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Potential Protective Effects Of Arabica Coffee Beans And Peels In Improving The Biological Condition Of Hyperlipidemic Rats

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ABSTRACT

Cardiovascular disease remains a major global health burden, and dietary strategies that improve lipid metabolism may help reduce related risk factors. Arabica coffee beans and coffee peels contain bioactive compounds that may exert beneficial metabolic effects. This study aimed to evaluate the effects of Arabica coffee beans and Arabica coffee peels on selected biochemical and physiological parameters in diet-induced hyperlipidemic rats. Twenty-four adult male Sprague-Dawley albino rats, weighing 250–260 g, were divided into four groups (n = 6 each). During the induction period, the control group received a standard diet, whereas the remaining groups received a hyperlipidemic diet. In the treatment period, one hyperlipidemic group remained untreated, while the other two groups received a hyperlipidemic diet supplemented with 5% coffee beans or 5% coffee peels for 6 weeks. At the end of the experiment, blood samples and organs were collected for biochemical evaluation. Supplementation with coffee beans and coffee peels reduced serum triglycerides, total cholesterol, free fatty acids, and aspartate aminotransferase compared with the untreated hyperlipidemic group, while body weight gain did not differ significantly among hyperlipidemic groups. These findings suggest that Arabica coffee beans and coffee peels may improve selected biochemical markers associated with hyperlipidemia in rats.

KEYWORDS: Arabica Coffee beans - Coffee arabica peels – hyperlipidemia- bioactive components.

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INTRODUCTION

Cardiovascular diseases are the primary etiology of mortality globally, accounting for approximately 19.8 million mortalities in 2022, which accounts for around thirty-two percent of all worldwide mortalities. Heart attacks and strokes are the most common causes, with 85% of CVD-related deaths attributed to these two conditions. While the global death rate per capita has declined

due to improved prevention and treatment, the overall number of deaths continues to rise, largely because of a growing and aging global population **(Petersen and Kris *et al* ., 2021).** Symptoms of cardiovascular disease may differ based on the underlying etiology. Older adults and females might have more nuanced symptoms. Nonetheless, they may still experience serious cardiovascular disease. (**Robson et al ., 2015).** Coffee is extensively known as one of the most preferred beverages worldwide, because of it's accessibility, consumer preferences, and health advantages. Nonetheless, the entire process from coffee generation to consumption produces about 2 billion tons of solid waste each year, with coffee husk constituting about 10 million tons of that waste. Coffee husk is regarded as the main co-product produced throughout the dry processing of coffee, with the majority being directly discarded in landfills. **(Duan *et al*,. 2022).** In the last fifteen years, the coffee demand has risen significantly. This increase may be related to multiple factors, involving growing populations and urbanization. Moreover, coffee has become as 1 of the most extensively consumed beverages globally. The coffee culture is essential to the global economy, being 1 of the most preferred beverages, with more than 500 billion cups drunk each year. **(Klingel *et al.,* 2024).** The 1st coffee plantation was founded in Yemen via Arabs in the thirteenth century with seeds obtained from Ethiopia. **(Patil *et al*., 2023).** Numerous investigations have shown the antioxidant and antimicrobial characteristics of phytochemicals found in coffee by-products. Moreover, there is a growing customer demand for natural ingredients in the food industry and nutrients with proven health advantages. (**Simoes *et al*. 2022).** Coffee husk is regarded as a major co-product produced during the dry processing of coffee beans, constituting forty to forty-five percent of the overall coffee harvest. The dry processing technique is a simple and economical method. **(Ontawong et al ., 2020).** The health advantages of bioactive phenolic compounds have attracted significant worldwide interest. Coffee husk is a rich source of phenolic compounds, resulting in continuous studies focused on extracting advantageous compounds from it. The primary phenolic compounds derived from coffee husk involve gallic a\, caffeic a\, chlorogenic a\, ferulic a\, quercetin, syringic a\, caffeine, 5-caffeoylquinic a\, anthocyanins, and tannins. **(Farias et al,. 2019).** Various techniques were utilized for extracting phenolic compounds from coffee husk, involving conventional solvent extraction (utilizing ethanol, methanol, isopropanol, and water), alternative solvent extraction (like ionic liquids and deep eutectic solvents), and advanced methodologies (including supercritical fluid extraction, microwave-assisted extraction, ultrasound-assisted extraction, pulsed electric field-assisted extraction, and pressurized liquid extraction). **(Chang *et al,*. 2023).** The antioxidant and radical scavenging properties of coffee beans can enhance wound healing by regulating excessive oxidative stress in the wound site. The coffee bean press cake has demonstrated diminished commercial value; nevertheless, it may acquire value as an essential biomass source of bioactive substances beneficial to human health applications. The examined residual coffee biomasses enhance the regeneration of damaged skin tissue, facilitating novel product development in the pharmaceutical and cosmetic sectors. **(Silva *et al*., 2020).** Numerous investigations have demonstrated that the active substances in coffee provide advantageous effects, such as antidiabetic and antioxidant effects. Furthermore, the active substances in coffee can inhibit the accumulation of lipids and carbohydrates. Chlorogenic acid in green coffee may enhance the oxidation of fatty acids**. (Cangeloni et al .,2022).**

AIM OF STUDY

Determine the effectiveness of coffee beans and coffee arabica peels in improving the biological condition of hyperlipidemic rats.

MATERIALS & METHODS

3.1- Materials:

Coffee beans and Coffee arabica peels: they were purchased from Al-Baha City, KSA, local market, washed, cleaned, blended, & ground into fine powder utilizing an electric grinder. To reduce oxidation, they were stored in dark-stoppered glass bottles until ready to be used. according to **A.O.A.C (1995).**

Cholesterol: from Morgan Chemical Ind., Cairo, Egypt.

Hyperlipidemic rats: Twenty-four adult male Sprague-Dawley albino rats, weighing 250–260 g, were obtained from the Institute of Nutrition, Cairo, Egypt. The rats were housed individually in wire cages under standard laboratory conditions and were fed the basal diet for one week for adaptation before the experiment.

Experimental design:

The rats were randomly divided into four groups, with six rats in each group. The experiment was conducted in two phases. During the first phase (3 weeks), Group 1 was fed a standard diet and served as the normal control group, whereas Groups 2, 3, and 4 were fed a hyperlipidemic diet according to **(Abdel Maksoud et al., 1996)** to induce hyperlipidemia. During the second phase (6 weeks), Group 2 continued on the hyperlipidemic diet and served as the untreated hyperlipidemic group, while Groups 3 and 4 continued on the hyperlipidemic diet supplemented with 5% Arabica coffee beans and 5% Arabica coffee peels, respectively. Throughout the induction and treatment periods, feed and tap water were provided ad libitum. Body weight was recorded twice weekly, and feed intake was calculated.

Table (1). The composition of the control and hyperlipidemic diet.

Group Ingredient	Control (-) Group 1	Hyperlipidemic Control Group 2	Hyperlipidemic diet	
			5% Coffee Beans Group 3	5% Coffee Peels Group 4
Corn starch	72.8	71.8	66.8	61.8

Casein	**12.5**	**12.5**	**12.5**	**12.5**
Corn oil	**10**	**-**	**-**	*
*** Vit. Mix.**	**1**	**1**	**1**	**1**
**** Salt mix**	**3.5**	**3.5**	**5.5**	**3.5**
Animal fat		**10**	**10**	**10**
Cholin chloride	**0.2**	**0.2**	**0.2**	**0.2**
Cholesterol	**-**	**1**	**1**	**1**

** Saltmix **(A.O.A.C, 1990)**

Table (2). The composition of salt mixture according to A.O.A.C(1990).

