



Potentiality of Combined Aqueous Extracts of Ginger, Garlic and Lemon Juice in Controlling Obesity and Diabetes Mellitus in Albino Wistar Rats

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ABSTRACT

Obesity and diabetes mellitus have been a great challenge to the rich and poor in our society, hence the potentials of combined aqueous extracts of garlic ginger and lemon juice research were embarked upon. Sixty (60) male albino wistar rats weighing 200-250g were selected for this study and they were divided into four (4) groups namely: Group A (15) is the control rats; Group B (15) is the obese rats without diabetes mellitus; Group C (15) is the diabetic rats with no obesity; Group D (15) is the group with obesity and diabetes. All the four (4) groups have their weight measured and they received 1.0ml of the combined aqueous extracts each day for 28 days except the control group that received only feed and water ad libitum. All the rat groups received water also.

Blood samples were collected from the animals after 28 days of acute study and analysis were carried out. Results of the study showed that the combined extracts of garlic, ginger and lemon juice have the potential elements that reduced glucose in diabetic rats in group C and in group D Table 2 (P<0.05). The diabetic rats in group C and in group D with FBS 160.41 ± 12.4 mg/dl and RBS 180.33 ± 0.51 mg/dl after days of extracts administration had their sugar level reduced to 93.52 ± 1.46 mg/dl and 113.42 ± 0.15 mg/dl respectively (P<0.05).

The obese rats in group B and D had their protein and cholesterol level also drastically reduced (P<0.05) after 30 days extract administration. The rats in group B with their cholesterol 67.1 ± 2.06 mg/dl and protein concentration of 2.25 ± 0.4 g/dl had their concentration of cholesterol reduced to 40.2 ± 1.51 mg/dl and protein 0.08 ± 0.05 mg/dl. It could be the presence of the potential and active elements present in the combined extracts that affected the reduction of protein, cholesterol and sugar levels in the test rats. It could be deduced that the combined extracts of garlic ginger and lemon contains active elements that can affect glucose, protein and cholesterol levels in the blood.

INTRODUCTION

From Neolithic times, some plants have been discovered to have medicinal value (Olaloye et al, 2000). These plants have been used as a source of various drugs where man can get a cure for almost all ailments. This have been by the use of recently developed phytochemical and phytopharmacological techniques of substances called active principle which have been implicated by extraction from these natural herbs. These active principles are most phytochemicals like alkaloids. The ability of these plants to cure different ailments have been traced to essential active principles (Ukario et al, 2001). The menace of diabetes mellitus and obesity among the rich and poor masses in our society stimulated our curiosity to engage in this research to come out with combined principles in extracts of plants that can be used to control these ailments with or without combination with allopathic remedies.

The need to know and identify the effectiveness of medicinal plants such as ginger, garlic and lemon (Citrus lemoni Russo) as plants with the potentials to control obesity and diabetes is very important in our society.

The objectives of this study are:

- a) To determine the effectiveness of combining extracts of ginger, garlic and lemon in shedding off weights in obese persons.
- b) To determine the effectiveness of combined extracts of ginger, garlic and lemon juice in reducing blood sugar in diabetic subjects.
- c) To determine the effect of combining extracts of ginger, garlic and lemon in reducing cholesterol levels in blood triglycerides and high protein levels in blood.
- e) To determine the effectiveness of the combined extracts of ginger, garlic and lemon in reducing the lipid profile of albino wistar rats. Obesity has caused disfigurement of goodly looking persons in the time past and diabetes mellitus has caused some women to be widows and vice versa in our society today; but knowledge of the potentials principles present in plants products can alleviate the suffering of the people.

