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Research Article

Studies on Carrageenan Induced Inflammation in Wistar Rats Treated with *Gongronema latifolium* Aqueous Leaves Extracts (Utazi)

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Abstract

AIM: The aim of this research study is to evaluate the ameliorative effects of aqueous solvent extracts of dried leaves of *Gongronema latifolium* preparations on liver enzymes- alkaline phosphatase, gamma glutamyl transferase and lipid profile concentration- total cholesterol, triglycerides, high density lipoprotein, low density lipoprotein on carrageenan induced inflamed female wistar rats. Materials and Method: Inflammation (rat paw oedema) was induced by injection of carrageenan into sub-plantar region of rat right hind paw. The paw sizes were measured using electronic Vernier caliper after 3 hours for confirmation of swelling (oedema) and along with behavioural and physical changes of these female wistar rats such as pain, flinching of their legs, redness, heat, leaking of their paws with tongues at interval. Forty female wistar rats were used for this study. The female wistar rats were divided into 5 groups of 8rats in each group and were sub divided into two groups for biochemical studies on 7th day and 14th day. Results: For the liver enzyme: This study showed that serum ALP concentration of the Negative control group decreased significantly ($p<0.05$) at 7th day when compared to the Normal control group. While the serum ALP concentration of 20mg/kg ibuprofen group increased significantly ($p<0.05$) at 7th day; aqueous extract 250mg/kg group and aqueous extract 500mg/kg group increased significantly ($p>0.05$) at 7th day when compared with the negative control group. The serum GGT concentration of Ibuprofen 20mg/kg group increased significantly ($p<0.05$). This study showed that serum GGT concentration of the Negative control group decreased but not significantly ($p>0.05$) when compared to the Normal control group. While serum GGT concentration of Ibuprofen 20mg/kg group increased significantly ($p<0.05$) at 14th day when compared to the Negative control group. More also serum GGT concentration of aqueous extract 500mg/kg group increased significantly ($p>0.05$) at 14th day when compared to the Negative control group. Furthermore, serum TG concentration of the

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Negative control group decreased but not significantly ($p>0.05$) at 14th day when compared to the Normal control group. While serum TG concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group and Ibuprofen 20mg/kg group decreased but not significantly ($p>0.05$) at 14th day when compared with the Negative control group. Conclusion: From the results of my findings in this research study, the changes in concentration of the liver enzymes and lipid profiles parameters was as a result of the treatment given to this female wistar. The implication of this findings suggest that dried leaves aqueous extracts of *Gongronema latifolium* may be used as novel drug like the synthetic drug (ibuprofen)in the treatment and management of inflammatory diseases that affects the lipid profile concentration and liver enzymes concentration.

Keywords

Gongronema latifolium, Inflammation, Liver Enzymes, Lipid Profiles

1. Introduction

Inflammation is the complex biological response of the body's immune system to external stimuli such pathogens or irritants. Inflammation is marked symptomatically by heat, redness, pain, loss of function and swelling. Agents causing inflammation are physical agents (mechanical trauma); chemical agents (inorganic and organic poisons); infective agents (viruses, bacteria, fungi) and immunological agents (antibody reaction). Inflammation is an indispensable immune response that capacitates the body to survive during an injury. The process of inflammation is complex and involves numerous cellular reactions and is mainly classified as acute and chronic inflammation. Chronic (prolonged) or acute inflammation (short duration) is the initial response of the body to harmful stimuli and is achieved by the increased movement of plasma and leukocytes (granulocytes) from the blood into the injured tissues. Acute inflammation provides protection to the body by healing injuries and resisting the microbial invasion whereas chronic inflammation targets critical cells, moieties and organs of the body that leads to the development of various chronic pathologies including cardiovascular diseases, skeletal muscle disorders, inflammatory bowel disease, autoimmune diseases, degenerative diseases, diabetes, cancer and neurological diseases etc. Chronic inflammation seriously threatens human life and health [1, 2]. Chronic inflammation can be caused by a host of lifestyles, physiological and environmental factors such as poor diet, stress, lack of physical activity, smoking, autoimmune disorders and exposure to toxins in the environment.

