

Short Communication

Effect of aqueous extracts of *Hibiscus sabdariffa* and *Zingiber Officinale* on blood cholesterol and glucose levels of rats

F. O. Agoreyo^{1*}, B. O. Agoreyo² and M. N. Onuorah²

¹Department of physiology, School of Basic Medical Sciences, University of Benin, Nigeria.

²Departments of Biochemistry, Faculty of Science, University of Benin, Nigeria.

Accepted 5 September, 2008

The effect of aqueous extract of *Hibiscus sabdariffa* and *Zingiber officinale* on plasma cholesterol and glucose concentration in albino rats was determined. Thirty albino rats weighing between 225 – 270 g were divided into six groups of five rats each. Group 1 (control 1) rats were fed 100% growers mash whereas group 2 (control 2) rats and other groups were fed 99% growers mash and 1% cholesterol. Subsequently, group 3 rats were given 0.8 ml/kg body weight of *H. sabdariffa* extract, while those in group 4 were given 0.2 ml *Z. officinale* extract/kg body weight. Rats in group 5 were given 1 ml of *H. sabdariffa* and *Z. officinale* mixture (17.2 mg/400 ml+ 8.6 mg/200 ml). Rats in group 6 were given the same treatment as those in group 5 but different concentration of the mixture (17.2 mg/200 ml+8.6 mg/100 ml) respectively. The rats were treated with the extracts once a day, 7 days a week for 6 weeks. Groups 3, 4, 5, and 6 revealed a statistically significant ($p < 0.05$) decrease in plasma cholesterol. Also, plasma glucose was significantly reduced ($p < 0.05$) in groups 3, 4, 5 and 6. Group 6 had the greatest reduction in plasma glucose, test value (group 6) 0.60 ± 0.28 when compared with control value 5.14 ± 0.89 . Therefore, the plants *H. sabdariffa* and *Z. officinale* apart from being hypocholesterolemic are also hypoglycemic.

Key words: *H. sabdariffa*, *Z. officinale*, aqueous extracts, plasma Cholesterol, plasma glucose.

INTRODUCTION

Cholesterol is the major sterol in the human body. It is a structural component of cell membrane and plasma lipoproteins, and it is also the starting material from which bile acid and steroid hormones are synthesized (Ganong, 1979). Hypercholesterolemia is defined as levels of cholesterol in plasma that are higher than normal. This increase may be a risk factor for coronary heart disease, which can lead to heart attack. Elevated levels of circulating cholesterol cause deposits on the inner layer of blood vessels and these deposits are called plaque. When these blood deposits become sufficiently large, they block blood vessels and then decrease the flow of blood. These deposits result in a disease process called atherosclerosis, which can cause blood clots that will ultimately stop blood flow. The deposits may also harden the vessel wall and thus lead to increased blood pressure.

The aim of this study was to know the effects of the above extracts on cholesterol level in the blood since studies revealed that *Hibiscus sabdariffa* have been used in folk medicine against hypertension (Tseng et al., 1997, 1999). *Zingiber officinale* is a common part of diet in many parts of the world. Research had shown ginger to have various pharmacological properties due to variety of active constituent. It is also known to contain antioxidants (Andersen et al., 2002).

MATERIALS AND METHODS

Experimental animals

Thirty (30) white albino rats (Wister strain) purchased from the Animal House of the research unit of University of Lagos Teaching Hospital (LUTH), Idi Araba, Lagos State, Nigeria were used for this study. They were housed in galvanized cages and maintained on Ewu grower's mash and water *ad libitum*. The animals were randomly distributed into six experimental groups Ra, Rb, Rc, Rd, Re and Rf, with five animals in each cage.

*Corresponding author. E-mail: agoreyof@yahoo.com.

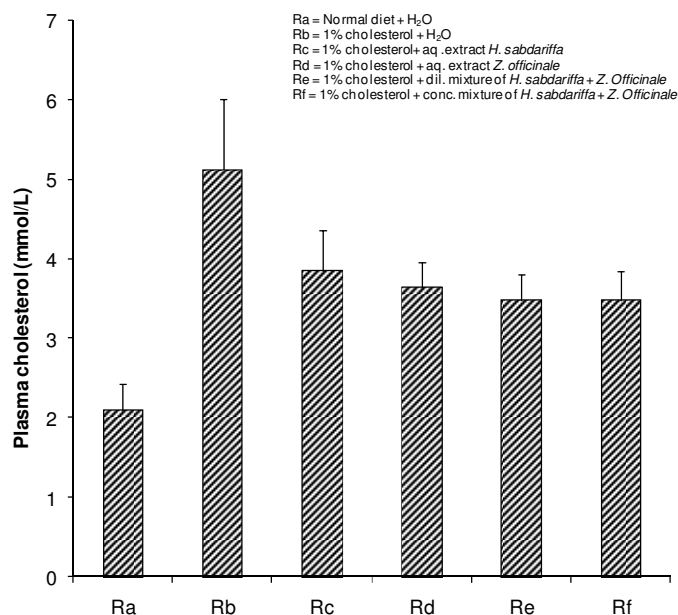


Figure 1. Effect of aqueous extract of *Hibiscus sabdariffa* and *Zingiber officinale* on plasma cholesterol in rat. Error bars are standard errors of the mean.

