Effect of *Senegalia senegal* (gum acacia) and *Boswellia* in Treating Liver and Kidney Functions in Male Rats Induced Arthritis

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Abstract

This study aimed to explain the effect of Senegalia Senegal (Gum Arabic) and Boswellia on some physiological and biochemical parameters of liver and kidney function. Thirty adult male rats were used after induction of arthritis. They were divided into six groups, with five rats for each group. The first group was the negative control group (rats without arthritis induction and treatment), the second group was the positive control group (rats with arthritis induction), the third group was (the group arthritis induction and intubated orally with 250 mg kg B.W Boswellia), the fourth group was (the group arthritis induction and intubated orally 400 mg/kg B.W. gum arabic), and the fifth group was (the group arthritis induction and intubated orally with Boswellia and gum arabic). The sixth group was arthritis induction and intubated 0.75 mg/kg of methotrexate. Blood samples were obtained after two and six weeks. The following tests were performed: liver function tests, glucose, kidney function, and lipid profile. The results showed a decrease in the liver enzymes AST, ALT, and ALP, and kidney functions, Urea, Uric acid, and Creatinine, as well as the glucose level, while there was an increase in the HDL level and a decrease in Triglyceride, cholesterol, VLDL, and LDL in comparison to two weeks and six weeks for one group.

Keywords: Arthritis, Boswellia,Gum arabic, Creatinine , Triglyceride

1. Introduction

Senegalia senegal or Acacia Senegal (gum arabic or gum acacia) (GA) from the Fabaceae family, Mimosoideae subfamily), is a dietary fiber containing a water-soluble heteropoly saccharide. It is derived from the dry, sticky secretions of the Senegalese plant found in a wide range throughout Africa, India, and Pakistan [1, 2]. Most gum Arabic is made up of macromolecules, primarily proteins and carbohydrates. Along with minerals and amino acids [3]. Because GA can raise total antioxidant capacity (TAC), it has beneficial anti-oxidative effects on sickle cell anemia patients [4] and reduces malondialdehyde (MDA) renal levels [5]. Gum arabic has a reduced effect on lipid peroxidation [6]. In Arabic traditional medicine, GA is used to reduce the frequency and requirement for hemodialysis in patients with chronic renal failure. Due to its potent antioxidant qualities, it is utilized to lessen the nephrotoxicity of gentamicin and cisplatin [7] in experimental animals and to reduce cardiotoxicity [8]. Boswellia carterii, a tree of the Burseraceae family, is said to be an effective therapy for a variety of inflammatory disorders. [9] Boswellia dried resins work by blocking the enzyme five lipoxygenases, which affects inflammatory illnesses [10]. Furthermore, because of its chemical constituents, such as arabinose, terpenoids xylose, betasitosterin, and volatile oils, boswellia can heal wounds. The exudate of the Boswellia tree yields frankincense, which has several therapeutic uses [11] that induce hepatoprotective effects, a decrease in the level of glucose, cholesterol, LDL-C, TG, urea, and enzyme ALP, GOT, and GPT in blood [12]. From the gum resin of Boswellia serrata and Boswellia carteri, a group of pentacyclic triterpene molecules known as boswellic acid (BA) is extracted. It turned out to be

one such substance that has shown promise in treating some chronic illnesses, including cancer, diabetes, asthma, inflammatory bowel disease, Parkinson's disease, Alzheimer's disease, and arthritis [13].

2- Materials and Methods:

2-1- Experimental Animals :

Thirty adult laboratory male rats weighing 200-300 g and aged between 10-12 weeks were obtained from the animal house of the AL-Nahrain University and placed in special plastic cages to raise rats with metal caps. the cages' floor on wood shavings to provide for adaption before to treatment at the carefully regulated temperature of 25℃. Rat pellets and tap water were given to the animals so they could eat and drink.

2-2- Arthritis induction:

Rheumatoid arthritis was induced in rats using a complete Freund adjuvant, according to [14].