Inflammation which causes oxidative stress that results from an imbalance between the production of free radicals and the body's antioxidants defense system. It can be caused by an increase in the production of free radicals and a reduction in the body's ability to fight them [3, 4]. Oxidative stress is responsible for the degradation of biomolecules (proteins, lipids and nucleic acid) leading to cell death and physiological disorders [5]. Oxidative stress and inflammatory disorders are implicated in the development of several diseases such atherosclerosis, diabetes mellitus, cancer, central nervous system disorders [6, 7]. The conventional anti-inflammatory therapy used in the management of inflammation is the employment of non-steroidal anti-inflammatory drugs (NSAIDs), this drug inhibit inflammatory enzymes [8]. Examples are diclofenac, ibuprofen, paracetamol, indomethacin etc. Chemically, NSAIDs are usually salicylate derivatives, aryl acid derivatives, propionic acid derivatives, indole derivatives that exhibit different mechanisms of action including non-selective irreversible or reversible inhibition of cyclooxygenase (Cox-1), selective inhibition of COX-2 and preferential inhibition of COX-2 [9]. NSAIDs have being reported affecting the normal functioning of body systems including the cardiovascular system and digestive system. To overcome the shortcomings of synthetic drug, continuous efforts have being made to explore the efficacy of medicinal herbs and their phytochemicals in the treatment of and prevention of inflammation. Since time immemorial, medicinal plants and natural bioactive compounds have been found to be potent against the majority of aliments including inflammatory diseases such as arthritis. Despite the existence of conventional drugs/ medicines for pain and inflammation, the high risk of side effects and exorbitant cost remain a major deterrent to many people especially in developing and underdeveloped countries [10, 11].

The administration of Non steroidal anti-inflammatory drugs in the treatment of inflammatory diseases may often be associated with severe side effects. The standard therapeutic dose of ibuprofen in sub chronic use and long duration may cause hepatic failure, kidney failure and alter hematological functions [12]. Hence alternative therapeutic modules are necessitated. *Gongronema latifolium* is a common herbaceous plant rich in phytochemical constituents that have many medicinal values such as anti-inflammatory, anti-diabetics, anti-malaria, anti-hypertensive etc. The use of medicinal plants in the treatment of diseases is a very ancient practice, which plays an important role in drug development. These plants are sources of secondary metabolites which act as defensive agents [13]. Studies are continuously being carried out to identify more antioxidant and anti-inflammatory molecules with fewer side effects and greater accessibility for populations [14]. Hence this study evaluated and compared the ameliorative effects of aqueous solvent extracts of dried leaves of *Gongronema latifolium* preparation and ibuprofen drug (most

used over the counter drug, a non –steroidal anti inflammatory drug) on lipid profile concentration- total cholesterol, triglycerides, high density lipoprotein, low density lipoprotein and liver enzymes- alkaline phosphatase, gamma glutamyl transferase on carrageenan induced inflamed female wistar rats.

2. Materials and Methods

2.1. Study Areas

This work was carried out in Human Biochemistry department, Faculty of Basic Medical Sciences, College of Health Sciences, Nnamdi Azikiwe University, Nnewi Campus, located in Okofia Nnewi, Anambra State, while the biochemical analysis was done in Chemical Pathology Laboratory, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State.

2.2. Collection and Identification of the Plant

Some fresh leaves of *Gongronema latifolium* (utazi). The fresh leaves were plucked from the garden of Mrs Helen Nwankwo in Obilikpa Eziama Nneato in Umunneochi Local Government Area of Abia State, Nigeria. It was identified and authenticated at the Botany Department of Nnamdi Azikiwe University, Awka by Dr. Ogbuozobe Gabriel Okwudili and issued with the voucher number; NAU/H/038.