Ingredients	***Gm***
Sod. Cholorid	139.3
KI	0.790
KH2PO4	389.0
Mg SO4	57.0
CaO3	381.0
Fe SO4.7H2O 27.0	
MuSO4. H2O	4.01
ZnSO4.7H2O	0.548
C11SO4.5H2O	0.470
COC12.6H2O	0.023

Table (3). The composition of vitamin mixture according to first report (1977).

Ingredients	***Gm***
Vitamin D3 acetate (1000 lu / gm)	1.0
Vitamin A palmitate (500.000 In / gm)	0.80
Menadione Sodium Bisul-Fate (62.5% menacione)	0.08
Vitamin E acetate (500 lu / gm)	10.0
Riboflavin	0.60
Thiamine HCI	0.60
Nicotinic acid	3.0
Pyridoxine HCI	0.07
Folic acid	0.20
Calcium Pantothenate	1.60
Cyano Cobalamine 0.01%	1.0
Biotin, 1%	2
Sucrose	978.42
Total	1000

Blood sampling

At the end of the experimental period, blood samples were collected from overnight-fasted rats for biochemical analysis. Serum was separated by centrifugation after clotting at room temperature and stored at −10°C until analysis. After blood collection, the rats were dissected, and the organs were removed, washed with saline solution, dried, and weighed for further examination according to **(Drury and Wallington, 1967)**.

Biological analysis

Body weight gain, feed intake, and food efficiency ratio were determined according to (**Chapman *et al*,1959).**

Biochemical analysis

- **Body weight gain, Food intake,** FER consistent with ***Chapman et al. (1959)***
- **Glucose concentration in the blood serum estimation:** Chemical kits were used to assess glucose levels in serum **(Trinder, 1969).**
- **Triglycerides:** Triglycerides have been estimated using an enzyme calorimeter as defined via **Fassati & Prencipe (1982).**
- **Total cholesterol:** The main use of total cholesterol testing, as indicated via **Allain, (1974)**.
- **Determination of phospholipids:** Phospholipids have been determined based on **Richard et al. (1974).**
- **Determination of free fatty acid:** Free fatty acid or, Nonesterified fatty acid (NEFA) has been determined based on **(Richard et al., 1974).**
- **Determination of serum calcium**: Serum calcium has been measured via a photometric test using cerophthalin complex (CPC). The kits were provided by Diagnostic Systems International GmbH- Germany, according to **Thomas (1998).**
- **Determination of serum iron: A** Colorimetric endpoint is used to determine serum iron. The kits were provided by Greiner Diagnostic Gmblt-Unter Gereuth, Germany.
- **Determination of serum Zinc:** Colormetric determination of Zinc according to **Makino (1991).**
- **Determination of serum Magnesium:** Magnesium was detected by the atomic absorption technique using SP 929 - PYE UNICAM.
- **Calcium and magnesium**:0.2 ml serum + 10 ml lanthanum chloride and dilute to 20 ml with water
- Determination of phosphorus: Phosphorus has been determined based on the technique of' **Hanson (1973).**

liver functions Determination

- **Alanine transferase Determination:** The method of **Tietz (1976)** has been utilized to estimate alanine transferase. This enzyme catalyzes the transfer of an amino group from L-alanine to a-ketoglutarate, leading to the creation of glutamate and pyruvate.
- **Aspartate transferase (AST) Determination:** The measurement of AST has been performed based on the technique of ***Henry (1974) and Yound (1975).***
- **Total Protein measurement:** An analysis of total protein was done employing the colorimetric technique developed by **Henry (1974).**

Kidney function assessment

- **Creatinine Estimation:** Creatinine has been calculated using **Henry's (1974)** kinetic procedure.
- **Evaluation of urea:** Urea has been detected by **Patton and Crouch's (1977)** enzymatic method.

Statistical Analysis: One-way categorization has been utilized for the statistical analysis. Analysis of variance (ANOVA) and least significant distinction (LSD) were performed based on **(Snedcor & Cochran 1967).**

Ethical Approval

The research has been approved via Al-Baha University's Research Ethics Committee (Reference. No. 46123022), Approval date 17 April 2025.

RESULTS & DISCUSSION

Determine the effectiveness of coffee beans and peels in improving the biological condition of hyperlipidemic rats.

Effect of coffee beans and peels on hyperlipidemic rats:

Feed consumption and gain in body weight: Table (4) All rats remained in good health during the study. The outcomes are expressed as mean +standard deviation (Mean + SD).

Table (4) demonstrates mean value of feed consumption, daily gain in body weight of hyperlipidemic rats fed normal and hyperlipidemic rats containing (5% of coffee beans and peels) for 6 weeks. There was no significant variance in the daily feed consumption of normal groups (G1) and untreated group (G2).

Conversely, an insignificant variance has been observed among untreated groups (G2) and the other groups feed (5% of coffee beans and 5% coffee peels). The gain in body weight per day, an insignificant variance has been observed among rats fed hyperlipidemic diet group (G2) (60.25 ± 12.39 g / group) and hyperlipidemic diet coffee beans 5% (G3) (64.0 ± 24.24 gm/group) and coffee peels 5% G4 (58.25+44.83gm/group), respectively.

Table (4). Mean values of feed consumption, body weight gain, daily feed consumption, and daily body weight gain of rats given a hyperlipidemic diet with coffee beans and peels

Variables / Groups	Daily food intake	Daily gain in body weight (g/m)	Food intake in 6 weeks (gm)	Body weight in 6 weeks (gm)
control (-) G1	11.43±1.63	21.75±26.88	480.25±68.69	1 74±76.041
Control(+) G2	11.39±0.481	60.25±12.39	478.5±56.37	482±35.059
5% coffee beans G3	11.1+0.62	64.0+24.24	527.625+39.86	512+68.55
5% coffee arabica peels G4	11.85+1.03	58.25+44.83	536.75+37.579	510+126.796

* $p < 0.05$ G1: Rat fed control diet. G2: Rat fed hyperlipidemic diet G3: Rat fed hyperlipidemic diet with 5% coffee beans, G4: Rat fed hyperlipidemic diet with 5% coffee peels

Effect of coffee beans and peels consumption on serum lipids of rats fed hyperlipidemic rats:
Figure (1,2,3and4) illustrates the mean values of serum triglycerides, phospholipids, total cholesterol, and serum free fatty acids of rats fed a hyperlipidemic diet with coffee beans and peels.

Serum triglycerides: Regarding serum triglycerides statistical analysis of the information demonstrates that there is significant variance (p-value below 0.01) between the untreated group G2 (3.63 + 0.02 m mol / L) and the other groups under examination. From data, the mean values of serum triglycerides reduced by 33.88% (G3) and 64.18% (G4) for groups of rats given a hyperlipidemic diet supplemented with untreated group (hyperlipidemic diet) G2.

Serum phospholipids: Serum phospholipid levels were significantly elevated in the untreated hyperlipidemic group compared with the normal control group. Supplementation with Arabica coffee beans and Arabica coffee peels reduced serum phospholipid levels compared with the untreated hyperlipidemic group, with a greater reduction observed in the coffee peels group.

