

Evaluation of The Slimming Effects of Diet Tea in Biochemical and Molecular Meaning

Abstract:

The replacement of foods consumed with foods containing high carbohydrates, fats and proteins instead of foods that the body needs daily causes many health problems, especially obesity. Complicated health problems are trying to be solved with drugs, but it is not possible to control diseases if obesity is not resolved. Obesity causes inflammation, creates insulin resistance, causes vascular endothelial dysfunction and low-density lipoprotein(LDL) increase.

There are very few weight loss drugs with acceptable side effects, and these drugs are not given to people who are not considered obese according to their body mass index. For this reason, people seek the remedy in over the counter (OTC) (mostly products with active ingredients derived from plants) products or herbal teas. These products, which do not have direct effects, have mechanisms that can help and can be supportive with diet and sports. However, these products and teas that cannot be dosed by a knowledgeable healthcare professional can disrupt the balance of the body and cause various diseases. Hepatotoxicity is common.

In the studies conducted with the active ingredients in these herbs, which are sometimes consumed alone and sold as diet tea in mixed form, how they affect the body with biochemical parameters is evaluated. Mechanisms that support weight loss are determined.

Keywords: Tea, Slimming, Herbal, Weight-Loss, Obesity.

1. Introduction

There exist ways to be followed in the treatment of obesity. However, individuals not considered obese, fleshy or overweight, may act upon the advice they receive from the environment instead of seeking professional help. The weight loss process, which is based on a healthy diet and exercise program, can be replaced by some miraculous and health-threatening methods. Studies have been performed on herbal cures, tea, and supplements consumed for weight loss¹.

It was found that besides the effect of self-esteem, a high level of impulsivity was also efficient in the development of obesity². Today, the perception of beauty underlies those women should have a slim body and men should have a slim but sportive body structure. This perception creates more severe psychological problems in women than in men. Psychiatry diagnoses more in obese women³.

The teas purchased for slimming purposes from herbalists and pharmacies in Turkey and the teas claimed to have a slimming effect on the internet have been determined, and the results of the active ingredients in clinical studies have been evaluated with biochemical parameters and mechanism of action and compiled after the botanical recognition.

2. General Information

2.1. Obesity

Obesity, which was a symbol of power and beauty in ancient times, but has now turned into a worldwide pandemic, appeared in our country at a rate of 20.5% in men, 41.0% in women, and 30.3% in total during the studies conducted in 2010. In addition to these values, 34.6% of overweight people, 64.9% of overweight or obese people, and 2.9% of morbidly obese people⁴. Today, obesity rates are increasing due to the increasing sedentary life with the COVID-19 outbreak⁵.

The uncontrolled increase in body fat mass because of unbalanced nutrition is one of the main reasons for overweight and is classified in the body mass index based on height⁶.

2.2. Mechanisms of the body that are effective in weight gain

Lack of genetic structure, hormonal, metabolic, hypothalamic, and psychological levels are argued as the causes for the development of obesity. In addition to all these, drug-induced obesity can also occur⁶.

The metabolic syndrome accompanies obesity, and the riskiest disease is hypertension. If it meets at least 3 criteria among the following conditions, such as if a person's fasting plasma glucose is greater than 110 mg/dL, triglyceride level is greater than 150 mg/dL, high-density lipoprotein (HDL) cholesterol is less than 40 mg/dL in men and less than 50 mg/dL in women, hypertension, and waist circumference is greater than 102 cm in men and greater than 88 cm in women, then the metabolic syndrome can be diagnosed. Insulin resistance and hyperinsulinemia are considered the primary source of metabolic syndrome⁷.

2.3. Herbal teas consumed for slimming and their effects

2.3.1. Lingonberry Tea

The total number of compounds observed in *V. vitis-idaea* was specified as 925⁸. Active ingredients are reported as arbutin, quercetin, chlorogenic acid⁹. The most abundant are "quercetin-derived flavanols"¹⁰. The flavonoids of primary importance found in lingonberry extract are flavan-3-ols (catechin and epicatechin) and the most important glycoside is quercetin¹¹.

Lingonberry extract displays antioxidant activity¹¹. Besides the antioxidant effect, polyphenols display anti-diarrheal, anti-

inflammatory, antibacterial, anti-lipidemic and anti-obesity activations⁹.