Table 1. *List of Chemicals And Equipment Used For The Study.*

Chemicals	Grade	Manufacturer
Carrgeenan	CDH(R) 044855	Vardaan, New, Delhi(India)
GGT reagents	Roche kit	U. S. A
Chloroform	GPR	BDH Ltd Poole England
Ibuprofen Drug	Mecure Ind.	Nigeria
Cholesterol reagents	Biosystems Kit	Spain
Triglyceride reagents	Randox Kit	United Kingdom
	Biosystems kit	Spain
HDL reagents	Biosystems kit	Spain
ALP reagents	Roche kit	U.S.A
Urea reagents	Roche kit	U.S.A
Creatinine reagents	Roche kit	U.S.A

Equipment	Model	Manufacturer
Centrifuge	CD600-72	Gallen Kamp England
Oral Gavage		Nigeria
Syringes		Nigeria
Collecting tubes		Nigeria
Coverslips		Nigeria
Electric weighing balance	BD164-34	Gallen Kamp England
Glass wares	Pyrex	England
Glass wares	Pyrex	England
Incubator	TT-9053	U.S.A
ELISA Well reader	Stat FAX 2100	U.S.A
Microscope	Carl Zeiss	Germany
Spectrophotometer	TT-20D	U.S.A

Equipment	Model	Manufacturer
Rotary Evaporator	TT22	U.S.A
Muslin cloth	Cotton	Nigeria
Christy-Norris hammer mill	BJE-750	Gallen Kamp England
Rat cage		Gallen Kamp England
Refrigerator	GC-269VL	Germany

2.3. Purchase of Standard Drug (Ibuprofen) and Its Preparations

A standard anti- inflammatory drug Ebu-200 was purchased from a pharmaceutical shop in Nnewi. It was manufactured by Mecure industries limited.

Five tablets of Ebu-200 was grinded into powdery form using glass mortar and dissolved in 50ml of distilled water to make a stock solution of 20mg/ml. With this stock solution daily dosage for female wistar rats to be given 20mg/kg of ibuprofen was calculated using the formula.

$$\text{Volume} = \frac{\text{weight of rats (kg)} \times \text{dosage (mg/kg)}}{\text{Stock solution (mg/ml)}}$$

2.4. Preparation of Plant Material Extracts

The plant leaves was prepared according to the method described by Sundarganapath [15]. The leaves of *Gongronema latifolium* were plucked from the garden of Mrs Helen Nwankwo in Obilikpa Eziama Nneato, Abia State. It was air dried at room temperature for about 16weeks to avoid the escape of volatile components by oven drying. The dried leaves of *Gongronema latifolium* were milled into fine powder using the Christy-Norris hammer mill. The leaves extracts was obtained by soaking 120g of powdered dried *Gongronema latifolium* leaves in a beaker containing 600ml of lukewarm water for 24hours. The beaker containing lukewarm water solvent after 24hours was filtered using muslin cloth. The filtrate was placed in an oven at 40^{0}C and resulted in a gel-like form of aqueous extracts of *Gongronema latifolium* dried leaves preparation. These extracts were in a gel-like form and was then stored in container in the refrigerator for further usage.

2.5. Animals and Experimental Method

Forty female wistar rats (100-160g) were used for this present experimental research study. They were housed at the Animal house of College of Health Sciences, Nnamdi Azikiwe, University, Nnewi Campus in plastic cages at room temperature and under standard condition, as well as maintained 12hour light/dark cycle. They were fed with standard pellet diet and tap water. All animals were acclimatized for eight days before the experimental session. All the experimental procedures were done following the guidelines of the Institutional Animals ethics Committee (IAEC).

