Ginseng Holds Promise Against Obesity

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Abstract

Objectives: To determine the effects of ginseng on obese albino rats.
Methods: This study was intended to correlate the role of ginseng in reducing body weight, liver weight and size as well as fatty accumulation in hepatocytes of male albino rats weighing between 110g to 140g. This experiment was designed to study the morbid anatomy of an animal model. It was conducted in Animal house of Dow University of Health Sciences. Fifty male Albino Wistar rats were divided into 5 groups. Group1 (Gp 1) was on normal balanced diet (control), Group 2 (Gp 2) was on high fat diet (HFD), Group 3 (Gp 3) on HFD plus ginsenoside 100 mg/kg body wt., Group 4 (Gp 4) on HFD plus ginsenoside 200mg/kg body wt., and Group 5 (Gp 5) on HFD plus 400mg/kg body.
Results: Weight was increased to 146 g (Gp1) and 236g (Gp 2). Group 3 reduced weight from 236g to 211g. Group 4 to 192g and Group 5 to 171g. Liver weight is also increased by HFD from 4.7g (Gp 1) to 9.3 g (Gp 2). Liver weight decreased from 9.3g to 7.2g (Gp 3), 7.6 g (Gp 4) and 5.3 g (Gp 5). Due to deposition of fat in liver, cells enlarged and number of hepatocytes decreased per unit area of reticule. Number of hepatocytes in group 1 was 78.5, in group 2 WAS 38.3, in group 3 was 47.4, in group 4 was 53.8 andin group 5 was 67.7. Random blood sugar (RBS) was altered to 74.3 mg/dl in Gp1, 148 mg/dl in Gp2, 91 mg/dl in Gp3, 92 mg/dl in Gp4 and 69 mg/dl in Gp5.
Conclusion: The results of this study revealed that HFD is a major cause of obesity and it should be prevented by introducing ginseng as an anti-obesity in our life. This study concluded that ginseng root extract proves to be more potent as anti-obesity, anti-hyperlipidemic, anti-hyperglycemic and anti-oxidant.
Keywords: Obesity, High Fat Diet, Fatty Liver, Ginsenoside.
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Introduction

This is the era of civilization; machines make our life easy but physically inactive. A sedentary life-style and junk foods are the leading cause of obesity[1]. Obesity is increased in body weight more than BMI (body mass index). It is a ratio between body weight and height[2]. In this modern era, obesity is an alarming global health problem. It is the root cause of many diseases including metabolic syndrome (hypertension, coronary artery disease, fatty liver, and diabetes)[3].

Basically whenever the fat contents increase in our body leads to an increase in blood glucose level (hyperglycemia), increase in blood lipid levels (hyperlipidemia), formation of exosomes, and reactive oxygen species[4]. Furthermore, hyperglycemia leads to neuropathy, nephropathy, and retinopathy[5]. Hyperlipidemia is the root cause of coronary heart disease ends up inmyocardial infarction (M.I), cerebral artery disease ends up in stroke and hypertension is a silent killer[6]. Exosomes are bad DNA modifier leads to mutation then cancer[7]. Fatty accumulation causes insulin resistance as well as non alcoholic

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fatty liver disease. ROS (reactive oxygen species) causes oxidative stress to the remote tissues leading to insulin resistance and damaging pancreatic beta cells resulting in decreased insulin secretion[8]. Hunger and fatigue cause an urge to take food but as the tissue receptors are resistant to insulin, glucose cannot get entry into the tissues. This excess glucose is stored as fat in adipose tissues resulting in more depositions of fats, so fatty becomes fattier.

Ginseng is an herb easily found in Asia, Europe, Egypt, China and Korea. The ginseng plant was used in the traditional medicine of China. They used its different parts for the correction of many diseases. Ginseng root extract was more potent in reducing weight as compared to its leaf, flower, and stem extract. Ginseng works by activating adenosine monophosphate kinase (AMPK) which converts ATP into AMP[10]. By decreasing absorption of glucose from the intestine, it decreases the plasma glucose level[11]. It increases mitochondrial biogenesis which results in increased uptake of glucose by muscles. It increases fats oxidation in adiposites[12]. It increases insulin secretion by stimulating pancreatic beta cells[13]. It decreases gluconeogenesis by the liver by down-regulating thegenes-responsible-for enzymes required for gluconeogenesis[14].

