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Aqueous Garlic Extract; Natural Remedy to Improve Haematological, Renal and Liver Status

Suleria HAR[1]*, Butt MS[2], Anjum FM[2], Sultan S[2] and Khalid N[3]

[1]*School of Agriculture and Food Science, The University of Queensland Australia*
[2]*National Institute of Food Science and Technology, University of Agriculture Faisalabad, Pakistan*
[3]*Department of Global Agriculture, Graduate School of Agriculture and Life Sciences,University of Tokyo, Japan*

Abstract

Functional foods are gaining popularity worldwide owing to the consumer's preference towards the consumption of natural and safe products in dietary modifications. Garlic (*Allium sativum* L., Liliaceae.) is an essential vegetable that have been widely utilized as seasoning, flavouring, culinary and in herbal remedies. Garlic is well known to acquire an array of phytochemicals. These bioactive molecules are playing pivotal role in maintaining human health and having potential to reduce various ailments like diabetes, cholesterol, cardiovascular diseases and cancer insurgence. Considering the aim, *in vivo* study was conducted using New Zeeland type rabbits, providing aqueous garlic extract for a period of 28 days. Accordingly, four groups (G_0, G_1, G_2 and G_3) were designed and provide different doses of extract (control, 3, 6 and 9 mL/kg b.w). Functional garlic extract containing water soluble active components resulted in significant reduction in RBC (6.94 ± 0.47 (10^6/mm^3 in G_2) while WBC improve (16.97 ± 1.70) in G_2. Haemoglobin and haematocrit, packed cell volume, mean corpuscular volume, mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration were also modulated well in G_2 as compare to other groups. Regarding the total protein, maximum was recorded (7.23 ± 0.58) in G_2 while lowest was (6.72 ± 0.15g/L) in G_0 Albumin, globulin and electrolytes like Sodium (Na) and potassium (K) exhibited significant difference by using different concentration of aqueous garlic extract. Moreover, liver functioning test, urea, creatinine, alanine aminotransferase (ALT) and aspartate aminotransferase (AST) also showed significant modulation using the aqueous garlic extract.From the present investigation, it is deduced that garlic preparations like aqueous extract is effective against various maladies because of its functional and nutraceutical aspects.

Keywords: Functional food; Aqueous garlic extract; Safety product; Serum analysis; Hypercholesterolemia & Hyperglycaemia and Rabbit modelling

Introduction

Functional and nutraceuticals foods provide an opportunity to improve human health by reducing care cost and to support livelihood in rural development. Functional foods are those healthy foods claimed to have a health-promoting or disease-preventing property beyond the basic function of supplying nutrients [1]. They often work like pharmaceuticals with specific effects on physiological system. Consumption of such foods is an emerging trend worldwide owing to their increasing popularity among health-conscious consumers [2,3].

Pivotal links have been established between dietary components and human health. There are lot of evidences that consumption of different fruits and vegetables are important for human health [4] as they are excellent sources of dietary fibers, antioxidants, carotenoids, sulfur containing compounds, vitamins and minerals [5]. Epidemiological studies conducted worldwide have revealed that consumption of these fruits and vegetables especially enriched functional ingredients is associated with reduction of health related chronic disorders [6].

Garlic (*Allium Sativum*) is one of the most commonly used plants, both for medicinal and culinary purposes as providing flavor and taste to the final product. It is believed to be originated from Central Asia over 6,000 years ago and has been extended towards west, south and east [7]. However, whole garlic as well as its components/fractions are used in medicines since long time and depict its presence in the Chinese medicines 3,000 years ago. Garlic-based medications were also famous in India about 5,000 years ago. Since from 1550 B.C. Egyptians fed garlic to boost their immunity thereby render safe from various maladies and improve their health performance [8].

Garlic health promoting perspectives have been proven and recommended worldwide as a dietary supplement [1]. In many countries, health potentials of garlic and its various products have been approved and are available as dietary supplements. Aqueous garlic extract, dehydrated garlic powder and its extracted oil is gaining popularity and sold as dietary [9,10].

Materials and Methodology

Preparation of aqueous garlic extract

The peeled garlic bulbs were weighed (100 g) and grounded thoroughly to obtain fine garlic juice. Afterwards, it was homogenized in 100 mL of 0.9% cold and sterile saline solution in a blender at high speed for 15 minutes followed by filtration with muslin cloth. Resultant aqueous extract of garlic was stored at −20°C and prepared its different concentrations with 0.9% saline solution for further analysis [11].