The female wistar rats were induced of acute inflammation (paw oedema) by sub- plantar injection of 0.1ml of 1% freshly prepared solution of carrageenan in distilled water into their right leg paw. Each female wistar rats of all the groups except group 1(Normal control group). Paw thickness were measured just before the carrageenan injection and then at three hours after carrageenan injection. Along with behavioural and physical changes of these female wistar rats such as swelling (oedema), pain, flinching of their legs, redness, heat, leaking of their paws with tongues at interval. The female wistar rats were then divided into 5 groups of 8rats in each group and were divided into two sub groups for biochemical and histological studies on 7th day and 14th day (1-5). The vehicle for the extracts and ibuprofen drug was water.

2.6. Grouping of Animals

Group 1: Normal control- No carrageenan and 1ml of water p.o. Using oral gavage once daily for fourteen days. They were fed with standard pellet diet and tap water.

Group 2: Negative control -0.1ml of 1% carrageenan and no treatment

Group 3: Positive control-0.1ml of 1% carrageenan and treated with 20mg/kg ibuprofen standard drug p.o. using oral gavage once daily for fourteen days. They were fed with standard pellet diet and tap water.

Group 4: 0.1ml of 1% carrageenan and treated with 250mg/kg aqueous extracts of *Gongronema latifolium* dried leaves p.o. using oral gavage once daily for fourteen days. They were fed with standard pellet diet and tap water.

Group 5: 0.1ml of 1% carrageenan and treated with 500mg/kg aqueous extracts of *Gongronema latifolium* dried leaves p.o. using oral gavage once daily for fourteen days. They were fed with standard pellet diet and tap water.

2.7. Analytical Methods

The serum TC concentration was estimated by enzymatic colorimetric method described by [15]. The serum HDL-C concentration was estimated by precipitation and CHOD-POD enzymatic colourimetric reaction, according to

the method as described by [16]. The serum TG concentration was estimated by GPO-POD enzymatic colorimetric reaction, according to the method as described by [17]. Gamma glutamyl transferase enzyme was determined using the spectrophotometric method of [18] and ALP concentration was assayed using the spectrophotometric method of [19]. The LDL-C concentration was estimated by computation, according to the methods described by [20].

2.8. Sample Collection

At 7th and 14th day following a night fast, four female wistar rats from each group were anaesthetized under chloroform and blood sample was collected by ocular puncture bleeding using heparinized capillary tube. Blood sample was collected for the biochemical assay of alkaline phosphatase, gamma glutamyl-transferase, lipid profile levels. It was retracted and centrifuged at 3000rpm for 10minutes. The serum was kept in new plain tubes and stored in the fridge at -20^{0}C until use.

2.9. Statistical Analysis

The data were analyzed using one-way analysis of variance (ANOVA) followed by Bonforoni's post hoc test. A p ‹0.05 was considered to be statistically significant.

3. Results

Table 2. *Liver function status of carrageenan induced inflammation(paw oedema) in female wistar rats and treated withAqueous leaf extracts (AE) of Gongronema latifolium (Utazi) or ibuprofen.*

Parameters	Days Control	1Normal Control	2Negative 20mg/kg	Solvent 3Ibuprofen	leaves 4AE 250mg/kg	extracts 5AE 500mg/kg
ALP	Day 7	220.51 ±	157.62 ±	271.63 ±	241.52 ±	241.70 ±
(IU/L)		42.82^a	6.96^b	60.14^c	86.50^d	71.04^d
GGT	Day 7	1.42 ±	2.13 ±	9.36 ±	3.87 ±	5.26 ±
(IU/L)		0.38^a	0.75^a	2.67^b	2.47^c	3.09^d
ALP	Day 14	114.31 ±	119.52 ±	143.66 ±	115.73 ±	128.59 ±
(IU/L)		5.50^a	65.39^a	75.61^b	69.96^a	71.58^c
GGT	Day 14	4.71 ±	3.06 ±	4.82 ±	3.48 ±	6.74 ±
(IU/L)		2.11^a	1.13^a	2.95^a	1.39^a	3.76^b

Values represent the mean ± SD for N= 4. Values in the same row bearing the same letter of the alphabet superscript are not significantly different from each other (p‹0.05).
Legend: ALP: Alkaline phosphatase; GGT: Gamma glutamyl transferase.

