

## A Comparative Study Between the Use of Aqueous Extract of Ginger, Green Tea and a Saxenda Drug for Weight Loss in Male Albino Rats

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**Annotation: Background:** Many weight reduction supplements, such as green tea and ginger, are based on herbal medicines and remedies that have been used for centuries in various parts of the world to maintain health and prevent or treat disease. **Aim of study:** comparative study between the combination effect of aqueous extract of ginger, Green tea with a saxenda drug against weight loss and Lipid profile , thyroid hormones, and hematological parameters in male albino rats: **Material and Method:** this study included 3 groups group 1 :a control group and was given food and water only, group III was given the Saxenda drug in concentration 6mg\ml for 20 days, group III was given the aqueous plant extract of each Ginger and green tea at a concentration 250 mg\kg for 20 days. At the end of the experiment, blood was conduct the following testsT3,T4,TSH, lipids profile, ALT,AST,ALP . The second part of the blood was received to conduct some blood tests, which included: RBC count, Hb and PCV. **Results:** there was a significant decreased in body weight in group treated

with Saxenda drug ( $165.67 \pm 3.48$ ) g and group treated with mix plants extract ( $161.33 \pm 3.38$ ) with significant differences as well as ,the results revealed a significant decreased in T3 hormone in groups treated with Saxenda drug ( $71.20 \pm 3.19$ ) ng/ml compared with treated group with mix extract ( $82.40 \pm 2.78$ ) ng/ml ,also the results show significant increased in T4 hormone in groups treated with Saxenda drug ( $9.06 \pm 0.25$ ) ug\ml and mix plant extract ( $8.33 \pm 0.43$ ) ug\ml compared control group moreover there was decrease in lipid profile in plant extract group compared with and Saxenda group but no significant difference, however liver enzyme ALT, AST, ALP increased in aqueous extract of the plants group ( $23.67 \pm 2.73$ ,  $27.33 \pm 2.72$ ,  $85.67 \pm 4.09$ ) respectively , the level RBC,HB, PCV in group treated with aqueous extract ( $4.81 \pm 0.28$  ,  $12.72 \pm 0.46$ ,  $36.67 \pm 1.20$ ) respectively increased compared with Saxenda with significant difference but there was no significant with control group. **Conclusion:** both green tea and ginger extract showed improvement in reduce the body weight as well improvement in thyroid hormones and blood parameter, the results showed both green tea and ginger extract has protective effect depending on liver enzyme levels.

**Keywords:** green tea, ginger, body weight, thyroid hormones, lipid profile, blood.

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## Introduction

Few of the numerous supplements on the market have scientific proof of their usefulness and safety. Clinical evidence is not necessary for supplements, in contrast to pharmaceutical medications that need approval before being marketed. Herbal remedies and nanoparticles, which have been used globally for health maintenance, disease prevention, and weight loss, are the basis of many weight loss supplements (Harris et al., 2012; Abbood & Luaibi, 2023). The main