2-3- Experimental design:

Thirty adult male rats were used in this experiment and divided into six groups; each group consisted of five rats as follows: Group 0: negative control (non arthritis induction). Group 1: positive control (arthritis induction without treatment). Group 2: Arthritic rats intubated orally with Senegalia sengal (gum Arabic), 400 mg/kg B.W [7]. Group 3: Arthritic rats intubated orally with Boswellia, 250 mg kg B.W [15]. Group 4: Arthritic rats intubated orally with 400 mg/kg B.W Senegalia sengal (gum arabic) and 250 mg kg B.W Boswellia.

Group 5: Arthritic rats intubated orally with 0.75mg /kg B.W. methotrexate [16]. All rats were weighed, and the dose was measured according to the weight of each rat. The rats were given all treatment orally, starting from day 1 of the induction of arthritis (day 21 of the experiment) and continuing until day 30 (day 51 of the experiment), which was the end of the experiment.

2- 4- blood collection :

Rats of all groups were observed on day 30 from the induction of arthritis (day 51 of the experiment). Blood was collected from rats at two weeks, and at the end of the experiment by cardiac puncture technique, the blood sample was kept in gel clot activator tubes. Then, serum was separated from coagulant blood by centrifugation at 5000 rpm for 10 min and stored at $^{-}$20 C to study the following: liver enzymes (AST, ALT, ALP) using an enzymatic kit, respectively, according to [17]. Kidney function parameters (Urea, Uric acid) according to the diamond enzyme kit [18], determination of LDL VLDL was measured according to [19], cholesterol by kit according to [20], Triglyceride according to [21] and glucose was determined using kits from Linear.

2-5- Statistical Analysis:

The Statistical Analysis. The least significant difference in the LSD test (Analysis of Variation -ANOVA) was used to compare the means in this study (27) significantly.

3- Result:

3-1- Liver function parameters:

Alkaline Phosphatase (ALP) activity U/L

Table (1) explains the results of serum Alkaline Phosphatase (ALP) activity (U/L); after two weeks, there was a significant increase (P≤0.05) in ALP activity at G1, G2, G3, G4, G5 compared to G0, activity of ALP at (6 weeks) showed that there were significant differences in G1, G2, G3, G4, G5 compared to G0. Comparing 2 periods, 2 weeks and 6 weeks, there was a significant decrease in P≤0.01 in G2, G3, and G4 and a decrease in P≤0.05in G1 and G5 compared to two weeks.

Table 1: Effect of Groups and Time in ALP U/L

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	67.68 ±2.39B	74.43 ±3.97CD	9.546 NS
G1	128.28 ±3.73A	114.01 ±4.24A	11.67 *
G2	99.49 ±3.14A	77.67 ±0.47BC	7.08 **
G3	138.66 ±11.84A	82.31 ±2.01B	26.54 **
G4	166.23 ±16.85A	70.37 ±0.71D	33.620 **
G5	98.53 ±4.89A	78.04 ±0.55BC	18.675 *
LSD value	19.798 **	7.428 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic) 400 mg/kg B.W, G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Gum Arabic). G5: Arthritic animals treated with 0.75mg /kg B.W. drug methotrexate.

Alanine aminotransferase (ALT) GPT activity U/L

Table (2) demonstrates the results of serum Alanine aminotransferase (ALT) activity (U/L); in two weeks, there was a significant increase (P≤0.01) in ALT activity at G1, G2, G3, G4, and G5 compared to G0, activity of ALT at (6 weeks) showed that there were significant differences in G1, G2, G3, G4, G 5 compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant decrease in P≤0.05 in G1, G2, and G5 and a decrease in P≤0.01 in G3 and G4, as compared with two weeks.

Table (2) Effect of Groups and Time in GPT U/L

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	25.45 ±0.75C	27.52 ±0.30C	3.75 NS
G1	46.29 ±1.70A	39.90 ±1.72A	5.44 *
G2	34.91 ±0.97B	29.24 ±0.34BC	3.85 *
G3	51.71 ±5.31A	32.85 ±3.10B	12.59 **
G4	29.10 ±0.43BC	25.94 ±0.28C	1.365 **
G5	34.98 ±1.52B	28.21 ±0.28C	3.712 *
LSD value	7.068 **	4.283 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic) 400 mg/kg B.W, G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Arabic gum). G5: Arthritic animals treated with 0.75mg /kg B.W. drug methotrexate.

