation<sup>11</sup>. It has also been identified the results of in-vivo studies in animals indicating that green tea affects weight loss and weight of adipose tissue. The results of in-vitro studies also indicate anti-obesity effects through inhibitory mechanism of proliferation and differentiation of adipocyte as well as reduced absorption of fats and carbohydrates through inhibition of various related enzymes<sup>12</sup>. The anti-obesity effect on green tea in humans was first reported in 2003 by researchers from Taiwan.

A variety of research results that consistently show green tea as effective in losing weight, both in-vitro and in-vivo. in human is interesting to be examined in the wider population<sup>13,14</sup>.

Ethnic, demographic and cultural differences affect the diet of Indonesian people. In addition, the body can also show a different response to the same substance so that this research needs to be done to know the effectiveness of green tea as a weight loss

therapy, especially for women in Mojokerto. From the explanation above, researchers want to know the virtues of the extract epigallocatechin gallate-3 (EGCG) against the loss of body weight in women with obesity in Mojokerto East Java.

### Materials and methods

The research design used a pre-experimental research plan one group pre-post-test design. The research was implemented in November 2020 for 14 days. Before the treatment was done, a pretest was first performed and post-test after being given the treatment. Samples in this study were women with obesity in Mojokerto East Java with a total sample of 125 respondents. Sampling technique used random sampling. The subjects of the study involved fulfilled the criteria of inclusion among women with obesity, women who are not undergoing other elemental programs, not suffering from chronic diseases (heart disease, liver, and kidneys), not taking medicines and supplements for weight loss or cholesterol lowering, and who are willing to follow the study by signing an informed consent sheet. The independent variable was EGCG and dependent variable was weight loss. Research instrument used was weight scales. The intervention was carried out by giving EGCG extract in green tea as much as 2 grams twice a day in the morning and before bedtime containing 625 mg daily with low-carb diet. Weight measurements were carried out after 7 and 14 days. The statistical test used a paired sample T-test. The research went through the ethical test from *Sekolah Tinggi Ilmu Kesehatan Maluku Husada* number 011/KEPK/STIK/III/2020.

### Results

The results of the study in Table 1 above show respondents 44%, (55 respondents) aged 25-40 years, respondents with a diet two times a day 56% (70 respondents). The results of the study in Table 2 show a frequency distribution before being given an EGCG extract (Epigallocatechin-3-gallate) from 125 respondents mostly with a weight of 62-71 kg, which was 50 respondents (40%).

Based on Table 3, results compared the weight of the respondents before given EGCG with the seven days was largely 62-71 kg with the total of respondents (40%), but weight of 72-81 kg increased from 28% to 32%, and weight of 8290 kg decreased from 20% to 16%. Then weight of the respondents on the day 14 between 62-71 kg and 72-81 kg amounted to 40 persons each (32%), but weight loss 51-61 kg increased from 12% to 24% and body weight 82-90 kg decreased from 16% to 12%.

Data	Category	f	%
Age	18-25 years	20	16.0
	26-40 years	55	44.0
	41-50 years	50	40.0
Diet	Three times a day	15	12.0
	Twice a day	70	56.0
	Three times a day with dinner	40	32.0

**Table 1.** Respondents' Characteristics.

Data	Category	f	%
Weight	51-61 kg	15	12.0
	62-71 kg	50	40.0
	72-81 kg	35	28.0
	82-90 kg	25	20.0
	Total	125	100.0

**Table 2.** Characteristic weight of respondents before being given EGCG extract.

Data	Category	Post-test 7 days		Post-test 14 days	
		f	%	f	%
Weight	51-61 kg	15	12.0	30	24.0
	62-71 kg	50	40.0	40	32.0
	72-81 kg	40	32.0	40	32.0
	82-90 kg	20	16.0	15	12.0
	Total	125	100	125	100

**Table 3.** Weight of respondents after being given EGCG extract on day 7<sup>th</sup> and 14<sup>th</sup>.

Data Test	Mean	SD	Coef. Correlation	Sig.
Pair 1 Pre-Test	72.46	9.119	.999	.000
Post-Test days 7	72.048	9.002		
Pair 2 Pre-Test	72.46	9.119	.978	.000
Post-Test days 14	70.552	9.986		

**Table 4.** Paired Samples Statistics before and after given the EGCG.

Based on Table 4. mean pre-test weight is 72.46. Mean post-test weight 7 days is 72.048 and mean post-test weight after 14 days is 70.552. The

results of the analysis using the paired T test and obtained P value (0.000) less than  $\alpha$  (0.05), which means that there is an effect of EGCG extract (Epigallocatechin-3-gallate) on body weight change in obese women. The value of the correlation coefficient is 0.999. There is an average difference in weight loss on days 7 and 14. The intervention is the introduction of EGCG extract packaging with each dose of 2 g/sachet of each steeped in hot water as much as 200 cc for approximately 3-4 minutes with low-carb. EGCG extract was taken two times a day for 14 consecutive days.

