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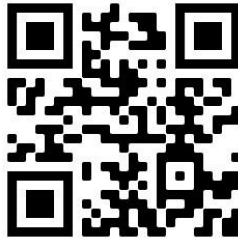
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Protective Effects of Moringa and Green Tea Leaves Aqueous Extracts on hypercholesterolemic rats

Abstract

This investigation aimed to study the protective effects of moringa (*Moringa oleifera L.*) and green tea (*Camellia sinensis L.*) leaves aqueous extracts on hypercholesterolemic rats. Twenty five male albino rats weighing $200\pm 5g$ were divided into two main groups (5 rats each); the first (5 rats) was control negative group (-ve) and fed on basal diet along the experimental period and the second (20 rats) divided into four groups; one fed on basal diet only and the rest three groups fed on basal diet with orally fed with moringa, green tea and mixture extracts of them, respectively, for 28 days, then all food groups fed on 1.5% cholesterol-enriched diet and 10% lamb fats for 21 days. At the end of the experimental period, all rats were mercy sacrificed then blood samples were collected to determine serum total cholesterol, triglycerides, LDL, VLDL, HDL, TP, Alb., Glob., CK, D. Bil., GGT, Fe, Na and Ca. The results revealed that oral administration with 5% aqueous extracts of moringa, green tea leaves and mixture of them produced significant decrease in serum total cholesterol, triglycerides, LDL, VLDL, TP, Alb., Glob., CK, D. Bil., GGT, Fe, Na, Ca and significant increase in HDL for all tested groups compared to hypercholesterolemic rats specially for mixture diet indicating synergistic action. It could be concluded that moringa, green tea leaves have protective effects on hypercholesterolemic rats.

Keywords: Total cholesterol, moringa, green tea, rats.

Introduction

Cholesterol plays an important role related to human heart health. Moreover, hypercholesterolemia is one of the important risk factors leading to cardiovascular disease including coronary heart disease and stroke (Hongbao and Kuan-Jiunn, 2006).

Moringa (*Moringa oleifera*), a plant belonging to the Moringaceae family, is rich in several bioactive compounds that are considered anti-malnutrition remedy that possesses several pharmacological properties including anti-inflammatory, antioxidant, anti-cancer and anti-diabetic actions. Their properties are related to the presence of substances with pharmacological effects compounds including flavonoids which provide a reference for its potential application as a functional food (Ma *et al.*, 2020). Moringa leaves are rich in many ingredients including minerals, vitamins and lots of essential phytochemicals. Around the world, Moringa leaf extracts are used to treat many types of malnutrition. It is also used as a potential anti-cancer, anti-inflammatory, antioxidant, anti-diabetic, and anti-microbial agent (Gopalakrishnan *et al.*, 2016).

Green tea has an important role in the metabolism of fats in the liver by reducing food intake, stopping emulsification and absorption of fats, suppressing lipogenesis and lipid synthesis, increasing energy expenditure during thermogenesis, lipid oxidation and excretion of fats in the stool (Huang *et al.*, 2014). In view of the above and based on what previously mentioned, this investigation aimed to evaluate the protective effects of moringa (*Moringa oleifera* L.), green tea (*Camellia sinensis* L.) leaves aqueous extracts on hypercholesterolemia in experimental rats.

Materials and Methods

1. Materials and rats

1.1. Plants:

Moringa (*Moringa oleifera*) and green tea (*Camellia sinensis*) leaves were bought and obtained dry from herb shop in Cairo, Egypt.

1.2. Cholesterol:

Cholesterol as a powdered material was purchased from Al-Gomhoria Chemical Company, Cairo, Egypt.

1.3. Rats:

Twenty-five (25) adult male albino rats weighing 200 ± 5 g were obtained from Research Institute of Ophthalmology, Medical Analysis Department, Giza, Egypt.

2. Methods

2.1. Basal and experimental diets:

The basal diet consisted of casein (12%), corn oil (10%), mineral mixture (4%), vitamin mixture (1%), cellulose (5%), choline chloride (0.2%), methionine (0.3%) and the remained is corn starch (67.5%) according to AIN (1993). While experimental diets consisted of basal diet plus cholesterol 1.5% for hypercholesterolemia induction as the method described by (Ónody *et al.*, 2003).

