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REVIEW ARTICLE

EVALUATION OF THE SLIMMING EFFECTS OF DIET TEA IN BIOCHEMICAL AND MOLECULAR MEANING

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Abstract

The replacement of consumed with foods containing high carbohydrates, fats and proteins exceed that the daily needs of body, causes many health problems, especially obesity. Complicated health problems have been trying to be solved with drugs, but it is not possible to control diseases if obesity is not resolved. Obesity causes inflammation, insulin resistance, 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. In this study, the effect levels with the mechanisms supporting weight loss on the biochemical parameters of the active substances in the herbal forms sold and consumed as diet tea, were evaluated.

Keywords: Herbal, obesity, slimming, tea, weight-loss.

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 received 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 loss[1]. It was found that beside the effect of self-esteem, a high level of impulsivity was also efficient in the development of obesity[2]. 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 has diagnosed more in obese women[3]. 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.

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 people[4]. Today, obesity rates are increasing due to the increasing sedentary life with the COVID-19 outbreak[5]. The uncontrolled increase in body fat mass because of unbalanced nutrition has been one of the main reasons for overweight and has been classified in the body mass index based on height[6].

Effective mechanisms in weight gain

Lack of genetic structure, hormonal, metabolic, hypothalamic, and psychological levels were argued as the causes for the development of obesity. In addition to all these, drug-induced obesity could also occur[6]. The metabolic syndrome accompanies obesity, and the riskiest disease was hypertension. If it met at least 3 criteria among the following conditions, such as if a person's fasting plasma glucose was greater than 110 mg/dL, triglyceride level was greater than 150 mg/dL, high-density lipoprotein (HDL) cholesterol was less than 40 mg/dL in men and less than 50 mg/dL in

women, hypertension, and waist circumference was greater than 102 cm in men and greater than 88 cm in women, then the metabolic syndrome can be diagnosed. Insulin resistance and hyperinsulinemia were considered the primary source of metabolic syndrome[7].

Herbal teas consumed for slimming and their effects

Lingonberry Tea

The total number of compounds observed in *Vaccinium vitis-idaea* was specified as 925[8]. Active ingredients were reported as arbutin, quercetin, chlorogenic acid[9]. The most abundant were quercetin-derived flavanols[10].The flavonoids of primary importance found in lingonberry extracts were flavan-3-ols (catechin and epicatechin) and the most important glycoside was quercetin[11]. Lingonberry extract displayed antioxidant activity[11]. Beside the antioxidant effect, polyphenols displayed anti-diarrheal, anti-inflammatory, antibacterial, anti-obesity, and anti-obesity activations[9]. In cases anti-obesity activation was provided via lipid destruction, the decrease in cholesterol levels could be partially explained by proanthocyanidins and cyanidin-3-Oβ-glucosides[12].

It was found that the ethanol extract of Lingonberry increased glucose consumption in skeletal muscles by activating AMPK (activated protein kinase). In skeletal muscles, the phosphatidylinositol-3 kinase (PI3-K)/Akt pathway was activated by insulin and stimulates intracellular GLUT4 vesicle for glucose uptake in membranes. AMPK activation also had effects that reduced the accumulation of intra-myocyte and increased the sensitivity of muscle cells to insulin. AMPK activation stimulated lipogenic enzymes and increased the oxidation of fatty acids[13]. 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% decreased in total plasma cholesterol and LDL were seen at the dose of 250 mg/kg. Lingonberry increased insulin-dependent and independent glucose consumption. It increased the level of GLUT4 protein. However, only 500 mg/kg resulted in a significant increased in these pathways[13].

In another study, the effects of Lingonberry were observed in rats a high-fat diet. When the results were evaluated, a significant difference was observed between a high-fat diet and lingonberry used in weight gain[12]. 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 supported our statement that toxicity started to occur.