Diabetes mellitus (often referred simply as diabetes) is a metabolic diseases characterized by a hyperglycemia (high glucose in the blood) due to lack of or low level of circulatory hormone called insulin in the blood (Akubue 2000). It is classified into two major categories Type 1 and Type 2. Type 2 diabetes accounts for <90% of diabetes and is resulting in impaired function in carbohydrates, lipid and protein metabolism. Effective control of hyperglycemia in diabetic patients is critical for reducing the risk of micro and macro vascular diseases (Li et al, 2002). The prevalence of diabetes mellitus has

reached epidemic proportions and has affected 6.4% of adults worldwide in 2010 (Elishater et al, 2009).

Obesity is a major public health problem recognized by world health organization. Many plump people do not know if they are overweight or obese. The international standard for measuring overweight and obesity is based on the value of body mass index (BMI) which is defined as the body weight (kg) divided by the height (meters squared) and expressed as kg/ms^2 . Obesity is a risk factor for a number of diseases such as high blood pressure, diabetes mellitus, coronary heart disease, stroke. It is a risk factor for certain type of cancer like cancer of the uterus, breast, colon, bladder, respiratory problem, and musculoskeletal disorders like arthritis (Akubue, 2000). Ginger is part of the zingiberaceae family alongside cardamom and turmeric. The root or underground stem (rhizome) of the ginger plants can be consumed fresh, powdered, dried as a spice in oil form or juice. It is commonly produced in India, Jamaica, Fiji, Indonesia, and Australia. It is a common ingredient in Asian and India cuisine. Antidiabetic, hypolipidemic, anti-oxidative properties of ginger have been discovered in several researches. Many studies have suggested that increasing consumption of plant foods like ginger decreases risk of obesity, diabetes, heart disease and overall mortality while promoting a healthy complexion and hair, increased energy and overall, lower weight (Meghan, 2016). Its phenolic compounds are known to help relieve gastrointestinal irritation, stimulates saliva and bile production and suppress gastric contractions and movement of food and fluid through the gastrointestinal tract. Garlic is a plant in the allium (onion) family. It is closely related to onions, shallote and leeks. It contains a compound called Allicin. Several health benefits go with garlic consumption such as improving cholesterol levels by lowering total LDL cholesterol; active compounds in garlic reduces high blood pressure and weight. Garlic contains antioxidants that supports the body's protective mechanisms against oxidative damage.

Lemon tree is a perennial tree of the citrus family rutaceae. It grows up to 3m. it has toothed, elliptical, or lanceolate leaves pointed. The fruit is a herperidium till 12.5cm wide with a thick rind, dark yellow when fully ripe. Lemon is an antioxidant which deactivates the free radicals preventing many dangerous disease and cancers. It also helps to fight infections. The main active ingredients in citrus lemon risso includes flavenoids, ascorbic acids (vit.C), essential oil, (lignin 2005), caffeine, pectin, minerals especially potassium and calcium, water, fibers and sucrose.

MATERIALS AND METHODS

SELECTION OF ANIMALS FOR STUDY:

Sixty (60) adult female albino wistar rats weighing 200-250 were randomly selected for this study which was

carried out at Chukwuemeka Odumegwu Ojukwu University Physiology lab. in the department of physiology, Faculty of Basic Medical Sciences. The animals were housed under standard conditions of temperature ($23\pm 2^{\circ}\text{C}$) and humidity, receiving 12h light (7:00am- 7:00pm). They were kept in wire mesh cages and fed with commercial pellets (guinea feed) and drinking water ad libitum. The animals were handled in accordance with National and Institutional guidelines for the protection of animals' welfare.

COLLECTION OF PLANTS AND PREPARATION OF EXTRACTS:

Bulbs of Ginger, rhizomes of Garlic, and lemon fruits were collected from botanical garden in the department of Biological Sciences, Chukwuemeka Odumegwu Ojukwu University and they were identified by a botanist in the botanical department of the university. The crude extracts were prepared according to the method described by Obiefuna et al, 1998.

A 5.0g of the slurry of each of the plants will be mixed together with each other to form a combined aqueous extract, later 5.0g of the combined aqueous extract will be mixed with 100ml of distilled water (5g/100ml) to be used for the administration to the animals for 28 days.