2.2. Preparation of aqueous extracts:

Moringa and green tea leaves were individually milled to soft powder using electric grinder. Extracts were prepared using 5g of herb added to 100 ml of boiling water (5%) and steeped for 10 min then filtered. All aqueous extracts were orally administrated to rats at a dose of 1 ml/100g of body weight for each of them according to Russo (2001).

2.3. Hypercholesterolemic induction:

Hypercholesterolemia induction for rats occurred by feeding on basal diet plus cholesterol 1.5% for hypercholesterolemia induction as the methods described by (Ónody *et al.*, 2003).

2.4. Design of the experiment:

Rats were fed on basal diet for a week for adaptation then divided into five groups (5 rats each) as follow:

Group (1): Control negative group (-ve) fed on basal diet along the experimental period.

Group (2): Control positive group (+ve) fed on basal diet for 28 days then fed on 1.5% cholesterol-enriched diet for 21 days.

Group (3): Orally administered with moringa 5% aqueous extract for 28 days with basal diet then fed on 1.5% cholesterol-enriched diet for 21 days.

Group (4): Orally administered with green tea 5% aqueous extract for 28 days with basal diet then fed on 1.5% cholesterol-enriched diet for 21 days.

Group (5): Orally administered with mixture of moringa and green tea 5% aqueous extract for 28 days with basal diet then fed on 1.5% cholesterol-enriched diet for 21 days.

2.5. Biochemical serum analysis:

At the end of the experiment, blood samples were collected after 12 hours fasting using the abdominal aorta in clean dry centrifuge tubes, in which blood was left to clot at room temperature, then centrifuged for 10 minutes at 3000 r.p.m to separate the serum which stored frozen at -20°C for biochemical analysis as the method prescribed by Schermer (1967).

Total cholesterol (TC) was determined according to Allen (1974), triglycerides (TG) according to Fossati and Prencipe (1982), low density lipoprotein cholesterol (LDL-c) according to Lee and Nieman (1996), high density lipoprotein cholesterol (HDL-c) according to Lopez (1997), atherogenic index (AI) was calculated according to Kikuchi *et al.*, (1998). Serum total protein (TP) was determined according to Gomal *et al.*, (1949), serum albumin according the method of Doumas *et al.*, (1971) and globulin was calculated as the method of Charry and Sharma (2004). Serum total bilirubin was determined according to Doumas *et al.*, (1985) and direct bilirubin were measured according to Sepulveda and Osterberg (1943). Serum gamma-glutamyl transferase (GGT) according to (Tietz, 1986) and creatine kinase (CK) according to Walker *et al.*, (1990). Finally, Serum iron (Fe) was determined according to Kok and Wild (1960), sodium (Na) according to Berry *et al.*, (1998) and calcium (Ca) according to Weybrew *et al.*, (1984).

2.6. Biochemical serum analysis:

The results were expressed as Mean \pm Standard Error (SE) statistical analysis of the results was performed using the statistical package software - statistical package for social science (SPSS), version 22 for windows. Paired-sample t-test was used to

compare the parameters between control positive group and diabetic rats' groups. A P-value less than 0.05 was considered statistically significant.

Results and Discussion

1. Protective effect on TC and TG on hypercholesterolemic rats:

Data listed in table (1) show the protective effect of moringa, green tea leaves aqueous extracts and mixture of them on total cholesterol (TC) and triglycerides (TG) in hypercholesterolemic rats.

Table (1): Protective effect of moringa, green tea leaves aqueous extracts and mixture of them on TC and TG on hypercholesterolemic rats

Parameters	TC (mg/dL)	TG (mg/dL)
Rats group	Mean \pm SE*	Mean \pm SE*
Control (-ve)	89.72 \pm 0.15 ^e	80.50 \pm 0.12 ^e
Control (+ve)	173.87 \pm 0.29 ^a	246.35 \pm 0.26 ^a
Moringa 5%	129.69 \pm 0.13 ^c	140.60 \pm 0.31 ^c
Green tea 5%	148.81 \pm 0.24 ^b	165.95 \pm 0.13 ^b
Mixture 5%	98.78 \pm 0.12 ^d	90.55 \pm 0.21 ^d

- *SE means standard error of the mean.

- Letters of (a, b, c, d, e) in one column significantly differ at $p \leq 0.05$.

