EFFECT OF GARLIC AND GINGER ON OBESITY INDUCED HAEMATOLOGICAL CHANGES AND BODY WEIGHT ON FEMALE ALBINO RATS

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ABSTRACT

Obesity has been shown to be one of the conditions that decrease antioxidant capacity. The aim of the present study was to investigate weight reducing effect of garlic and ginger on high fat diet induced obesity on albino rats. This was compared with standard herbal (ayurslim) and synthetic (sibutrex10^{TM}) anti-obesity drugs. Albino rats were divided in to three groups. Group I : Control group - the rats received 0.9% saline orally. Group II: Received vanaspathi orally (hydrogenated oil), 200mg/kg body weight. Group III: Received 4.2mg of garlic capsules / kg bodyweight along with vanaspathi (hydrogenated oil). Group IV: Received 7mg of ginger capsules/ kg bodyweight along with vanaspathi (hydrogenated oil). Group V: Received a combined dose of garlic + ginger (3.4mg of garlic and 2mg of ginger / kg bodyweight along with vanaspathi (hydrogenated oil). Group VI: Received 7mg of ayurslim capsules/ kg bodyweight along with vanaspathi (hydrogenated oil). Group VII: Received 0.17mg of sibudrex / kg bodyweight along with vanaspathi (hydrogenated oil). Body weight, liver weight and Kidney weight was increased in obese animals which was considerably reduced in the combination of garlic and ginger group. RBC, WBC and Hb levels were markedly raised in obese group and restored to normal level in ginger and garlic group.

Keywords : Obesity, garlic, garlic, ayurslim, sibudrex, RBC, WBC, Hb and Body weight

INTRODUCTION

Obesity is a global epidemic and is recognized as an energetic imbalance caused mainly by increased consumption of high-calorie foods. Other factors include physical inactivity and socioeconomic and environmental changes, particularly rising purchasing power and education level and the influence of other individuals to increase food consumption [1-4]. Obesity is associated with dyslipidemias, diabetes, musculoskeletal disturbances, particularly osteoarthritis, and some types of cancer, such as endometrial, breast and colon cancer [2, 5]. Obese individuals also have cardiac risk factors that manifest clinically, including hypertension, insulin resistance, glucose intolerance and an elevated body mass index (BMI) [6, 7].

Choosing the best treatment for obesity depends on the correct diagnosis [2, 8]. Pharmacological strategies are recommended for the treatment of obesity, mainly because they are non-invasive. Recommended pharmaceuticals include sibutramine, fluoxetine, ser traline, orlistat and topiramate, among others [9]. However, these should be used with caution, especially in patients with cardiovascular disorders, because they possible may aggravate the clinical picture [2, 9, 10].

Currently, obesity remedies based on dietary supplements are popular, suggesting that ethnopharmacology and phytotherapy can serve as strategies in obesity treatment and prevention [11]. Medicinal use of plants arises from ethnobotanical and ethnopharmacological approaches that test their therapeutic use in treating and preventing numerous diseases. These approaches include popular knowledge; thus the traditional has become something of great importance to science. These approaches also contribute to the selection of species to be studied and the development of phytotherapeutic medicines based on ethnopharmacological investigation [12].

Indian traditional medicinal plants such as *Commiphora weghtii* (Guggulu), *Allium cepa* (Onion), *Zingiber officinale* (Ginger), *Trigonella foenum* graecum (Fenugreek), *Garcinia cambogia* (Garcinia) *Gymnema sylvestre* (Meshashringi), *Terminalia chebula* (Chebulic myrobalan, Haritaki), *Terminalia bellirica*, *Phyllanthus emblica*, *Plantago psyllium* (Psyllium**)** and *Oenothera biennis* (primrose), have gained great reputation to reduce harmful cholesterol and triglycerides in blood, prevent fat formation and reduce obesity (13).