Mate Tea

*Ilex paraguariensis*is an evergreen tree from the *Aquifoliaceae* family that can reach 18 m in height. Mate trees have bloomed in autumn and produced fruit until summer. Mate tea was blanched, dried, and aged before used[14]. Caffeine, nicotinic acid, which were the active ingredients obtained from mate leaves, were specified as anti-obesity and cholesterol-lowering. Although not yet certain, caffeine and saponin of mate were 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 explained[15]. Chlorogenic acid, a polyphenol, showed an effect on glucose metabolism, reduced LDL and cholesterol oxidation, and reduced the risk of cardiovascular disease. The components in its content created a weakening effect through different mechanisms[16]. Caffeine, one of the main active compounds of mate tea, was highly absorbed through the liver. Caffeine had an anti-obesity effect with its thermogenic feature in reducing body mass index and was a fat burner. Caffeine prevented thermogenesis from induction of cyclic adenosine monophosphate (cAMP) from phosphodiesterase and ensured fat burning not to stop[17]. Mate tea compounds provided high fat burning in individuals who did not exercise, but their effects have not been examined in sedentary individuals[18]. 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 days[19]. 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, 24% increase in fat oxidation was observed compared to the placebo 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 study[18]. During eight weeks, the consumption of mate tea caused a decrease in glucose, cholesterol, TG, HDL, LDL values of the experimental animal group fed on a high-fat diet. It should be used with exercise and a low-calorie diet[20].

Green Tea

It was obtained from the dried leaves of *Camellia sinensis* and was a member of the *Theaceae* family. The length of the green tea tree grown by leaf sprouting has been shortened to two meters. Light green leaves were preferred for the purpose of tea making. Green tea contained around 4000 active ingredients[21]. Most of them consisted on polyphenols[22]. Catechin which was the most effective and high in green tea content wasepigallocatechin-3-gallate. Black tea had less catechin content compared to green. One of the most important xanthines included in the alkaloid group was caffeine. Oolong tea, and black tea had high ascorbic acid content[23].

As a result of the stimulation of ephedrine by caffeine, thermogenesis increased. The same effect was observed at a higher level with green tea extract. It could be said that epigallocatechin, constituting more than half of the green tea content, greatly increased the efficiency of green tea in thermogenesis. It was

observed that when used separately, the effects of epigallocatechin and caffeine were lower but created a synergistic effect when given together[24]. Epigallocatechin, catechin, and their derivatives, namely flavanols, were sympathetic system stimulants. Sympathetic nervous system activation suppressed appetite by increasing energy consumption. It contributed to the desired weakening effect. There were clinical studies on compounds that activated the sympathetic nervous system[25]. 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 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 low calories increased by 21.43%[26]. Beside its anti-obesity and cholesterol lowering effected, it was also active in suppressing postprandial hypertriacylglyc-erolemia. Carbohydrate-rich diets were the cause of postprandial lipidemia. The triglyceride concentration that will occur as a result of a diet rich in carbohydrates should be controlled[27]. 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 inhibited the effect of lipase on the pancreas. Catechins, with their effect on pancreatic lipase activity, reduced postprandial hypertriacylglycerolemia and fat absorption. The effect varied depending on the dose[28].

Oolong Tea

Camellia sinensis L. is perennial plant with small leaves and is resistant to cold weather. The leaves and buds were semi-fermented and semi-oxidized to obtain oolong tea from *Camellia sinensis*, which had different tea forms according to the way of processing. Polyphenols were concentrated in tea[29]. Although the amount of flavanol glycosides in oolong tea was not known, it was known that they were higher in fresh tea leaves, which were in green tea[30]. Cholesterol was converted into bile acids and cholesterol regulation was provided. Bile acids were produced as cholic acid and chenodeoxycholic acid. Bile acids were metabolized in the intestine[31]. It was considered that epigallocatechin gallate, which was one of the catechins in herbal teas obtained from *Camellia sinensis*, inhibited cholesterol and lymphatic TG absorption and had inhibitory properties for pancreatic lipase[32]. This could be considered as the mechanism of oolong tea in fat excretion. It was thought that oolong tea was more efficient in lipid excretion than green tea[32]. During the conversion of epigallocatechin gallate and catechins to 1-methyl-3-isomethyl butilxanthine, dexamethasone, and insulin-induced adipocytes, murine preadipocytes reduced TG accumulation. They prevented fatty acid synthesis by limiting acetyl-CoA carboxylase activity. Catechins regulated the balance between LDL and HDL levels[33]. Epigallocatechin gallates have been shown to reduce cell viability and inhibit preadipocytes. Methylated tea catechins showed these effects at higher levels[34]. The fatty acid synthetase (FAS) enzyme was lipogenic. It catalyzed 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 was involved in fatty acid and triglyceride synthesis, could also be shown as one of the anti-obesity mechanisms of oolong tea[35].

