TO ESTABLISH THE EFFECT OF GINGER-JUICE ZINGIBER OFFICINALE (ZINGIBERACEAE) ON IMPORTANT PARAMETERS OF LIPID PROFILE.

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ABSTRACT:
Investigation of hypolipidimic effects of ginger-juice (ZINGIBER OFFICINALE ROSCOE) in rat. Methods: Albino rats (n=6-12) were administered G.J at single dose (4ml/rat, p.o) as a chronic treatment over period of 21 days. Effect of ginger-juice treatment was studied in rats on the following Lipid profile parameters: 1.Total cholesterol 2. HDL-cholesterol 3. LDL-cholesterol 4. Triglycerides The rats were divided into control and test groups, each group consisting of 6-12 rats. Results: Twenty-one days' treatment with ginger-juice in rats significantly reduced the total serum cholesterol level (136.46 ± 4.06mg/dl of control group to 109.46 ± 3.38mg/dl, P<0.001) and significantly increased the serum HDL-cholesterol (41.82 ± 1.32mgldl of control group to 65.42 ± 1.54mg/dl, P<0.001). LDL-cholesterol and triglycerides remained unaltered. It is found that ginger-juice act as hypolipidaemic agent. Conclusion: Ginger-juice reduced the serum total cholesterol which was observed rise in normal rats administered ginger-juice over period of twenty-one days.

Key words: Ginger-juice, Total cholesterol, HDL-cholesterol, LDL-cholesterol, Triglycerides

INTRODUCTION

A Ginger is one of the most important and oldest spices, consisting of the prepared and sun-dried rhizomes of Zingiber officinale (Zingiberaceae). It is cultivated in many tropical countries. It is produced all over India from ancient times. It has a good commercial value and is claimed to have many medicinal uses. Because of differences in cultivation pattern, harvesting technique and climatic conditions it's commercial value differs and so also the medicinal actions and uses. It is referred by different names in the languages of different regions and countries.

It is widely consumed almost all over the world however in tropical countries or warm regions like Asia, it is more popular1 (Katiyar et al., 1996). Because of its typical taste and a pleasant odor it's widely used as flavoring agent in numerous food recipes, beverages, pickles, many popular soft drinks etc2 (Guenther, 1952).

From the ancient times it is included in many traditional medicinal systems for treatment of number of diseases. It is widely claimed as a Stomachic, aromatic, carminative, aphrodisiacs, diaphoretic, antiemetic, allergic rhinitis and gastric stimulant and for treating migrane headache. It is also used an antispastic against intestinal colic. Ginger oil is used in mouthwashes and liquors3 (Evans et al., 1989).

Many varieties of ginger are found such as processed, coated or unscraped, unbleached (natural) and bleached ginger. There are different types of active principles present in the ginger. Ginger oil is isolated by distillation of dried ginger. Many scientists have investigated the ginger oil and found about 50 constituents, mainly aroma, Starch, Volatile oil, Zingiberene, Gingerol, Oleoresin (Gingerin), Zingiberol, Zingerone, Shagaol etc. The acetone extract of ginger contains Zingerberone and ether extract contain Zingerone (Pungent principles).

In view of the available literature, we have tried to screen some actions of ginger-juice; as crude form of ginger. We presume that crude form contains majority of active principles, may be in very low concentrations. Keeping in mined some of its potential therapeutic applications we have carried out animal experiments to investigate the effects of ginger-juice on lipid profile

HYPOLIPIDAEMIC EFFECT:

Sharma et al., (1990) have shown that rhizome of Z. officinale lower the lipid content of the liver and ventricular heart muscles when it was administered to cholesterol fed rabbits4. In rabbits the Zingiber officinale effectively regressed atheroma and inhibited of plaque formation. (E)-8-beta, 17-epoxylabd-12-ene-15,16-dial (ZT) is an active principle isolated from the rhizome of ginger. This active principle was studied in vivo in rats

and in vitro in mice. It inhibited the cholesterol biosynthesis in rat liver in a dose dependent manner while in mice, it inhibited Trion WR-1339-induced hypercholesterolemia. ZT exhibited low toxicity (no deaths in mice after 600mg/kg p.o or 25mg,kg i.a)5 (Tanabe et al., 1993).