Serum total cholesterol: Regarding serum total cholesterol statistical analysis of the information show that there were significant variance (p-value below 0.01) between untreated group(G2) (4.88 + 0.01 mmol / L) and G1 (2.31 + 0.02 mmol / L), G3 (3.85 ± 0.05 mmol / L) and G4 (3.25 ± 0.03 mmol / L).From data the mean values of serum TC reduced by 21.1% (G3) and 33.4% (G4) for groups of rats given a hyperlipidemic diet with coffee beans and peels in comparison with untreated group (hyperlipidemic diet) G2.

Serum free fatty acids: The mean value of serum free fatty acids was (2.96 ± 0.03 mmol / L) for animals of rats fed on hyperlipidemic diet (G2). There was significant variance (p-value below 0.01) among untreated group G2 and other groups under examination. From fig (4) the mean value of serum free fatty acids reduced by 45.48% (G3) and 56.06%(G4) for groups of rats given a hyperlipideic diet supplemented with coffee beans and peels as compared with untreated groups (G2).

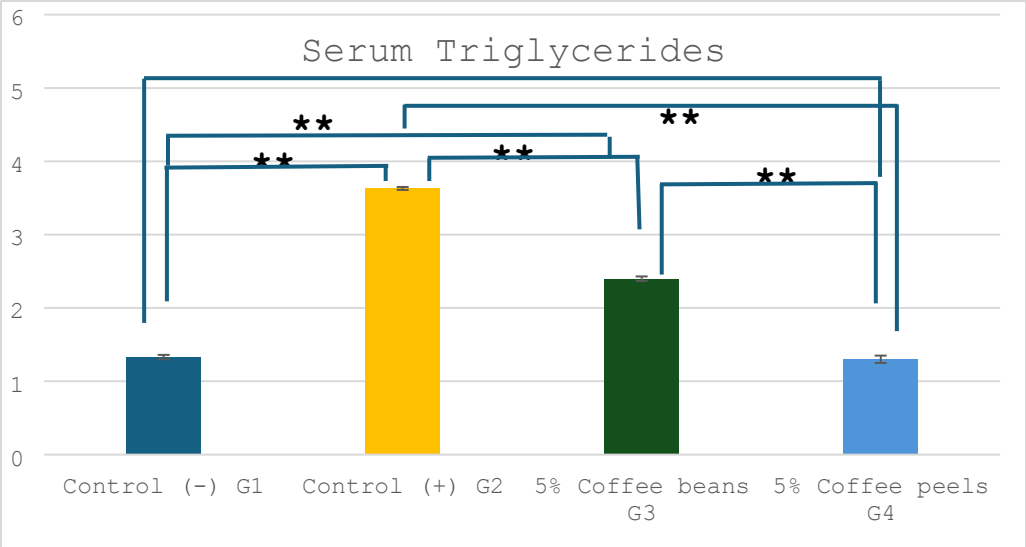

Figure (1). Mean values of Triglycerides of rats given a hyperlipidemic diet with coffee beans and peels.

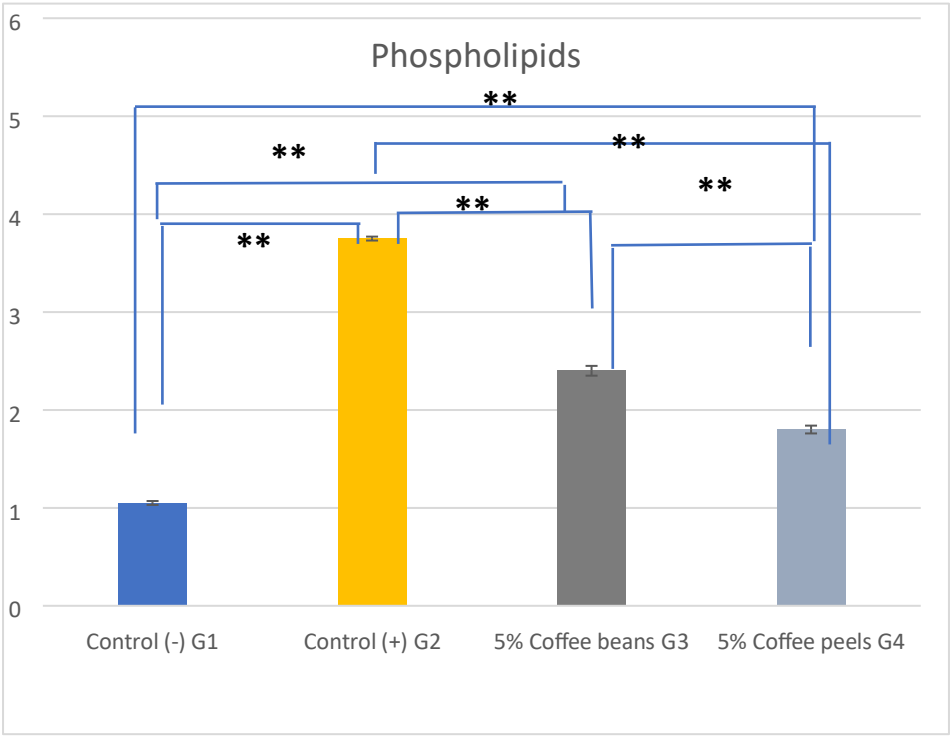

Figure (2). Mean values of phospholipids of rats given a hyperlipidemic diet with coffee beans and peels.

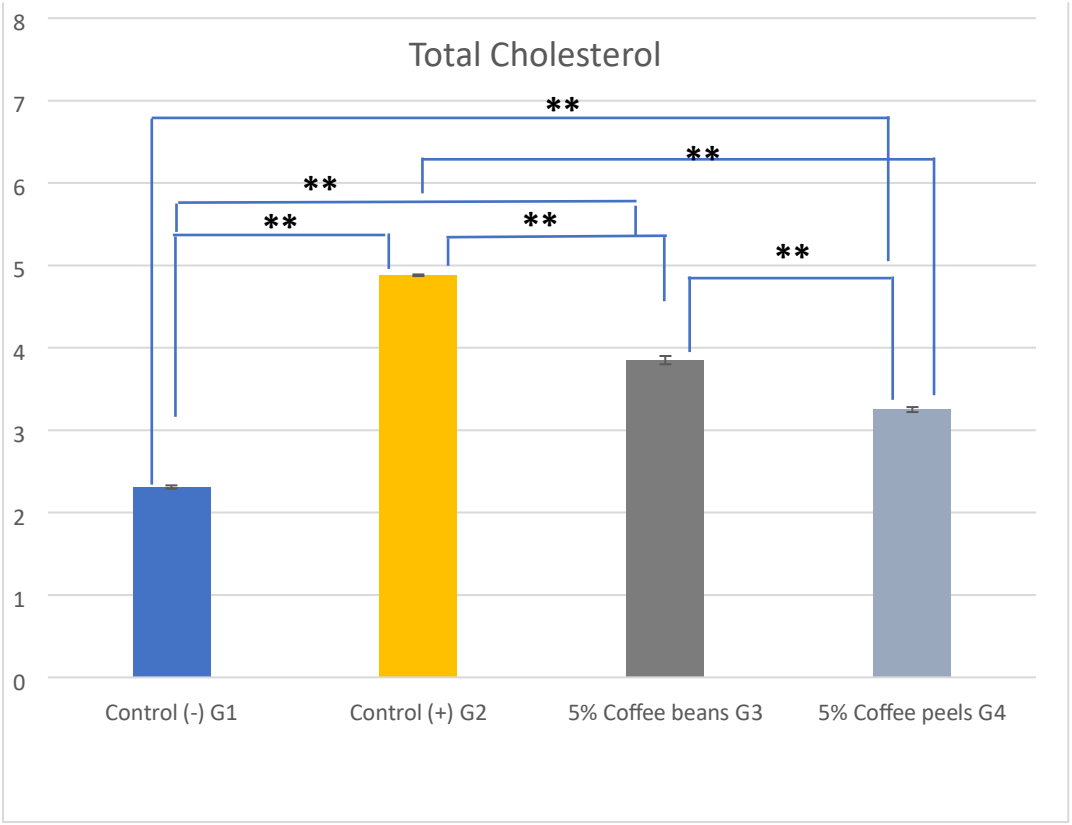

Figure (3). Mean values of Serum total cholesterol of rats given a hyperlipidemic diet with coffee beans and peels.