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* teas[31]. As a result of another study conducted, the amount of lipid in the stool was higher in the group which consumed oolong tea[32]. 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 treatment[33].

White Tea

It was 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 tea[36]. Although it was shown by glycerol measurement that white tea extract induced the increase of lipolysis activity in differentiated adipocytes, it was inadequate to explain the decrease in triglycerides. It was considered that the effects of epigallocatechin gallate, which were compared with previous studies, could not explain the lipolytic activity of white tea[37].

Cherry Stalk Tree

Total 14 kinds of phenolic compounds, seven of which were phenolic acid groups and seven of which were flavonoid groups, were found in cherry textures. While cherry stalk had a high rate of hydroxycinnamic acid, hydroxybenzene was quite low[38,39]. As a result of the studies conducted that it was determined by gallic acid method that the drug with the highest free phenolic acid content was cherry stalk. The numbers of flavonoids were evaluated through epicatechin. It seemed 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. Cyanidin-3-glycoside was found abundantly in cherry stones, while it was low in other drugs. Cherry stalk was the richest cherry tree texture in terms of phenolic compounds, flavonoids, hydrolyzed tannins, and anthocyanins[39-41].

It had the potential to affect antidiabetics due to its esterifying effect on compounds. Polyphenols were successful in decreasing blood glucose levels.

However, some studies also have shown that cherries had 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 used of cherry[39,40]. Although some studies were contradictory, existing studies with cherry stalk and sour cherry stalk extracts indicated that they could be used for weight loss.

Senna Tea

When the biological activities of senna leaf and fruit extracts were compared, it was seen that they consisted of sennosides A and B, which have high synergistic effects[42]. From the substances in senna seeds, those with slimming effects were determined. These compounds were divided into anthraquinones, naphthopyrones, volatile oils and oils[43]. In a study, rabbits were divided into five groups and fed equally. Extracts of 100 mg/kg, 200 mg/kg, 400 mg/kg senna seeds were administered to groups 2, 3, and 4, respectively. It was seen that no significant changes in glucose levels, as well as undesirable changes in liver values, such as increased urea[44].

Many studies conducted have shed light on the ways that ensured weight loss for different substances. It was considered that there were 4 different mechanisms including decreased lipid absorption by inhibiting pancreatic lipase, decreasing appetite with 5-HT2C activation, increasing the feeling of satiety with glucagon-like peptide-1 (GLP-1) activation, and decreasing carbohydrate absorption by suppressing pancreatic alpha-amylase[43].

Sage Tea

Sage tea was rich in terms of flavonoids, densely including rosmarinic acid and luteolin-7-glucoside. There were differences between flower, root, and leaf. The linalool was denser at the root. In the flower, alpha-pinene and cineol were 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 thuyonewere found, while they also contained apigenin, salvianolic acid, and carnosic 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 followed; 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 improved insulin sensitivity in rats[47]. It has been observed that *S. officinalis* has a high inhibitory capacity of xanthic oxidase activity, which was thought to be dependent on the presence of flavones[48].

Stinging Nettle Tea

Urtica dioica was an herbaceous plant and often grows to about 2 meters in height. It has toothed leaves, and there were stinging trichomes on the stem and leaf. Small white or green flowers were found in clusters at the tip of stem and leaf branches. Its fruits were small achenes[49]. The most abundant compounds were rutin, quercetin, 5-O-caffeoylquinic acid, iso-quercetin[50]. Type 2 diabetic rats were 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 success[51]. 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 synthesis[52]. 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 ceruloplasmin[53].

Rosehip Tea

Rosa canina was a plant that could be consumed fresh or dried[54]. It was known that rosehip, used against diabetes among people, prevented the increase in body fat weight, reduced visceral fat, improves glucose tolerance, and was useful in metabolic syndrome accompanying obesity. It was considered that the substance that reduced the glucose level was trans-thyroid. Studies conducted were contradictory. There were also some studies reporting that it was not efficient in lipid metabolism and glucose tolerance[55]. 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 was thought that kaempferol 3-O-β-glucopyranoside, kaempferol, and p-coumarin did 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 effects[56].