This study showed that serum ALP concentration of the Negative control group decreased significantly (p‹0.05) at 7th day when compared to the Normal control group. While the serum ALP concentration of 20mg/kg ibuprofen group increased significantly (p‹0.05) at 7th day; aqueous extract 250mg/kg group and aqueous extract 500mg/kg group increased significantly (p›0.05) at 7th day when compared with the negative control group. This study also showed that serum GGT concentration of the negative control group increased but not significantly (p›0.05) at 7th day when compared to the Normal control group. While serum GGT concentration of Ibuprofen 20mg/kg group increased significantly (p‹0.05); aqueous extract 250mg/kg group and aqueous extract 500mg/kg group increased but not significant at 7th day when compared to the Negative control group. This study also showed that serum ALP concentration of the Negative control group increased but not significantly (p‹0.05) at 14th day when compared to the Normal control group. This study showed that serum ALP concentration of Ibuprofen 20mg/kg group increased significantly (p‹0.05) at 14th day when compared to the Negative control group. The result also showed that, aqueous extract 500mg/kg group increased significantly (p‹0.05) at 14th day when compared with the Negative control group. While serum ALP concentration of aqueous extract 250mg/kg group decreased but not significantly (p›0.05) at 14th day when compared with the Negative control group.

This study showed that serum GGT concentration of the Negative control group decreased but not significantly (p›0.05) when compared to the Normal control group. While serum GGT concentration of Ibuprofen 20mg/kg group increased significantly (p‹0.05) at 14th day when compared to the Negative control group. More also serum GGT concentration of aqueous extract 500mg/kg group increased significantly (p›0.05) at 14th day when compared to the Negative control group. While serum GGT concentration of aqueous extract 250mg/kg group increased but not significantly (p›0.05) at 14th day when compared to the Negative control group.

Table 3. *Lipid profile function status of carrageenan induced inflammation (paw oedema) in female wistar rats and treated with Aqueous leaves extracts (AE) of Gongronema latifolium (Utazi) or ibuprofen.*

Parameters	Days	1Normal Control	2Negative Control	Solvent 3Ibuprofen 20mg/kg	leaves 4AE 250mg/kg	extracts 5AE 500mg/kg
TC	Day 7	2.55 ±	2.48 ±	2.42 ±	2.75 ±	2.38 ±
(mmol/l)		0.44[a]	0.18[a]	0.29[a]	0.40[a]	0.18[a]
TG	Day 7	0.76 ±	0.65 ±	0.75 ±	0.76 ±	0.69 ±
(mmol/l)		0.24[a]	0.09[a]	0.18[a]	0.16[a]	0.60[a]
HDL	Day 7	0.81 ±	0.88 ±	0.75 ±	0.73 ±	0.60 ±
(mmol/l)		0.19[a]	0.22[a]	0.13[a]	0.13[a]	0.19[a]
LDL	Day 7	1.40 ±	1.30 ±	1.32 ±	1.67 ±	1.47 ±
mmol/l)		0.37[a]	0.08[a]	0.32[a]	0.35[b]	0.13[a]
TC	Day 14	2.39 ±	2.46 ±	2.87 ±	2.26 ±	2.38 ±
(mmol/l)		0.11[a]	0.15[a]	0.41[b]	0.16[a]	0.19[b]
TG	Day 14	0.86 ±	0.84 ±	0.79 ±	0.56 ±	0.60 ±
(mmol/l)		0.17[a]	0.11[a]	0.11[a]	0.06[a]	0.19[a]
HDL	Day 14	0.70 ±	0.78 ±	0.82 ±	0.68 ±	0.69 ±
(mmol/l)		0.06[a]	0.05[a]	0.19[a]	0.09[a]	0.17[a]
LDL	Day 14	1.23 ±	1.30 ±	1.69 ±	1.32 ±	1.41 ±
(mmol/l)		0.05[a]	0.20[a]	0.36[b]	0.14[a]	0.01[a]