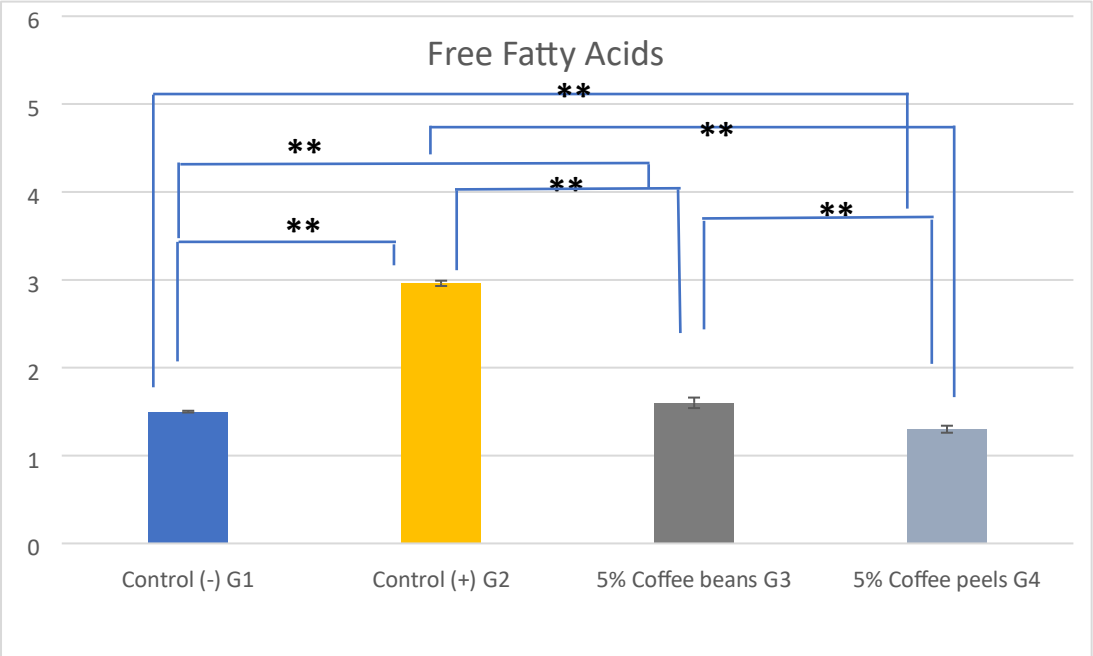

Figure (4). Mean values of Serum free fatty of rats given a hyperlipidemic diet with coffee beans and peels.

Effect of coffee beans and peels consumption on liver enzymes of rats fed a hyperlipidemic diet:
Figure (5,6 and 7) shows mean value ± SD of serum liver enzymes, alkaline phosphatase (ALP u / 1), Aspartate aminotransferase (AST u /1), and Alanine aminotransferase (ALT u / I) for the studied group of rats fed on coffee beans and peels for 6 weeks.

As demonstrated in fig (5) the mean **values of Aspartate aminotransferase** in control positive group (untreated group) G2 was increased significantly at (p-value less than 0.001) than control negative group (G1) that were 85.1 ± 6.11 and 28.1 ± 3.35 (u / 1), respectively. From data the mean values of AST decreased by 5.28% (G3) and 31.72% (G4) for rats fed hyperlipidemic diet supplemented with coffee beans and peels as compared with untreated group (hyperlipidemeic diet) G2.

The mean value of ALT Serum ALT was significantly elevated in the untreated hyperlipidemic group compared with the normal control group. Supplementation with Arabica coffee beans and Arabica coffee peels reduced ALT levels compared with the untreated hyperlipidemic group, with the coffee peels group showing the greater reduction.

The mean value of ALP in the control positive (untreated group) (G2) increased significantly at (p-value less than 0.001) than the control negative group (G|) that were 105.1 ± 1.16 and 70 ± 2.43 (u / 1), respectively. The mean values of G3 were reduced significantly at (p-value less than 0.05) in comparison with control positive group (untreated group) G2, which was 90.5 ± 5.45 (u /1) The mean value of (G3) has been decreased significantly at (p-value below 0.001) compared to the control positive, which was 75 ±1.15 (u /1). From data, the mean value of alanine aminotransferase reduced by 13.46% (G3) and 28.25% (G4) for groups of rats given a hyperlipidemic diet with coffee beans and peels in comparison with the untreated group (control positive group) G2.

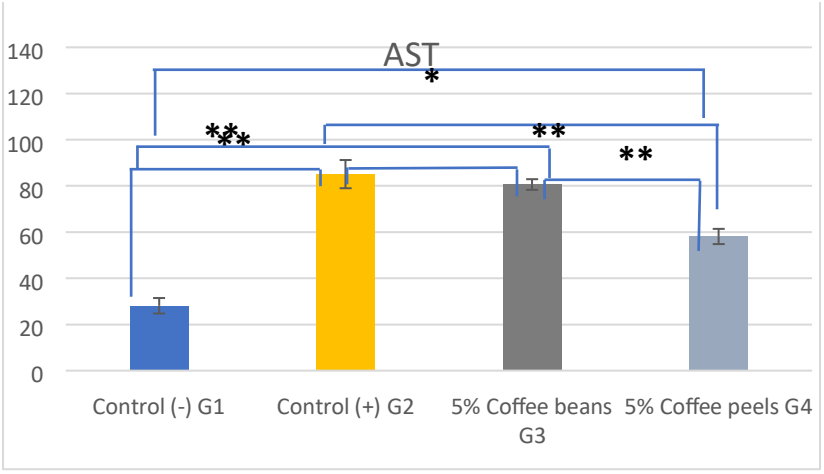

Figure (5). Mean values of AST of rats fed hyperlipidemic diet with coffee beans and peels.