Each Ayurslim capsule contains the following herbal ingredients: *Garcinia combogia* (limits the synthesis of fatty acids in the muscles and liver, it also arrests lipogenesis), *Commiphora wightii* (Guggulu) (reduces cholesterol and triglyceride level), *Gymnema sylvestre* (Meshashringi) (abolishes the taste of sugar and nutralizes excess sugar present in the body), *Terminalia chebula* (Haritaki) (detoxifies the body and has purgative action), and *Trigonella foenum* Graecum (Medhika) (effectively reduces weight, hyperlipidemia and craving for sugar) (www.himalaya healthcare.com)

Ayurslim limits the formation of fatty acids in the muscles and liver. It redues the cholesterol and triglyceride levels. It also improves digestion and accelerates metabolism to pass the food along the gastrointestinal tract quickly and prevents the transformation of undigested carbohydrates into triglycerides. Ayurslim has a favourable effect on weight reduction and lipid profiles. It is a researched ayurevedic herbal product, that can be safely used with no side effects (www.himalaya healthcare.com)

Ayurslim reduces the craving for food, thereby reducing the intake of fats and carbohydrates. It leads to optimal utilization of nutrients. It inhibits fatty acid synthesis, thereby reducing fat accumulation in the body. Ayurslim is useful in controlling obesity, reduces lipid deposits in the blood and liver. *Trigonella foenum* Graecum (Fenugreek, Medhika) effectively reduces weight (www.himalaya healthcare.com).

Sibutramine is a tertiary amine originally developed as a potential antidepressent and but with weight-loss inducing properties. These properties are induced by a dual mechanism involving the inhibition of neuronal reuptake sites that effect food intake, and the prevention of the decline in energy expenditure during weight loss. This drug induces dose dependent weight loss (14).

Garlic (Allium sativum L.) has been widely used as a foodstuff and, for many centuries, has also been used as a traditional medicine due to its perceived effects in preventing and curing ailments [15]. Several organosulfur compounds present in garlic oil have been shown to possess numerous biological activities. The four most important organosulfur compounds, considered to be the major biological agents, are diallyl sulfide (DAS), diallyl disulfide (DADS), diallyl trisulfide (DATS) and allylmethyl trisulfide [16]. A series of biological benefits, such as hypolipidemic and hypocholesterolemic effects [17], antioxidant potential [18], and antimicrobial activity [19], have been reported. The pungent fractions of garlic are mostly sulfur-containing moieties, while its two chemical groups, namely, flavonoids and ALK (EN)-based cysteine sulfoxides (ACSOs), have marked effects on human health [20].

Ginger has staring potential for treating a number of ailments including degenerative disorders (arthritis and rheumatism), digestive health (indigestion, constipation and ulcer), cardiovascular disorders (atherosclerosis and hypertension), vomiting, diabetes mellitus, and cancer. It also has anti-inflammatory and anti-oxidative properties for controlling the process of aging. Furthermore, it has antimicrobial potential as well which can help in treating infectious diseases.[21,22] Generation of free radicals or reactive oxygen species (ROS) during metabolism beyond the antioxidant capacity of a biological system results in oxidative stress,[23] which plays an essential role in heart diseases, neurodegenerative diseases, cancer, and in the aging process.[24] The bioactive molecules of ginger like gingerols have shown antioxidant activity in various modules.[25]

The present study was aimed to prove the effect of garlic or ginger or their combination when compared to standard herbal (Ayurslim) and synthetic (Sibudrex) anti-obesity drugs.

MATERIALS AND METHODS

CHEMICALS AND REAGENTS

Sibutramine hydrochloride (sibutrex10^{TM}) was purchased from British Drug House, India. Garlic, Ginger and ayurslim from the Himalaya Drug Company, Makali, Bangalore, India. All chemicals, reagents, substrates, solvents, enzymes and coenzymes used in the present study were of analytical grade (AR) and they were purchased from M/s. Sigma Chemical Company, USA, SISCO Research Laboratories Pvt. Ltd., India and Loba Chemie, Austria.

RECOMMENDED DOSAGE

Recommended dosage by Himalaya Drug Company for garlic tablets (250mg), ginger (400mg), Ayurslim tablets (400mg) for human. In a study weight maintenance with Sibutramine patients underwent a managed weight reduction phase with 10mg of Sibutramine daily. This dosage was extrapolated according to body weight of rats.

EXPERIMENTAL ANIMALS

The experimental protocol was approved by the Institutional Animal Ethics Committee(IAEC) of Bharathiyar University, Coimbatore which was registered with committee for the purpose of Control and Supervision of Experiments on animals (CPCSEA), (No. 722/02/a/CPCSEA). Adult female albino rats of Wistar Strain weighing about 180 – 200g were procured from Kerala Agricultural University, Kerala and acclimatized to our animal house conditions for 2 weeks. The animals were housed in well-ventilated animal house with constant 12 $\pm$1 hours light and dark schedule. They were provided with standard diet and clean water *ad libitum.* After acclimatization 35 rats were randomly divided into seven groups with five animals each group and subjected to respective treatment.