Aspartate aminotransferase (AST) GOT activity U/L

Table (3) demonstrates the results of serum Aspartate aminotransferase (AST) activity (U/L); after two weeks, there was a significant increase (P≤0.01) in AST activity at G1, G2, G3, G4, G5 as compared to G0. The activity of AST at (6 weeks) showed significant differences in G2, G3, G4, and G5, compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant decrease in P≤0.01 in G3 and P≤0.05 in G2, G4, and G5 compared to two weeks.

Table (3) Effect of Groups and Time in (AST) GOT U/L

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	32.23 ±0.98C	34.45 ±0.41C	2.971 NS
G1	48.22 ±1.23A	44.48 ±1.03A	4.36 NS
G2	42.32 ±0.26B	39.17 ±0.50B	1.276 *
G3	52.23 ±3.37A	39.32 ±0.67B	7.442 **
G4	40.52 ±0.17B	35.32 ±0.15C	2.905 *
G5	42.50 ±0.52B	40.31 ±0.02B	1.294 *
LSD value	4.494 **	1.672 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic) 400 mg/kg B.W., G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Arabicgum). G5: Arthritic animals treated with 0.75mg /kg B.W. drug methotrexate.

3-2- Kidney function Parameters

Serum Urea concentration (mg/dl)

Table (4) demonstrates the serum Urea concentration (mg/dl) results in two weeks. There was a significant increase (P≤0.01) in Urea concentration at G1, G2, G3, G4, and G5 compared to G0, activity Urea at (6 weeks) showed that there were significant differences in G1, G2, G3, G4, G5 compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant decrease in P≤0.05 in G2 G5 compared to two weeks.

Table 4: Effect of Groups and Time in Urea mg/dL

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	14.93 ±0.69B	15.23 ±0.42C	2.077 NS
G1	29.93 ±1.35A	24.74 ±2.82B	4.78 NS
G2	19.51 ±0.59B	16.53 ±0.05C	1.265 *
G3	30.48 ±4.08A	32.41 ±0.14A	4.037 NS
G4	17.58 ±0.78B	15.56 ±0.36C	2.29 NS
G5	18.60 ±0.02B	17.09 ±0.37C	1.245 *
LSD value	5.324 **	3.468 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic) 400 mg/kg B.W., G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Arabic gum). G5: Arthritic animals treated with 0.75mg /kg B.W. drug methotrexate.

Uric acid concentration (mg/dl)

Table (5) demonstrates the serum Uric acid concentration (mg/dl) results in two weeks. There was a significant increase (P≤0.01) in Uric acid activity at G1, G2, G3, G4, and G5 compared to G0. Uric acid at (6 weeks) showed significant differences in G1, G2, G3, G4, G5 compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant decrease in P≤0.05 in G2 compared with two weeks.

Table 5: Effect of Groups and Time in Uric acid mg /dl

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	2.42 ±0.08C	2.46 ±0.05C	0.316 NS
G1	3.73 ±0.16A	3.27 ±0.23B	0.472 NS
G2	2.97 ±0.02B	2.65 ±0.06C	0.156 *
G3	4.01 ±0.41A	3.86 ±0.02A	0.881 NS

G4	2.56 ±0.06BC	2.61 ±0.03C	0.267 NS
G5	2.81 ±0.06BC	2.74 ±0.01C	0.308 NS
LSD value	0.548 **	0.296 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic) 400 mg/kg B.W., G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Arabic gum). G5: Arthritic animals treated with 0.2 ml of 0.75mg

Creatinine concentration (mg/dl)

Table (6) explains the results of serum Creatinine concentration (mg/dl) after two weeks; there was a significant increase (P≤0.01) in Creatinine concentration at G1, G2, G3, G4, and G5 compared to G0 while Creatinine concentration at (6 weeks) showed that there were significant differences n G1, G2, G3, G4, G5 compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant decrease in P≤0.05 in G1, G2, and G3 compared to two weeks./kg B.W. drug methotrexate.