Ahmed et al., (1997) have shown that serum HDL-cholesterol was significantly increased in ginger fed rats. While blood glucose, serum total cholesterol, serum alkaline phosphatase was significantly decreased in ginger fed rats6.

Bhandari and his co-workers (1998) have studied the ethanolic extract of Z. officinale in cholesterol fed rabbits. Ethanolic extract of ginger (200mg/kg,p.o) significantly reduced the serum and tissue cholesterol, serum triglycerides, serum lipoproteins and phospholipids that followed 10 weeks of cholesterol feeding7. The results were compared with a standard orally effective hypolipidaemic drugs. The severity of aortic atherosclerosis was judged by gross grading. The aortic atherosclerosis was more marked in the hypercholesterolaemic group. The animals receiving ginger extract with cholesterol showed a lower degree of atherosclerosis.

Sharma et al., (1996) had studied the effects of 50% ethanolic extract of rhizomes of Z. officinale in cholesterol fed rabbits8. It reduced the total serum cholesterol and LDL-cholesterol levels (the atherogenic index was reduced from 4.7 to 1.2). The tissue lipid profile of liver heart and aorta showed similar changes to those noticed in serum lipids. Administration of the 50% ethanoilc extract increased the faecal excretion of cholesterol thus suggesting a modulation of absorption.

Material and Methods:

A keeping in view the aims and objectives, experiments were planned to study the effects of ginger in different physiological function.

Preparation of ginger-juice:

The commercially available ginger was obtained from the local market. It was confirmed from the botanist that it was Zingiber officinale. The rhizome of ginger after cleaning and scrapping the superficial skin was cut into small pieces. With the help of mixer-grinder the pieces were made in to paste. The paste was taken on a white clean cloth and the liquid was squeezed out. The juice so obtained was used in the experiments. The stock of juice was kept in a refrigerator for maximum period of 15 days and the required quantity was used for the experiments after removing particulate matter from it.

500gm ginger rhizome yielded about 250ml juice.

250ml juice was filtered which yielded about 120 - 150ml filtrate.

The liquid portion which was obtained in the course of filtration, looked like yellowish hazy opalescent liquid. It was administered orally in chronic experiments. The doses were either 2 ml to 4 ml per rat.

LIPID PROFILE:

Effect of ginger-juice treatment was studied in rats on the following parameters:

1. Total cholesterol **3. LDL-cholesterol**

2. HDL-cholesterol **4. Triglycerides**

The rats were divided into following groups, each group consisting of 6-12 rats.

Control group:

Each rat received 4ml of normal saline orally over a period of 21days. They were sacrificed after 24 hours of the last dose of normal saline. Under anaesthetized with sodium pentobarbitone (50mg/kg, i.p.), blood samples were collected directly from the heart in plain as well as heparin zed bulbs for various parameters. The cold centrifuge machines separated the serum. The sample of blood was centrifuged at 4000 to 5000 r.p.m for 15 minutes.

Test group:

Each rat received 4ml of ginger-juice orally for 21 days. They were sacrificed as described above after 24 hours of the last dose of ginger-juice was given and Blood samples were collected as described earlier. The following parameters were studied in each group.

The methods to estimate these parameters are as under:

1. Total cholesterol

This total cholesterol was assayed in each sample by using MENARINI Diagnostics kit. This was a fully enzymatic procedure with colorimetric determination at 500nm. This reaction took place in three stages by oxidation and catalysis. Principles of reaction:

$$\text{Esterified cholesterol} \xrightarrow[\text{(cholesterol-esterase)}]{} \text{Cholesterol + Fatty acids}$$

$$\text{Cholesterol} + O_2 \xrightarrow[\text{(cholesterol oxidase)}]{} \text{Cholest-4-en-3 one} + H_2H_2$$

$$H_2O_2\text{+Phenol+4-Aminoantipyrine} \xrightarrow[\text{(peroxidase)}]{} \text{Chinoeimmine} + H_2O$$

The optical density read at 500nm on ultra-violet spectrometer (UV-1201) was proportional to the concentration of total cholesterol.