It could be observed for hypercholesterolemic rats (C+ve group) that total cholesterol (TC) and triglycerides (TG) were 173.87 \pm 0.09 and 246.35 \pm 0.26 mg/dL compared to 89.72 \pm 0.05 and 80.50 \pm 0.12 mg/dL in (C-ve) normal rats ($p < 0.05$). These results denote that there was significant increase in total cholesterol and triglycerides serum level in hypercholesterolemic rats compared to normal rats. All rats orally preventable administered with aqueous extracts of moringa, green tea and mixture of them at a dose of 5% showed significant decrease in TC and TG when compared to control positive rats. Rats orally preventable administered with aqueous extracts of the mixture of moringa and green tea reflected the highest significant decrease in TC and TG compared to control positive groups which were 98.78 \pm 0.12, 90.55 \pm 0.21; 173.87 \pm 0.29 and 246.35 \pm 0.26 mg/dL, respectively.

These results confirmed by the findings of Aborhyem *et al.*, (2016) who compared *Moringa oleifera* with atorvastatin as a hypolipidemic drug in improving the lipid profile of mice fed an atherosclerotic diet; concluding that *Moringa oleifera* caused effective prevention of hyperlipidemia when compared to hypolipidemic drugs. Moreover, Bakr and Header (2014) studied the effect of aqueous green tea extract on obese mice and side effects on their liver condition, which led to a significant decrease in total cholesterol and lipid levels in the green tea-treated groups.

Kao *et al.*, (2000) reported that green tea mechanism for body weight regulation is related to the presence of catechins and caffeine that interrupt the norepinephrine pathway. They also mentioned that antioxidants also had a direct effect on the gene expression of different separating proteins that affected thermogenesis by heat production. Klaus *et al.*, (2005) examined the anti-obesity effect of epigallocatechin gallate (EGCG) as a bioactive green tea polyphenol for diet-induced obesity in a rat model decreasing diet-induced body fat accumulation in rats thus promoting lipid oxidation associated with its effect on reducing diet digestion.

Long-term consumption of catechins in tea is beneficial for suppressing the diet that causes obesity and reduces the risk of coronary heart disease and hyperglycemia, indicating an increased regulation of lipid metabolism enzymes followed by an increase in lipid oxidation. (Murase *et al.*, 2002).

2. Protective effect on LDL, VLDL HDL and AI on hypercholesterolemic rats:

Data presented in table (2) demonstrated the protective effect of moringa, green tea leaves aqueous extracts and mixture of them on low density lipoprotein (LDL), very low-density lipoprotein (VLDL), high density lipoprotein (HDL) and atherogenic index (AI) in hypercholesterolemic rats.

Table (2): Protective effect of moringa, green tea leaves aqueous extracts and mixture of them on LDL, VLDL, HDL and AI on hypercholesterolemic rats

Parameters	LDL (mg/dL)	VLDL (mg/dL)	HDL(mg/dL)	AI
Rats group	Mean±SE*	Mean±SE*	Mean ±SE*	Mean ±SE*
Control (-ve)	25.34±0.20 e	16.10± 0.13 e	48.28±0.35 a	0.86±0.01 e
Control (+ve)	113.40±0.39 a	49.27±0.99 a	11.20±0.18 e	14.52±0.09 a
Moringa 5%	80.75±0.31 c	28.12±0.17 c	20.82±0.21 c	5.23±0.04 c
Green tea 5%	98.78±0.28 b	33.19±0.26 b	16.84±0.19 d	7.84±0.05 b
Mixture 5%	51.70±0.13 d	18.11±0.14 d	28.97±0.09 b	2.41±0.02 d

- *SE means standard error of the mean.

- Letters of (a, b, c, d, e) in one column significantly differ at $p \leq 0.05$.

It could be demonstrated that the mean values of low density lipoprotein (LDL), very low density lipoprotein (VLDL), high density lipoprotein (HDL) and atherosclerosis index (AI) in (C +ve) group were 113.40 ± 0.39 , 49.27 ± 0.99 , 11.20 ± 0.18 mg/dL., and 14.52 ± 0.09 , respectively, compared to 25.34 ± 0.20 , 16.10 ± 0.13 , 48.28 ± 0.35 mg/dL., and 0.86 ± 0.01 in control negative, respectively. These data denoted that there were significant increase in LDL, VLDL and AI but significant decrease of HDL for control positive groups when compared to control negative ones. All groups orally preventable administered with aqueous extracts of moringa, green tea and mixture of them at a dose of 5% showed significant decrease in LDL, VLDL and AI while significant increase in HDL as compared to control positive group. The highest significant decrease were recorded in all previously parameters in mixture group except for HDL concluding that the highest significant decrease of LDL, VLDL and AI was recorded in the mixture group.