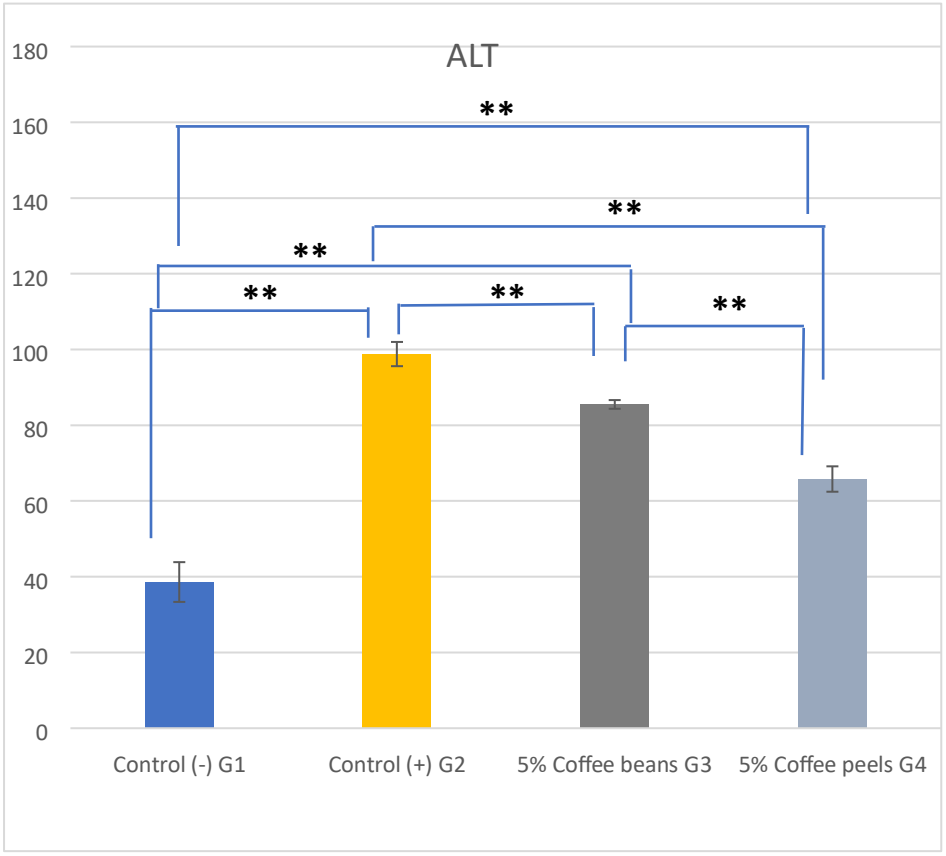

Figure (6). Mean values of ALT of rats fed hyperlipidemic diet with coffee beans and peels.

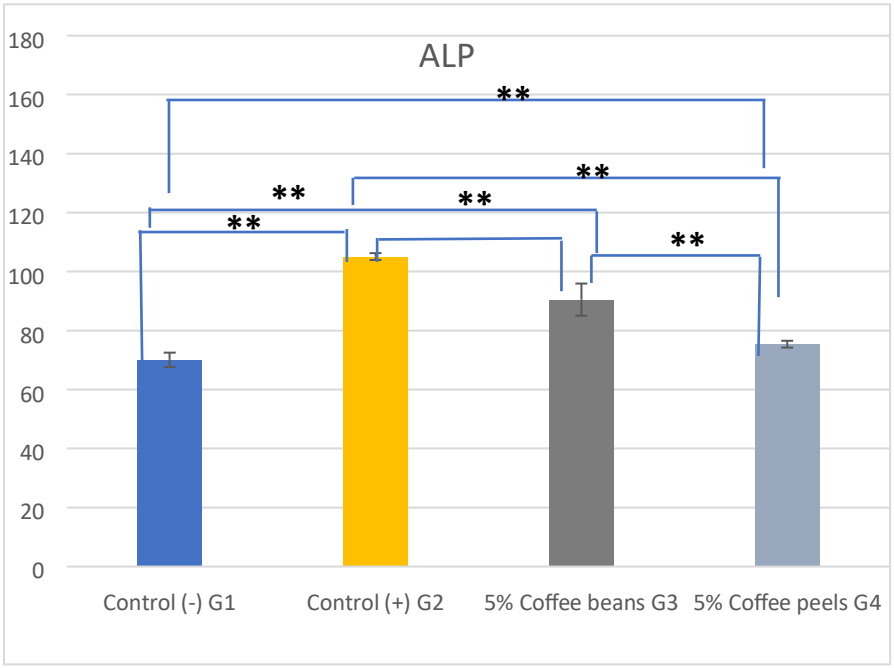

Figure (7). Mean values of ALP of rats fed hyperlipidemic diet with coffee beans and peels.

Effect of coffee beans and peels consumption on kidney function of rats fed on hyperlipidemic diet: Figure (8 and 9) shows mean value + SD of kidney function of rats fed on hyperlipidemic diet.

Fig (8) illustrated the mean value of renal functions in hypercholesterolemic rats. As shown in this table, the mean values of creatinine in untreated group G2 was increased significantly at (p-value below 0.01) than control negative G1, by means 1.10 ± 0.2 and 0.65 ± 0.3 mg / 100 ml respectively. The mean value of (G3), were reduced significantly at (p-value below 0.05) than untreated group G2, by means 0.88 ± 0.1 mg / 100 ml respectively. Also the mean value of G4 has been decreased significantly at (p-value below 0.01) compared to untreated group G2, this was 0.73 ± 0.1 mg / 100 ml.

From above data the mean values of creatinine reduced by 20.0% (G3) and 33.63% (G4) for rats given a hyperlipidemic diet supplemented with 5% coffee beans and 5% coffee peels with untreated group (hyperlipidemic diet) G2.

In fig (9) the mean values of urea in untreated group (G2) was increased significantly at (p-value below 0.01) than control negative (G1), by means 58.50 ± 0.1 and 36.20 ± 0.2 mg / 100 ml, respectively. The mean values of G3 were reduced than untreated group (G2), by means 54.25 ± 0.1 mg / 100 ml, respectively. Additionally, the mean values of G4 have been decreased significantly at (p-value below 0.05) than untreated group G2, by means 48.25 ± 0.3 mg / 100 ml, respectively. From data the mean values of serum urea reduced by 7.26% G3 and 17.52% G4 for rats fed hyperlipidemic diet supplemented with coffee beans and peels as compared with untreated group (hyperlipidemic diet) G2.

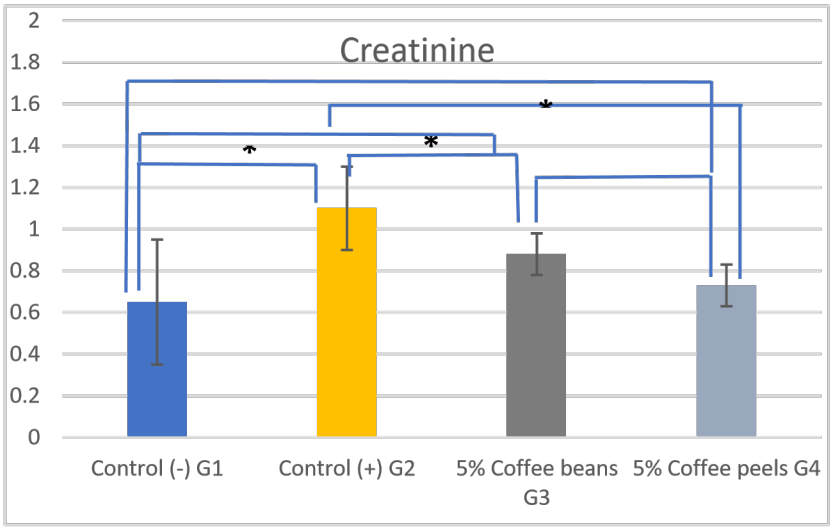

Figure (8). Mean values of serum creatinine of mice given a hyperlipidemic diet with coffee beans and peels.