***Corresponding author:** Suleria HAR, Research High Degree Scholar, School of Agriculture and Food Sciences, Hartley Teakle Building, Room C505, The University of Queensland, Brisbane QLD 4072, Australia, Tel: +61 7 336 56335; +61 470 439 670; E-mail: hafiz.suleria@uqconnect.edu.au

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Efficacy Studies

In rabbit experimental modelling, twenty four New Zeeland red eyes male rabbits with age of 20-23 weeks, average body weight 2.5 Kg were procured from National Institute of Health (NIH), Islamabad and housed in the Animal Room of National Institute of Food Science and Technology, University of Agriculture Faisalabad, Pakistan. During experiment, temperature (23 ± 2°C) and relative humidity (55 ± 5%) were controlled for 12 hours light and dark period. For efficacy trials, four groups of rabbits were made five in each as mentioned in Table 1. At the initiation of study some rabbits were sacrificed to develop baseline values. Different concentrations of aqueous garlic extracts (Table 1) were given orally by using 6-8 French feeding tube as gavage to the respective group for a period of twenty eight days regularly to determine the effect of functional garlic juice (aqueous garlic extract) in comparison to control (Normal Feed, no garlic extract). Feed and water intake were recorded daily whilst body weight was measured after three days in whole experiment. Left diet and faeces were also collected. In the end of study, the overnight fasted rabbits were sacrificed to evaluate the effect of respective treatments on the selected parameters including serum lipid profile, glucose level, haematological, renal & liver functions and protein analysis. Blood samples of rabbits were collected through main jugular vein and serum was collected in heparin coated tubes for different assays through Microlab-300, Germany [1].

It is assured that all the experimental trails were performed in compliance with the relevant laws and institutional guidelines of National Institute of Food Science and Technology, University of Agriculture Faisalabad, Pakistan. Furthermore, all the experimental modelling includes safety and dietary plans were reviewed and approved by the institutional committee(s) (Table 1).

Hematological Analysis

Hematological analysis mainly red blood cells, white blood cells, hemoglobin (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), and hematocrit (hct) were estimated according to respective methods of Hillman and Finch [12].

Renal Function Test

Renal function include sodium, potassium urea andcreatinine were evaluated by using commercial kits of Thomas [13].

Liver Function Test

Finally, their liver function tests were evaluated for the safety concern of the physiological body functions. Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were calculated by following the protocols of Moss [14].

Protein Analysis

Serum protein profile mainly total protein, albumin and globulin were calculated by using kits of Sigma-Aldrich Chemicals Co. [15].

Statistical Analysis

The data obtained from entire study were subjected to statistical analysis to determine the level of significance described by Steel [16]. Analysis of variance was calculated by ANOVA test and means were interrupted by Duncan's Multiple Range Test.

Groups	Treatments
G_0	Control (Without garlic extract)
G_1	3 mL garlic extract(per kg body weight of rabbit)
G_2	6 mL garlic extract (per kg body weight of rabbit)
G_3	9 mL garlic extract (per kg body weight of rabbit)

Table 1: Different groups conducted in the efficacy trials.

Results

It was concluded from my pervious experimental result published in Journal of Medicinal Plants Research, maximum cholesterol was recorded as (51.57 ± 0.7) in G_0 followed by (50.24 ± 0.7) G_1 and G_3 (49.28 ± 0.5 mg/dL). Furthermore, it was also predicted that during the whole study the total cholesterol reduced in all treated groups from 51.15 ± 0.5to 49.66 ± 0.3 in G_1, 52.83 ± 0.4 to 47.64 ± 0.2 in G_2 while 49.73 ± 0.4 to 48.71 ± 0.3 mg/dL in G_3 from the initiation to the end of the study. It was observed that total cholesterol was significantly different in days, groups and their interaction at the level of significance ($P<0.05$) [1].

Further investigated that serum glucose was recorded as (7.35 ± 0.1) in G_0 followed by (6.43 ± 0.2) G_3 and G_1 (6.30 ± 0.6 mg/dL). Moreover, it was also predicted that during the whole study the serum glucose was reduced in all treated groups from 6.50 ± 0.2 to 6.10 ± 0.4 in G_1, 6.60 ± 0.2 to 5.80 ± 0.3 in G_2 while 6.70 ± 0.3 to 6.20 ± 0.3 mg/dLin G_3 in whole study. It was recorded that serum glucose was significant in the action of days, groups and their interaction at the level of significance ($p <0.05$) [1].