In cases anti-obesity activation is provided via lipid destruction, the decrease in cholesterol levels can be partially explained by proanthocyanidins and cyanidin-3-O- β -glucosides¹².

It was found that the Lingonberry extract intake with ethanol increased glucose consumption in skeletal muscles by activating AMPK (activated protein kinase). In skeletal muscles, the phosphatidylinositol-3 kinase (PI3-K)/Akt pathway is activated by insulin and stimulates intracellular GLUT4 vesicle for glucose uptake in membranes. AMPK activation also has effects that reduce the accumulation of intramyocyte and increase the sensitivity of muscle cells to insulin. AMPK activation stimulates lipogenic enzymes and increases the oxidation of fatty acids¹³.

In a study, rats were fed a high-fat diet and were made obese, hyperglycemic, insulin resistant. The group which was administered 250 mg/kg/day had the best results of decreased adiposity. Triglyceride (TG) values decreased at the dose of 125 mg/kg and 250 mg/kg. 12% and 18% decrease in total plasma cholesterol and LDL were seen at the dose of 250 mg/kg. Lingonberry increases insulin-dependent and independent glucose consumption. It increases the level of GLUT4 protein. However, only 500 mg/kg resulted in a significant increase in these pathways¹³.

Again, in another study, the effects of Lingonberry were observed in rats a high-fat diet. When the results are evaluated, a significant difference is observed between a high-fat diet and a high-fat diet with lingonberry use in weight gain¹².

As a result of 500 mg/kg dosing, an antihyperglycemic effect was observed, as well as the fact that aspartate aminotransferase (AST), alanine transaminase (ALT), and creatinine values were higher than the other

groups, which supports our statement that toxicity started to occur.

2.3.2. Mate Tea

Ilex paraguariensis an evergreen tree from the *Aquifoliaceae* family that can reach 18 m in height. Mate trees bloom in autumn and produce fruit until summer. Mate tea is blanched, dried, and aged before use¹⁴. Caffeine, nicotinic acid, which are the active ingredients obtained from mate leaves, are specified as anti-obesity and cholesterol-lowering. Although not yet certain, caffeine and saponin of mate are considered to be efficient in weight loss. With the lipolytic effect of caffeine and the saponin interference with cholesterol, its retarding effect on fat absorption might be explained¹⁵. Chlorogenic acid, a polyphenol, shows an effect on glucose metabolism, reduces LDL and cholesterol oxidation, and reduces the risk of cardiovascular disease. The components in its content create a weakening effect through different mechanisms¹⁶. Caffeine is highly absorbed from mate tea compounds and through the liver. It is the main active ingredient. Caffeine has an anti-obesity effect with its thermogenic feature in reducing body mass index and is a fat burner. Caffeine prevents thermogenesis from induction of cyclic adenosine monophosphate (cAMP) from phosphodiesterase and ensures fat burning not to stop¹⁷. Mate tea compounds provide high fat burning in individuals who do not exercise, but their effects have not been examined in sedentary individuals¹⁸.

In a study conducted with the preparation of Mate tea on obese people, while the group receiving the placebo remained at the same weight, the gastric emptying period of the obese group taking the preparation was prolonged, and a significant decrease in weight was observed with the support created by the feeling of satiety at the end of the 45 days¹⁹.

In a study, capsules contained placebo or Mate extract were administered in two

different groups. During the administration, exercise control (inactivity was provided) and diet control were applied periodically, and then an exercise loaded with bicycle and stairs was applied. As a result of this study, a 24% increase in fat oxidation was observed compared to the placebo study group. With catechol-O-methyltransferase (COMT) inhibition of chlorogenic acid and caffeoyl derivatives, increased adrenaline has been observed. With the interaction of chlorogenic acids and caffeine in the content of Mate tea, it created an ergogenic effect in the study¹⁸.

While the animal group fed a high-fat diet continues the same diet, eight weeks of consumption of mate tea results in a decrease in glucose, cholesterol, TG, HDL, LDL values. It should be used with exercise and a low-calorie diet²⁰.