Ginseng root extract decreases the plasma glucose level which in turn results in depletion of stored glycogen from the liver. When more glucose is required then fatty acids and glycerol are also oxidized and converted into glucose thus, reducing fatty deposition. As insulin sensitivity is increased, more glucose enters into the muscular cells foracting. As ginseng stimulates the beta-pancreatic cells to secrete more insulin. Hyperinsulinemia further reduces serum glucose level leading to the conversion of glycogen and fats into glucose. This results in reducing the glycogen and fat droplets from the liver.

This experiment correlates the administration of ginseng with the reducing body weight,liver weight and size, blood glucose levels, and fatty droplets in liver cells (hepatocytes).

Subject and Method

This animal study was conducted in the animal house of Dow University of Health Sciences (DUHS) in 2015 after approval from Institutional Review Board (IRB). The total duration of the study was 12 weeks of which 6 weeks were for preparing the obese model and 6 weeks for the treatment with ginseng root extract. The sample size was calculated through open epi, found 6 animals pergroup. We have taken 10 animals per group to reduce the chances of error. Only male rats of weight 120g to 140g were included in this study. Female rats, rats of weight less than 120g and higher than 160g were excluded. Animals were weighted initially at the time of starting the experiment and this was noted as the initial weight. Then they were weighed weekly and finally after 12 weeks was the final weight.

Fifty male albino rats were acclimatizedin the animal house of DUHS. Rats were divided into 5 groups, each had 10 animals. Group 1 was on a normal diet, groups 2,3,4, and 5 had taken HFD in the first 6 weeks; then groups 3,4 and 5 were treated with ginseng root extract for further 6 weeks and dissected.

The first group was on a standard diet containing the standard ratio of carbohydrates, proteins, and fats. The second, third, fourth and fifth groups were on HFD for the initial 6 weeks. It was prepared in the animal house by mixing animal fat, cheese, butter and standard diet containing wheat flour and proteins. So in a high fat diet, fats are in higher amount as compare to that in a standard diet.

The animals were sacrificed after 12 weeks; liver wasdissected out, weight and size were measured and then kept in formalin 10%. Tissue was processed and stained in haematoxylin and eosin (H&E) and Sudan black.

Ginseng root extract was prepared in a laboratory under the expert guidance. The extract was given orally with the help of nasogastric tube in potency of 100g, 200g and 400g to groups 3, 4 and 5 respectively. First 6 weeks' group 1 was on stan-

dard diet (control), group 2, 3, 4 and 5 were on high fat diet. Then after 6 weeks' group 1(control) and group 2 (obese control) were dissected and livers were isolated and saved in formalin. Groups 3, 4 and 5 were treating with ginsenoside in different potency for further 6 weeks. Then they were dissected and before dissection the final weight was noted.

Livers were weighed and the size, weight and morphological changes of different groups were compared. After dissection the livers were isolated and slides were made for histological assessments. Liver cells or hepatocytes containing fatty droplet became larger, so little cells are countable in unit area of reticule while hepatocytes containing less fatty droplets or small amount of fat content are smaller in size so the number of hepatocytes increases per unit area of reticule.

The data was analyzed using SPSS 16 Software. Data was statistically evaluated using One Way analysis of variance (ANOVA) test to evaluate the significance between various groups studied. Post hoc Dunnett t-test is applied to compare the groups. P-value of <0.05 is considered as statistically significant with 5% margin of error (α-error) with 95% confidence interval (C.I). The collected data was interpreted as Mean ± standard deviation (S.D.).