## Discussion

### Weight loss before being given an EGCG extract

The main cause of obesity is lack of physical activity (exercise) causing the buildup of fat in the body. Weight of respondents if calculated with BBI or the ideal body weight shows 125 respondents with an average weight not ideal. This is due to the factors that become the cause of obesity, among them respondents with the habit of eating snacks at night. The excess calories in respondents will be stored by the body in the form of body fat<sup>15</sup>. Another factor related to weight gain is an emotional factor (stress), this is due to that during of stress, the body secretes cortisol, which is a hormone that triggers stress. This affects the body's response with a rapid increasing in the formation of glucose in the body. This affects the body's response which will be faster in delivering glucose and the body's response immediately activates the brain to repair glucose in the body. As a result, increased appetite will be higher, the more often it feels hungry.<sup>16</sup>

### Weight loss after administering EGCG

Table 3 shows the average respondent experiencing weight loss, although it is still within the same range. One of its non-pharmacological impacts is by consuming the influence of EGCG extract (Epigallocatechin-3-gallate) because it contains many flavonoids.

This indicates that, with the administration of EGCG, it will inhibit the activity of digestive enzymes and emulsion of fats in the stomach and duodenum so that fat burning can reduce the inhibiting and, activate AMPK which is

converted into energy which burns up fat and eventually joints fat becomes thinning, joints fat into weight change.

#### **Analysis of the influence of EGCG extract to weight loss in obesity**

The occurrence of weight loss can be known through the mechanism of action of EGCG in the body as an anti-obesity agent. EGCG can play a role in the digestive enzymes activity (lipase, protease, amylase), inhibiting the emulsification of fats in the stomach and duodenum, and can stimulate thermogenesis and body fat oxidation<sup>11</sup>. Catechin in green tea is reportedly able to inhibit the enzyme Catechol-Omethyltransferase (COMT), which is the enzyme that degrades norepinephrine.

With the loss of COMT enzyme by catechins, the reduction produces norepinephrine degradation which will result in the addition of the working time of norepinephrine in the sympathetic nervous system. Activation of this sympathetic nervous system will stimulate energy expenditure among them by increasing thermogenesis and fat oxidation<sup>5</sup>. Some reports also state that EGCG may inhibit the proliferation of adipocyte and reduce the viability of adipocyte via activation of adenosine monophosphate-activated proteins kinase (AMPK). AMPK is a target phytochemical in the function of green tea as an anti-obesity agent. In general, AMPK is activated by various stimuli, such as sports, heat shock, and reactive oxygen species or ROS<sup>17</sup>. AMPK activation is an important factor in the inhibition of adiposeness by EGCG. It is supported by the results of the research stating that the tea (EGCG) is able to help lose weight significantly<sup>18</sup>. This shows women's weight before being treated 68.7 kg decreased to 67.3 kg. Research about men and women with obesity, it showed that consumption of drinks containing catechin from green tea (625 mg daily) can decrease the weight and abdominal fat<sup>19</sup>.

State that tea (EGCG) has a role in helping decrease body weight<sup>5</sup>. Weight loss is influenced by the amount of food intake consumed and activities performed<sup>20</sup>. Low-carb diet can lower insulin to produce an anabolic state, reduce fat storage, improve cardiometabolic function, and induce weight loss. This suggests that reduced physical activity triggers the occurrence of excess fat filling in the body<sup>21</sup>. Thus, the occurrence of

weight is far above normal. By consuming EGCG extract it can provide a change in body weight The administration of EGCG extracts can be a barrier to the activity of digestive enzymes (lipase, protease, amylase), inhibiting the emulsification of fats in the stomach and duodenum, as well as it can stimulate thermogenesis and oxidation of body fat<sup>22</sup>. Respondents kept eating as much as they wanted, but eating only a little had them feeling full. This can lead to a slight intake of fat, so, the permeability of fat in the body is reduced so that weight decreases bringing about weight changes in women with obesity.

#### **Conclusions**

This study showed EGCG extract (Epigallocatechin-3-gallate) can help weight loss in women with obesity in Mojokerto East Java. Epigallocatechin-3 gallate plays a role in inhibiting the digestive enzymes activity, emulsifying fat in the stomach and duodenum, as well as stimulating thermogenesis and oxidation of body fat so that weight loss occurs.

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#### **Declaration of Interest**

The authors reported no conflict in this article pertaining to any of the products or companies.

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