Red blood cells (RBC's) and white blood cells (WBC's)

The mean square values for the effect of treatments on red blood cells and white blood cells revealed significant differences in all groups. From mean (Table 2) it was observed that maximum red blood indices were recorded as (7.56 ± 0.2) in G_0 means followed by (7.16 ± 0.2)G_1 and G_2 6.94 ± 0.4 (10^6/mm^3). Furthermore, it also predicted that during the whole study the red blood cells were reduced in all treated groups i.e. 7.40 ± 0.1 to 6.96 ± 0.2 in G_1, 7.45 ± 0.3 to 6.51 ± 0.2 in G_2 while 7.30 ± 0.3 to 6.26 ± 0.3 (10^6/mm^3) in $G_3$from the initiation of study to termination respectively. Regarding WBC's, mean values showed that maximum WBC's were recorded (16.97 ± 1.7) in G_2 followed by (16.22 ± 0.9)G_1 and G_3 16.16 ± 1.1 (10^3/mm^3). It was also observed from the table that maximum value for WBC's were 18.71 ± 0.2 in G_2 while lowest value was 15.15 ± 0.2 (10^3/mm^3) in G_2 from day 0 to 28th day trail (Table 2).

Groups	0 Days		14 days		28 days		Means	
	RBC (10^6/mm^3)	WBC (10^3/mm^3)	RBC (10^6/mm^3)	WBC (10^3/mm^3)	RBC (10^6/mm^3)	WBC (10^3/mm^3)	RBC (10^6/mm^3)	WBC (10^3/mm^3)
G_0	7.38 ± 0.11bc	15.35 ± 0.10g	7.50 ± 0.14ab	16.08 ± 0.19ef	7.80 ± 0.17a	16.46 ± 0.16d	7.56 ± 0.21a	15.96 ± 0.56c
G_1	7.40 ± 0.14 bc	15.2 ± 0.20g	7.13 ± 0.32cd	16.33 ± 0.31de	6.96 ± 0.23d	17.13 ± 0.23bc	7.16 ± 0.21b	16.22 ± 0.97b
G_2	7.45 ± 0.31 bc	15.3 ± 0.20g	6.86 ± 0.30d	16.90 ± 0.38c	6.51 ± 0.29e	18.71 ± 0.27b	6.94 ± 0.47c	16.97 ± 1.70a
G_3	7.30 ± 0.35 bc	15.15 ± 0.21g	6.96 ± 0.44d	15.98 ± 0.30f	6.26 ± 0.37e	17.35 ± 0.28a	6.84 ± 0.52c	16.16 ± 1.11b
Mean	7.38 ± 0.06a	15.25 ± 0.09c	7.11 ± 0.27b	16.32 ± 0.41b	6.88 ± 0.67c	17.14 ± 0.94a		

Table 2: Means for red blood cells(RBC) and white blood cells (WBC).

Hemoglobin (Hb), hematocrit (hct) and Mean corpuscular hemoglobin (MCH)

The mean square value for effect of treatments on Hb and hct revealed significant differences in all groups. From (Figure 1) it was observed that maximum Hb was recorded as (10.73 ± 0.1) in G_0 means followed by (10.71 ± 0.2)G_1 and G_2 (10.60 ± 0.1 g/dL). Regarding the hct, maximum value was recorded as (37.47 ± 0.5) in G_1 means followed by (36.92 ± 0.4)G_2 and G_0 (36.14 ± 0.2 %). It was also observed from the graphical description that maximum value for hct was 38.30 ± 0.36 in G_1 while lowest value was 35.02 ± 0.2% in G_3. Mean values for MCH trait showed that maximum MCH was recorded as (18.42 ± 0.8) in G_0 means followed by (17.93 ± 0.4)G_3 and G_1(17.33 ± 0.4pg). It was also observed from the graph that maximum value for MCH was 18.91 ± 0.3 in G_0 while lowest value was 16.21 ± 0.2 pg observed in G_1 from the 0 days study to 28th days trail (Figure 1).