Table 6: Effect of Groups and Time in Creatinine mg/dl

Mean ± SE			**LSD value**
Group	2 Week	After 6 week	
G0	0.280 ±0.01C	0.283 ±0.01B	0.198 NS
G1	0.485 ±0.03B	0.435 ±0.02A	0.316 *
G2	0.350 ±0.01C	0.311 ±0.01B	0.154 *
G3	0.625 ±0.09A	0.390 ±0.03A	0.298 *
G4	0.340 ±0.01C	0.287 ±0.01B	0.113 NS
G5	0.296 ±0.02C	0.302 ±0.01B	0.0381 NS
LSD value	0.120 **	0.044 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic) 400 mg/kg B.W., G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Arabic gum). G5: Arthritic animals treated with 0.2 ml of 0.75mg /kg B.W. drug methotrexate

Glucose concentration (mmol/L)

Table (7) explains the results of serum glucose concentration mmol/L (two weeks). There was a significant increase (P≤0.05) in glucose activity at G1 , G2, G3, G4, and G5 compared to G0. Glucose concentration after (6 weeks) showed significant differences in G1, G2, G3, G4, G5 compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant decrease in P≤0.01 in G1, G2, G3, G4, and G5 compared to two weeks.

Table 7: Effect of Groups and Time in Glucose mmol/L

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	108.65 ±5.98D	107.62 ±2.66D	39.36 NS
G1	151.97 ±3.73B	144.85 ±2.65A	8.907 **
G2	134.34 ±1.36C	129.41 ±0.12B	3.565 **
G3	175.90 ±4.50A	132.41 ±0.02B	30.271 **
G4	133.05 ±0.94C	108.89 ±1.18D	3.427 **
G5	132.98 ±0.86C	123.07 ±0.93C	2.412 **
LSD value	10.219 **	4.824 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic) 400 mg/kg B.W. G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Arabic gum). G5: Arthritic animals treated with 0.2 ml of 0.75mg /kg B.W. drug methotrexate.

HDL concentration

Table (8) explains the results of serum HDL concentration U/ml in (2 weeks) there was a significant decrease (P≤0.01) in G1, G2, G3, and G4 compared to G0. HDL concentration after (6 weeks) showed significant differences in G1, G2, G3, G4, G5 compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant increase in P≤0.01 in G1, G2, G3, G4, and G5 compared to two weeks.

Table 8: Effect of Groups and Time in HDL U /ml

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	52.88 ±0.72A	52.28 ±0.70D	6.696 NS
G1	44.74 ±1.74C	53.39 ±0.41CD	3.184 **
G2	51.52 ±0.75AB	56.21 ±0.59B	1.340 **
G3	48.30 ±1.81B	54.82 ±0.04CD	7.091 **
G4	50.25 ±0.81AB	56.29 ±0.04A	1.467 **
G5	53.01 ±0.26A	54.14 ±0.45CB	1.078 **
LSD value	3.399 **	1.121 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic), 400 mg/kg B.W. G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Gum Arabic). G5: Arthritic animals treated with 0.75mg /kg B.W. drug methotrexate.

Triglyceride concentration

Table (9) explains the results of serum Triglyceride concentration mmol/L in (2 weeks) there was a significant increase (P≤0.01) in Triglyceride concentration at G1, G2, G3, G4, G5 compared to G0 Triglyceride value after (6 weeks) showed that there were significant differences in G1, G2, G3, G4, G5 compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant decrease in P≤0.01 in G1, G2, G3, G4, and G5 compared with two weeks.