EXPERIMENTAL PROCEDURE:

1. Fattening of the rats and Induction of Diabetes: the weight of the randomly selected female albino rats was taken, later, they were fattened by feeding them with high proteinous diet for eight weeks to make them obese. Their weight was also taken again. They were given the combined extracts according to their groups after inducing diabetes mellitus to groups C and D. The animals were randomly divided into four (4) groups of 15 rats each. Initial blood specimens of the animals were withdrawn and weight taken from the test and animals to determine their initial blood picture, and weight after fattening them before commencing the enteral administration. The procedure is as followed:

Group A: Control groups to receive grower feeds and water ad libitum. Group B: Obese rats without diabetic mellitus to receive the combined extracts, feed and water ad libitum. Group C: Induced diabetic rats without obesity to receive the combined extract feed and water ad libitum.

Group D: Obese and diabetic rats to receive the combined extracts, feed and water ad libitum. The dose of 5g/100ml of the combined extracts will be given to the animals in groups B, C and D for 28 days.

OBTAINING OF BLOOD SAMPLE FOR THE STUDY (EPHRAIM et al 2000)

At the end of the administration of the combined aqueous extract of plants, the weight of the animals, will be taken, later they were stunned and sacrificed. Blood samples (5.0ml) was collected by cardiac puncture and placed in plain tubes. After clotting of the samples, the serum will be expressed for tests such as serum cholesterol, serum protein. Another 2.0ml of blood was collected and placed in fluoride bottles mixed and kept for fasting blood sugar (FBS) and random blood sugar test for the diabetic rats.

TOXICITY STUDIES:

The LD_{50} of the three (3) plants were determined using Lorke's method (1983). The procedure of determining the lethal dose was by increasing the concentration of the extracts administered to the rats (after weighing them) in each of the groups consisting of eight rats per groups for five days. The concentration to give will be 50mg/kg, 100mg/kg, 150mg/kg, 200mg/kg, 250g/kg, 3500mg/kg, 4500mg/kg, and 5000mg/kg. the percentage is noted and a graph is plotted to determine the LD_{50} .

TESTS:

Serum cholesterol was determined by the method of COX et al, 1990; Protein concentration was determined by the method as described by Baker et al, 1985; while fasting and random blood sugar concentration were determined using B G meter (Blood Glucose Meter).

STATISTICAL ANALYSIS:

The data obtained from the study were expressed as mean and standard deviation (Mean \pm S.D) while students' t-test was used to compare the result of the control and the test. A-P value of less than or equivalent to ($P < 0.05$) or ($P = 0.05$) was regarded as statistically significant.

RESULTS:**TABLE 1:** Shows the effect of combined extracts of garlic, ginger and lemon on protein and cholesterol concentrations of obese rats and diabetic rats.

GROUPS	CHOLESTEROL CONC. Mg/dl	PROTEIN CONC. g/l
CONTROL RATS Group A, n=15	43.2±0.14	0.17±0.11
Test rats Day 1, before extract administration: Obese rats Group B, n=15	67.1±2.06	2.25±0.4
Diabetic rats Group C, n=15	44.7±0.12	0.14±0.3
Obese and Diabetic rats Group D, n=15	69.4±2.55	0.15±0.22
30 days after combined extract administration in Test rats. Group B, n=15	40.2±1.51	0.08±0.05
Group C, n=15	44.5±0.11	0.14±0.3
Group D, n=15	41.6±1.18	0.15±0.20
P-value	P<0.05	P<0.05

TABLE 2: Shows the effect of combined extracts of garlic, ginger and lemon on blood glucose level of diabetic albino wistar rats.