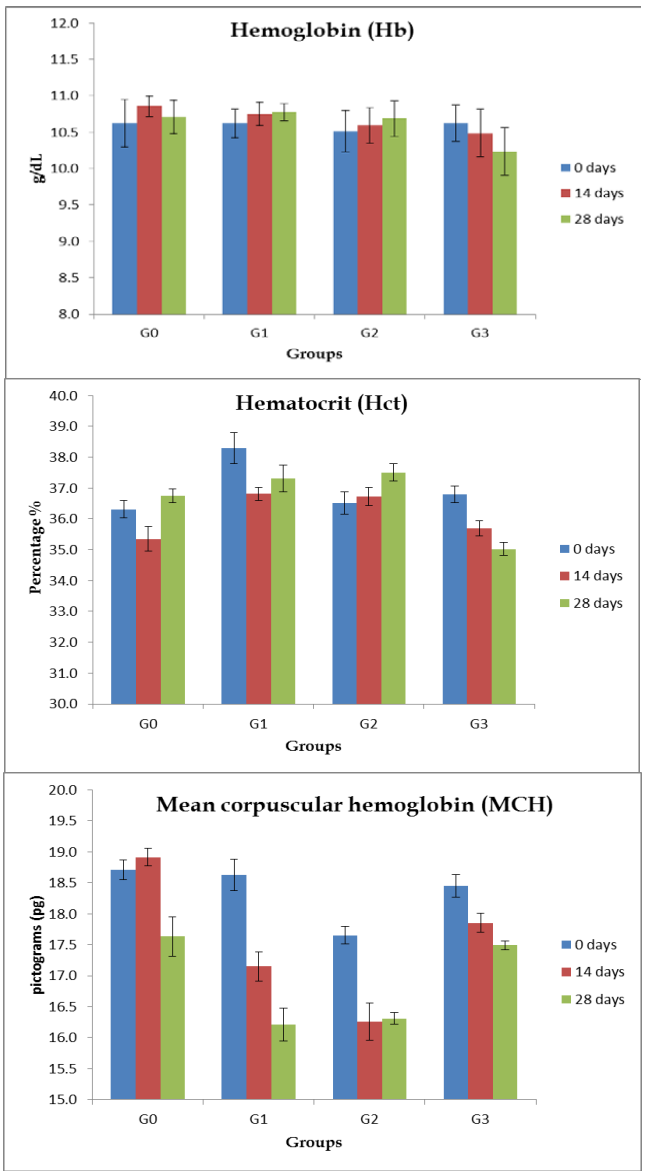

Figure 1: Means for Hemoglobin (Hb), Hematocrit (hct) and Mean corpuscular hemoglobin (MCH).

Packed cell volume (PCV) and mean corpuscular volume (MCV)

It is obvious from the mean square values that treatments exhibited significant differences on PCV and MCV of different groups of rabbits. Mean values for this trait in study showed that maximum PCV were recorded as (34.50 ± 0.8) in G_3 means followed by (34.28 ± 0.6)G_0 and G_2 (32.66 ± 0.7 %) in (Table 3). It is observed from the table that maximum value for PCV was 35.48 ± 0.2 in G_3 while lowest value was 30.16 ± 0.3 % observed in G_2 from the 0 days study to 28th days trail. Regarding the MCV maximum value was recorded (52.58 ± 2.1) in G_2 means followed by (52.01 ± 1.8)G_3 and G_1 (51.68 ± 1.3 fl). Furthermore, it also predicted that during the whole study MCV was improved in all treated groups i.e. 50.30 ± 0.2 to 52.90 ± 0.3 in G_1, 50.43 ± 0.7 to 54.68 ± 0.5 in G_2 while 50.26 ± 0.8 to 53.91 ± 0.2 fl in whole study (table 3).

Mean corpuscular hemoglobin concentration (MCHC) and Total protein

Mean square values of MCHC exhibited significant differences between treatments and different groups of rabbits. Regarding the MCHC maximum value was recorded (37.47 ± 0.6) in G_1 means followed by (36.92 ± 0.5)$G_2$and G_0 (36.14 ± 0.3 %) in Figure 2. The mean square values for effect of treatments on total protein revealed significant differences in all groups. It was evaluated that maximum total protein content was recorded as (7.45 ± 0.5) in G_2 means followed by (7.21 ± 0.4)G_1 and G_0 (6.93 ± 0.1 g/L). Furthermore, it also predicted that during the whole study the total protein was improved in all treated groups during the whole study (Figure 2).

Albumin and globulin

It was obvious from the mean square values that albumin and globulin exhibited significant differences with different groups of rabbits. Mean values (Table 4) showed that maximum albumin was recorded as (3.52 ± 0.3) in G_2 means followed by (3.27 ± 0.4)G_3 and G_1 (3.07 ± 0.2 g/dL). It was also observed from the table that maximum value for albumin was 3.88 ± 0.2 in G_2 while lowest value was 2.76 ± 0.2 g/dL observed in G_1 from the 0 days study to 28th days trail. Regarding the globulin, maximum value was recorded (3.91 ± 0.5) in G_2 means followed by (3.68 ± 0.2)G_1 and G_3 (3.67 ± 0.4 g/dL). Furthermore, it also predicted that during the whole study the globulin was improved in all

