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The Effects of Crude Extracts of Ginger *(Zingiber officinale)* On Some Lipid Profile Parameters In High Fat Fed Rats.

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Abstract

The effects of various doses of ginger (Zingiber officinale) on lipid profile parameters of rats fed high fat diets for six (6) weeks were determined. Results obtained shows that the administration of crude extract of ginger for two weeks at 200mg/kg body weight significantly ($p<0.05$) reduced the level of cholesterol, triglyceride, low density lipoproteins (LDL) and increase High density lipoproteins (HDL) (69.15±4.69, 100.00±3.91, 6.90±1.96, 20.00±0.78 and 41.05±2.99) respectively compare to value obtained in rats fed normal diet (71.50±7.75, 120.63±4.54, 20.85±1.18, 18.32±0.90 and 26.12±4.82) respectively. This shows that consumption of ginger at higher doses may be beneficial in reducing some lipids profile parameter and body weight which could aid in preventing cardiovascular diseases.

Keywords: Lipid profile, *Zingiber officinale*, cardiovascular disease, High fat diet

Introduction

Cardiovascular disease is a general term that describes a conditions caused by an interrupted or diminished blood flow through the coronary arteries to the heart muscle. The main cardiovascular diseases are heart attack, angina, stroke and peripheral vascular disease (PVD), (Holman *et al*; 1995).

Lipid profile, also known as coronary risk panel or lipid panel, is the collective term given to the estimation of, typically, total cholesterol, high density lipoprotein- cholesterol, and triglycerides, used to assess risk of coronary heart diseases. An extended lipid profile may include very low density lipoprotein cholesterol and non HDL-C.

Coronary artery disease develops as a result of various risk factors, including increased plasma LDL levels, as well as LDL modifications, such as oxidation or aggregation. Consumption of phenolic flavonoids in the diet has been shown to be inversely associated with morbidity and mortality from coronary heart diseases. (Hertog *et al*; 1993)

Plants in the treatment and cure of sicknesses conditions have been with the man since time immemorial. Early 20th century witnessed the arrival of hormones, chemotherapy, vitamins, antibodies, and more recently, the biotechnological products, which marked a sharp decline in the contribution of herbal medicine to health care delivery. Fortunately however, there is blossom of herbal medicine at the early 21st century (Osai, 1998). This is especially so with the rising cost of imported medication to the extents that government cannot meet the demand of the populace.

Ginger is used extensively in Ayurveda, the traditional medicine of India, to block excessive clotting (i.e. heart disease) reduce cholesterol and fight arthritis (Foster and Tyler, 2000). The major active ingredients in ginger oil are the Sesquiterprenes; bisapolene, Zingiberene, and Zingibenol. The concentrations of the active ingredients have a variety of physiologic effects. For example, the gingerols have analgesic, sedative, antipyretic and antibacterial effects in vitro and animal (Slender and withal, 2004).

MATERIALS AND METHODS

Equipments and Apparatus

Spectrophometer (Ryan science and instrumental company England), Bench centrifuge (Shangai surgery factory),

Weighing balance (Scout pro 401. Chaus Corporation, pine brooks NJ USA), Steam water bath (Memment, West Germany), Morta/Pestel.

Chemicals

All chemicals that were used in the study are of the highest grading possible (Analar). Randox commercial reagents for cholesterol, high density lipoproteins (HDL), Low density lipoproteins (LDL) and triglycerides kits were purchased.

COLLECTION AND PREPARATION OF SAMPLES

Plants Materials

The Plants materials Zingiber officinale (Ginger) was purchased from a local market around the University community of Sangere in Girei Local Government Area of Adamawa state. And it was taken to the Department of Plant Science of the same University for proper identification and authentication before the commencement of the experiment.

The fresh plant was washed with clean water and allowed to dry under a shade (at room temperature). It was then ground into a fine powder using a laboratory motor. The powder was sieved into fine powder and stored in black polyethylene bag in an air tight in a refrigerator container pending its use.

Animals for experiment

Thirty six (36) young albino male rats weighing (90±10kg) was purchased from the National Veterinary Research Institute (NVRI), Vom Plateau State, Nigeria. The animals were allowed to acclimatize with its environment for one week before start of the experiment. The animals were housed in a well ventilated room and were fed with vital feeds (Grand Cereals and Oil Mills Ltd, Jos) and drinking water ad libitum.