examples of natural plant products include green tea (*Camellia sinensis*), caffeine, and capsaicin supplements. These products are safe, healthful, and have been pushed as weight loss aids all over the world (Sun et al., 2016). It contains anti-pain, anti-inflammatory, antioxidant, and anti-cancer qualities (Luo, Peng, & Li, 2011). Even though green tea (*Camellia sinensis*) is a staple beverage in Asia, particularly in China and Japan, it has recently gained popularity in western nations. Epigallocatechin gallate, epicatechin gallate, epigallocatechin, and caffeine are among the several polyphenolic chemicals that are abundant in it. It can shield the body from diabetes mellitus and cardiovascular disease (CVD) and has an antioxidant capacity. Green tea has the potential to enhance energy expenditure and fat oxidation, leading to weight loss (Hursel, Viechtbauer, & Westerterp-Plantenga, 2009). Additionally, caffeine, a sports supplement, is found in tea and coffee leaves. Caffeine can lower body weight by promoting thermogenesis, fat oxidation, and energy expenditure (Joy et al., 2016). Green tea catechins have been demonstrated to dramatically lower plasma triglyceride, total cholesterol (TC), and low-density lipoprotein (LDL) cholesterol levels in both in vitro and animal studies (Klaus et al., 2005 ; Xing et al., 2019). Regarding these benefits of green tea, however, the results of clinical trials have not been definitive. According to several meta-analyses and randomised controlled trials (RCTs), green tea may have an impact on the lipid profiles of both healthy people and those with cardiovascular-related conditions such as hypertension, hypercholesterolaemia, and glucose intolerance (Ferreira et al., 2017). However, the beneficial metabolic effects of green tea have not been confirmed by additional randomised controlled trials (Amozadeh et al., 2018). A popular spice and flavouring, ginger (*Zingiber officinale* Roscoe, Zingiberaceae) has also been utilised in traditional medicine in many places. In rats given a high-fat diet, ethanolic extract of ginger decreased blood glucose levels (Nammi et al., 2009). Additionally, by lowering blood triglycerides and cholesterol, ginger helps diabetic rats with hyperlipidaemia (Al-Amin et al., 2006; Saravanan et al., 2014). Ginger supplements have been shown to ameliorate fatty liver caused by fructose utilisation (Gao et al., 2012). Gingerol, a potent anti-inflammatory molecule, is one of the significant phenol chemicals and volatile oil that make up ginger root's active ingredients (Shaukat et al., 2023). Body weights were reduced by cumin and ginger (Sayed et al., 2020). Although there is data regarding the effects of ginger and green tea on body weight and other physiological indicators, less is known about the combined effects of the two on these same parameters. The aim of the current study was comparative between the combination effect of aqueous extract of ginger, green tea with Saxenda drug against weight loss and Lipid profile, thyroid hormones, and hematological parameters in male albino rats. The hypothesis of the current study: the combination administration of aqueous extract of ginger, green tea may show synergistic effect that reduce the body weight and improve physiological parameter in rats more than aqueous extract of ginger and aqueous extract of tea individually comparing with Saxenda drug. The aim of the current study is to investigate the synergistic effect of aqueous extract of ginger and green tea to reduce the body weight in rats and evaluate different physiological parameters compared with anti-obesity drugs as Saxenda.

## Materials and Methods

### Green tea extract preparation

Green tea extract preparation (GTE) To make the green tea water extract solution, 10 g of tea powder was added to 100 ml of boiling water in a flask, and the mixture was stirred for 10 minutes in a water bath shaking incubator. The concentration was made after the extraction solution had cooled to room temperature and been filtered through Whatman No. 1 filter paper (Wu et al., 2013) then the concentrations were made.

### Ginger extraction preparation

To get dried ginger to fit through 160 mesh sieves, it was ground. Using a 250 mL flask of hot boiling water, 20 g of powdered materials were extracted. Then, for 72 hours, each container was shaken at room temperature. After filtering. After weighing and storing the dried extracts at 4°C

(Farmoudeh et al., 2021), then the concentrations were made.

### **Experimental design**

The experiment was conducted to compare the physiological effects between some plants extract used for slimming and a Saxenda drug. The study included 15 male rats, divided into three groups as follows. The first group was considered a control group and was given food and water only. The second group was given the Saxenda drug in concentration 6mg/ml (Novo Nordisk A/S, Denmark) for 20 days, while the third group was given the aqueous plant extract of each Ginger and Green tea at a concentration 250 mg/kg for 20 days. At the end of the experiment, blood was drawn and separated using a centrifuge 3000 r.p.m for 10 min. to obtain the serum to conduct the following tests T3, T4, TSH, lipids profile, ALT, AST, ALP. The second part of the blood was received to conduct some blood tests, which included: RBC count, Hb and PCV.

### **Body Weights Measurements**

All animals for each group were weighed on an electronic balance before and after the exposure periods (20) day.

### **liver function tests**

The following kit was used in the measurement of study parameters: ALT, AST, (BIMERIEUX, France) (Bioassay System, USA),.

### **Lipid profile test**

Lipid profile test was measured by using an automated analyzer instrument (Cobas® 6000 analyzer series cobas® c 501 module, LABSERVIS LTD, Azerbaijan).

### **Thyroid hormones**

T3, T4, and TSH Estimation of serum Triiodothyronine (T3), total serum Thyroxin (T4) and serum thyrotropin (TSH) were performed utilizing ELISA assay kit (Labor Diagnostika Nord GmbH, Nordhorn, Germany) and following the manufacturer instructions.

### **Hematological parameters**

After being drawn into EDTA-containing tubes, the blood samples were used right away to measure the haematological parameters. White blood cell (WBC) and total red blood cell (RBC) counts were calculated using Dacie and Lewis's (1991) visual approach. The haematocrit method (Alexander and Griffiths, 1993) was used to calculate the percentage packed cell volume (PCV), and the cyanomethaemoglobin method (Alexander and Griffiths, 1993) was used to estimate the blood haemoglobin (Hb) content in all samples.