GROUPS	FASTING BLOOD SUGAR (FBS) mg/dl	RANDOM BLOOD SUGAR (RBS) mg/dl
Control rats Group A, n=15	92.63±6.14	112.31±0.05
Test rats: Day 1, before combined extract administration Obese rats Group B, n=15	94.03±0.03	115.02±0.12
Diabetic rats Group C, n=15	160.41±12.14	180.33±0.51
Obese and Diabetic rats Group D, n=15	179.20±0.8	193.5±16.0
28 days after combined extract administration in Test rats. Group B, n=15	94.02 ±11.5	115.0±0.02
Group C, n=15	93.52±1.46	113.42±0.15
Group D, n=15	96.14±4.12	115.35±1.04
P. value	P<0.05	P<0.05

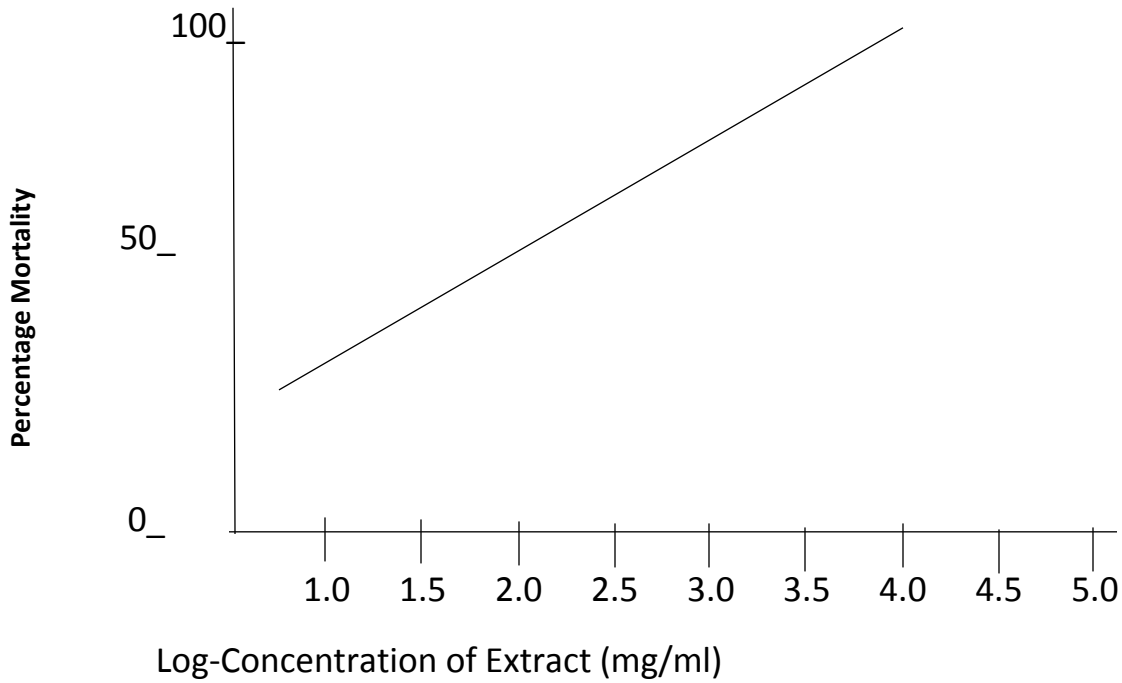


FIGURE 1: Lethality studies of ginger showing the effects of administering graded doses (1000-5000mg/kg ip rat) of the ginger extracts against the percentage mortality.