Values represent the mean ± SD for N= 4. Values in the same row bearing the same letter of the alphabet superscript are not significantly different from each other (p‹0.05). Legend: TC: Total cholesterol, TG: Triglyceride, HDL High density lipoprotein, LDL: Low density lipoprotein

This result show that serum TC concentration of the Negative control group decreased but not significantly (p›0.05) at 7th day when compared to the Normal control group. While serum TC concentration of ibuprofen 20mg/kg group, aqueous extract 500mg/kg group decreased but not significantly (p›0.05) at 7th day and serum TC concentration of the aqueous extract 250mg/kg increased but not significantly (p›0.05) at 7th day when compared with the Negative control group. Furthermore, serum TG concentration of the Negative control group decreased but not significantly (p›0.05) at 7th day when compared to the Normal control group. While serum TG concentration of Ibuprofen 20mg/kg group, aqueous extract 250mg/kg group, and aqueous extract 500mg/kg group increased but not significantly (p›0.05) at 7th day when compared with the Negative control group. More also serum HDL-C concentration of the Negative control group increased but not significantly (p›0.05) at 7th day when compared to the Normal control group. While serum HDL-C concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group and Ibuprofen 20mg/kg group decreased but not significantly (p›0.05) at 7th day when compared with the Negative control group. This study also show that serum LDL–C

concentration of the Negative control group decreased but not significantly ($p>0.05$) at 7th day when compared to the Normal control group. While serum LDL-C concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group and Ibuprofen 20mg/kg group increased but not significantly ($p>0.05$) at 7th day when compared with the Negative control group. This result show that serum TC concentration of the Negative control group increased but not significantly ($p>0.05$) at 14th day when compared to the Normal control group. While serum TC concentration of ibuprofen 20mg/kg group increased but not significantly ($p>0.05$) at 14th day when compared with the Negative control group. While serum TC concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group decreased but not significantly ($p>0.05$) at 14th day when compared with the Negative control group. Furthermore, serum TG concentration of the Negative control group decreased but not significantly ($p>0.05$) at 14th day when compared to the Normal control group. While serum TG concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group and Ibuprofen 20mg/kg group decreased but not significantly ($p>0.05$) at 14th day when compared with the Negative control group. More also serum HDL-C concentration of the Negative control group increased but not significantly ($p>0.05$) at 14th day when compared to the Normal control group. While serum HDL-C concentration of ibuprofen 20mg/kg group increased but not significantly ($p>0.05$) at 14th day when compared with the Negative control group. While serum HDL-C concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group decreased but not significantly ($p>0.05$) at 14th day when compared with the Negative control group. This study also show that serum LDL –C concentration of the Negative control group increased but not significantly ($p>0.05$) at 14th day when compared to the Normal control group. While serum LDL-C concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group and Ibuprofen 20mg/kg group increased but not significantly ($p>0.05$) at 14th day when compared with the Negative control group.

4. Discussion

This research showed that the negative control group, positive control group 3 treated with 20mg/kgbw ibuprofen once daily for 14days had changes in concentration of the liver enzymes and lipid profile parameters analyzed when compared with the normal control group 1. This may imply that the change was due to treatment given and not caused by any external factor. Whence the change in the concentration of the liver enzymes and lipid profile parameters analyzed in the Negative control group 2(untreated group) and groups treated (4, 5) with different doses of dried leaves of *Gongronema latifolium* aqueous solvent extract.