### **Statistical Analysis:**

The Statistical Packages of Social Sciences-SPSS (2019) program was used to detect the effect of difference groups in study parameters. Least significant difference-LSD (ANOVA) was used to significant compare between means in this study.

## **Results and Discussion**

### **body weight**

The confirmed results in Table No. 1 showed a significant decreased in body weight in group treated with Saxenda drug ( $165.67 \pm 3.48$ ) g and group treated with mix plants extract ( $161.33 \pm 3.38$ ) g at the last day of experiment compared with body weight at the first day of experiment for both groups ( $165.53 \pm 3.87$ ) ( $173.96 \pm 1.84$ ) g respectively while the results show a significant increase of body weight of control group ( $190.63 \pm 4.09$ ) g at the end of experiment.

**Table 1: Comparison between difference groups in body weight**

Group	Means $\pm$ SE	
	Initial weight (g)	Final weight (g)
Control	183.33 $\pm$ 4.41	196.33 $\pm$ 5.78 a
Saxenda 6mg/ml	181.00 $\pm$ 2.08	165.67 $\pm$ 3.48 b
aqueous extract of Ginger, Green tea (250)mg/kg	172.00 $\pm$ 3.05	161.33 $\pm$ 3.38 b
LSD	11.496 NS	15.084 **
P-value	0.110	0.0025
Means having with the different letters in same column differed significantly. ** ( $P \leq 0.01$ ).		

The study's goal was to look into the synergistic effect of both green tea and ginger extract on rat body weight in addition to several physiological parameters when compared to Saxenda drug. This result was in line with the findings of Hashem et al. (2018), who examined the biochemical effects of ginger and/or green tea extracts in high-fat diets. They found that rats fed high-fat diets (HFDs) alone showed a significant increase in final body weight and lee index compared to the normal control, The obtained results agreed with findings of other researchers(Ahmad et al., 2015; Ibrahim et al., 2014). Green tea's thermogenic properties were ascribed to its high levels of catechin polyphenols and caffeine (Dulloo et al., 1999). When compared to the normal control, obese rats given a ginger and green tea mixture showed negligible changes in their lee index, however their body weight outcomes improved when compared to rats given high calories and other treatment groupsthis could be because of the complementary effects of both herbal plants , (Franata et al., 2023) that examined how providing male Wistar rats doses of 4.5, 5.5, and 6.5 grammes of green tea leaf extract affected their weight loss before and after receiving the extract and found that the 6.5-gram dosage of green tea extract was much less than that of the other groups. Green tea's potential for weight loss has been the subject of numerous studies. According to one study, weight loss in white male Wistar rats with the strain *Rattus norvegicus* was impacted by the administration of green tea leaf extract (*Camellia sinensis*) both before and after the rats received the extract (Zalukhu & Lubis, 2020). With an ideal dose of 400 mg/kg BW, nearly equal to the medication simvastatin and near the normal value of total cholesterol levels, green tea extract was found in another study to be able to lower total cholesterol levels in alloxan-induced diabetic Wistar rats (Sarel & Simanjuntak, 2020).

Green tea has an impact on adipose tissue weight and weight reduction, according to the findings of in-vivo research conducted on experimental animals. Increasing lipid absorption is one way that green tea drinking can help people lose weight. In high-fat/induced rats, the amounts of lipids in the faeces are also elevated by green tea extract and tea catechins. Through the inhibition of adipocyte proliferation and differentiation, as well as the inhibition of numerous associated enzymes, the results of in-vitro investigations also demonstrate anti-obesity actions (Ariani & Sutriningsih, 2017).