Rosemary Tea

Rosemary extract increased faecalis fat burning, increased energy burning, inhibited pancreatic lipase activity, reduced cholesterol levels, inhibited β-glucosidase enzyme, which was effective in the conversion of polysaccharides to short-chain fatty acids, and showed antiadipogenic effects by inhibiting preadipocyte differentiation in murine 3T3-L1 cells[57]. It was also observed that erucic acid caused changes in osteoblasts[58]. Carnosol was found to exert suppressive activity on gene extraction induced by cyclic adenosine monophosphate (cAMP) and response element-binding protein. Carnosol moderately suppressed 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 was thought that rosemary extract might also be efficient in fat absorption in the stomach[59].

Black Seed Tea

Active ingredients in black cumin seeds were thymoquinone, dithioquinone, and thymol. Thymoquinone was abundant in the seed[60]. 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 placebo[61]. Because thymoquinone was an active substance in obesity and was a fat-soluble component, consumption of black seed as tea reduced its efficiency in weight loss. It was recommended to be used in powder[62]. As a result of clinical studies, it has not been determined by which pathways the effect on the lipid profile was activated[63].

Morphogenetic protein (MP8b) induced the thermogenesis of brown adipose tissue and generated 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 mechanistic target of rapamycin (mTOR) pathway have been proven to contribute to bone morphogenetic protein (BMP7) control[64]. It was thought that black seed might act as a PPAR-γ2 agonist and stimulated the receptor, and might increase energy homeostasis, expression of lipogenic genes and differentiation of adipocytes in adipose tissues in this way[62].

St. John's Wort Tea

Hypericum perforatum L. is shrub plant whose height can vary between 40-80 cm. Several dozen five petaled yellow flowers were produced on the tops of mature plants. Leaves had small and black dots along the edges of their petals. When the flowers were crushed, the blood-red pigment was oozed. In late summer, the flowers produced capsules with dozens of tiny, dark brown seeds[65]. Hyperforin and adhyperforin from phloroglucinol derivative in St. John's wort and hypericin from anthraquinone derivatives were active compounds[66]. Its primary active ingredients have been identified as hypericin and naphthodiantron[65]. It was observed in a different study that high cholesterol, triglyceride, and blood sugar levels decreased in mice with St John's Wort extract[67]. It was a factor in the development of insulin resistance. FATP1 deactivation reduced lipid accumulation in skeletal muscle and improved insulin sensitivity[68]. 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) pathway[69].

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 has been consumed by grinding and was ground when the young leaves turned from red to green. Eugenol was the main component in cinnamon leaves, and (E)-cinnamyl acetate and caryophyllene in fruits and flowers. The main ingredients in their drugs were different. Eugenol was 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 increased glucosidase enzymes and GLUT4, inhibited ATPase in the intestine, and reduced glucose absorption in the small intestine while delaying the gastric emptying. These effects of cinnamon were due to epicatechin, catechin, and procyanidin[73]. 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 parameters[74]. The result of the study conducted with the administration of 5 mg/kg and 10 mg/kg cinnamaldehyde with different groups showed the antiadipogenic effect of cinnamaldehyde by inhibiting accumulation of lipid[75]. It seemed that using cinnamon significantly reduced 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 HbA1c[73]. It has been observed that trans-cinnamic acid could promote the browning of 3T3-L1 white adipocytes by inducing adipocytes and activate metabolic responses. Cinnamaldehyde, the essential oil in cinnamon, performed thermogenesis using the PKA-p38 mitogen-activated protein kinase (MAPK) signaling pathway[76].

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 sugar[73].

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 were as follows: Glucosinolates, betalains, carotenoids, phenolic compounds[77]. Studies about the effects of tea on this

issue were limited. In a study, the effects of parsley and carob were compared. In consequence of the study, there seemed to be an improvement in lipid parameters using carob and parsley extracts[77].

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 was 6-gingerol[78]. Curcumin (diferuloyl methane) was a polyphenol and an active ingredient in *Zingiberaceae* species such as ginger[79]. In studies with humans, no significant weight-related results have been found, except that ginger extract, taken on an empty stomach, reduced appetite and created a feeling of satiety, and provided some reduction in hip circumference. In the examination of a review, animal experiments have shown achievement in controlling and reducing weight[80]. 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 inhibited adipogenesis in 3T3-L1 cells, which are a fibroblast-like morphologyfrom derived from mouse, 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 were all effective mechanisms of action[80].