Group I : Control group - the rats received 0.9% saline orally.

Group II: Received vanaspathi orally (hydrogenated oil), 200mg/kg body weight.

Group III: Received 4.2mg of garlic capsules /kg bodyweight along with vanaspathi (hydrogenated oil).

Group IV: Received 7mg of ginger capsules/kg bodyweight along with vanaspathi (hydrogenated oil).

Group V: Received a combined dose of garlic + ginger (3.4mg of garlic and 2mg of ginger / kg bodyweight along with vanaspathi (hydrogenated oil).

Group VI: Received 7mg of ayurslim capsules/ kg bodyweight along with vanaspathi (hydrogenated oil).

Group VII: Received 0.17mg of sibudrex / kg bodyweight along with vanaspathi (hydrogenated oil).

EXPERIMENTAL PROCEDURE

The animals were weighed before and after treatment. Twenty four hours after the last treatment schedule the animals were sacrificed by decapitation method. Serum was separated immediately after the sacrifice by centrifugation of blood at 3000 x g for 30 minutes and stored at –20^{o}C until used for hormone assays and biochemical parameters. The animals were dissected out and heart was removed based on the guidelines of Hamilton (1975) (26). The organs were cleaned off adhering connective tissues and blood stains, washed in cold physiological saline thrice, blotted on a filter paper and weighed using electronic balance, wrapped in aluminum foil and stored at –20^{o}C in air tight glass containers until assayed for biochemical parameters. In the present study, the anti obesity effect was studied using the dietary cafeteria animal model of obesity as they have been reported to bear close resemblance to human obesity based on the study conducted by Harris, 1996 (27).

HAEMATOLOGICAL STUDIES

Red blood corpuscle, white blood corpuscle and were counted by the method of Samuel (1986) using haemocytometer. The haemoglobin concentration of blood was estimated by the method of Samuel (1986) (28) using Shali's haemoglobinometer.

STATISTICAL ANALYSIS

The data of every experiments were statistically expressed as mean ± standard error of mean (SEM).

The SEM was calculated by using the following formula. $SEM = \frac{\sigma}{\sqrt{n}}$

All the means observed by every treatment were compared by ANOVA and ranked by using Duncan's Multiple Range Test (DMRT) (Duncan, 1955) (29) for analyzing the significance of treatments at 1% and 5% level. The following package was used to calculate ANOVA and DMRT.

Irristat version 3/393, Biomatrics unit, International Rice Research Institute, P.O. Box 933, Manila. Philippines.

RESULTS AND DISCUSSION

Obesity is a global nutritional concern. The increasing prevalence of overweight, obesity and its consequences promoted the World Health Organization to designate obesity as a global epidemic (WHO, 1998). Obesity has serious long term consequences. Hypertension, hypercholesterolemia, type-2 diabetes mellitus, gall bladder disease, asthma, mental health concerns and orthopaedic disorders have been linked to obesity. Thus, there is an urgent need to address the problem and efforts should be made to prevent the epidemic of obesity and its associated health disasters (30).

People were making use of plants having discovered their beneficial and curative effects, long before scientific explanations were advanced. Plant remedies are harmless, provided they are selected carefully and taken under medical guidance. The natural products (herbal) have a milder effect on the system than the man-made one. Though synthetic drugs afford a faster rate of recovery, but the plant substances have a much more positive and lasting effects (31).

Effect on Body weight

Compared to the body weight of control group, administration of hydrogenated fat vanaspathi, the obesity agent had caused a significant ($P<0.01$) percentage of increase in the body weight of rats. The standard anti-obesity drug, sibudrex and herbal drug ayurslim administrations to the obese rats had caused a significant reduction in the body weight to below control values and ayurslims effect was more prominent than the effect of sibudrex.

When the herbal powders of garlic and ginger given singly or in combination were administered that also brought about an effective lowering of the body weight to near control levels only. The result suggests that development of high fat diet induced obesity. It has been reported that polyphenolic compounds, including mangiferin, catechins and tannins, may be involved in the anti-obesity effects through inhibition of lipid-metabolizing enzymes and enhanced lipolysis.