Groups	0 Days		14 days		28 days		Means	
	PCV (%)	MCV (fl)	PCV (%)	MCV (fl)	PCV (%)	MCV (fl)	PCV (%)	MCV (fl)
G_0	34.21 ± 0.59bcd	50.13 ± 0.25f	34.30 ± 0.20bc	50.56 ± 0.37ef	34.33 ± 0.27b	50.85 ± 0.20e	34.28 ± 0.06a	50.51 ± 0.36d
G_1	33.50 ± 0.21e	50.30 ± 0.25f	32.40 ± 0.20f	51.86 ± 0.49d	32.10 ± 0.37f	52.90 ± 0.32c	32.66 ± 0.73b	51.68 ± 1.30c
G_2	33.85 ± 0.28de	50.43 ± 0.76ef	31.26 ± 0.46g	52.65 ± 0.38c	30.16 ± 0.38h	54.68 ± 0.57a	31.76 ± 1.89c	52.58 ± 2.12a
G_3	35.48 ± 0.20a	50.26 ± 0.08f	34.11 ± 0.31bcd	51.85 ± 0.38d	33.90 ± 0.40cde	53.91 ± 0.29b	34.50 ± 0.85a	52.01 ± 1.83b
Mean	34.26 ± 0.86a	50.28 ± 0.12c	33.02 ± 1.44b	51.73 ± 0.86b	32.62 ± 1.90c	53.08 ± 1.66a		

Table 3: Means for Packed cell volume (PCV) and mean corpuscular volume (MCV).

treated groups i.e. 3.46 ± 0.2 to 3.88 ± 0.2 in G_1, 3.43 ± 0.2 to 4.43 ± 0.2 in G_2 while 3.33 ± 0.1 to 4.11 ± 0.2 g/dL in G_3in whole study(Table 4)

Sodium (Na) and potassium (K)

The mean square value for effect of treatments on sodium and potassium revealed significant differences in all groups. From mean (Table 5) it was observed that maximum Na was recorded as (139.11 ± 1.3) in G_0 means followed by (138.94 ± 2.2)G_1 and G_3 (136.61 ± 1.6 mmole/L). Furthermore, it also predicted that during the whole study the Na was reduced in all treated groups i.e. 141.33 ± 2.1 to 136.83 ± 2.8 in G_1, 139.66 ± 2.1 to 127.83 ± 2.8 in G_2 while 138.16 ± 2.3 to 136.83 ± 2.8 mmole/L in G_3, respectively. Regarding the potassium (K), maximum value was recorded as (6.81 ± 0.3) in G_3 means followed by (6.40 ± 0.3) G_1 and G_2 (5.57 ± 1.2 mmole/L). It was also observed from the table that maximum value for K was 7.08 ± 0.2 in G_3 while lowest value was 4.36 ± 0.2 mmole/L in G_2 from the 0 days study to 28th days trail.

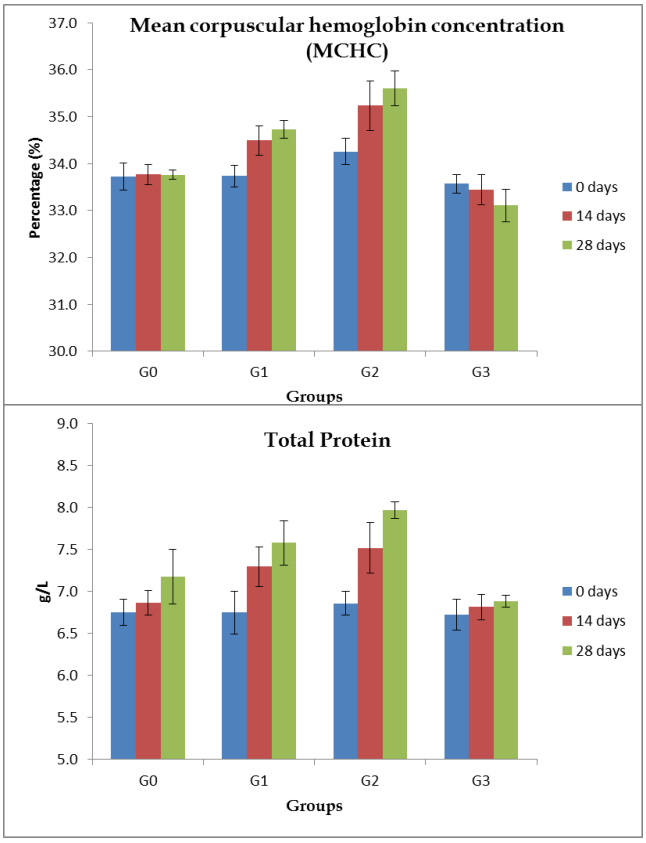

Figure 2: Means for mean corpuscular hemoglobin concentration (MCHC) and total protein.