2. HDL-Cholesterol

The HDL - Cholesterol was assayed in each sample by using RANDOX (U.K) kit.

Principle:

Low-density lipoproteins (LDL and VLDL) and chylomicron fractions were precipitated quantitatively by the addition of phosphotungstic acid in the presence of magnesium ions. After centrifugation, the cholesterol concentration in the HDL (high density lipoprotein) fraction, which remained in the supernatant, was determined.

The HDL-cholesterol was determined on the principle of estimation of total cholesterol.

3. LDL-Cholesterol

This was assayed in each sample by using RANDOX (U.K) kit.

Principle:

Low-density lipoproteins (LDL) were precipitated by heparin at their isoelectric point (pH- 5.04). After centrifugation the high density lipoproteins (HDL) and the very high-density lipoproteins (VLDL) remained in the supernatant. The LDL was determined by enzymatic methods.

LDL-Cholesterol = Total Cholesterol-Cholesterol in the supernatant.

4. Triglycerides

The triglycerides were assayed in each sample by using RANDOX (U.K) kit.

Principle:

The triglycerides are determined after enzymatic hydrolysis with lipases. The indicator was a quinoneimine formed from hydrogen peroxide, 4-aminophenazone and 4-Chlorophenol under the catalytic influence of peroxidase.

$$\text{Triglycerides} + H_2O \xrightarrow{\text{Lipases}} \text{glycerol} + \text{fattyacids}$$

$$\text{Glycerol} + \text{ATP} \xrightarrow{\text{Glycerol-kinase}} \text{glycerol-3-phosphate} + \text{ADP}$$

$$\text{Glycerol-3-phosphate} + O_2 \xrightarrow{\text{Glycerol-3-phosphate oxidase}} \text{dihydroxyacetone phosphate} + H_2O_2$$

$$2H_2O_2 + \text{4-aminophenazone} + \text{4-chlorophenol} \xrightarrow{\text{Peroxidase}} \text{quinoneimine} + HCl + 4H$$

Result:

LIPID PROFILE:

This section describes the results of various experiments related to lipid profile.

Effect of ginger-juice 4ml/rat administration over 21 days:

(a) Total Cholesterol:

In the vehicle treated control group the mean total cholesterol was 136.41 ± 4.06 mg/dl, while in ginger-juice treated test group it was 109.46 ± 3.38 mg/dl. Thus it is evident that ginger-juice treatment significantly reduced the total serum cholesterol level. The results are depicted in table-1 and figure1.

(b) HDL-cholesterol:

The mean HDL-cholesterol in the vehicle treated group was 41.82 ± 1.32 mg/dl and in ginger-juice treated test group the serum HDL-cholesterol level 65.42 ± 1.54 mg/ dl expressed in table-1 and figure1. This shows that there is significant increased in serum HDL- cholesterol level in ginger-juice treated group.

(c) LDL-cholesterol:

The mean serum LDL - cholesterol level in the vehicle treated group was 54.02 ± 3.55 mg/dl and in the ginger-juice treated test group the serum LDL-cholesterol level 39.46 ± 4.55 mg/dl expressed in table-1 and figure 2. This shows that there is no significant difference between the two groups indicating that there is no effect of ginger-juice treatment for 21 days on the serum LDL-cholesterol.

(d) Triglycerides:

In the vehicle treated control group the mean of serum triglycerides was 48.76 ± 1.41 mg/dl, while in ginger-juice treated test group it was 49.99 ± 1.39 mg/dl. This reflects that there is no significant difference between two groups indicating that there is no effect of ginger-juice treatment for 21 days on the serum tryglycerides levels. The above results are depicted in table-1 and figure1.