Amin and Nagy (2009) (32) reported that feeding rats on HFD significantly increased the final body weight and fat pad weights when compared to the rats fed on basal diet. The dietary ginger is known to stimulate digestion absorption of dietary fat in high fat fed situation by enhancing the secretion of bile salts and increasing the activity of pancreatic lipase. The beneficial effects of garlic can be attributed to diverse organosulfur compounds, including allicin derivatives. Allicin is a volatile compound and is highly unstable; it breaksdown into a series of compounds, such as sulfides, ajoene,vinyldithinins, and many others (33).

Ayurslim, the ayurvedic anti-obesity formulation is a combination of *Garcinia cambogia* contains hydroxyl citric acid reported to inhibit lipogenesis, *Commiphora wightii* known hypolipidemic and hypocholesterolemic compound, *Gymnema sylvestre* contains gymnemic acid- reduces the cravings for sweets and controls blood sugar levels and lowers the cholesterol levels), and *Trigonella foenum graecum* effectively reduces weight.

Effect on Liver and Kidney weights

In the present study, the weight of liver was increased nearly 25% that of the control after vanaspathi treatment (fig 2). The observed kupffer cell hyperplasia enlargement of central vein and dilatation of sinusoids due to lipid secretions might have resulted in an increase in cell mass which was reflected as a weight gain of the liver. Sibudrex and ayurslim had significant effect on liver weight of obese rats. Whereas, ginger and garlic + ginger extracts could effectively maintain the liver weights. Garlic extract alone could partially (15%) reduced the liver weight to control weight.

The kidney weight was increased by 15% in the obese group (fig3). Except treatments with ginger all other treatment groups showed no change in kidney weight of obese rats. Ginger and garlic combination was more effective in reducing the kidney weight of obese rats to normalcy.

Effect on RBC, WBC count and Hemoglobin concentration

In the present study, RBC count (fig 4), hemoglobin concentration (fig 6) ($P < .01$) and WBC counts (fig 5) were markedly raised by the induction of obesity. Ayurslim administration to the obese rats had decreased the RBC count (18%) and hemoglobin concentration (12%) than the obese rats. WBC count is nearer to normalcy. This effect is similar to those induced by garlic + ginger combination. Anti-obesity drugs ayurslim and Sibutrex10^{TM} were effective in restoring the RBC counts to near normalcy. Restoration of RBC by ayurslim might be due to the action of fenugreek. Sibutramine treatment might be associated with its enhanced insulin sensitivity (34).

Fig 1. Effects of Garlic, Ginger and their combination, Ayurslim, Sibudrex on body weights of female adult albino rats