2.3.3. Green Tea

It is obtained from the dried leaves of *Camellia sinensis* and is a member of the *Theaceae* family. The green tea tree grown for leaf output is cut off less than two meters in length. Light green leaves are preferred for the purpose of tea making. Green tea contains around 4000 active ingredients²¹. Most of them consists of polyphenols²². Catechin which is the most effective and high in green tea content is EGCG. Black tea has less catechin content compared to green. One of the most important of the xanthines included in the alkaloid group is caffeine. Three teas, including oolong tea and black tea, have high ascorbic acid content²³.

As a result of the stimulation of ephedrine by caffeine, thermogenesis increases. The same effect is observed at a higher level with green tea extract. It can be said that epigallocatechin, constituting more than half of the green tea content, greatly increases the efficiency of green tea in thermogenesis. It is observed that when used separately, the effect of epigallocatechin and caffeine is lower but creates a synergistic effect when given

together²⁴. Epigallocatechin, catechin, and their derivatives, namely flavanols, are sympathetic system stimulants. Sympathetic nervous system activation suppresses appetite by increasing energy consumption. It contributes to the desired weakening effect. There are clinical studies on compounds that activate the sympathetic nervous system²⁵. In a study on two groups of human subjects, differences were observed between the group on a low-calorie diet and the group that consumed green tea catechins in addition to low calories. LDL decreased by 9.33% in the group that did not consume green tea, while a decrease of 20.45% was observed in the group that directly consumed catechins in uncomplicated form, but not in the tea form at the end of 90 days. While the HDL value of the group on a low-calorie diet increased by 10%, the HDL value of the group that consumed green tea catechins in addition to low calories increased by 21.43%²⁶.

Besides its anti-obesity and cholesterol-lowering effects, it is also active in suppressing postprandial hypertriglycerolemia. Carbohydrate-rich diets are the cause of postprandial lipidemia. The triglyceride concentration that will occur as a result of a diet rich in carbohydrates should be controlled²⁷.

Oral oil emulsions containing varying proportions of catechin were given to rats. It was observed that the triacylglycerol ratios of rats that received catechin after administration decreased. It was also observed that catechins inhibit the effect of lipase on the pancreas. Catechins, with their effect on pancreatic lipase activity, reduce postprandial hypertriglycerolemia and fat absorption. The level of effect varies depending on the dose²⁸.

2.3.4. Oolong Tea

Camellia sinensis L. are perennial plants with small leaves and are resistant to cold weather. The leaves and buds are semi-fermented and

semi-oxidized to obtain oolong tea from *Camellia sinensis*, which has different tea forms according to the way of processing. Polyphenols are concentrated in tea²⁹.

Although the amount of flavanol glycosides in oolong tea is not known, it is known that they are higher in fresh tea leaves, that is, in green tea³⁰.

Cholesterol is converted into bile acids and cholesterol regulation is provided. Bile acids are produced as cholic acid and chenodeoxycholic acid. Bile acids are metabolized in the intestine³¹. It is considered that epigallocatechin gallate, which is one of the catechins in herbal teas obtained from *Camellia sinensis*, inhibits cholesterol and lymphatic TG absorption and has inhibitory properties for pancreatic lipase³². This can be considered as the mechanism of oolong tea in fat excretion. It is thought that oolong tea is more efficient in lipid excretion than green tea³².

During the conversion of epigallocatechin gallate and catechins to 1-methyl-3-isomethylbutylxanthine, dexamethasone, and insulin-induced adipocytes, murine preadipocytes reduce TG accumulation. They prevent fatty acid synthesis by limiting acetyl-CoA carboxylase activity. Catechins regulate the balance between LDL and HDL levels³³. Epigallocatechin gallates have been shown to reduce cell viability and inhibit preadipocytes. Methylated tea catechins show these effects at higher levels³⁴.

The fatty acid synthetase (FAS) enzyme is lipogenic. It catalyzes the formation of palmitate from the reaction of acetyl-CoA through malonyl CoA. FAS was significantly inhibited by oolong tea ingredients. Inhibition of this enzyme, which is involved in fatty acid and triglyceride synthesis, can also be shown as one of the anti-obesity mechanisms of oolong tea³⁵.

In one study, green, black, white, and oolong tea were used as the sole fluid source,

and bile acid metabolism was observed in rats. As a result of the 28-day observation, we found that the slowing effect of oolong tea on weight gain was more successful than other *Camellia sinensis* teas³¹.

As a result of another study conducted, the amount of lipid in the stool was higher in the group which consumed oolong tea³².