On the other hands Al Asoom et al. (2023) discovered research on the combined effects of ginger and nigella sativa in rats. Their study comprised five groups: positive control (intraperitoneal 50  $\mu$ g/kg ligarglutide), negative control, ginger (500 mg/kg), and nigella sativa-ginger (both interventions). The body weight decreased over time, although there was no significant difference between the groups ( $p > 0.05$ ). However, compared to the control group (196.33  $\pm$ 5.78 g), the animals treated with the Saxenda medication had a lower weight (165.67  $\pm$ 3.48). The development of anti-obesity drugs has changed significantly in recent years, mostly as a result of new scientific discoveries that have improved our understanding of the systems governing appetite, glucose, fat, and lipid metabolism. These days, anti-obesity medications are used to treat obesity. They are categorised based on how they work: a. phentermine-topiramate (Qsymia®), setmelanotide

(IMCIVREE®), naltrexone-bupropion (Contrave®), which act on the nervous system; b. orlistat (Xenical®), which inhibits lipase and hence fat absorption; c. liraglutide (Saxenda®), semaglutide (Wegovy®), which are agonists of the glucagon like peptide 1 (GLP-1) receptors; and tirzepatide (Mounjaro®), a dual glucose-dependent insulinotropic polypeptide, GIP, and GLP-1 receptor agonist (Bischoff & Schweinlin2020). Due to the strong effects of these medications on weight loss, hyperglycemia, and other significant cardiometabolic parameters including dyslipidaemia, the latter category of anti-obesity medications is continuously attracting a lot of attention (Patti et al., 2019). Green tea has been linked to weight loss through a number of biological mechanisms, such as improved thermogenesis and fat burning, decreased adipocyte lipogenesis, or decreased fat absorption (Wolfram et al., 2006). Studies have indicated that ginger may boost thermogenesis and energy expenditure, stimulate the hormone-sensitive lipase enzyme, and reduce appetite and food cravings, though the precise mechanisms by which it reduces obesity have not yet been conclusively determined (Konstantinidi & Koutelidakis, 2019).

### Thyroid hormones

Table 2 revealed a significant decreased in T3 hormone in groups treated with Saxenda drug. (71.20 ±3.19) ng/ml compared with treated group with mix extract (82.40 ±2.78) ng/ml ,also the results show significant increased in T4 hormone in groups treated with Saxenda drug (9.06 ±0.25) ug/ml and mix plant extract (8.33 ±0.43) ug/ml compared control group (5.76 ±0.29) ug/ml. Statistical analysis showed significant decreased in the TSH hormone in the treated group with Saxenda drug (1.90 ±0.08) ug /ml compared with control group (3.46 ±0.30) ug /ml and non no significant difference with mix plant extract (2.64 ±0.29) ug /ml

**Table 2: Comparison between difference groups in Hormones**

Group	Means ±SE		
	T3 (ng/ml)	T4 (ug/ml)	TSH (ug /ml)
Control	79.73 ±2.03 ab	5.76 ±0.29 b	3.46 ±0.30 a
Saxenda 6mg/ml	71.20 ±3.19 b	9.06 ±0.25 a	1.90 ±0.08 b
aqueous extract of Ginger, Green tea (250)mg/kg	82.40 ±2.78 a	8.33 ±0.43 a	2.64 ±0.29 ab
LSD	9.373 *	1.159 **	0.866 *
P-value	0.0498	0.0010	0.0129
Means having with the different letters in same column differed significantly. * (P≤0.05), ** (P≤0.01).			

Regardless of the ginger dosage, the thyroid gland results were consistent with those of Moustafa et al. (2017), who discovered that T3 increased noticeably 15 days after delivery. Furthermore, after 30 days, this elevation ceased to be noteworthy. It's interesting to note that this T3 alteration is reversible and returns to normal once Ginger administration is stopped. After 15 and 30 days, T4 was increased by both Ginger dosages. Similarly, T4 dropped and then rose to normal when Ginger treatment was stopped. After 15 and 30 days, TSH was raised by both dose levels of ginger (50 and 100 mg/kg), however the increase was less pronounced after 100 mg/kg Additionally, the results concurred with Al-(Amoudi, 2018). The study examined the harmful effects of lambda-cyhalothrin (LCT) on the rat thyroid in conjunction with oxidative stress and the protective benefits of ginger extract. It found that the group receiving ginger treatment had higher T3, T4, and TSH levels. While the administration of LCT and ginger resulted in an increase in T3 and T4 and a decrease in TSH, no discernible changes were found between the control and ginger-treated groups.