The furs of the rats were marked so as to obtain easier identification after being weighed. They were acclimatized for one week under controlled temperature, humidity and illumination conditions with only grower's mash and water. After this period of acclimatization in the Animal House of Department of Biochemistry, University of Benin, Benin city, Nigeria, the rats in different groups were fed as stated below:

Ra = Normal diet + water

Rb = 99% of normal diet + 1% cholesterol + water

Rc = 99% of normal diet + 1% cholesterol + aqueous extract of *H. sabdariffa*

Rd = 99% of normal diet + 1% cholesterol + aqueous extract of *Z. officinale*

Re = 99% of normal diet + 1% cholesterol + dilute mixture of *H. sabdariffa* and *Z. officinale*

Rf = 99% of normal diet + 1% cholesterol + concentrated mixture of *H. sabdariffa* and *Z. officinale*.

For groups Rb, Rc, Rd, Re, and Rf, 99 g feeds was mixed with 1 g of cholesterol.

The administrations were done orally with the use of gavage (a gastric tube). This lasted for another six weeks. This is to allow for a proper integration of the feed and extract into the animal before analysis. The weights of the animals were taken at interval of three days. First assay was conducted at the third week following initial administration. Blood samples were collected through the tail from each rat and put in plain heparinised tubes. At the end of the six weeks each rat was sacrificed and blood removed by cardiac puncture for plasma assay. Cholesterol was assayed for using enzymatic end point method. Glucose was assayed for by the oxidase method.

Preparation of plant extract

The dried calyces of *H. sabdariffa* L. and rhizome of *Z. officinale* were purchased at Oba market, Benin City, Edo State, Nigeria. 100

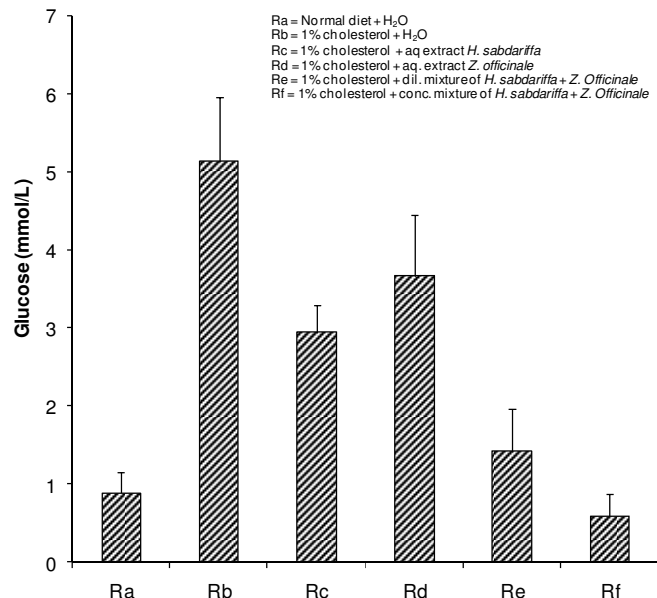


Figure 2. Effect of aqueous extract of *Hibiscus sabdariffa* and *Zingiber officinale* on plasma glucose in rat. Error bars are standard errors of the mean.

g of the dried calyx of *H. sabdariffa* L. was put in a pot containing 200 ml of distilled water. Another 100 g was put in a pot containing 400 ml distilled H₂O respectively. These were allowed to boil for 15 min, after which they were allowed to cool. They were later filtered through a filtration funnel and clear red colored decoctions were obtained. One milliliter of each extract was then evaporated to dryness in pre-weight watch glass to determine the concentration of its solute content. These were found to be 17.2 mg/200 ml and 17.2 mg/400 ml respectively. Also 100 g each of ginger rhizomes were weighed. These were then blended. 100 and 200 ml of distilled water were used to obtain the extract separately. Each extract was evaporated to dryness, weighed and their concentrations obtained as 8.6 mg/100 ml and 8.6 mg/200 ml of extracts, respectively.

RESULTS AND DISCUSSION

The concentration of total cholesterol and glucose (mmol/l) in plasma samples at the end of experiment after administration of *H. sabdariffa* and *Z. officinale* aqueous extracts are shown in Figures 1 and 2. The weight of the rats at the end of the experiment is depicted in Table 1.

After four weeks of feeding experimental rats with grower's mash supplemented with 1% cholesterol and administration of extracts of *H. sabdariffa* and *Z. officinale*, it was observed that both extracts have hypocholesterolemic and hypoglycemic effect. At the end of this study, a comparison of various test group blood samples with the control groups indicate a statistically significant ($p < 0.05$) reduction in the plasma cholesterol and glucose levels in samples Rc, Rd, Re, and Rf. This hypocholesterolemic as well as hypoglycemic effect of *H. sabdariffa* and *Z. officinale* have been attributed to their

Table 1. The weights of rats before and after treatment with 1% cholesterol, *H. Sabdariffa* and *Z. officinale* extracts are shown below.