A group of 102 obese volunteers was administered 8g of oolong tea per day for six weeks. At the end of six weeks, the average weight decreased from 74.1 to 71.2. It was observed that the amount of weight loss in women is higher. Especially, an average of 2 cm decrease was observed in the waist measurements of women. All the subjects showed more than one kg of weight loss. A significant decrease was observed in the TG levels of the subjects with hyperglycemia in comparison with the blood samples taken after the treatment³³.

2.3.5. White Tea

It is prepared by applying the only discoloration and drying processes without fermenting the young leaves and buds of *Camellia sinensis*. Epigallocatechin gallates have been indicated as major polyphenols in white tea as such in green tea³⁶.

Although it is shown by glycerol measurement that White Tea extract induces the increase of lipolysis activity in differentiated adipocytes, it is inadequate to explain the decrease in triglycerides. It is considered that the effects of epigallocatechin gallate, which are compared with previous studies, cannot explain the lipolytic activity of white tea³⁷.

2.3.6. Cherry Stalk Tree

14 kinds of phenolic compounds, seven of which are phenolic acid groups and seven of which are flavonoid groups, were found in cherry textures. While cherry stalk has a high

rate of hydroxycinnamic acid, hydroxybenzenes was quite low^{38,39}. As a result of the studies conducted, it was found that the drug with the highest free phenolic acid content through gallic acid was the cherry stalk. The numbers of flavonoids were evaluated through epicatechin. It seems that the drug with the highest number of free flavonoids was the cherry stalk. It was found that the hydrolyzed tannins were mostly in the cherry stalk in the free and bound form. And the numbers of anthocyanins, which are considered cyanidin-3-glycoside, was found abundantly in cherry stones, while it was low in other drugs. Cherry stalk is the richest cherry tree texture in terms of phenolic compounds, flavonoids, hydrolyzed tannins, and anthocyanins^{39,40,41}.

It has the potential to affect antidiabetics due to the influence of esterified compounds. Polyphenols are successful in decreasing blood glucose levels. However, some studies also have shown that cherries have no effect on insulin and lipid metabolism. In a study, no change was observed in the parameters of fasting blood sugar, insulin, and blood fats after the use of cherry^{39,40}. Although it has been observed that the extracts have many beneficial effects in the studies conducted with cherry stalk and sour cherry stalk, it has not been stated that it provides weight loss and can be used for this purpose. There isn't sufficient study on cherry stalk and fruit. Present studies are contradictory.

2.3.7. Senna Tea

The biological activity of extracts of senna leaf and fruit were compared with each other. Although it was found at a higher rate in the fruit in the two samples, in which the high amount was composed of Sennoside A and B, the same biological activity was attributed to a third synergistic active substance. In addition, it is thought that this compound, which has a synergistic effect, is more in the leaf with a lower amount of sennoside⁴².

From the substances in senna seeds, those with slimming effects were determined. These compounds are divided into anthraquinones, naphthopyrones, volatile oils and oils⁴³.

In a study, rabbits were divided into five groups and fed equally. Extracts of 100mg/kg, 200mg/kg, 400mg/kg senna seeds were administered to groups 2, 3, and 4, respectively. It was seen no significant changes in glucose levels, as well as undesirable changes in liver values, such as increased urea⁴⁴.

Many studies conducted have shed light on the ways that ensures weight loss for different substances. It is considered that there are 4 different mechanisms including decreased lipid absorption by inhibiting pancreatic lipase, decreasing appetite with 5-HT_{2C} activation, increasing the feeling of satiety with glucagon-like peptide-1 (GLP-1) activation, and decreasing carbohydrate absorption by suppressing pancreatic alpha-amylase⁴³.

2.3.8. Sage Tea

Sage tea is rich in terms of flavonoids, densely including rosmarinic acid and luteolin-7-glucoside. There are differences between flower, root, and leaf. The linalool is denser at the root. In the flower, alpha-pinene and cineol are found more intensely as well as hispidulin glucuronide, hispidulin, apigenin, and sagerinic acid. In the leaves, higher levels of bornyl acetate, camphene, camphor, humulene, limonene, and thuyone are found, while they also contain apigenin, salvianolic acid, and carnolic acid^{45,46}.