A number of investigations concurred with our findings about the green tea impact. Zaki and associates, 2022. Twenty-four adult albino Sprague-Dawley rats were used in the study. For a period of eight weeks, they were split into three groups: control, lithium carbonate, and concurrent

lithium carbonate 400 mg + green tea 200 mg. Serum levels of TT3, TT4, FT3, and FT4 rose by 16%, 23%, 28%, and 22% when GTE was used in comparison to the control group. Additionally, this group's TSH level dropped by 45% in comparison to the LC group, but it was still higher (41%) than the control group's. Furthermore, a study by El Mgeed et al. (2009) examined the effects of green tea, liquorice, or their combination on rat plasma thyroid hormone levels and discovered that the group treated with green tea had higher levels of TSH, T4, and lower levels of T3. Lastly, Saxenda was linked to a higher risk of thyroid C-cell focal hyperplasia, adenomas, and C-cell tumours, according to a mouse study. C-cell hyperplasia may be one of the causes of medullary thyroid cancer (Bjerre Knudsen et al., 2010). It's unclear exactly how herbal medicine treats hypothyroidism, but it appears that ashwagandha has endocrine-stimulating qualities that can lower cortisol levels and improve thyroid function (Sharma et al., 2018), ginger (Al-Amoudi, 2018), and Nigella sativa (Xiong et al., 2017) may have antioxidant activity and lessen oxidative stress in the thyroid. Green tea drinking at large doses may negatively affect thyroid function, and tea extract may act as an antithyroid agent (Chandra & De 2010).

### Lipid profile

The results in Table No. 3 showed there was a significant decrease in cholesterol level in the treated group Saxenda drug (79.67 ±1.45) mg\dl and group treated with mix plants extract(82.67 ±2.40) mg\dl compared with control group(92.33 ±2.18)mg\dl, The results also showed a significant decrease in the level of Triglyceride in both treated group with Saxenda and mix plant extract(73.00 ±1.74, 75.33 ±1.45) mg\dl respectively compared with control group(81.67 ±2.03) mg\dl. The results also obtained non significant difference in the level of HDL among three groups, while the results recorded a significant decrease in LDL in group treated with Saxenda drug (31.67 ±2.60)mg\dl and mix plants extract(35.33 ±0.33)compared with control group(45.33 ±3.71) mg\dl and significant decrease in VLDL in group treated with Saxenda (14.60 ±0.34) and mix plant extract(15.06 ±0.29) mg\dl compared with control group(16.33 ±0.40) mg\dl

**Table 3: Comparison between difference groups in Lipid profile**

Group	Means ±SE (mg/dl)				
	Cholesterol mg\dl	Triglyceride mg\dl	HDL mg\dl	LDL mg\dl	VLDL mg\dl
Control	92.33 ±2.18 a	81.67 ±2.03 a	31.00 ±1.52	45.33 ±3.71 a	16.33 ±0.40 a
Saxenda 6mg/ml	79.67 ±1.45 b	73.00 ±1.74 b	33.33 ±0.88	31.67 ±2.60 b	14.60 ±0.34 b
aqueous extract of Ginger, Green tea (250)mg/kg	82.67 ±2.40 b	75.33 ±1.45 b	32.67 ±2.40	35.33 ±0.33 b	15.06 ±0.29 b
LSD	7.110 **	6.067 *	5.956 NS	9.820 *	1.213 *
P-value	0.0100	0.0311	0.6365	0.0250	0.0311
Means having with the different letters in same column differed significantly. * (P≤0.05), ** (P≤0.01).					

Our results concurred with those of Hashem et al. (2018). Five groups were included in this study: group 1 was fed a basal diet (control group); group 2 was fed only a high-fat diet (HFD) for 45 days, acting as an obese control; group 3 was fed a high-fat diet (HFD) and received one tablet of ginger extract (400 mg/kg BW) in 1 millilitre of distilled water by gavage every day for 45 days;