From this research study, serum ALP concentration of the Negative control group decreased significantly ($p<0.05$) at 7th day when compared to the Normal control group. This may imply that the liver enzymes were inflamed. While the serum ALP concentration of 20mg/kg ibuprofen group increased significantly ($p<0.05$) at 7th day; aqueous extract 250mg/kg group and aqueous extract 500mg/kg group increased significantly ($p>0.05$) at 7th day when compared with the negative control group. This may suggest that the female wistars had ameliorative effect due the treatment given to them for 7days. This study also showed that serum GGT concentration of the negative control group increased but not significantly ($p>0.05$) at 7th day when compared to the Normal control group. While serum GGT concentration of Ibuprofen 20mg/kg group increased significantly ($p<0.05$); aqueous extract 250mg/kg group and aqueous extract 500mg/kg group increased but not significant at 7th day when compared to the Negative control group. This may imply that these female wistar rats had no ameliorative effects, because of the increase in serum GGT concentration of the treated groups (4, 5) and in the same increase of serum GGT of the Negative control group. This may also be caused by the new drug introduced. The liver hepatocytes may have being inflamed too.

This study also showed that serum ALP concentration of the Negative control group increased but not significantly ($p<0.05$) at 14th day when compared to the Normal control group. This may imply that there was an increase in chronic pain in the bones due to the carrageenan induced inflammation. This study showed that serum ALP concentration of Ibuprofen 20mg/kg group increased significantly ($p<0.05$) at 14th day when compared to the Negative control group. The result also showed that aqueous extract 500mg/kg group increased significantly ($p<0.05$) at 14th day when compared with the Negative control group. This may imply that there were no ameliorative effects in the female wistar rats. While serum ALP concentration of aqueous extract 250mg/kg group decreased but not significantly ($p>0.05$) at 14th day when compared with the Negative control group. This may imply that this treated group had ameliorative effects. The ameliorative effects may be dependent upon the dose of aqueous extract administered which is non synthetic treatment too. This study showed that serum GGT concentration of the Negative control group decreased but not significantly ($p>0.05$) when compared to the Normal control group. While serum GGT concentration of Ibuprofen 20mg/kg group increased significantly ($p<0.05$) at 14th day when compared to the Negative control group. More also serum GGT concentration of aqueous extract 500mg/kg group increased significantly ($p>0.05$) at 14th day when compared to the Negative control group. While serum GGT concentration of aqueous extract 250mg/kg group increased but not significantly ($p>0.05$) at 14th day when compared to the Negative control group. This may imply that the treated groups (4, 5) had ameliorative effects as result of the aqueous extract administered to them. Also the group 3 (ibuprofen treated group) may have ameliorative effects because of the increased GGT concentration.

Although there were increases in the ALP concentration of ibuprofen treated group, 500mg/kg aqueous extract treated

group, and their GGT concentration did not decrease. This may imply that the liver cells had ameliorative effects. Also there may be no inflammation of the liver cells (hepatocytes).

So Ibuprofen drug treated group, being a well known conventional drug that has being used in treatment of inflammation had ameliorative effects, the aqueous extract treated groups had ameliorative effects too. So this aqueous extracts may be used as well in the treatment of inflammation.

This result showed that serum TC concentration of the Negative control group decreased but not significantly ($p>0.05$) at 7^{th} day when compared to the Normal control group. While serum TC concentration of ibuprofen 20mg/kg group, aqueous extract 500mg/kg group also decreased but not significantly ($p>0.05$) at 7^{th} day and serum TC concentration of the aqueous extract 250mg/kg increased but not significantly ($p>0.05$) at 7^{th} day when compared with the Negative control group. This may imply that ibuprofen treated group and 500mg/kg aqueous extract treated group had no ameliorative effects on the 7^{th} day. This study showed that group treated with 250mg/kg aqueous extract may have ameliorative effects hence the increase in TC concentration. Furthermore, serum TG concentration of the Negative control group decreased but not significantly ($p>0.05$) at 7^{th} day when compared to the Normal control group. While serum TG concentration of ibuprofen 20mg/kg group, aqueous extract 250mg/kg group, and aqueous extract 500mg/kg group increased but not significantly ($p>0.05$) at 7^{th} day when compared with the Negative control group. More also serum HDL-Concentration of the Negative control group increased but not significantly ($p>0.05$) at 7^{th} day when compared to the Normal control group. While serum HDL-C concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group and Ibuprofen 20mg/kg group decreased but not significantly ($p>0.05$) at 7^{th} day when compared with the Negative control group. This may that the treated groups (3, 4, 5) had ameliorative effects. This study also show that serum LDL –C concentration of the Negative control group decreased but not significantly ($p>0.05$) at 7^{th} day when compared to the Normal control group. While serum LDL-C concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group and Ibuprofen 20mg/kg group increased but not significantly ($p>0.05$) at 7^{th} day when compared with the Negative control group. This may imply that all the treated groups had ameliorative effects.