In a study of 32 male rats, a high diet was applied for a long period of time. The rats were divided into 4 different groups at the end of the period as follows; the 1st control group, the 2nd group received 100 mg of sage extract, the 3rd group received 400 mg of sage extract, and the 4th group received 3 mg of rosiglitazone. Lipid inhibition was observed even in the group which received a low

amount of sage tea. It has also been observed that sage tea improves insulin sensitivity in rats⁴⁷. It has been observed that *S. officinalis* has a high inhibitory capacity of xanthic oxidase activity, which is thought to be dependent on the presence of flavones⁴⁸.

2.3.9. Stinging Nettle Tea

Urtica dioica is an herbaceous plant and often grows to about 2 meters in height. It has toothed leaves, and there are stinging trichomes on the stem and leaf. Small white or green flowers are found in clusters at the tip of stem and leaf branches. Its fruits are small achenes⁴⁹. The most abundant compounds are rutin, quercetin, 5-O-caffeoylquinic acid, isoquercetin⁵⁰.

Type 2 diabetic rats are divided into three groups. One of the groups was fed with normal water, the second with deionized water, and the third with nettle leaf extract. The first two groups received glibenclamide. At the end of the administration, compared to the control group, the group that used the extract had a decrease in cholesterol levels, a decrease in triglyceride levels, an increase in HDL levels, and a decrease in LDL levels. It has been observed that stinging nettle leaves have attained a particular glycemic and lipidemic success⁵¹. It was observed in a different study that the extract had no effects on insulin receptor protein extraction, PI3K, and AMPK protein expression. Stinging nettle extract caused a decrease in phosphorylation of AKT and increased glycogen synthesis⁵².

In a study conducted on rats with high lipid peroxidation and liver enzymes, and low antioxidant levels, stinging nettle leaf extract was administered to a control group and a group. As a result of the experiment, it was observed a decrease in the alkaline phosphatase (ALP), alanine aminotransferase (ALT), aspartate transaminase (AST), and malondialdehyde (MDA) values in the rat group that received the extract. It showed a

low increase in antioxidant levels, except for ceruloplasmin⁵³.

2.3.10. Rosehip Tea

Rosa canina is a plant that can be consumed fresh or dried⁵⁴. It is known that rosehip, used against diabetes among people, prevents the increase in body fat weight, reduces visceral fat, improves glucose tolerance, and is useful in metabolic syndrome accompanying obesity. It is considered that the substance that reduces the glucose level is trans-thyroid. Studies conducted are contradictory. There are also some studies reporting that it is not efficient in lipid metabolism and glucose tolerance⁵⁵.

In the results of the studies conducted, it was seen that trans-tiliroside inhibited the fat weight in the organs and the body and increased the expression of peroxisome proliferator and receptor messenger ribonucleic acid (mRNA) level in liver tissue. It is thought that kaempferol 3-O- β -glucopyranoside, kaempferol, and p-coumarin do not have anti-obese effects. It was observed that the consumption of rosehip caused a decrease in very-low-density lipoprotein (vLDL), HDL, LDL/HDL values of rats. Although low, kaempferol 3-O- β -glucopyranoside also showed anti-obese effects⁵⁶.

2.3.11. Rosemary Tea

Rosemary extract increases faecalis fat burning, increases energy burning, inhibits pancreatic lipase activity, reduces cholesterol levels, inhibits β -glucosidase enzyme, which is effective in the conversion of polysaccharides to short-chain fatty acids, and shows antiadipogenic effects by inhibiting preadipocyte differentiation in murine 3T3-L1 cells⁵⁷. It was also observed that erucic acid caused changes in osteoblasts⁵⁸.

Carnosol was found to exert suppressive activity on gene expression induced by cyclic adenosine monophosphate (cAMP) and

response element-binding protein. Carnosol moderately suppresses diacyl glycerol immediate transferase 1 (DGAT1) activity and exerts an inhibitory effect on intracellular triglyceride synthesis in human hepatic cells (HepG2)⁵⁷.

In a study with rosmarinic acid, both obese and healthy rats lost weight. An increase was observed in the feces of rats. And this increase was considered to be dependent on rosmarinic acid. It is thought that rosemary extract may also be efficient in fat absorption in the stomach⁵⁹.

2.3.12. Black Seed Tea

Active ingredients in black cumin seeds are thymoquinone, dithioquinone, and thymol. Thymoquinone is abundant in the seed⁶⁰.