group 4 was fed a high-fat diet and received one tablet of green tea extract (300 mg/kg BW) for 45 days; and group 5 was fed a combination of HFD and both ginger and green tea extracts in the same doses and duration. Compared to the normal control group, there was a significant increase in serum cholesterol, TAGs, LDL-C, VLDL-C, and leptin levels in groups 2–5. Groups 2–5 showed a significant drop in HDL-C when compared to normal control. When given ginger, green tea, or both, obese rats demonstrated a notable, similar results found in other authors (Xu et al., 2015; Padmaja et al., 2014). as well as the results agreed (Khosravani et al., 2016) Results showed the control group's TG concentration was noticeably greater than those of the other groups. Additionally, there was no significant difference between the aerobic exercise and ginger extract groups, while the mean concentration of TG in the aerobic exercise group was significantly lower than that of the ginger extract group. When compared to the ginger group, the combination of aerobic exercise and ginger ingestion dramatically lowered the TG level. All groups' TC and LDL concentrations were considerably lower than the control. HDL values were increased when aerobic exercise and ginger extract eating were combined. Consuming ginger might considerably enhance lipid profiles, including total triglycerides (-12.54 (-20.01 to -5.08)), cholesterol (-6.53 (-10.76 to -2.31)), LDL (-5.14 (-8.79 to -1.50)), and HDL (1.13 (0.35 to 1.91)), according to a study by Asghari-Jafarabadi & Khalili (2022). Additionally, taking ginger supplements may result in a considerable reduction in body mass index (BMI) of -0.49 (-0.79 to -0.18). Nevertheless, the few sample studies that looked into body weight decreases (-0.52; -1.48 to 0.43), were not statistically significant. Furthermore, according to Pourmasoumi et al. (2018), using ginger supplements decreased LDL-C (-4.90 mg/dl) and TAG (-17.59 mg/dl). Neither (TC) (-5.13 mg/dl) nor (HDL-C) (2.18 mg/dl) were significantly impacted by ginger. Studies were categorised by ginger dosage because of the significant level of inter-study variability. A significant decrease in TC (-12.26 mg/dl) and TAG (-38.42 mg/dl) was revealed by stratified analysis. Trials using more than 2 g of ginger per day, however, did not show a comparable substantial benefit. There were no discernible improvements in LDL-C or HDL-C in studies using less than 2 g of ginger per day or trials using more than 2 g per day. Furthermore, in a study conducted by Haidari et al. (2012), the effects of green tea were examined in 48 male wistar rats with diabetes. The experimental groups were given alcohol extract of green tea leaves at doses of 100 and 200 mg/kg for four weeks, and the animals' body weight was recorded daily. When compared to the diabetic control group, the administration of 200 mg/kg of green tea extract to diabetic rats resulted in a significant improvement in body weight loss and a significant decrease in serum glucose and total cholesterol levels. Triglyceride, low-density lipoprotein, and high-density lipoprotein cholesterol levels did not significantly alter after the intervention.

The results were consistent with a number of studies that looked into the protective impact of green teas, such as Amanolahi and Rakhshande (2013), which found Throughout the trial, all groups—aside from group A—were fed a diet high in fat. From day 28 to the end of the trial, Group C was given 25 mg/kg/day of nicotinic acid. Additionally, group D received 100 mg/kg/day of the extract from day 28 till the study's conclusion, while group E received 100 mg/kg/day of the extract from the beginning to the completion of the study. Compared to group C, the levels of total cholesterol, LDLc, HDLc, and triglycerides were significantly lower in group (D) by 33.3%, 30.2%, and 40%, respectively ( $p < 0.001$ ). Nicotinic acid reduced serum levels of every parameter that was examined ( $p < 0.001$ ). When ginger and green tea extracts were administered together to obese rats, the outcomes of their lipid profiles were better than when they were administered separately. Additionally, there is proof that the tea's polyphenol content improves the excretion of bile acids and cholesterol in the faeces (CHISAKA et al., 1988). Furthermore, ginger may have a hypocholesterolemic effect because it contains certain chemical constituents that prevent dietary fat from being absorbed by preventing its hydrolysis. These constituents also increase the activity of the hepatic enzyme cholesterol-7-alpha hydroxylase, which promotes the conversion of cholesterol to bile acids, a crucial pathway for the body to eliminate cholesterol (Sayama et al., 2000). While Liraglutide dramatically reduced blood glucose, serum triglycerides (TG), total cholesterol (TC), and low-density lipoprotein cholesterol (LDL-C) when compared to a study. In

db/db mice given HFD, it also decreased liver lipid deposition. Moreover, the movement of 3H-cholesterol from macrophages to plasma and feces was significantly enhanced in db/db mice fed with HFD after liraglutide administration in mice (Wu et al.,2019).

### Liver enzymes

The results showed that there was a significant increase in the ALT enzyme in the treated group with Saxenda ( $38.33 \pm 2.33$ ) IU/l compared with the group treated with aqueous extract of the plants( $23.67 \pm 2.73$ ) and the control group( $21.67 \pm 2.60$ ) IU/l. This was also the case with regard to the activity of the AST enzyme, as the results showed that there was a significant increase in the AST enzyme in the treated group with Saxenda ( $39.67 \pm 2.33$ ) IU/l compared with the group treated with aqueous extract of the plants( $27.33 \pm 2.72$ ) IU/l and the control group( $27.00 \pm 1.73$ ) IU/l. There were no significant differences between the three groups with regard to the activity of the ALP enzyme.