This result showed that serum TC concentration of the Negative control group increased but not significantly ($p>0.05$) at 14^{th} day when compared to the Normal control group. While serum TC concentration of ibuprofen 20mg/kg group increased but not significantly ($p>0.05$) at 14^{th} day when compared with the Negative control group. This implies that this treated group had no ameliorative effects. More also though ibuprofen is a normal conventional drug used for the treatment of inflammation may cause more harm to the body system. This collaborates with the findings by [11]. While serum TC concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group decreased but not significantly ($p>0.05$) at 14^{th} day when compared with the Negative control group. This may imply that these treated groups (non synthetic drug) had ameliorative effects. Furthermore, serum TG concentration of the Negative control group decreased but not significantly ($p>0.05$) at 14^{th} day when compared to the Normal control group. While serum TG concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group and Ibuprofen 20mg/kg group decreased but not significantly ($p>0.05$) at 14^{th} day when compared with the Negative control group. This may imply that there were no ameliorative effects in the treated groups. More also serum HDL-C concentration of the Negative control group increased but not significantly ($p>0.05$) at 14^{th} day when compared to the Normal control group. While serum HDL-C concentration of ibuprofen 20mg/kg group increased but not significantly ($p>0.05$) at 14^{th} day when compared with the Negative control group. While serum HDL-C concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group decreased but not significantly ($p>0.05$) at 14^{th} day when compared with the Negative control group. This may imply that only group 4 and 5 treated with aqueous extracts (non synthetic) had ameliorative effects.

This study also showed that serum LDL–C concentration of the Negative control group increased but not significantly ($p>0.05$) at 14^{th} day when compared to the Normal control group. While serum LDL-C concentration of aqueous extract 250mg/kg group, aqueous extract 500mg/kg group and Ibuprofen 20mg/kg group increased but not significantly ($p>0.05$) at 14^{th} day when compared with the Negative control group. This may imply that these treated groups had no ameliorative effects.

This research study also showed that TG concentration, decreased and TC and LDL-C concentration of the treated groups (ibuprofen drug, aqueous extracts) increased when compared with negative control group(untreated group) at 14^{th} day. These groups had no ameliorative effects at 14days. This may imply that both synthetic drug (ibuprofen drug) and aqueous extracts of *gongrenema latifolium* should not be taken for a longer duration. It may worsen or cause arthrosclerosis, which may lead to hypertension.

In conclusion, from the results of my findings in this research study, the changes in concentration of the liver enzymes and lipid profiles parameters may be as a result of the treatment given to this female wistar rats. The implication of these findings may suggest that dried leaves aqueous extracts of *Gongronema latifolium* may be used as novel drug like the synthetic drug (ibuprofen) in the treatment and management of inflammatory diseases that affects the lipid profile concentration and liver enzymes concentration.

Abbreviations

NSAIDS	Non-steroidal Anti-inflammatory Drugs
COX-1	Cyclooxygenase 1 Enzyme
COX-2	Cyclooxygenase 2 Enzyme
TC	Total Cholesterol

HDL-C	High Density Lipoprotein Cholesterol
LDL-C	Low Density Lipoprotein Cholesterol
ALP	Alkaline Phosphatase
GGT	Gamma Glutamyl Transferase
ANOVA	Analysis of Variance

Conflicts of Interest

The authors declare no conflicts of interest.

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