Forty-one studies examined the meta-analysis in the clinical trial reported that black seed might have anti-obese effects. Some studies, on the other hand, could not observe a significant effect against placebo⁶¹.

Because thymoquinone is an active substance in obesity and is a fat-soluble component, consumption of black seed as tea reduces its efficiency in weight loss. It is recommended to be used in powder⁶². As a result of clinical studies, it has not been determined by which pathways the effect on the lipid profile is activated⁶³.

MP8b induces the thermogenesis of brown adipose tissue and generates more heat in the body instead of producing ATP. Therefore, an increased weight in the high-fat diet group was considered to be dependent on the reduction in white adipose tissue caused by the high-fat diet, BMP8b. Processes having a positive effect on obesity by affecting appetite and the mTOR pathway have been proven to contribute to BMP7 control⁶⁴. It is thought that black seed may act as a PPAR- γ 2 agonist and stimulate the receptor, and may increase energy homeostasis, expression of lipogenic

genes and differentiation of adipocytes in adipose tissues in this way⁶².

2.3.13. St. John's Wort Tea

Hypericum perforatum L. are shrub plants whose height can vary between 40-80 cm. Several dozen five-petaled yellow flowers are produced on the tops of mature plants. Leaves have small and black dots along the edges of their petals. When the flowers are crushed, the blood-red pigment is oozed. In late summer, the flowers produce capsules with dozens of tiny, dark brown seeds⁶⁵. Hyperforin and adhyperforin from phloroglucinol derivatives in St. John's wort and hypericin from anthraquinone derivatives are active compounds⁶⁶. Its primary active ingredients have been identified as hypericin and naphthodiantron⁶⁵.

It was observed in a different study that high cholesterol, triglyceride, and blood sugar levels decreased in mice with St John's Wort extract⁶⁷.

It is a factor in the development of insulin resistance. FATP1 deactivation reduced lipid accumulation in skeletal muscle and improved insulin sensitivity⁶⁸. St. John's Wort has been shown to increase adipocyte differentiation through unrelated mechanisms dependent on PPAR- γ and dependent on the activated protein kinase sirtuin-1 (AMPK-Sirt1) pathway⁶⁹.

2.3.14. Cinnamon Tea

Cinnamomum verum grows on trees up to 15 meters in height. Dark green pointed leaves are oblong -or oval-shaped, naked, and leathery in texture. It has a single-seeded fruit and green to yellowish-white flowers. The bark is consumed by grinding and is ground when the young leaves turn from red to green. Eugenol is the main component in cinnamon leaves, and (E)-cinnamyl acetate and caryophyllene in fruits and flowers. The main ingredients in their drugs are different.

Eugenol is more dominant in leaves, cinnamaldehyde in bark, camphor in root bark, trans-cinnamyl acetate in fruit, terpene hydrocarbons, and alpha bergamotene in buds, (E)-cinnamyl acetate and trans-alpha-bergamotene in flowers^{70,71}.

A study was conducted by excluding students with 2nd level obesity, drug-induced obesity, obesity due to disease's side effects, peptic ulcer, oral mucosal ulceration, and obesity-related diseases among college students. Before the study, 70% of the students were overweight, and 30% were class 1 obese. After the study, while 20% of them were normal weight and 66.67% were overweight, the rate of class 1 obesity decreased to 13.33%⁷².

Cinnamon increases glucosidase enzymes and GLUT4, inhibits ATPase in the intestine, and reduces glucose absorption in the small intestine while delaying the gastric emptying. These effects of cinnamon are due to epicatechin, catechin, and procyanidin⁷³. However, as a result of a study conducted with the consumption of 3g of cinnamon extract daily, any net data on gastric emptying could be reached in the consumption of cinnamon for the short term. It was observed that it could not show any effect reflected on the parameters⁷⁴.

The result of the study conducted with the administration of 5mg/kg and 10mg/kg cinnamaldehyde with different groups showed the antiadipogenic effect of cinnamaldehyde by inhibiting accumulation of lipid⁷⁵.

It seems that using cinnamon significantly reduces body weight, body mass index, waist circumference, and fat weight. A meta-analysis with randomized controlled studies demonstrated the importance of the potential role of flavanols against obesity.