Urea and creatinine

The mean square value for effect of treatments on urea and creatinine revealed significant differences in all groups. From mean (Table 6) it was observed that maximum urea content was recorded as (58.11 ± 2.8) in G_0 means followed by (49.94 ± 3.9)G_3 and G_1 (49.16 ± 2.1 mg/dL). Furthermore, it also predicted that during the whole study urea content was reduced in all treated groups i.e. 55.16 ± 2.8 to 43.16 ± 2.8 in G_1, 55.66 ± 2.1 to 40.83 ± 2.8 in G_2 while 54.33 ± 2.1 to 46.83 ± 3.3 mg/dL in G_3, respectively. Regarding the creatinine, maximum value was recorded as (0.81 ± 0.8) in G_0 means followed by (0.67 ± 0.2) G_2 and G_1 (0.64 ± 0.1 mg/dL). It was also observed from the table that maximum value for creatinine was 0.88 ± 0.1 in G_0 while lowest value was 0.46 ± 0.2 mg/dL in G_2 from the 0 days study to 28th days trail (Tables 5 and 6).

Alanine aminotransferase (ALT) and aspartate aminotransferase (AST)

The mean square values for effect of treatments on ALT and AST revealed significant differences in all groups. From mean (Table 7) it was observed that maximum ALT was recorded as (199.38 ± 1.6) in G_4 means followed by (181.61 ± 1.5)G_0 and G_2 (144.05 ± 3.8 U/dL). Furthermore, it was also predicted that during the whole study the ALT was reduced in all treated groups i.e. 179.33 ± 2.1 to 111.83 ± 2.8 in G_1, 181.33 ± 2.1 to 107.66 ± 2.7 in G_2 while 187.16 ± 3.54 to 218.16 ± 2.31 U/dL in G_3, respectively. Regarding the aspartate aminotransferase (AST),maximum value was recorded as (32.05 ± 1.4) in G_0 means followed by (27.44 ± 5.4)G_1 and G_3 (27.33 ± 6.0 U/L) (Table 7).

Groups	0 Days		14 days		28 days		Means	
	Albumin (g/dL)	Globulin (g/dL)	Albumin (g/dL)	Globulin (g/dL)	Albumin (g/dL)	Globulin (g/dL)	Albumin (g/dL)	Globulin (g/dL)
G_0	6.58 ± 0.30de	3.61 ± 0.17cdef	6.71 ± 0.28de	3.68 ± 0.17cdef	6.88 ± 0.28cd	3.76 ± 0.21cd	6.72 ± 0.15c	3.68 ± 0.07b
G_1	6.48 ± 0.23e	3.46 ± 0.21efg	7.08 ± 0.27bc	3.71 ± 0.28cde	7.33 ± 0.31b	3.88 ± 0.28bc	6.96 ± 0.43b	3.68 ± 0.20b
G_2	6.71 ± 0.28de	3.43 ± 0.25fg	7.11 ± 0.28bc	3.88 ± 0.28bc	7.86 ± 0.25a	4.43 ± 0.25a	7.23 ± 0.58a	3.91 ± 0.50a
G_3	6.53 ± 0.24e	3.33 ± 0.18g	6.68 ± 0.17de	3.58 ± 0.17defg	6.88 ± 0.23cd	4.11 ± 0.28b	6.7 ± 0.17c	3.67 ± 0.40b
Mean	6.57 ± 0.1c	3.46 ± 0.11c	6.90 ± 0.23b	3.71 ± 0.12b	7.24 ± 0.46a	4.05 ± 0.29a		

Table 4: Means for Albumin and globulin.

Groups	0 Days		14 days		28 days		Means	
	(Na) (mmole/L)	(K) (mmole/L)	(Na) (mmole/L)	(K) (mmole/L)	(Na) (mmole/L)	(K) (mmole/L)	(Na) (mmole/L)	(K) (mmole/L)
G_0	139.33 ± 2.16abc	5.83 ± 2.56abc	137.66 ± 2.16bcd	5.48 ± 0.28bcd	140.33 ± 3.14ab	4.83 ± 2.31cd	139.11 ± 1.34a	5.38 ± 0.50b
G_1	141.33 ± 2.16a	6.66 ± 2.06ab	138.66 ± 2.58abc	6.48 ± 0.28ab	136.83 ± 2.85cd	6.06 ± 0.32abc	138.94 ± 2.26a	6.40 ± 0.30a
G_2	139.66 ± 2.16abc	6.88 ± 0.28a	132.33 ± 2.16e	5.46 ± 0.25bcd	127.83 ± 2.85f	4.36 ± 0.21d	133.27 ± 5.97c	5.57 ± 1.26b
G_3	138.16 ± 2.31bc	7.08 ± 0.28a	134.83 ± 2.85de	6.86 ± 0.34a	136.83 ± 2.85cd	6.48 ± 0.28ab	136.61 ± 1.67b	6.81 ± 0.30a
Mean	139.62 ± 1.30a	6.61 ± 0.54a	135.87 ± 2.86b	6.07 ± 0.71ab	135.45 ± 5.34b	5.43 ± 1.00b		

Table 5: Means for Sodium (Na) and potassium (K).