These findings agreed with the results of Pankaj *et al.*, (2010) who mentioned the leaves of *Moringa oleifera Lam.*, Moringaceae, used by Indians in herbal medicine for obese patients as a hypolipidemic agent which resulted in a significant decrease in blood cholesterol, triglyceride and LDL-c levels and an increase in HDL-c levels in the high-fat diet fed animals compared to control rats.

Also, Bakr and Header (2014) concluded that oral intake of green tea had a significant effect on lowering lipids and

cholesterol in all green tea treatment groups. Moreover, Al-Gebily *et al.*, (2019) studied the effect of *Moringa oleifera* aqueous extract on lipid profiles in rats concluding significant reduction in serum cholesterol in all groups tested. Furthermore Ahmed *et al.*, (2014) explained the effect of *Moringa oleifera* as documented by the improvement of oxidative stress, hyper-resistance, hypoalbuminemia, and hyperleptinemia indicating that get rid of obesity can be attributed to hypolipidemia and increase of antioxidants & anti-inflammatories. Also, Rifai *et al.*, (1999) mentioned that beta-sitosterol appears in *Moringa oleifera* extract as plant sterols reduce the plasma concentration of LDL and inhibit the reabsorption of cholesterol from internal sources with a simultaneous increase in its excretion in the feces in the form of neutral stimulants. Therefore, it can be concluded that beta-sitosterol may be a bioactive plant component in *Moringa oleifera* leaves.

3. Protective effect on TP, Alb., and Glob. on hypercholesterolemic rats:

Data illustrated in table (3) show the protective effect of moringa, green tea leaves aqueous extracts and mixture of them on total protein (TP), albumin (Alb.) and globulin (Glob.) in hypercholesterolemic rats.

Table (3): Protective effect of moringa, green tea leaves aqueous extracts and mixture of them on TP, Alb., and Glob., on hypercholesterolemic rats

Parameters	TP (g/dL)	Alb.(g/dL)	Glob.(g/dL)
Animal group	Mean ±SE	Mean ±SE	Mean ±SE
Control (-)	9.30±0.19 a	5.29±0.08 a	4.01±0.03 a
Control (+)	2.69±0.35 e	2.01±0.03 e	0.68±0.05 e
Moringa	5.13±0.46 d	3.99±0.02 d	1.14±0.04 d
Green tea	7.98±0.16 c	4.20±0.05 c	3.78±0.02 b
Mixture	8.13±0.25 b	5.19±0.04 b	2.94±0.01 c

- *SE means standard error of the mean.

- Letters of (a, b, c, d, e) in one column significantly differ at $p \leq 0.05$.

It is concluded that total protein (TP), albumin (Alb.) and globulin (Glob.) in (C+ve group) were 2.69 ± 0.35 , 2.01 ± 0.03 and 0.68 ± 0.05 g/dL., compared with 9.30 ± 0.19 , 5.29 ± 0.08 and

4.01±0.03 g/dL., respectively in (C-ve group). These results denote that there were significant decrease in total protein, albumin and globulin for control positive group compared to control negative one. All groups orally preventable administered with aqueous extracts of moringa, green tea and mixture of them at a dose of 5% showed significant increase in total protein, albumin and globulin compared with control positive group. The highest significant increase was recorded in mixture group followed by green tea group then moringa group as compared to control positive.

These results confirmed by the findings of Al-Gebily *et al.*, (2019) who studied the effect of aqueous *Moringa oleifera* extract on lipid profiles in mice, and it was concluded that there was a significant decrease in total protein in all treated groups.

Furthermore, Bakr and Header (2014) confirmed that oral intake of green tea had a significant effect in improving total protein in all treated groups compared to control group. In addition, Reddy *et al.*, (2017) assessed the effect of *Moringa oleifera* polyphenol leaves on obese mice and discovered a significant decrease in cholesterol, but no effect on serum protein.

4. Protective effect on CK, D.Bil. and GGT on hypercholesterolemic rats:

Data illustrated in table (4) show the protective effect of moringa, green tea leaves aqueous extracts and mixture of them on creatine kinase (CK), direct bilirubin (D.Bil) and gamma-glutamyl transferase (GGT) in hypercholesterolemic rats.