Pomegranate Tea

Those the most abundant in the pomegranate flower were polyphenols (gallic acid and ellagic acid) and triterpenes (oleanolic, ursolic, maslinic and asiatic acids). The flower also contained daucosterol, a sterol, and Punic flavone, a flavonoid[81]. It was known that cinnamic acid has an anti-obese effect[82]. 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 peels[83]. As a result of studies with pomegranate extract, it seemed that it was good for hyperlipidemia and liver fattening caused by feeding with a high-fat diet, and it reduced high blood sugar levels by 31%[81]. Pomegranate flower extracted with ethanol was theoretically considered to provide a lipid-lowering effect by affecting the PI3K-Akt pathway and PPAR-γ protein[84]. 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 studies[85].

DISCUSSION

Many remedies were sought for obesity, which caused psychological disorders by affecting all well-being as well as creating metabolic disorders. Consumption of herbal teas was one of them[86]. In consequence of the 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 were among the plants widely consumed in Sanliurfa[87]. Rosemary, rosehip, cassia, St. John's wort, stinging nettle were common plants consumed in Istanbul[88]. Parsley and cherry stalk were the most consumed plants in a study conducted in Gumushane[89]. 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 Denizli[90].

The anti-obesity effects of lingonberry tea were dependent on the proanthocyanidins and cyanidin-3-Oβ-glucosides in its content[12]. As a result of clinical studies, it could be said that it was effective in the given dosing range. Mate tea was a good antioxidant due to its high amount of chlorogenic acid and was at the forefront with this feature[15]. However, it showed auxiliary effects on slimming with the high absorption of caffeine in its content, accompanied by sports and a low diet[18]. 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 were different from green tea due to the difference in preparation conditions, they had polyphenol-based ingredients like green tea. There were clinical trials with anti-obesity effects other than white tea. White tea was a tea among the *Camellia sinensis* teas which did not have anti-obesity effects. In general, they showed activity from similar pathways. It was considered that some components that remained undegraded in green tea made the anti-obesity effect more successful than other *Camellia sinensis* species[91].

Components, bound or esterified in cherry fruit, seeds, leaves, were found free in the cherry stalk[39]. It was stated that it was the drug with the highest concentration of components[40]. There was no clinical study on the slimming effect of cherry stalk tea, which was known to have a good antioxidant effect because of its high polyphenol content, but it had a mass using it for this purpose. It required clinical studies to evaluate its anti-obesity effects. Sennosides in senna tea were known due to their laxative effect[92]. Some studies found the compounds and biochemical pathways of senna that had anti-obesity effects, but clinical studies were contradictory. Clinical studies for sage tea were promising but insufficient. Nettle tea was a good antioxidant[50]. Although the effective mechanism for stinging nettle in slimming was unknown, it has been observed that it could be successful in insulin resistance accompanied by obesity[51]. Although it could not be said to be promising in terms of slimming, more studies were required for more meaningful evaluation. It was stated that rosehip theoretically prevented lipid formation, but contradictions were found in clinical studies[55].The trans-tiliroside containing of it had a moderate anti-obesity effect[56]. Clinical studies must be increased. It has been theoretically stated that erucic acid, luteolin, carnosol in rosemary extract provided 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 metabolism[94]. The number of clinical studies conducted related to rosemary extract was few, and the components of rosemary tea must be clarified with clearer lines. As a result of the studies, it was thought that black seed tea makes it difficult to take the thymoquinone ingredient, which was considered to be effective in anti-obesity, and therefore, it could be more effective with alternative consumption forms[62]. Longer-term studies were 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 might not be suitable for regular use due to its psychoactive effects and might 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 were indicated[76]. More studies were required for its active ingredients. Studies on parsley tea were so limited. There was a study stating its hypolipidemic effect[77]. Its components were 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 existed studies of drugs other than pomegranate flower, experimental studies for pomegranate flower were 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.

CONCLUSION

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.

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AUTHOR'S CONTRIBUTION

EYUPOGLU OE: writing original draft, methodology. **ARMAN BS:** investigation, conceptualization, literature survey. Both authors revised the article and approved the final version.

DATA AVAILABILITY

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

CONFLICT OF INTEREST

None to declare.

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