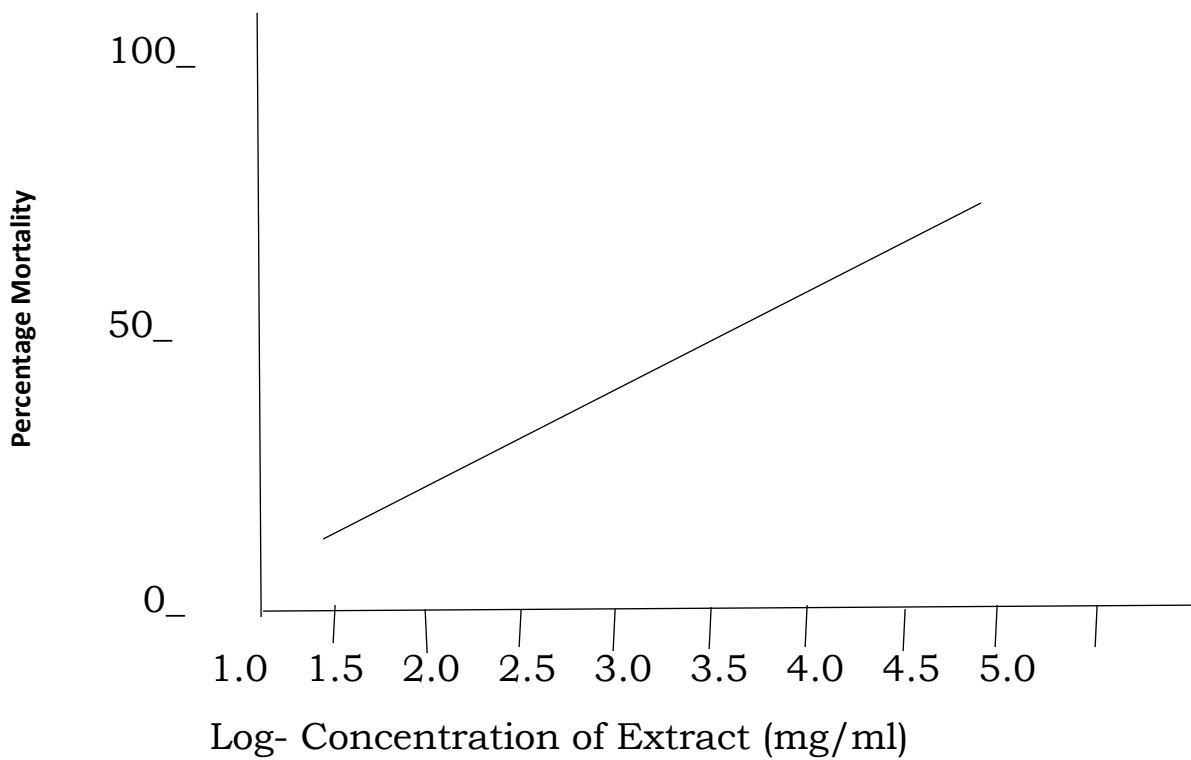


FIGURE 2: Lethality studies of garlic showing the effects of administering graded doses (1000-5000mg/kg ip rats) of garlic extracts against the percentage mortality.