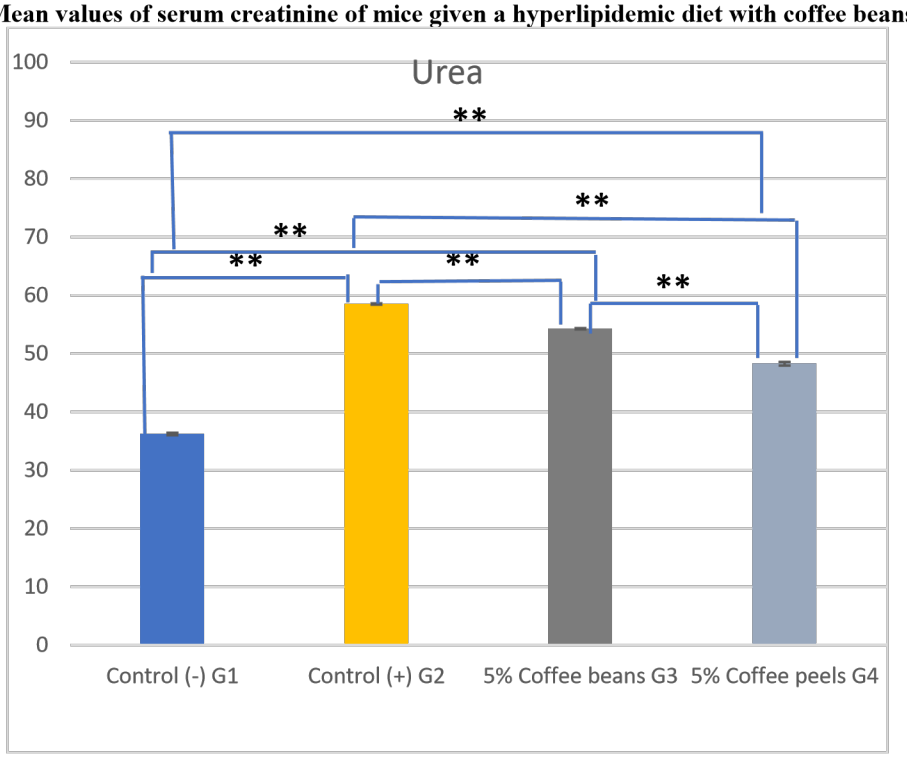

Figure (9). Mean values of Urea of rats fed hyperlipidemic diet with coffee beans and peels.

Effect of coffee beans and peels on some minerals of rats fed hyperlipidemic

Figure (10,11,12, 13and 14) illustrates the mean values of some minerals in hypercholesterolemic rats.

Serum Ca in fig (10) untreated group (G2) was reduced significantly at (p-value below 0.01) than control negative G|, by means 1.6 ± 0.01 and 2.4 ± 0.01 mmol / L, respectively. While the mean values of G3 and G4 have been increased significantly at (pvalue below 0.05) than untreated group G2, by means 2.1 ± 0.02 and 2.1 ± 0.03 mmol / L, respectively.

Serum P in fig (11) untreated group (G2) was decreased significantly at (p-value under 0.01) than control negative G1, by means

0.51 ± 0.1 and 0.69 ± 0.2 mmol / L, respectively. Additionally, the mean values of G4 have been increased significantly at (pvalue below 0.01) than untreated group G2, by means 0 0.69 ± 0.3 mmol / L, respectively.

Serum Mg in fig (12) untreated group (G2) was decreased significantly at (p-value under 0.01) than control negative (G1), by means 0.61 ± 0.02 and 0.75 ± 0.02 m mol / L, respectively. The mean values of G4 have been increased significantly at (p-value below 0.01) than untreated group (G2), by means 0.70 + 0.04m mol / L.

Serum Fe in fig (13) untreated group (G2) was decreased significantly at ($p < 0.05$) than control negative G1, by means 60.2 ± 2.3 and 68.3 ±3.3 pg / dl, respectively. The mean values of G3 were reduced compared to control positive, by means 58.29 ± 1.5 pg / dl, respectively. While the mean values of G4 have been increased significantly at (p-value under 0.05) than control positive, by means 65.10 ± 4.5 pg / dl.

Serum Zn in fig (14) untreated group (G2) was reduced significantly at (p-value less than 0.01) than control negative G1, by means 10.4 ± 0.1 and 12.4 ± 0.2 p mol / dl, respectively. The mean values of G3 were reduced compare to control positive, by means 10.3 ±0.1 p mol / dl, respectively.

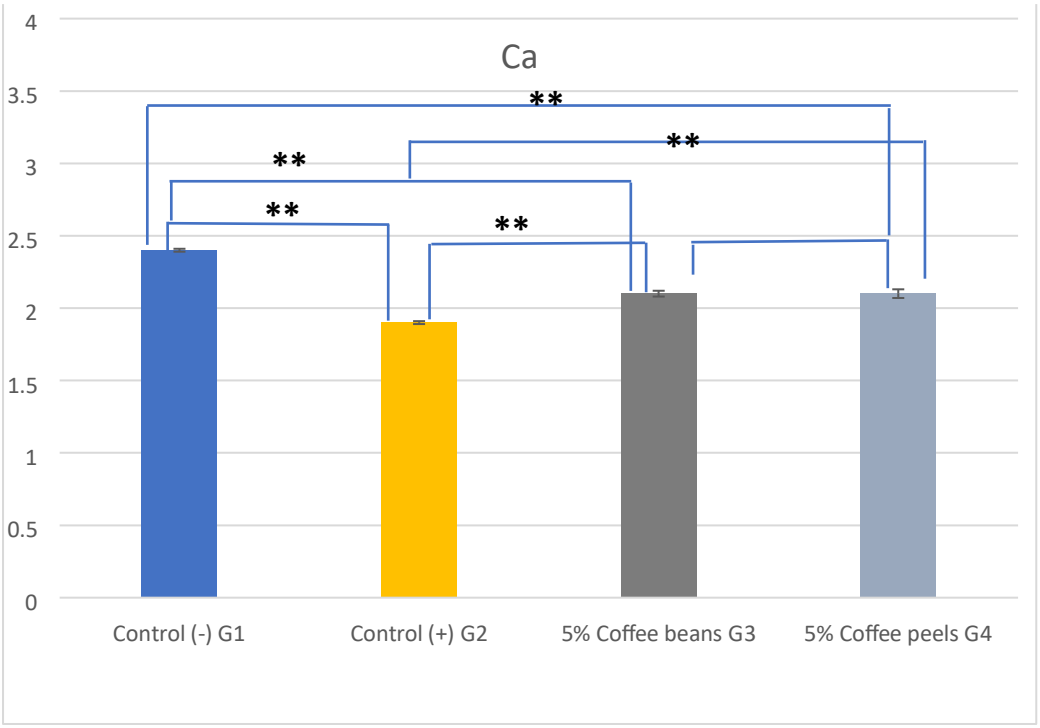

Figure (10). Mean values of serum calcium of rats fed hyperlipidemic diet with coffee beans and peels.