Groups	0 Days		14 days		28 days		Means	
	Urea (mg/dL)	Creatinine (mg/dL)	Urea (mg/dL)	Creatinine (mg/dL)	Urea (mg/dL)	Creatinine (mg/dL)	Urea (mg/dL)	Creatinine (mg/dL)
G_0	56.16 ± 2.92b	0.88 ± 0.18a	56.83 ± 2.85b	0.82 ± 0.24ab	61.33 ± 4.96a	0.72 ± 0.32abc	58.11 ± 2.81a	0.81 ± 0.08a
G_1	55.16 ± 2.85b	0.83 ± 0.16ab	49.16 ± 2.85c	0.61 ± 0.23abc	43.16 ± 2.85ef	0.48 ± 0.28c	49.16 ± 6.00b	0.64 ± 0.17b
G_2	55.66 ± 2.16b	0.88 ± 0.19a	44.83 ± 2.85de	0.66 ± 0.20abc	40.83 ± 2.85f	0.46 ± 0.21c	47.11 ± 7.67c	0.67 ± 0.21ab
G_3	54.33 ± 2.16b	0.66 ± 0.17abc	48.66 ± 2.58c	0.56 ± 0.25bc	46.83 ± 3.31cd	0.51 ± 0.28c	49.94 ± 3.90b	0.58 ± 0.07b
Mean	55.33 ± 0.78a	0.81 ± 0.10a	49.87 ± 5.02b	0.66 ± 0.11b	48.04 ± 9.19c	0.54 ± 0.11b		

Table 6: Means for Urea and Creatinine.

Groups	0 Days		14 days		28 days		Means	
	ALT (U/dL)	AST (U/L)	ALT (U/dL)	AST (U/L)	ALT (U/dL)	AST (U/L)	ALT (U/dL)	AST (U/L)
G_0	180.33 ± 2.16e	30.83 ± 2.85ab	181.166 ± 2.31de	33.66 ± 2.16a	183.33 ± 2.58d	31.66 ± 2.16a	181.61 ± 1.54b	32.05 ± 1.45a
G_1	179.33 ± 2.16e	32.66 ± 3.32a	134.83 ± 2.31g	27.83 ± 3.71b	111.83 ± 2.85h	21.83 ± 2.85c	142.00 ± 3.31d	27.44 ± 5.42b
G_2	181.33 ± 2.16de	34.16 ± 3.31a	143.16 ± 2.85f	16.83 ± 3.48d	107.66 ± 2.73i	8.66 ± 2.16e	144.05 ± 3.84c	19.88 ± 13.02c
G_3	187.16 ± 3.54c	34.16 ± 2.85a	192.83 ± 2.31b	21.16 ± 2.31c	218.16 ± 2.31a	27.66 ± 3.77b	199.38 ± 16.50a	27.33 ± 6.00b
Mean	182.04 ± 3.51a	32.70 ± 1.39a	163.00 ± 28.32b	24.87 ± 7.40b	155.25 ± 54.45c	22.45 ± 10.04c		

Table 7: Means for Alanine aminotransferase (ALT) and aspartate aminotransferase (AST).

Discussion

Mikail reported that there was decrease in the red blood cell in garlic extract and Berenil-treated rabbits group compared to the infected non treated ones [17]. He observed that red blood cells were reduced by the supplementation of garlic intake dose from 7.8 ± 0.25 to 6.4 ± 0.1 (10^6/mm^3). However, increase in the WBC's count was observed in garlic extract and Berenil-treated rabbits group compared to the infected non treated ones. WBC's were improved by the supplementation of garlic intake dose from 17 ± 0.9 to 20 ± 0.6 (10^3/mm^3). Kung-chi reported that garlic oil helped to reduce the Hb level up to certain doses but if its level increased than it showed negative effect on rats [18]. Low dose of garlic oil regulated the Hb level while overdose may impact negative effect. They concluded that control group had value of 14.2 ± 0.8, low dose garlic oil improved 14.6 ± 0.6 while high dose of garlic oil induced negative impact on rats Hb level i.e. 14.2 ± 0.8 to 12.7 ± 0.5 g/dL. Regarding the hct, same trend was observed by giving low dose of garlic oil regulated the hct level high while overdose showed inverse effect. It was reported that control group had value of 37.3 ± 2.2, low dose garlic oil improved 37.5 ± 1.1 while high dose of garlic oil reduced the level from 37.3 ± 2.2 to 34.4 ± 1.1%.