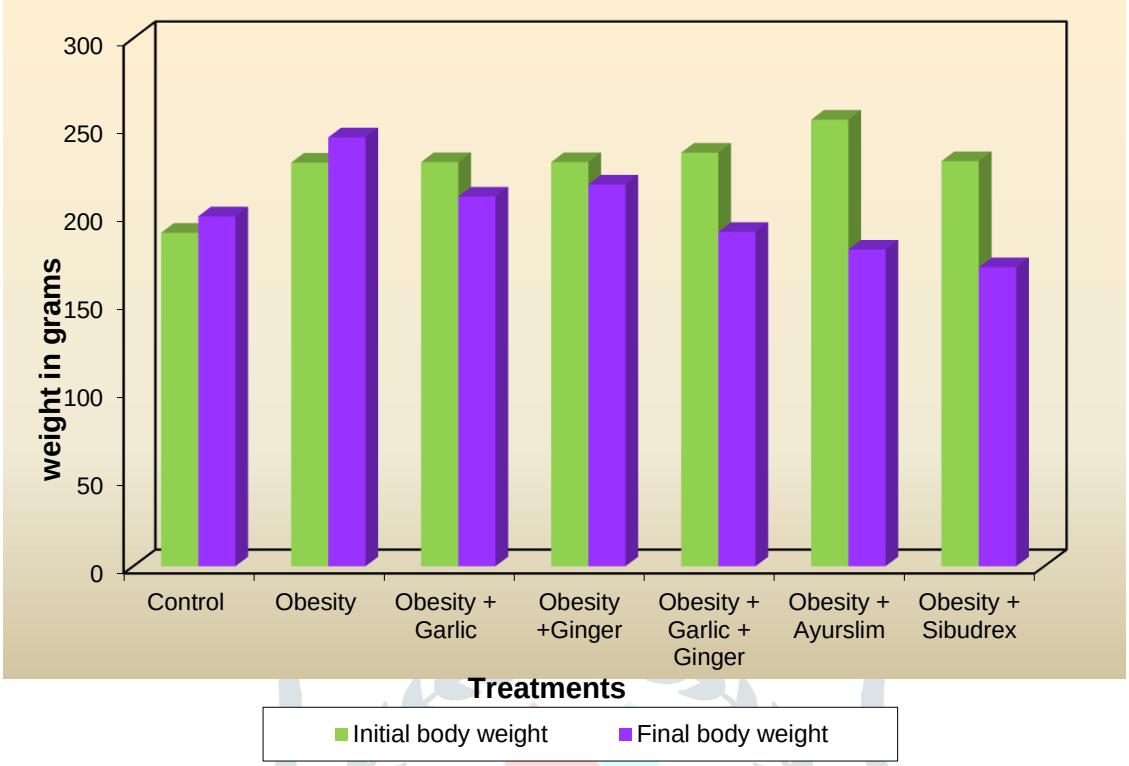


Fig 2. Effects of Garlic, Ginger and their combination, Ayurslim, Sibudrex on liver weights of female adult albino rats

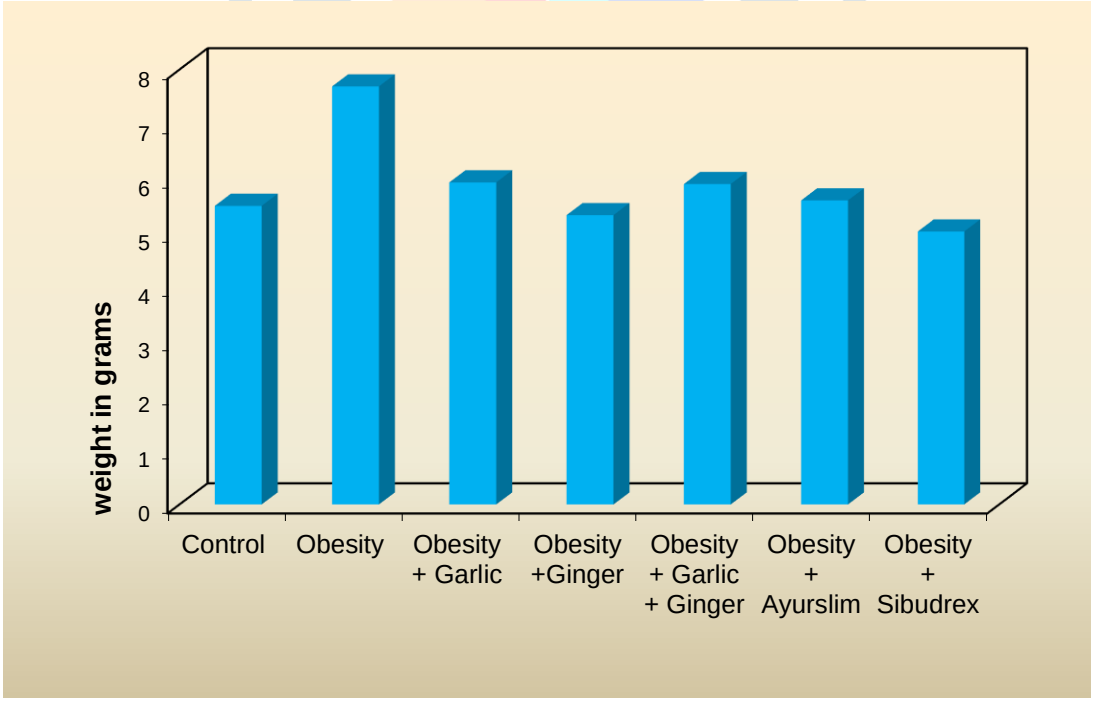


Fig 3. Effects of Garlic, Ginger and their combination, Ayurslim, Sibudrex on Kidney weights of female adult albino rats