Table 9: Effect of Groups and Time in Triglyceride mmol/L

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	159.37 ±0.91C	160.33 ±0.68 C	18.38 NS
G1	184.23 ±3.78A	176.09 ±2.52 A	5.028 **
G2	180.58 ±5.59B	162.82 ±0.39 C	10.308 **
G3	194.30 ±9.33A	164.68 ±0.38 B	37.669 **
G4	165.58 ±0.95BC	160.07 ±0.19 C	2.669 **
G5	165.55 ±0.34B	159.87 ±0.46 C	1.109 **
LSD value	13.826 **	3.234 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic), 400 mg/kg B.W. G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Arabicgum). G5: Arthritic animals treated with 0.2 ml of 0.75mg /kg B.W. drug methotrexate

Cholesterol concentration

Table (10) Explains the results of serum cholesterol concentration mmol/L in (2 weeks) there was a significant increase (P≤0.01) in cholesterol activity at G1, G2, G3, G4, G5 compared to G0. Cholesterol concentration after (6 weeks) showed significant differences in G1, G2, G3, G4, G5 compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant decrease in P≤0.01 in G1, G2, G3, and G4 and a decrease in P≤0.05 in G5 compared to two weeks.

Table 10: Effect of Groups and Time in Cholesterol mmol/L

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	157.21 ±0.84 D	155.59 ±1.15 BC	2.554 *
G1	190.44 ±4.28 B	180.40 ±3.83 A	10.239 **
G2	177.16 ±2.94 BC	163.34 ±0.91 BC	5.491 **
G3	213.96 ±13.71 A	166.79 ±0.10 AB	38.437 **
G4	166.85 ±0.83 DC	162.32 ±0.44 BC	1.728 **
G5	170.68 ±2.05 DC	142.32 ±19.71 C	35.393 *
LSD value	17.703 **	2399 *	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic) 400 mg/kg B.W. G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Arabic gum). G5: Arthritic animals treated with 0.75mg /kg B.W. drug methotrexate.

VLDL concentration

Table (11) Explains the results of serum VLDL concentration (2 weeks). There was a significant increase (P≤0.01) in VLDL activity at G1, G2, G3, G4, and G5 compared to G0. VLDL concentration after (6 weeks) showed significant differences in G1, G2, G3, G4, G5 compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant decrease in P≤0.01 in G1, G2, G3, G4, and G5 compared to two weeks.

Table 11: Effect of Groups and Time in VLDL

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	31.87 ±0.18B	31.45 ±0.37C	45.53 NS
G1	36.27 ±0.71A	35.22 ±0.50A	1.815 **
G2	36.12 ±1.11A	32.56 ±0.08B	2.071 **
G3	38.86 ±1.87A	32.43 ±0.10B	7.529 **
G4	33.12 ±0.19B	31.85 ±0.09BC	0.556 **
G5	33.11 ±0.07B	31.97 ±0.09BC	0.206 **
LSD value	2.746 **	0.781 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (gum Arabic), 400 mg/kg B.W. G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Gum Arabic). G5: Arthritic animals treated with 0.75mg /kg B.W. drug methotrexate.

LDL concentration

Table (12) Explains the results of serum LDL concentration at (2 weeks) there was a significant increase (P≤0.01) in LDL activity at G1, G2, G3, G4, and G5 compared to G0. LDL concentration after (6 weeks) showed significant differences in G1, G2, G3, G4, and G5 compared to G0. Comparing two periods, two weeks and 6 weeks, there was a significant decrease in P≤0.01 in G1, G2, G3, G4, and G5 compared to two weeks.

Table 12: Effect of Groups and Time in LDL

Mean ± SE			LSD value
Group	2 Week	After 6 week	
G0	72.81 ±1.38C	73.25 ±1.01C	14.93 NS
G1	109.42 ±5.32A	91.79 ±3.08A	10.969 **
G2	83.52 ±0.53B	75.89 ±0.79C	1.837 **
G3	102.07 ±4.91A	81.26 ±0.08B	30.899 **
G4	84.31 ±1.39B	74.08 ±0.52C	2.807 **
G5	84.65 ±2.21B	76.21 ±0.77C	5.543 **

LSD value	9.347 **	4.128 **	---
*** (P≤0.05), ** (P≤0.01).**			

* (P<0.05); ** (P≤0.01). Values expressed as mean ± SE; n=5 each group G0: negative control (nonarthritis induction). G1: positive control (arthritic animal without treatment). G2: Arthritic animals treated with Senegalia sengal (Gum Arabic), 400 mg / kg B.W. G3: Arthritic animals treated with Boswellia 250 mg/kg B.W. G4: Arthritic animals treated with Boswellia and Senegalia (Gum Arabic). G5: Arthritic animals treated with 0.75 mg/kg B.W. drug methotrexate.