Late reported that the total protein were significantly increased in all groups during the experimental periods compared to the control group ($P < 0.05$) with *Moringa oleifera* supplemented [19]. By comparing the control group with *Moringa oleifera* supplemented group for 6 weeks showed that *Moringa oleifera* improved total protein value about 6.43 ± 0.17 mg/dL to 10.98 ± 0.91 mg/dL. These results are supporting to project finding as in precent it was same. It was also concluded that after receiving garlic extract up to 12 weeks, total protein was improved greater as compared to the normal group. Yousef reported that the value of albumin content was enhanced by consuming the functional drinks like isoflavones from 5.91 ± 0.17 to 5.96 ± 0.16 g/dL [20]. It was further assumed that the presence of various active ingredients may improve the albumin level. Furthermore, it was observed that some active molecules like cypermethrin may decrease the level of globulin 5.24 ± 0.13g/dL. Moreover, values of globulin content were also enhanced by consuming the functional drinks like isoflavones from 2.65 ± 0.13 to 2.68 ± 0.11g/dL and decreased by consuming cypermethrin up to 2.55 ± 0.12g/dL. Yousef reported that the value of urea content was reduced by taking the functional drinks like isoflavones from 28.3 ± 0.59 mg/dL to 27.9 ± 0.63 mg/dL. It was further assumed that the presence of various active ingredients may reduce the urea level [20]. Furthermore, it was observed that some active molecules like cypermethrin may increase the level of urea 31.7 ± 0.61mg/dL.

Faezeh also reported that supplementation of garlic juice significantly reduced the serum urea levels compared with the reperfusion group ($P < .001$) [21]. Pretreatment with aqueous garlic extract also resulted in significant increase in urine potassium ($P = 0.03$) compared to reperfusion. It is also reported that serum creatinine reduced by the intake of aqueous garlic extract as compare to normal from 0.82 ± 0.04 mg/dL to 0.76 ± 0.05 mg/dL. El-Demerdash reported that the value of ALT in control group was (51 ± 2.07 U/dL) but after taking the feed of garlic it was slight improved as compared to control group [22]. In case of diabetic group value of ALT was (82 ± 4.37 U/dL) that was greater than that of control group. Metwally also reported that by feeding the garlic to the fish *Tilapia nilotica* significant changed in AST level was observed in different groups [23]. It was concluded that different groups like control group, fed natural garlic, garlic oil and garlic powder had reduce AST as 117.86 ± 4.57 U/L, 92.63 ± 3.50 U/L, 80.73 ± 2.63 U/L and 82.46 ± 1.92 U/L respectively. It was concluded that AST level decrease in serum by consuming different sources of garlic. El-Demerdash reported that the value of ALP in control group was (48 ± 3.03 U/dL) after feeding the onion and garlic it was reported that it reduced while in case of diabetic group the value of ALP was slightly increased (73 ± 3.40 U/dL)[22].

Conclusion

Functional foods are gaining popularity worldwide owing to the consumer's preference towards the consumption of natural, fewer side effects, cost effective and safe products in dietary modifications. Garlic (*Allium sativum* L.) is an essential vegetable that have been widely utilized as seasoning, flavoring, culinary and in herbal remedies. Bioactive molecules present in garlic are playing pivotal role in maintaining human health and reduce various ailments like diabetes, cholesterol, cardiovascular diseases and cancer insurgence. Functional garlic extract containing water soluble active components resulted in reduction in cholesterol, red blood cells, PCV, Na, K, urea, creatinine, ALT and AST indicating their effectiveness against hypercholesterolemic perspectives. Likewise, serum glucose was also

substantially reduced and hematological analyses were also improved by phytotherapy of functional food diets. Moreover, renal and liver function test, serum biochemistry, protein ratios, electrolytes and non-electrolytes were within normal range revealing safety health concerns of garlic. However, improvement in WBC's, MCV, albumin and globulin may also confirm its functional and nutraceutical utilization. From the present investigation, it is deduced that garlic preparations like aqueous extract, garlic oil, garlic macerates are effective against hypercholesterolemia and hyperglycemia therefore, proposed to cure various life threatening disorders.

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