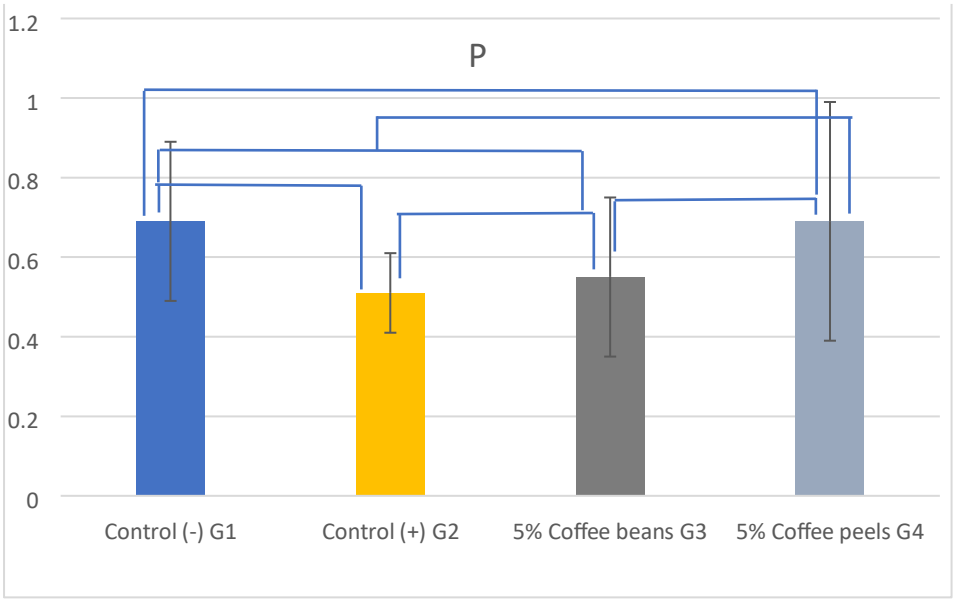

Figure (11). Mean values of phosphorus of rats fed hyperlipidemic diet with coffee beans and peels.

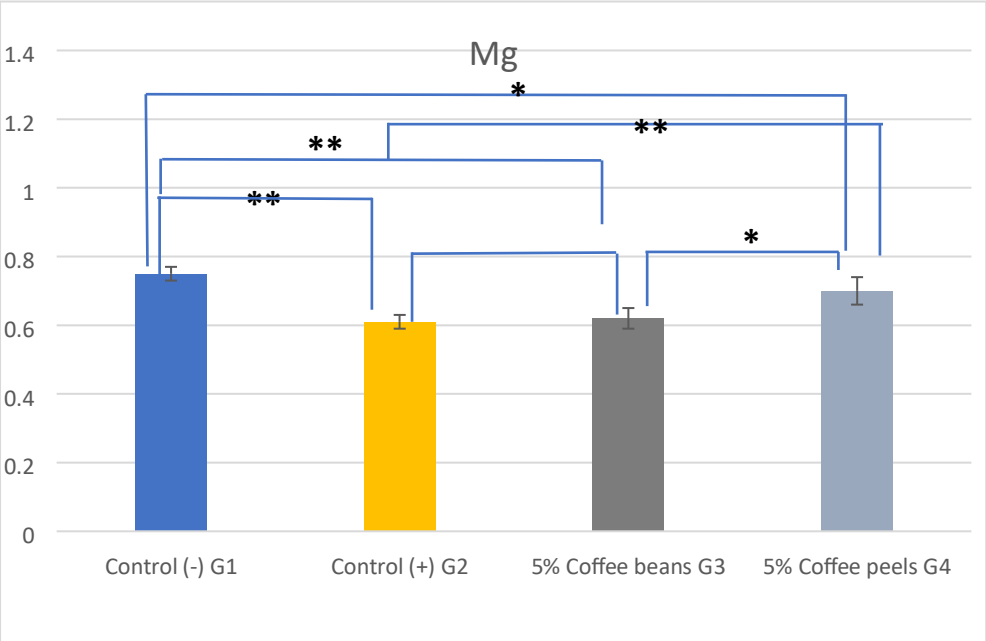

Figure (12). Mean values of magnesium of rats fed hyperlipidemic diet with coffee beans and peels.

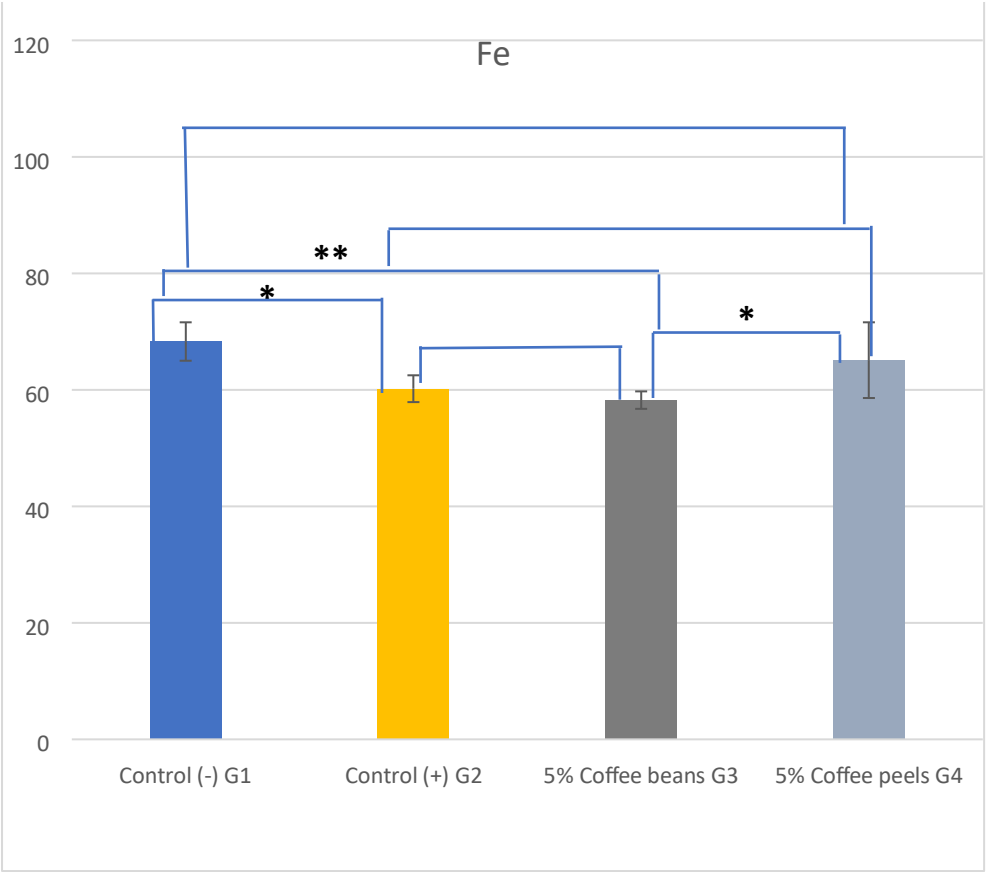

Figure (13). Mean values of iron of rats fed hyperlipidemic diet with coffee beans and peels.