EXPERIMENT DESIGN

Thirty six (36) albino rats were divided into six (6) groups of six (6) rats each (i.e. 6 rats per cage) at an ambient temperature of 25±27, 60-70% relative humidity, with 12Hrs light, 12Hrs dark cycle. All animals were given access to vital standard food and water.

The first group was fed standard normal diets as a normal control while the second group which served as experimental control was fed high fat diets (20% animal fat) for four weeks. The third, fourth, fifth and sixth group were also fed 20% high fat diets for four weeks. After which, animals in these groups received an oral administration of ginger extracts at different doses. Group 3 were administered 50mg/kg body weight, group 4 (100mg/kg body wt), 5 (150mg/kg Body wt), 6 (200mg/kg Body Wt) respectively for two weeks. At the end of the experiments periods, the animals were sacrificed, blood sample were collected by cardiac puncture and centrifuged. Serum samples were then taken for biochemical analysis. Lipid profile was assayed using analytical kits for lipid profile parameters.

The total Cholesterol, Triglyceride, HDL, LDL and VLDL was determined using the method of Franey and Elias, 1986 respectively.

EXPERIMENTAL GROUPS

Groups	Diets Fed	Crude extract of Zingiber officinale
Group 1	Normal diet	Absent
Group 2	High fat diets (20%)	Absent
Group 3	High fat diets (20%)	50mg/kg Body weight
Group 4	High fat diets (20%)	100mg/kg body weight
Group 5	High fat diets (20%)	150mg/kg Body weight
Group 6	High fat diets (20%)	200mg/kg Body weight

RESULTS

TABLE 1: The table shows the result of weight gained during the first four weeks before administration and two weeks after administration. During the first four weeks, five groups were fed with 20% high fat diets and the rats in these groups were less active and increased in weight significantly compared to the normal control group which normal diets were given.

THE BODY WEIGHT OF RAT IN (g)

Groups	1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week
Normal control	92.4±2.37[a]	133.86±14.38	139.28±14.82	127.25±11.82	144.58±8.36	146.30±6.35
High fat diet (20%) experimental control	91.97±5.86	139.77±3.00[a]	144.61±4.95[a]	156.44±4.00[a]	157.56±5.49[a]	159.29±3.8[a]
High fat diet (20%) +50mg/kg	93.67±10.94	107.43±22.69[b]	121.54±20.41[b]	121.98±21.86[b]	120.11±3.78	117.99±7.9
High fat diet (20%) + 100mg/kg	96.55±9.13	117.76±19.78	133.73±19.59	129.06±18.76	115.98±21.86	114.68±25.4
High fat diet (20%) + 150mg/kg	83.58±16.02[b]	128.69±33.00	133.73±39.18	144.18±21.05	144.02±20.41	108.43±22.9
High fat diet (20%) + 200mg/kg	109.86±11.36	131.63±18.39	133.66±14.77	138.01±15.56	94.66±7.29[b]	92.13±8.3[b]

Results are expressed as mean ± S.D (n=4)

a= significantly higher compared to other values in the same column ($p<0.05$)

b= significantly lower compared to other values in the same column ($p<0.05$)

N.B Mean with the same letter are not significantly different at ($p<0.05$)

TABLE 2 Shows the percentage reduction in body weight of groups treated with *Zingiber officinale:*

GROUPS	4th Week Body weight	Final body weight	% reduction in the Body weight
High fat diet(20%)+ 50mg/kg Body wt	121.98±46.51[b]	117.99±15.87[a]	3.27[b]
High fat diet(20%)+ 100mg/kg Body wt	129.06±37.51	114.68±50.88	11.14
High fat diet(20%)+ 150mg/kg Body wt	138.01±31.12	108.43±45.87	21.43
High fat diet(20%)+ 200mg/kg Body wt	144.18±42.10[a]	92.13±16.66[b]	36.09[a]

Results are expressed as mean ± S.D (n=4)
a= significantly higher compared to other values in the same column ($p<0.05$)
b= significantly lower compared to other values in the same column ($p<0.05$)

N.B Mean with the same letter are not significantly different at ($p<0.05$)

TABLE 3 Shows the result obtained after the administration of crude extract of *Zingiber officinale* for two weeks. The result shows that the level of Cholesterol(chol.) , Low density lipoprotein (LDL), Triglyceride(TG) were significantly ($p<0.05$) reduced in group 3, 4, 5, and 6 compared to group two which is the experimental control; while the level of High density lipoprotein (HDL) significantly increased in group 3,4,5 and 6.
Values for total cholesterol, TG, HDL-c, LDL-c, and VLDL after administration in mg/dl