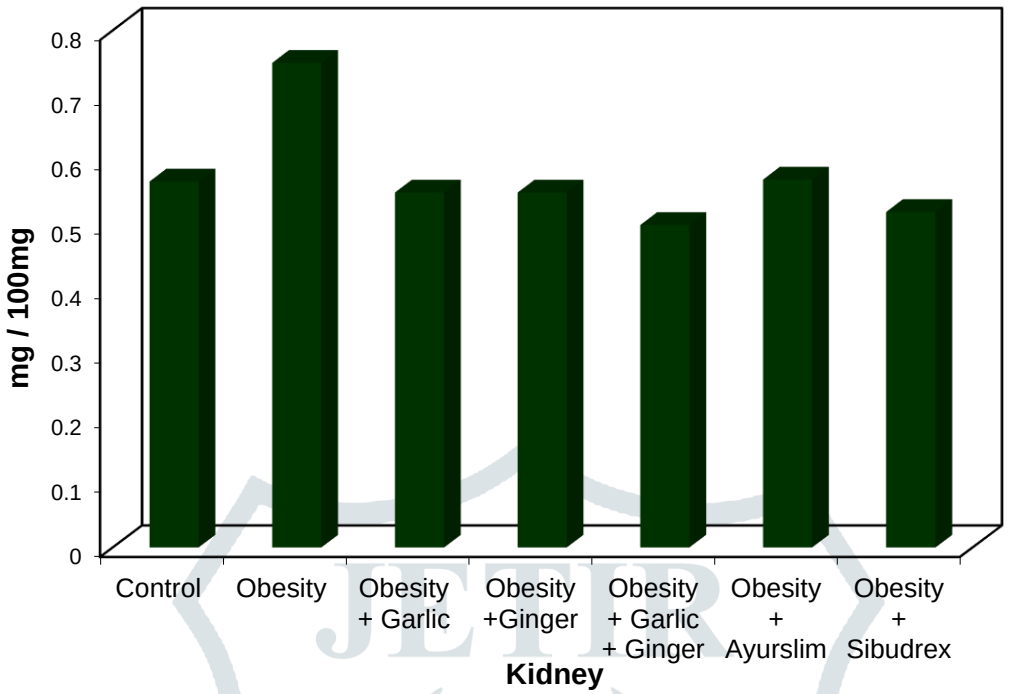


Fig 4. Effects of Garlic, Ginger and their combination, Ayurslim, Sibudrex on RBC count of female adult albino rats

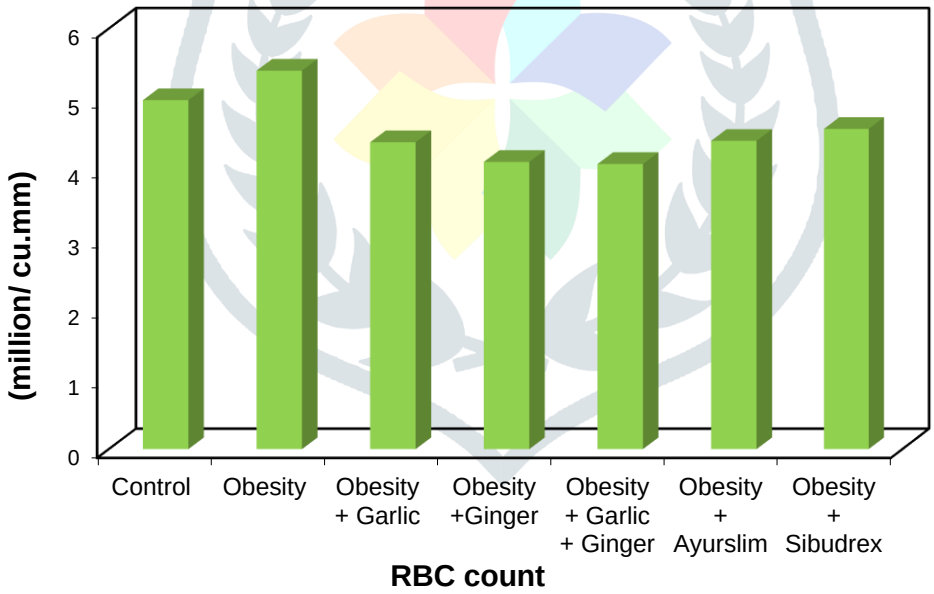


Fig 5. Effects of Garlic, Ginger and their combination, Ayurslim, Sibudrex on WBC count of female adult albino rats