4- Discussion:

Rheumatoid arthritis (RA) is the leading cause of disability and is a devastating joint illness. This autoimmune condition causes discomfort and inflammation in the synovial joints. TNF-α and other pro-inflammatory indicators, such as cytokines like interleukin-1 (IL-1), IL-6, IL-7, IL-8, and others, were implicated in RA. B cell therapy, IL-1 and IL-6 blockers, angiogenesis inhibition, and TNF-α blockade were all used to treat RA. [22]. As part of the disease pathophysiology or as a side effect of disease treatments, RA significantly affects liver and renal functions. The current study showed a significant increase in ALP, GPT, and GOT levels in all groups compared to the control group that agreed with [23]. This is because the induction of rheumatoid arthritis CFA may cause changes in liver enzyme levels of ALT and AST enzymes in serum and ALP. Raised levels of liver enzymes (ALT, ALP, and AST) can occur in patients with RA for that anti-rheumatic medication or the patient's sickness. It was observed that DMARDs or disease-modifying antirheumatic medications frequently cause hepatic function abnormalities [24, 25], which are common in people with inflammation-related arthritis. Methotrexate causes an increase in the levels of liver enzymes, and this is what was reported by Alwachi [26]. The reason for the increase may be the toxic effect of methotrexate on liver cells, which leads to an increase in the permeability of the liver membranes, which causes the transfer of high amounts of enzymes into the blood serum [27], Kremer *et al.* [28]In rheumatoid arthritis, treatment with methotrexate leads to an increase in liver enzyme levels. Griffith *et al*. [29] found that methotrexate is effective in treating arthritis, but it causes damage to liver function, so the aim of the current study substances like Gum Arabic (GA) is an exudate of Acacia Senegal. In experiments involving humans, gum arabic has a wide range of health benefits due to its antioxidant [5], anti-inflammatory [30], and antimicrobial effects [31] and is protective against experimental hepatotoxicity and nephrotoxicity [32], which found in our study that continues for 6 weeks Gum arabic causes a decrease in the level of liver enzymes. In the study, in line with other research, the elevated serum ALP levels in arthritic rats suggest the presence of persistent skeletal injury. The current study showed a significant increase in urea, creatinine, and uric acid concentrations compared to the control groups [33]. It may be due to the induction of rheumatoid arthritis with CFA, which leads to an increase in the level of creatinine and disorders or dysfunction of kidney function in the blood serum and may lead to necrosis in the renal tubules in male albino rats, and this is what was indicated by the study conducted on rats [34]. As for cholesterol and triglycerides, the results of our study

showed an increase in their levels in all groups compared to the control group, an elevated level in hepatoglobin activity, which is closely associated with apolipoprotien A1, is responsible for the rise in both cholesterol and triglyceride concentrations. This substance also inhibits the esterification of cholesterol and its transfer to the liver, thereby increasing its concentration in the blood. This aligns with research findings [35] frankincense or olibanum resin that is from Boswellia causes a decrease in glucose level, cholesterol, LDL-C ,TG, urea, and liver enzyemes ALP,AST, ALT [36].

5- Conclusion

This study explained that using natural substances, including Boswellia and Senegalia Senegal, had a therapeutic effect on liver and kidney function and lipid profile caused by arthritis induced in male rats. It was a drug used for arthritis treatment.

Authors' Declaration

- We hereby confirm that all the Figures and Tables in the manuscript are ours.
- Ethical Clearance: The local ethical committee at the University of Baghdad approved the project.

Conflict of Interest: The authors declare no conflicts of interest.

Authors' Contribution Statement

Statement B.A.J was responsible for designing, acquiring data, organizing research ideas, and contributing to the paper writing. Statement A.H.A. was responsible for the design and conducted the revision and proofreading of the manuscript.

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