Groups	Total cholesterol	TG	HDL-c	LDL-c	VLDL
Normal diet	71.50±7.75[b]	120.63±4.54[b]	26.12±4.82[b]	20.85±1.18	18.32±0.90[b]
High fat diet {20%} experimental control	81.80±00[a]	195.25±51.88[a]	27.35±3.01	25.55±5.05[a]	39.05±10.37[a]
High fat diet (20%) + 50mg/kg	80.75±4.33	157.15±22.68	33.60±3.94	19.50±6.81	31.43±4.53
High fat diet (20%) + 100mg/kg	78.62±4.06	144.37±15.31	35.27±3.09	15.27±5.84	28.87±3.06
High fat diet (20%) +150mg/kg	76.30±4.15	135.06±18.21	37.27±1.51	9.72±1.11[b]	26.96±3.61
High fat diet (20%)+200mg/kg	69.15±4.69[b]	100.00±3.91[b]	41.05±2.99[a]	6.90±1.96[b]	20.00±0.78[b]

Result expressed as mean ± S.D (n=4)

a= significantly higher compared to other values in the same column ($p<0.05$)
b= significantly lower compared to other values in the same column ($p<0.05$)

N.B Mean with the same letter are not significantly different at ($p<0.05$)

DISCUSSION

Cholesterol is an important constituent of cellular membrane and is a precursor of steroid hormone and bile acid. However, high cholesterol levels in the blood are the primary cause of cardiovascular disease (CVD), and can result in atherosclerosis, myocardial infarction, and coronary heart disease. (Agbedana, E.O.,1999). As incidence of cardiovascular related death in Nigeria is on the rise; research concerning the management of hyperlipedemia and associated disease is warranted.

Result from table 1; demonstrated that high fat diets (saturated fats) from animals source incorporated into their normal diets can greatly increase the palatability and body weight of rats. These results are consistent with the earlier report of (Fuhrman, B. and Aviram, M.,2000) which indicate that excess intake of fatty foods could greatly increased the body weight and cholesterol, low density lipoprotein e.t.c in any individual system. As excessive weight gain has been implicated as a risk factor for development of hypertension, ischemic heart diseases and heart failure (Dele, B; 2003) table 1 showed an increased weight gained on the group fed with fat diet before administration compared to the normal groups and also indicated a slight decreased in weight loss after administration, which was significantly different from the control at ($p<0.05$), these data suggest that administration of *Zingiber officinale* extract may have benefit on those suffering from obesity (Rorbert, 2003).

Result from table 2 show percentage (%) reduction in the body weight observed in the hyperlipedemia rats fed the crude extract of ginger *(Zingiber officinale)* was due to gingerols present in ginger, as they are known to inhibit intestinal absorption of dietary lipid, and interfere with emulsification, digestion, and micellar solubilisation of lipids, which are critical steps involved in the intestinal absorption of dietary fat, cholesterol and other lipids (Kadnur *et al*; 2005).

Results in table 3 shows that the administration of *Zingiber officinale* extracts caused significant decreased in serum total cholesterol, low density lipoprotein, triglyceride at ($p\leq0.05$) suggesting modulatory influence on cholesterol metabolism and turnover. The decline in the total cholesterol, low density lipoprotein, Triglyceride observed in the extracts treated rat might be a consequences of higher proportion of HDL-c which reduced antherogenic risk by virtue of increased reverse cholesterol transport from peripheral organs to liver (Kinosian *et al*; 1994, Hermansen *et al*; 2003).

The lipid-lowering effects of gingers of ginger consumption in rats have also been reported and are assumed to be due to increased intestinal fermentation and formation of volatile fatty acid acetate in the caecum and colon. These alteration stimulate the secretion of hormonal factor from the large intestine or central nervous system to modify cholesterol metabolism (Mehta *et al;* 2003, Purohit and Vyas, 2006).

CONCLUTIONS

It could be concluded that the crude extracts of *Zingiber officinale* contains an active component which possess the ability to decrease serum lipid profile and lower the risk of atherosclerosis in high fat fed rats and reduce the level of cardiovascular risk factors especially at higher doses.

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