Cinnamon also regulated triglyceride levels, total cholesterol, HDL-C levels, fasting plasma glucose, and HbA1c⁷³. It has been observed that trans-cinnamic acid can promote the browning of 3T3-L1 white adipocytes by inducing adipocytes and activate metabolic

responses. Cinnamaldehyde, the essential oil in cinnamon, performs thermogenesis using the PKA-p38 mitogen-activated protein kinase (MAPK) signaling pathway⁷⁶.

Using cinnamon has shown effect by inhibiting pancreatic amylase and decreasing intestinal glucose absorption, increasing cellular glucose uptake and stimulating glycogen synthesis, inhibiting gluconeogenesis, stimulating insulin receptor activity, improving weight loss, increasing insulin levels, and lowering fasting blood sugar⁷³.

2.3.15. Parsley Tea

Petroselinum crispum, a plant that dies after seed maturation, has taproot and tripinnate leaves. Compounds considered to be related to the hypolipidemic activity of parsley are as follows: Glucosinolates, betalains, carotenoids, phenolic compounds⁷⁷. Studies about the effects of tea on this issue are limited. In a study, the effects of parsley and carob were compared. In consequence of the study, there seems to be an improvement in lipid parameters using carob and parsley extracts⁷⁷.

2.3.16. Ginger Tea

Zingiber officinale is a plant that is herbaceous and perennial and can grow up to 1 meter. It has leaf-blades that are lanceolate or linear. Its flowers are fragile. The most abundant gingerol analog in fresh ginger is 6-gingerol⁷⁸. Curcumin (diferuloylmethane) is a polyphenol and an active ingredient in *Zingiberaceae* species such as ginger⁷⁹.

In studies with humans, no significant weight-related results have been found, except that ginger extract, taken on an empty stomach, reduces appetite and creates a feeling of satiety, and provides some reduction in hip circumference. In the examination of a review, animal experiments have shown achievement in controlling and reducing weight⁸⁰.

In a study using 6-shogaol and 6-gingerol, it was seen that they reduced body weight. The ginger extract containing 6-gingerol and 8-gingerol provided improvement in metabolic disorders caused by obesity. It has not been determined whether it inhibits adipogenesis in 3T3-L1 cells with 6-gingerol or 6-shogaol⁷⁸.

It has been stated that thermogenesis and increased energy burning, increased lipolysis, suppression of lipogenesis and lipid accumulation, suppression of adipogenesis, suppression of fat absorption, and appetite control are all effective mechanisms of action⁸⁰.

2.3.17. Pomegranate Tea

Those the most abundant in the pomegranate flower are polyphenols (gallic acid and ellagic acid) and triterpenes (oleanolic, ursolic, maslinic and asiatic acids). The flower also contains daucosterol, a sterol, and Punic flavone, a flavonoid⁸¹. It is known that cinnamic acid has an anti-obese effect⁸².

A study was performed to assess the effects of obesity with the consumption of pomegranate peel extract. A strong inhibitory effect on pancreatic lipase enzymes was observed in ethanol-extracted peels instead of water-extracted peels⁸³. As a result of studies with pomegranate extract, it seems that it is good for hyperlipidemia and liver fattening caused by feeding with a high-fat diet, and it reduces high blood sugar levels by 31%⁸¹. Pomegranate flower extracted with ethanol is theoretically considered to provide a lipid-lowering effect by affecting the PI3K-Akt pathway and PPAR- γ protein⁸⁴.

As a result of a meta-analysis, it was clearly understood that pomegranate had no significant effect on lipid levels by evaluating 17 different clinical studies⁸⁵.

3. Discussion and Conclusion

Many remedies are sought for obesity, which causes psychological disorders by affecting all well-being as well as creating

metabolic disorders. Consumption of herbal teas is one of them⁸⁶. In consequence of this research to examine in our study, the plants that were taken from herbalists and pharmacies in different cities for consumption as slimming tea were selected among those frequently mentioned on the internet and social media. Mate, senna, and white tea are among the plants widely consumed in Sanliurfa⁸⁷. Rosemary, rosehip, cassia, St. John's wort, stinging nettle are common plants consumed in Istanbul⁸⁸. Parsley and cherry stalk were the most consumed plants in a study conducted in Gumushane⁸⁹. Oolong tea, ginger, cinnamon, sage, cherry stalk, and green tea were also determined among the commonly consumed plants as a result of a study conducted in Denizli⁹⁰.