**Table 4: Comparison between difference groups in Liver enzymes**

Group	Means $\pm$ SE		
	ALT (IU/L)	AST (IU/L)	ALP (IU/L)
Control	$21.67 \pm 2.60$ b	$27.00 \pm 1.73$ b	$87.33 \pm 1.45$
Saxenda 6mg/ml	$38.33 \pm 2.33$ a	$39.67 \pm 2.33$ a	$81.00 \pm 7.00$
aqueous extract of Ginger, Green tea (250)mg/kg	$23.67 \pm 2.73$ b	$27.33 \pm 2.72$ b	$85.67 \pm 4.09$
LSD	8.860 **	7.963 *	16.462 NS
P-value	0.0071	0.0128	0.6427
Means having with the different letters in same column differed significantly. * (P $\leq$ 0.05), ** (P $\leq$ 0.01).			

The results were in line with those of El-Bakry et al. (2017), who investigated how green tea extract increases ALT and AST levels in comparison to the control group and causes liver damage and exacerbates paracetamol-induced hepatotoxicity. agreed with Dorreyatim and Bavil (2017) as well five groups of forty male wistar rats were randomly assigned: For four weeks, the fibrosis group received injections of carbon tetrachloride (1 ml/kg/IP) diluted in corn oil three times a week, the control group received GTE powder dissolved in distilled water orally at doses of 125 mg/kg body weight, the green tea extract group received both green tea and carbon tetrachloride simultaneously, and the corn oil group received corn oil 1 mL/kg body weight three times a week discovered ALT, AST, and ALP levels were higher in the fibrosis group than in the control group (P $<$ 0.01). In the fibrosis model, green tea dramatically decreased all of the enzymes (P $<$ 0.05). Under normal circumstances, the enzymes were unaffected by GTE or maize oil.

In order to assess the hepatoprotective efficacy of green tea aqueous extract against methotrexate-induced liver damage in rats, Jwied (2009) presented a study. 20 mg/kg MTX was injected intraperitoneally as a single dose, followed by saline, and 1.25% and 2.5% aqueous extract of green tea were given orally seven days before and five days after Methotrexate intoxication as the only source of drinking water. This caused a model of liver damage in rats. Blood samples were taken after the animals were killed in order to assess the serum levels of alkaline phosphatase (ALP) and alanine and aspartate aminotransferases (ALT and AST) the results demonstrated that, in comparison to the group treated with methotrexate, the administration of green tea extract (GTE) considerably reduced the high levels of ALT, AST, and ALP activity in the serum.

While Emam and Abugherin (2019) discovered that the group given a high-fat diet (HFD) received both ginger and HFD for ten weeks, group III received ginger extract orally two weeks prior to HFD, and group IV received both. When compared to the control group, the ginger-treated group displayed non-significant changes in all examined parameters. A study found that rats

treated with ginger at three different dose levels (100, 200, and 400 mg/kg) showed hepatic protective efficacy in comparison to silymarin at 16.88, 67.89, and 80% for ALT serum level, 59, 86, and 81% for AST serum level, 7, 34, 67% for ALP, and 103,105, 106% for serum total bilirubin level (Yassin et al., 2010). In their 2024 study, Mustafa and Jawad evaluated the hepatoprotective potential of ginger ethanolic extract against lambda-cyhalothrin-induced toxicity in males. They discovered that, by the 12th week, the serum levels of hepatic enzymes (AST, ALT) in the LCT-treated group were significantly higher ( $P < 0.05$ ) than in the control group, indicating liver damage. The LCT-GEE group was considerably decreased by this rise, indicating ginger's protective effect.

These enzyme levels decreased when *Zingiber officinale* extract was administered, indicating that it had hepatoprotective properties. This finding is consistent with previous research that links ginger's strong antioxidant qualities to its liver-protective actions, providing therapeutic advantages by boosting the liver's detoxifying capacities (Egwurugwu et al., 2007). The FDA reported that during the Saxenda clinical trials, five (0.15%) Saxenda-treated patients (two of whom had ALT greater than 20 and 40 times the upper limit of normal) experienced increases in alanine aminotransferase (ALT) greater than or equal to 10 times the upper limit of normal, while one (0.05%) placebo-treated patient experienced the same side effect. The association with Saxenda is unclear because, in the majority of instances, clinical assessment to rule out other causes of ALT and aspartate aminotransferase (AST) elevations was not performed. Gallstones and other confounding variables were linked to certain elevations in ALT and AST.