Group	Mean weight (g) before treatment	Mean weight (g) after treatment	Mean weight (g) gain
Ra	140.8	187.2	46.40
Rb	187.2	259.9	72.70
Rc	185.7	198.5	12.80
Rd	194.0	212.6	18.60
Re	180.7	186.9	6.20
Rf	184.7	189.2	4.50

Ra = Normal diet + H₂O.

Rb = 1% cholesterol + H₂O.

Rc = 1% cholesterol + aq extract *H. sabdariffa*.

Rd = 1% cholesterol + aq. extract *Z. officinale*.

Re = 1% cholesterol + dil. mixture of *H. sabdariffa* + *Z. Officinale*.

Rf = 1% cholesterol + concentrated mixture of *H. sabdariffa* + *Z. Officinale*

antioxidant composition (Andersen et al., 2002). It has been shown from experimental studies that the high content of ascorbic acid and anthocyanin in *H. Sabdariffa* significantly lowered lipid peroxidation by maintaining the activities of the antioxidant enzymes; superoxide dismutase and catalase in rats (Herunsalee and Suthisang, 2005). Also a comprehensive study in rats found that ginger extract reduced cholesterol, inhibited lipid peroxidation and reduced the development of atherosclerosis (Fuhrman et al., 2000). The results indicated that ginger is comparatively as effective as ascorbic acid contained in *H. sabdariffa*. It has also been observed that variations in reduced cholesterol and glucose levels in the different groups with group VI (R_i) being highest was as a result of differences in concentration of the extracts. Hence, *H. sabdariffa* and *Z. officinale* could inhibit and/or scavenge radicals of rat's body in different degrees (Liu et al., 2003). These features of *H. sabdariffa* and *Z. officinale* are very important in the prevention against atherosclerosis, cardiovascular disease (CVD) (Kromhout, 2001). In fact according to Austin et al. (1998), a 1 mmol/L decrease in plasma cholesterol is associated with a 25% reduction in CVD risk.

Thus assuming a linear relationship, a decrease of cholesterol from 5.13 to 2.53 mmol/L after administration of extracts of *H. sabdariffa* and *Z. officinale*, could be expected to decrease the risk of CVD by 65%.

It can be concluded that extracts of *H. sabdariffa* and *Z. officinale* apart from being hypocholesterolemic, have the potential of lowering plasma glucose. The extracts have a role in the control of blood sugar especially in those prone to diabetes mellitus. Hence, administration of extracts in moderate amount to rats will protect against atherosclerosis, cardiovascular disease, coronary heart disease and diabetes and thus enhance good health.

REFERENCES

- Andersen LF, Mosco O, Jacobs DR, Blomhoff R (2002). A systemic screening of total antioxidants in dietary plants. *Nutrition* 132(3): 461-471.
- Austin MA, Talmud PJ, Luong LA, Haddad L, Day IN, Newman B, Edwards KL, Krauss RM, Humphries SE (1998). Candidate-gene studies of the atherogenic lipoprotein phenotype: a sib-pair linkage analysis of DZ women twins. *Am. J. Hum. Genet.* 62: 406-419.
- Fuhrman B, Rosenblat M, Hayek T, Coleman R, Aviram M (2000). Ginger Extract Consumption Reduces Plasma Cholesterol, Inhibits LDL Oxidation and Attenuates Development of Atherosclerosis in Atherosclerotic, Apolipoprotein E-Deficient Mice. *J. Nutr.* 130: 1124-1131.
- Ganong W (1979). *Energy balance, metabolism and Nutrition.. Rev. Med. Physiol.* (9th edition), pp. 239-240.
- Herunsalee J, Suthisang C (2005). Antioxidant effect aqueous extracts from dried calyx of *Hibiscus sabdariffa* Linn.(roselle) in vitro using rat low- density lipoprotein (LDL), *Bio. Pharm.* 28(3): 481-484.
- Kromhout D (2001). Epidemiology of Cardiovascular diseases in Europe. *Public Health Nutr.* 4(2b): 441-457.
- Liu N, Huo G, Zhang X (2003). Effect of *Zingiber officinale* Rosc on lipid peroxidation in hyperlipidemia rats. *Wei SYJ.* 32(1): 22-23.
- Tseng CH, Chong CK, Chen CJ, Tai TY (1997). Lipid profile and peripheral vascular disease in arseniasis hyperendemic villages in Taiwan. *Angiol.* 48: 321-335.
- Tseng CH, Kao ES, Chu HT, Chuo FP, Linwu HW, Wang CJ (1999). Protective effects of dried extracts of *Hibiscus sabdariffa* L against oxidative stress in rat primary hepatocytes. *Food Chem. Toxicol.* 35: 1159-1164.