The anti-obesity effects of lingonberry tea are dependent on the proanthocyanidins and cyanidin-3-O β -glucosides in its content¹². As a result of clinical studies, it can be said that it is effective in the given dosing range. Mate tea is a good antioxidant due to its high amount of chlorogenic acid and is at the forefront with this feature¹⁵. However, it shows auxiliary effects on slimming with the high absorption of caffeine in its content, accompanied by sports and a low diet¹⁸. It has shown successful results depending on the dose in clinical studies with caffeine, epigallocatechin, and a high amount of polyphenol in green tea content. Although oolong tea and white tea are different from green tea due to the difference in preparation conditions, they have polyphenol-based ingredients like green tea. There are clinical trials with anti-obesity effects other than white tea. White tea is a tea among the *Camellia sinensis* teas which did not have anti-obesity effects. In general, they show activity from similar pathways. It is considered that some components that remain undegraded in green tea make the anti-obesity effect more successful than other *Camellia sinensis* species⁹¹.

Components, bound or esterified in cherry fruit, seeds, leaves, are found free in the cherry stalk³⁹.

It is stated that it is the drug with the highest concentration of components⁴⁰. There is no clinical study on the slimming effect of cherry stalk tea, which is known to have a good antioxidant effect because of its high polyphenol content, but it has a mass using it for this purpose. It requires clinical studies to evaluate its anti-obesity effects. Sennosides in senna tea are known due to their laxative effect⁹².

Some studies found the compounds and biochemical pathways of senna that has anti-obesity effects, but clinical studies are contradictory. Clinical studies for sage tea are promising but insufficient. Nettle tea is a good antioxidant⁵⁰.

Although the effective mechanism for stinging nettle in slimming is unknown, it has been observed that it can be successful in insulin resistance accompanied by obesity⁵¹. Although it cannot be said to be promising in terms of slimming, more studies are required for more meaningful evaluation. It is stated that rosehip theoretically prevents lipid formation, but contradictions are found in clinical studies⁵⁵. The trans-tiliroside substance it contains has a moderate anti-obesity effect⁵⁶. Clinical studies must be increased. It has been theoretically stated that erucic acid, luteolin, carnosol in rosemary extract provide anti-obesity effects through some pathways^{59,93}.

In a study conducted with curcumin, an effect was observed in diabetes-related problems, but no change was observed in lipid metabolism⁹⁴. The number of clinical studies conducted related to rosemary extract is few, and the components of rosemary tea must be clarified with clearer lines. As a result of the studies, it is thought that black seed tea makes it difficult to take the thymoquinone ingredient, which is considered to be effective in anti-obesity, and therefore, it can be more effective with alternative consumption forms⁶². Longer-term studies are required for clearer results.

St John's Wort extract has been reported to have anti-obesity effects, and the hyperforin ingredient in its content was reported to be

effective in reducing body fat mass in a study^{67,69}. It should be considered that St John's wort may not be suitable for regular use due to its psychoactive effects and may not be used for the treatment of obesity. Anti-obesity effects of the cinnamon extract have been observed. Trans-cinnamic acid and its biochemical pathway are indicated⁷⁶. More studies are required for its active ingredients. Studies on parsley tea are so limited. There is a study stating its hypolipidemic effect⁷⁷. Its components are not specified in detail enough. As a result of studies conducted with ginger tea and its 6-shogaol, 6-gingerol, and curcumin ingredients, its anti-obesity effect has been stated and its biochemical pathways have been enlightened^{78,79}. Although there exist studies of drugs other than pomegranate flower, experimental studies for pomegranate flower are insufficient. Although it was stated that a hypolipidemic effect was observed as a result of the extraction of pomegranate flowers with ethanol, the studies with other drugs of pomegranate did not show a significant hypolipidemic effect^{81,85}. Studies should be conducted with the extract of pomegranate flowers prepared with water.

The botanical knowledge, content, common uses, clinical trials, and biochemical pathways of herbal teas popularly used nowadays were all examined. In conclusion, some results about the effects of herbal teas on slimming were discussed and the missing points were emphasized in order to shed light on future studies.

Conflict of Interest

All the authors declare that they have no conflict of Interest.

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