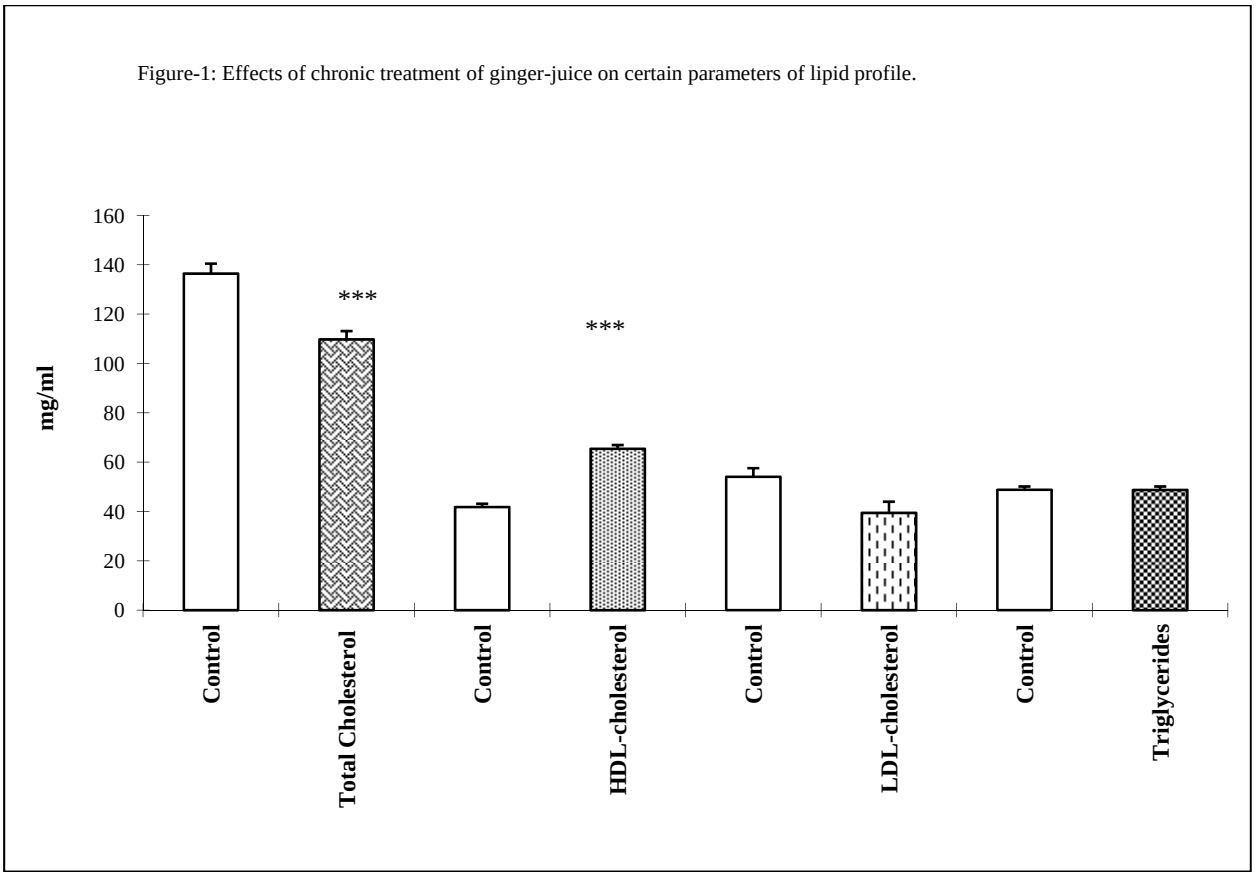
The above results are depicted in table-1 and figure1.

Table-1: THE EFFECTS OF GINGER-JUICE TREATMENT (21 DAYS) ON DIFFERENT PARAMETERS IN RATS.

Parameters	**N**	**Control**	**G. juice (21 days)**
TotalCholesterol (mg/dl)	12	136.41 ± 4.06	109.75 ± 3.38***
HDL-Choles. (mg/dl)	12	41.82 ± 1.32	65.42 ± 1.54***
LDL-Choles. (mg/dl)	12	54.02 ± 3.55	39.46 ± 4.55
Triglyceride (mg/dl)	12	48.76 ± 1.41	49.99 ± 1.39

Table-1: It shows the effect of ginger-juice (4ml/rat, p.o. for 21 days) on various parameters like Total cholesterol, HDL-Cholesterol, LDL-Cholesterol, and Tryglycerides in rats. The statistical significance vis-à-vis the vehicle treated control is presented as *p<0.05 **P<0.01 ***P<0.001.