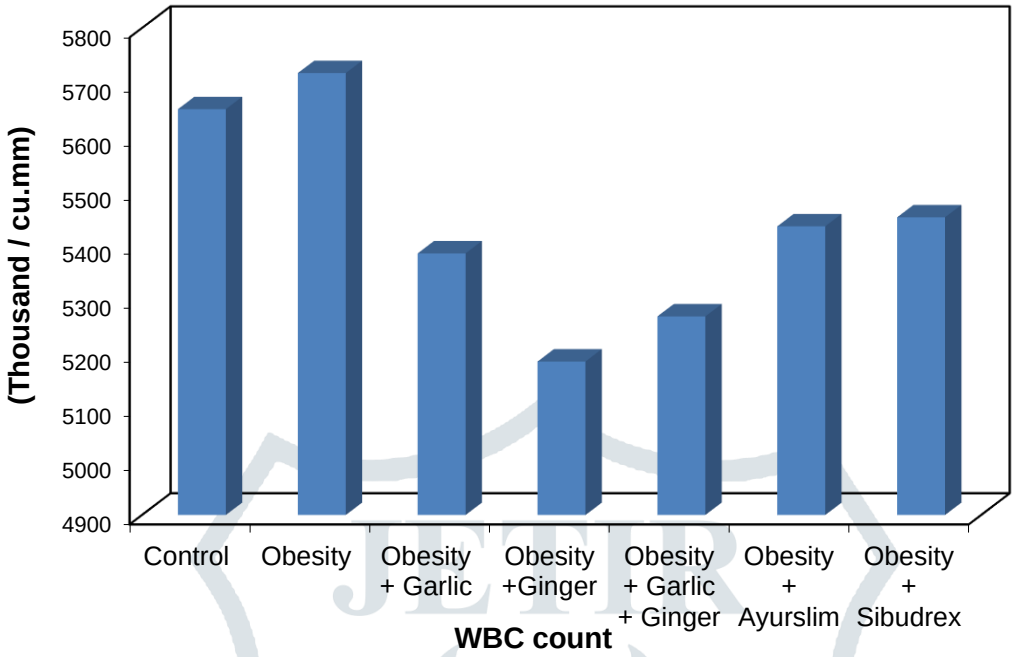
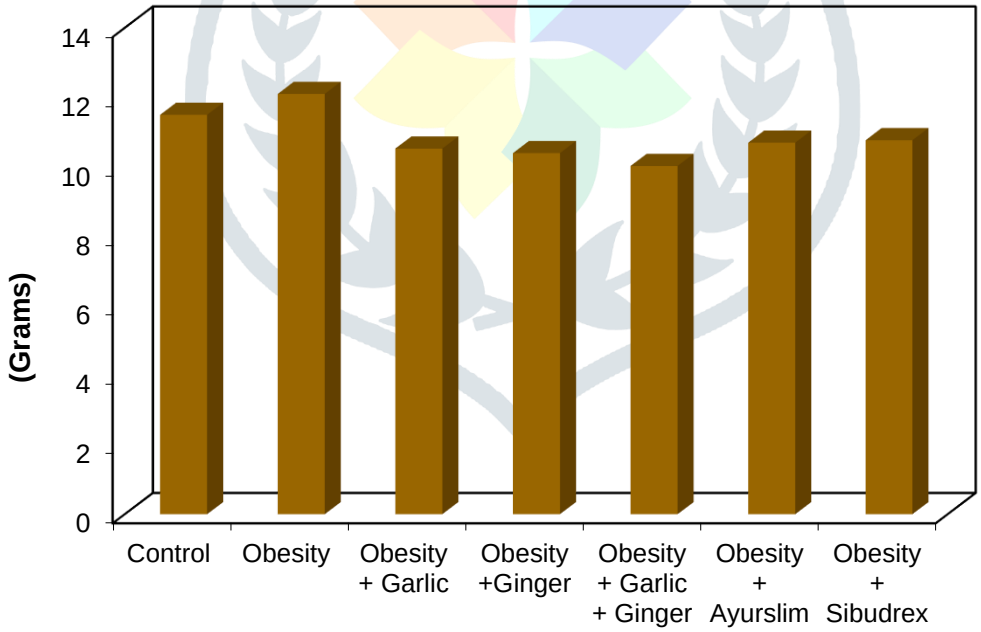


Fig 6. Effects of Garlic, Ginger and their combination, Ayurslim, Sibudrex on Haemoglobin Concentration of female adult albino rats



CONCLUSION

The ginger and garlic showed noteworthy protection from the HFD – induced metabolic disturbances by strongly suppressing the body weight gain and haematological changes. Thus the present finding emphasize that combination of ginger and garlic possesses potential medicinal value and hence its traditional consumption in foods as a spice is beneficial in the prevention of metabolic disorders caused by high fat diet.

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