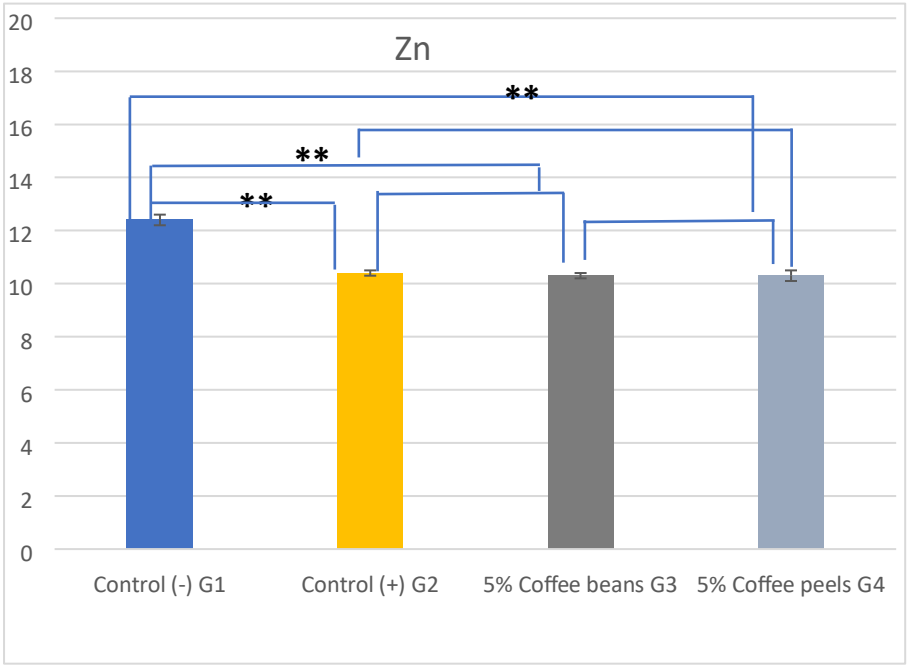

Figure (14). Mean values of zinc of rats fed hyperlipidemic diet with coffee beans and peels.

Effect of coffee beans and peels on serum glucose of rats fed hyperlipidemic diet

The results in fig. (15) showed that the level of serum glucose for control untreated group (G2) has been significantly increased to reach the highest value which being 115.9 ± 2.2 milligrams per deciliter at p-value under 0.05, while the corresponding level for control negative Gi was 95.5 ± 3.5 mg / dl. Serum glucose (mg / dl) values decreased in hypercholestrolemic rat G3 which were 110.4 ± 2.0 mg / dl. But rat groups which consumed 5% coffee peels G4 were decreased significantly at $p < 0.05$ than untreated group G2, by means 98.2 ± 3.5 mg / dl.

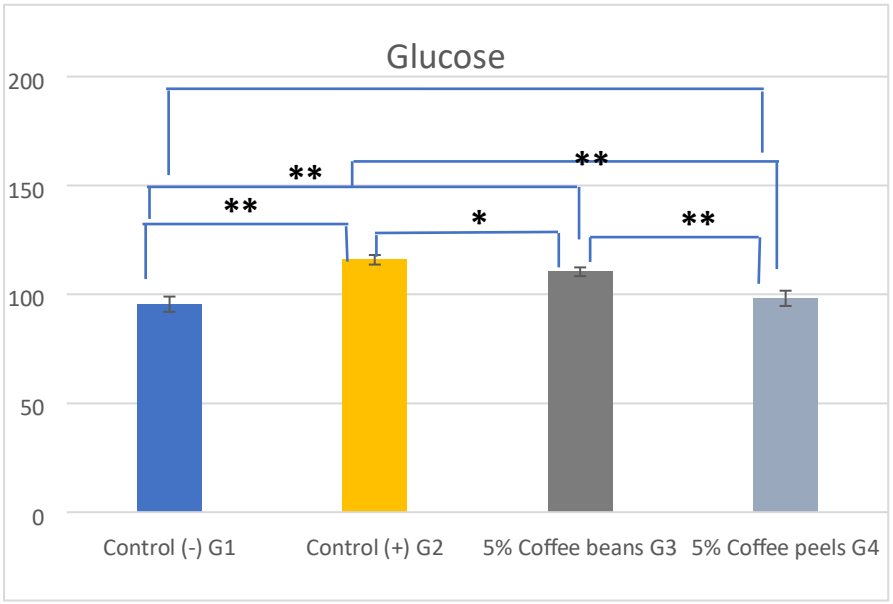

Figure (15). Mean values of serum glucose of rats given a hyperlipidemic diet with coffee beans and peels.

Coffee beans and peels show potential protective effects in hyperlipidemic rats by improving lipid profiles, lowering cholesterol and triglycerides, and increasing HDL levels. Studies indicate that coffee bean extracts can significantly reduce total cholesterol, LDL, and triglycerides, while also decreasing body weight and improving antioxidant status. Coffee peels also demonstrated beneficial effects on biochemical changes, suggesting a potential use in therapeutic formulations**. (Yuniarti et al., 2019).** Coffee peels could be incorporated into dietary supplements or functional foods aimed at supporting heart health and managing lipid levels. Their antioxidant properties may also enhance the body's ability to combat oxidative stress. Additionally, formulations containing coffee peels might be developed to target specific metabolic disorders, offering a natural and holistic approach to treatment. **(Surma et al., 2023).** Coffee extracts may downregulate the expression of Acetyl-CoA carboxylase (ACC), thereby reducing the synthesis of fatty acids. They can also improve the activity of Carnitine Palmitoyltransferase 1 (CPT1), enabling the

transport of fatty acids into the mitochondria for oxidation. Additionally, the suppression of fatty acid synthase (FAS) by these extracts could further decrease lipid biosynthesis, contributing to the overall reduction in lipid levels. (**Schoeneck *et al.*,2021).** Coffee peels contain bioactive compounds, such as polyphenols and antioxidants, that may help regulate glucose and lipid metabolism. These compounds interact with enzymes and pathways involved in sugar and fat breakdown, potentially reducing serum glucose and improving lipid profiles. Additionally, their anti-inflammatory properties may alleviate diabetes-related organ damage, such as liver and kidney disorders. **(Zhang *et al* .,2011)**. Roasted coffee can reduce beneficial compounds like chlorogenic acid, making green coffee bean extracts potentially more effective for hyperlipidemia treatment. While studies show a general trend of improvement, individual results may vary based on factors like the specific coffee type, roasting degree, and extract used **(Kwon et al ., 2011)** Coffee contains chlorogenic acid is an antioxidant that has a significant role in reducing inflammation and regulating blood sugar levels. It helps to inhibit glucose absorption in the small intestine, which can lead to better blood sugar control. Additionally, chlorogenic acid may help in weight loss through elevating metabolism and improving fat-burning processes (**Nihei *et al.* 2018)**. The influence of coffee beans is due to the existence of compounds such as diterpenes, which are naturally occurring substances found in coffee beans. These compounds can influence cholesterol levels by affecting the body's production of bile acids and other lipid-regulating processes. **(Feng *et al*. 2010)**. Caffeine contributes to increased lipolysis (fat breakdown), improved blood pressure, and anti-inflammatory responses. (**Christianty *et al.* 2020)**. Chlorogenic Acid (CGA), most abundant in green (unroasted) coffee beans and peels, is a primary driver of the hypocholesterolemic, cardioprotective, and hepatoprotective effects observed. **(Wan *et al.* 2012**). Moreover, the extracts have been observed to diminish lipid peroxidation in both aorta and plasma during in vivo investigations. Although considerable study has been conducted on coffee pulp and coffee bean extracts regarding the digestion and absorption of lipids, the influence of coffee leaves has mostly been uninvestigated. The knowledge gap is significant, especially as the primary bioactive compounds, like caffeine and chlorogenic acids (CGAs), differ in concentration across coffee leaves and different portions of the coffee plant. **(Wanderley Dong Affoso *et al.* 2017**).

CONCLUSION

In conclusion, the outcomes showed a significant improvement in blood lipids in rats with hyperlipidemia, as well as an improvement in overall functional status in the affected rat where. These results facilitate the utilization of coffee beans and coffee arabica peels as functional ingredients in dietary strategies for the management of hyperlipidemia and obesity, providing a natural and available method for enhancing cardiovascular health.

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