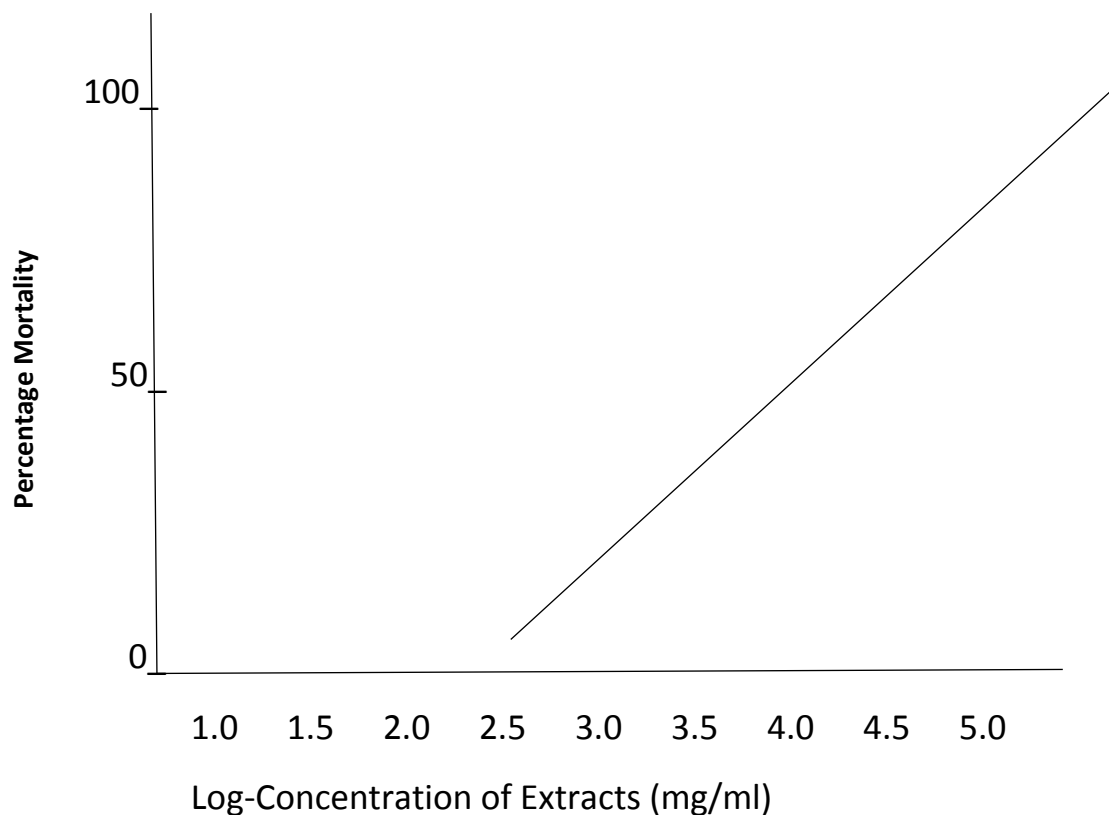


FIGURE 3: Lethality studies of lemon juice showing the effects of administering graded doses (1000-5000mg/kg ip rats) of lemon juice against the percentage mortality.

DISCUSSION

The present studies were conducted to investigate the potentiality of the combined aqueous extracts of ginger, garlic and lemon juice in controlling obesity and diabetes mellitus using albino wistar rats. In this study, it was discovered that the lethality dose of ginger was 2.0mg/kg ip rat, garlic is 3.0mg/kg ip rats, lemon is 4.0mg/kg ip rats. The concentration of extracts used in this study is so minimal that they will not cause any harm to the test rats throughout the 28 days' study. It was also demonstrated in this study that the potential elements in the combined extracts of ginger, garlic and lemon reduced the concentration of glucose in diabetic rats (Group C and D) refer to table 2; the extracts also reduced the cholesterol and protein levels in obese rats (Group B and D), refer to table 1. Many investigators reported that compounds of ginger such as 6-gingerol, tannins, polyphenolic compounds, flavenoids, triterpenoids possess hypoglycemic and other pharmacological properties. Rani M.P et al, 2010 suggested that ginger acts via its major component, gingerol, by inhibition of key enzymes relevant to type 2 diabetes, α -glucosidase and α -amylase are known to improve diabetes. Li Y et al, 2012 found that polar portion of ginger extract containing mainly gingerols

which promotes glucose uptake significantly in cultured rats skeletal muscle cells. Many studies have suggested that increasing consumption of ginger decreases the risk of obesity, diabetes, heart diseases and overall mortality while promoting a healthy complexion and hair, increased energy and overall lower weight. Fresh or cooked garlic help to lower down blood pressure and cardiovascular problems. It increases the levels of high density lipoprotein and reduces harmful cholesterol in the blood and keeps arteries and heart healthy. A study published in American Journals suggest that garlic contains a potent substance called Allicin which has been shown to not only lower blood pressure, insulin and triglyceride levels in laboratory animals fed a sugar rich diet, but also to prevent weight gain. This agrees with our research as the cholesterol levels were highly reduced in test rats. It could be deduced from this study that the potential elements present in garlic, ginger, lemon juice when combined together can drastically influence blood sugar levels, cholesterol concentrations and protein levels in the negative side which is advantageous to man.

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