Table (4): Protective effect of moringa, green tea leaves aqueous extracts and mixture of them on CK, D.Bil and GGT on hypercholesterolemic rats

Parameters	CK (U/L)	D.Bil (mg/dL)	GGT (U/L)
Animal group	Mean ±SE	Mean ±SE	Mean ±SE
Control (-)	135.00±2.31 ^d	0.25±0.05 ^c	48.00±0.25 ^c
Control (+)	189.00±5.22 ^a	0.78±0.08 ^a	78.00±0.33 ^a
Moringa	154.67±3.16 ^b	0.58±0.03 ^b	61.00±0.12 ^b
Green tea	157.33±2.09 ^b	0.49±0.03 ^c	55.00±0.19 ^c
Mixture	147.33±1.91 ^c	0.35±0.02 ^d	52.00±0.08 ^d

- *SE means standard error of the mean.

- Letters of (a, b, c, d, e) in one column significantly differ at $p \leq 0.05$.

It is cleared from the table that the mean values for control positive groups regarding creatine kinase (CK), direct billurubin (D.Bil) and gamma-glutamyl transferase (GGT) were 189.00 ± 5.22 U/L, 0.78 ± 0.08 mg/dL and 78.00 ± 0.33 U/L., respectively while the mean values in control negative group were 135.00 ± 2.31 U/L, 0.25 ± 0.05 mg/dL and 48.00 ± 0.25 U/L., respectively. It could be concluded that there were significant increase in creatine kinase (CK), direct billurubin (D.Bil) and gamma-glutamyl transferase (GGT) in control positive compared to control negative group. All groups orally preventable administered with aqueous extracts of moringa, green tea and mixture of them at a dose of 5% showed significant decrease in creatine kinase (CK), direct billurubin (D.Bil) and gamma-glutamyl transferase (GGT) compared with control positive group. The highest significant decrease was recorded in mixture group followed by green tea group then moringa group as compared to control positive group for all previously mentioned parameters.

These results confirmed by the findings of Mahendra *et al.*, (2010) who explained that oral administration of aqueous extract of *Moringa oleifera* (250 and 500 mg/kg) showed a significant improvement in the lipid profile with marker enzymes in serum and cardiac homogeneity which reduced levels of thiobarbituric acid reactants and improved antioxidant status by increasing antioxidant activities enzymes. Moreover, Toppo *et al.*, (2015) demonstrated that supplementation of *M. olifera* extract showed a hepatotoxic effect against cadmium toxicity. Furthermore, Heikal *et al.*, (2013) observed that green tea reduces oxidative stress due to its antioxidant properties, which improves the structural integrity of the cell membrane and ultimately alleviates histopathological changes as well as biochemical disturbances.

5. Protective effect on serum Fe, Na and Ca on hypercholesterolemic rats:

Data present in table (5) show the effect of moringa, green tea and mixture of them on serum iron (Fe), sodium (Na) and calcium (Ca) in hypercholesterolemic rats.

Table (5): Protective effect of moringa, green tea and mixture of them on serum iron (Fe), sodium (Na) and calcium (Ca) on hypercholesterolemic rats

Parameters	Fe ($\mu\text{g}/\text{dl}$)	Na (mmol/L)	Ca (mmol/L)
Animal group	Mean \pm SE	Mean \pm SE	Mean \pm SE
Control (-)	101.22 \pm 3.18 ^e	136.00 \pm 5.39 ^e	1.90 \pm 0.03 ^d
Control (+)	190.38 \pm 4.15 ^a	249.00 \pm 9.23 ^a	3.03 \pm 0.06 ^a
Moringa	151.58 \pm 3.06 ^b	193.00 \pm 4.30 ^b	2.65 \pm 0.05 ^c
Green tea	137.59 \pm 5.27 ^c	179.00 \pm 2.09 ^c	2.67 \pm 0.02 ^c
Mixture	119.03 \pm 2.49 ^d	155.00 \pm 3.52 ^d	2.87 \pm 0.02 ^b

- *SE means standard error of the mean.

- Letters of (a, b, c, d, e) in one column significantly differ at $p \leq 0.05$.