### CBC

The results showed a significant decrease in the number of red blood cells in the treated group with Saxenda ( $3.74 \pm 0.16$ ) cellx10<sup>3</sup> compared with the group treated with aqueous extract of the plants ( $4.81 \pm 0.28$ ) cellX10<sup>3</sup> and the control group ( $4.95 \pm 0.43$ ) cellX10<sup>3</sup>. The results also showed a significant decrease in hemoglobin concentration the treated group with Saxenda ( $10.36 \pm 0.15$ ) g/dl compared with the group treated with aqueous extract of the plants ( $12.72 \pm 0.46$ ) g/dl and the control group ( $13.01 \pm 0.56$ ) g/dl. Finally, the results showed a significant decrease in the PCV in the treated group with Saxenda ( $31.00 \pm 0.57$ )% compared with the group treated with aqueous extract of the plants ( $36.67 \pm 1.20$ )% and the control group ( $37.67 \pm 1.20$ )%.

**Table 5: Comparison between difference groups in CBC**

Group	Means $\pm$ SE		
	RBC CellX10 <sup>3</sup>	Hb (g/dl)	PCV (%)
Control	4.95 $\pm$ 0.43 a	13.01 $\pm$ 0.56 a	37.67 $\pm$ 1.20 a
Saxenda 6mg\ml	3.74 $\pm$ 0.16 b	10.36 $\pm$ 0.15 b	31.00 $\pm$ 0.57 b
aqueous extract of Ginger, Green tea (250)mg\kg	4.81 $\pm$ 0.28 a	12.72 $\pm$ 0.46 a	36.67 $\pm$ 1.20 a
LSD	1.087 *	1.484 **	3.586 **
P-value	0.0499	0.010	0.0013
Means having with the different letters in same column differed significantly. * ( $P \leq 0.05$ ), ** ( $P \leq 0.01$ ).			

This was in line with (Elkirdasy et al., 2015), which found that giving diabetic rabbits green tea and/or ginger extracts enhanced ( $p < 0.05$ ) their decreased RBC and WBC counts, PCV, and neutrophil percentage. Nevertheless, the administration of green tea and/or ginger extracts brought the diabetic rabbits' high MCV, MCH, and MCHC levels down to normal. Reduced lipid peroxide levels in the RBC membrane may be the cause of the higher RBC count in diabetic rabbits treated with green tea and/or ginger, which would lessen the RBCs' vulnerability to haemolysis. Given

that hyperglycemia is correlated with non-enzymatic glycosylation of membrane proteins (Sharma et al., 2018), One may argue that the way that green tea and ginger extract worked was by lowering the high levels of glucose in the diabetic rabbits that were treated with them. To show the precise mechanism of action of green tea and ginger extracts on the elevated RBC count of diabetic rabbits, additional research is required to measure the RBC fragility as well as blood levels of calcium, iron, cobalt, vitamin B12, and folic acid. Thus, our findings imply that in anaemic diabetic rabbits, the erythropoiesis (the production of new blood cells) and erythrocyte concentration are stimulated by green tea and ginger extracts until the RBC returns to normal. Their significance in erythropoiesis is suggested by the statistically significant drop in the diabetic rats PCV (measure of the volume of blood composed of solid cells) and its normalization after green tea or ginger extract administration (Elkirdasy et al., 2015). Improvements in thyroid hormones, liver enzymes, and hematological parameters ultimately led to weight loss in obese rats receiving treatment; however, a combination of ginger and green tea was noted as having a protective impact. These findings validated the complementary effects of both herbal plants. The use of ginger and green tea extract, which contains a number of potentially harmful substances, and the possibility that each ingredient in the combo may change the other ingredients were the study's limitations. As a result, it is challenging to identify which components of ginger extract and green tea are in charge of the harmful effects seen in our investigation.

## Conclusion

Both green tea and ginger extract showed improvement in reduce the body weight as well improvement in thyroid hormones and blood parameter, moreover comparison with Saxenda drug , the results showed both green tea and ginger extract has protective effect depending on liver enzyme levels .

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