Figure-1: Effects of chronic treatment of ginger-juice on certain parameters of lipid profile.



Over all view indicates that 21 days' treatment with ginger-juice resulted into decrease of Total -cholesterol level and increased of HDL- cholesterol level; LDL-cholesterol and Triglycerides levels remained unaltered.

Discussion: Hyperlipidaemia is a major risk factor for causing coronary heart disease. Lipid profile is becoming an important parameter from the point of view of various cardiovascular disorders. Hence, this is considered worthwhile to study the effect of ginger-juice on lipid profile. In the present study, we have taken following lipid profile parameters for assessing the effect of ginger-juice.

Total serum cholesterol	LDL-Cholesterol
HDL-Cholesterol	Triglycerides

"Panchcole"- an Ayurvedic preparation containing Zingiber officinale as one of the main components has been shown to control hyperlipidaemia[4] (Sharma et al., 1990).
Twenty-one days' treatment with ginger-juice in rats significantly reduced the total serum cholesterol level (136.46 ± 4.06mg/dl of control group to 109.46 ± 3.38mg/dl, P<0.001) and significantly increased the serum HDL-cholesterol (41.82 ± 1.32mgldl of control group to 65.42 ± 1.54mg/dl, P<0.001). LDL-cholesterol and triglycerides remained unaltered. It is found that ginger-juice act as hypolipidaemic agent. The various authors reported lipid profile levels in certain group of rats are tabulated as under;

Authors name (Year)	SerumTotal-cholesterol	SerumHDL-cholesterol	SerumLDL-cholesterol	Triglycerides
Prasad (2001)	136.41mg/dl	41.82mg/dl	54.02mg/dl	48.76mg/dl
Khosla et al., 1995)	102.0mg/dl	41.0mg/dl	45.4mg/dl	78.00mg/dl
Bopanna et al., (1998)	88.9mg/dl	42.8mg/dl	40.6mg/dl	54.4mg/dl
Paritha et al., (1997)	93.36mg/dl	17.16mg/dl	32.68mg/dl	23.91mg/dl
Gehlot et al., (1998)	65mg/dl	------	------	86mg/dl
Bahram et al., (1999)	88mg/dl	------	------	------
Mahendran et al (2001)	70.4mg/dl	------	------	107.8mg/dl

It is obvious that there is lot of variations in lipid profile levels in certain animals (rat) reported by different laboratories. The variation noted cannot be easily accounted for. The differences in species of the rat, dietary habits, age, and weight may be contributory factors for this variation.

Literature shows paucity of studies in this direction. One study reported by Ahmed and Sharma,[9] (1997) points out effects of ginger in this direction. Adult male Wistar rats, fed diet containing 0.5% ginger showed decrease in total serum cholesterol and increase in HDL-cholesterol, triglycerides remained unaltered.

The findings in the present study as well as of Ahmed and Sharma (1997) are related to experiments in normal rats. Studies on the animals having hyperlipidemia are lacking. It will be worth studying the effect, if any, in hyperlipidemic animals in future[10].

As hyperlipidemia is associated with ischaemic heart disease and diabetes (Kannel et al., 1979; Maison et al., 1978), potential benefits of ginger-juice in these conditions are worth studying. Again our attempts failed to find any study in these directions with ginger-juice[11,12].

Explanation for hypocholesterolemic effect of ginger cannot be provided. Presently, there is need of specific experiments to be conducted to establish the mechanism of hypocholesterolemic effect.

Conclusion: According to the present study, On lipid profile reduction in serum total cholesterol was observed in normal rats administered ginger over period of twenty-one days.

Limitation of study: The present study does not show the exact cause of altered serum lipid profile after rats administered 21 days ginger juice.

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