It could be concluded from the table that the mean values of serum iron (Fe), sodium (Na) and calcium (Ca) in control positive groups were 190.38 \pm 4.15 $\mu\text{g}/\text{dl}$, 249.00 \pm 9.23 and 3.03 \pm 0.06 mmol/L., respectively while the mean values in control negative group were 101.22 \pm 3.18 $\mu\text{g}/\text{dl}$, 136.00 \pm 5.39 and 1.90 \pm 0.03mmol/L., respectively. It could be demonstrated that there were significant increases in serum iron (Fe), sodium (Na) and calcium (Ca) in control positive compared to control negative group. All groups orally preventable administered with aqueous extracts of moringa, green tea and mixture of them at a dose of 5% showed significant decrease in serum iron (Fe), sodium (Na) and calcium (Ca) compared with control positive group. The highest significant decrease was recorded in mixture group followed mostly by green tea group then moringa group as compared to control positive group.

These findings confirmed with Amaglo *et al.*, (2010) and Karthivashan *et al.*, (2013) who revealed that *Moringa oleifera* leaves have been reported to be rich in proteins, vitamins, carotenoids, and polyphenols including kaempferol, rampin, quercetin, chlorogenic acid rutin and apigenin. Moreover, Amaglo *et al.*, (2010) reported that administering an ethanol leaf extract from *Moringa oleifera* mitigated the negative effect of aluminum chloride on hemoglobin (Hb) and red blood cells (RBC) according to having a profile of nutrients such as protein, amino acids, trace elements, and various phenols.

Conclusion

The present investigation concluded that moringa, green tea leaves and their mixture aqueous extracts at a dose of 5% could be used certainly for enhancing serum total cholesterol, triglycerides, LDL, VLDL, HDL, TP, Alb., Glob., CK, D. Bil., GGT, Fe, Na and Ca in hypercholesterolemic rats. Combining extracts of moringa and green tea showed a synergistic action.

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التأثيرات الوقائية للمستخلصات المائية لأوراق المورينجا والشاي الأخضر

على الفئران المصابة بارتفاع الكوليسترول في الدم

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استهدف البحث إلى دراسة التأثيرات الوقائية للمستخلصات المائية لأوراق المورينجا والشاي الأخضر في الفئران التي تعاني من ارتفاع الكوليسترول في الدم. تم تقسيم خمسة وعشرون فأر ذكر من نوع الالينو بمتوسط وزن 200 ± 5 جم تم إلى مجموعتين رئيسيتين (5 فئران لكل منهما). تركت الأولى (5 فئران) كمجموعة ضابطة سالبة (5 فئران) وتغذت على العليقة الأساسية طوال فترة التجربة. أما المجموعة الثانية (20 فأر) فقد قسمت إلى أربع مجموعات، تغذت احداها على العليقة الأساسية فقط بينما تغذت الثلاث مجموعات المتبقية على العليقة الأساسية تم الحقن فمويا بمستخلصات المورينجا والشاي الاخضر ومزيج منها على التوالي لمدة 28 يومًا ، ثم تم تغذيتهم على غذاء غني بالكوليسترول بنسبة 1,5% إضافة إلى 10% دهن ضأن 21 يوم. في نهاية فترة التجربة تم ذبح الفئران ثم تم تجميع عينات سيرم الدم لتحليل الكوليسترول الكلي والدهون الثلاثية والليبيروتينات منخفضة ومنخفضة جدا ومرتفعة الكثافة والبروتين الكلي والاليومين والجلوبيولين وكرياتين الكاينيز والبيليروبين المباشر والجاما جلوتاميل ترانس فيريز والحديد والصوديوم والكالسيوم. وقد أظهرت النتائج أن تناول المستخلصات المائية 5% للمورينجا والشاي الأخضر ومخلوطهما عن طريق الفم أدى إلى انخفاض معنوي في سيرم الدم من الكوليسترول الكلي والدهون الثلاثية والليبيروتينات منخفضة ومنخفضة جدا في الكثافة والبروتين الكلي والاليومين والجلوبيولين وكرياتين الكاينيز والبيليروبين المباشر والجاما جلوتاميل ترانس فيريز والحديد والصوديوم والكالسيوم وزيادة معنوية في الليبيروتينات مرتفعة الكثافة لجميع المجموعات المعاملة بالمقارنة بالفئران المصابة بارتفاع الكوليسترول في الدم خاصة في مجموعة الخليط مما يدل على التأثير التآزري. ويمكن استنتاج أن المورينجا والشاي الأخضر تمتلك تأثيرات واقية على الفئران المصابة بارتفاع الكوليسترول في الدم.

الكلمات المفتاحية: الكوليسترول الكلي، المورينجا، الشاي الأخضر، الفئران.