Results

Mean initial weight of group 1 rats were 123g, after 6 weeks of taking normal diet the final weight of Group 1 was 146g. Group 2 mean initial weight of 117g was changed to 236g after taking high fat diet for 6 weeks. Group 3 mean initial weight was 132g was changed after taking high fat diet for 6 weeks to 240g then treated with ginseng root extract 100mg/kg body weight for further 6 weeks, mean final weight after 12 weeks 112g was noted. Group 4 mean initial weight was 134g then after taking HFD for 6 weeks 246 g then treated with ginseng root extract for 6 weeks in dose of 200mg /kg body weight. Mean Final weight of Group 4 was 192g. In group 5 the mean initial weight was 134g, after taking HFD for 6 weeks it was 248g. Then they were treated with ginseng with dose of 400mg/kg body weight, and mean final weight was noted to be 171g.

There is a marked significant change in weight by taking high fat diet which was reduced by taking ginseng in different doses.

Animals were sacrificed after noting final weight, their livers were isolated.Gross morphological changes of the liver, the weight, size, color, and consistency were observed. Color of obese rat liver was dull and faded although the consistency wasthe same in all groups. Liver weight was increased by the high fat diet and reduced by ginseng in a dose-dependent manner. The liver size also increased by the high fat diet due to accumulation of fats in the form of fatty droplets.

Mean liver weight of group 1 rats were 4.7 mg, group 2 was 9.3 mg, group 3 was 7.2mg, group 4 was found to be 7.6, group 5 was 5.3 noted. The mean liver weight of the rats was noted to be 4.7g, 9.3g, 7.2g, 7.6g and 5.3g in groups 1, 2, 3, 4, and 5 respectively. Due to HFD the liver weight increased from 4.7g to 9.3g. While the liver weight was reduced from 9.3g to 7.2g, 7.6g, and 5.3g with the treatment of ginseng in doses of 100, 200 and 400mg/kg body weight respectively.

Fat increases the liver size and ginseng reverses it in a dose-dependent manner as shown in Table 1.

Due to fatty accumulation in hepatocytes, they increase in size. The number of hepatocytes per unit area of reticule is inversely proportional to the size of hepatocytes.

In group 1 the mean hepatocytes per reticule was 78.5. In group 2,which were on a fatty diet (control obese group), the liver cells (hepatocytes) containing fatty droplets resulting in large size of hepatocytes, so less number of hepatocytes are present in a unit area of reticule. Hepatocytes of group 3 were 47.4, of group 4 were 53.8 and group 5 were found to be 67.7 per unit area of reticule after treating rats with ginseng in different doses.

Table 1. Mean Size of liver of different groups

Rats	n	Mean	Standard Deviation	Standard Error	95% Confidence Interval for Mean Lower Bound	Upper Bound	Minimum Value	Maximum Value
GROUP1	10	19.2800	4.81844	1.52372	15.8331	22.7269	13.50	25.80
GROUP2	10	51.5500	19.79401	6.25942	37.3902	65.7098	25.50	90.00
GROUP3	10	35.4450	15.29260	4.83594	24.5053	46.3847	13.50	60.00
GROUP4	10	26.2800	8.78266	2.77732	19.9973	32.5627	10.20	40.00
GROUP5	10	16.7950	4.57544	1.44688	13.5219	20.0681	12.00	24.00

P- Value =0.000

Table 2. Mean Random blood sugar of different groups

Rats	n	Mean	Standard Deviation	Standard Error	95% Confidence Interval for Mean Lower Bound	Upper Bound	Minimum Value	Maximum Value
GROUP1	10	74.3000	11.40224	3.60571	66.1433	82.4567	64.00	98.00
GROUP2	10	148.8000	34.69486	10.97148	123.9808	173.6192	98.00	183.00
GROUP3	10	91.4000	14.90116	4.71216	80.7404	102.0596	70.00	111.00
GROUP4	10	92.1000	37.91936	11.99115	64.9741	119.2259	65.00	160.00
GROUP5	10	69.4000	5.08156	1.60693	65.7649	73.0351	64.00	82.00

P- Value =0.000

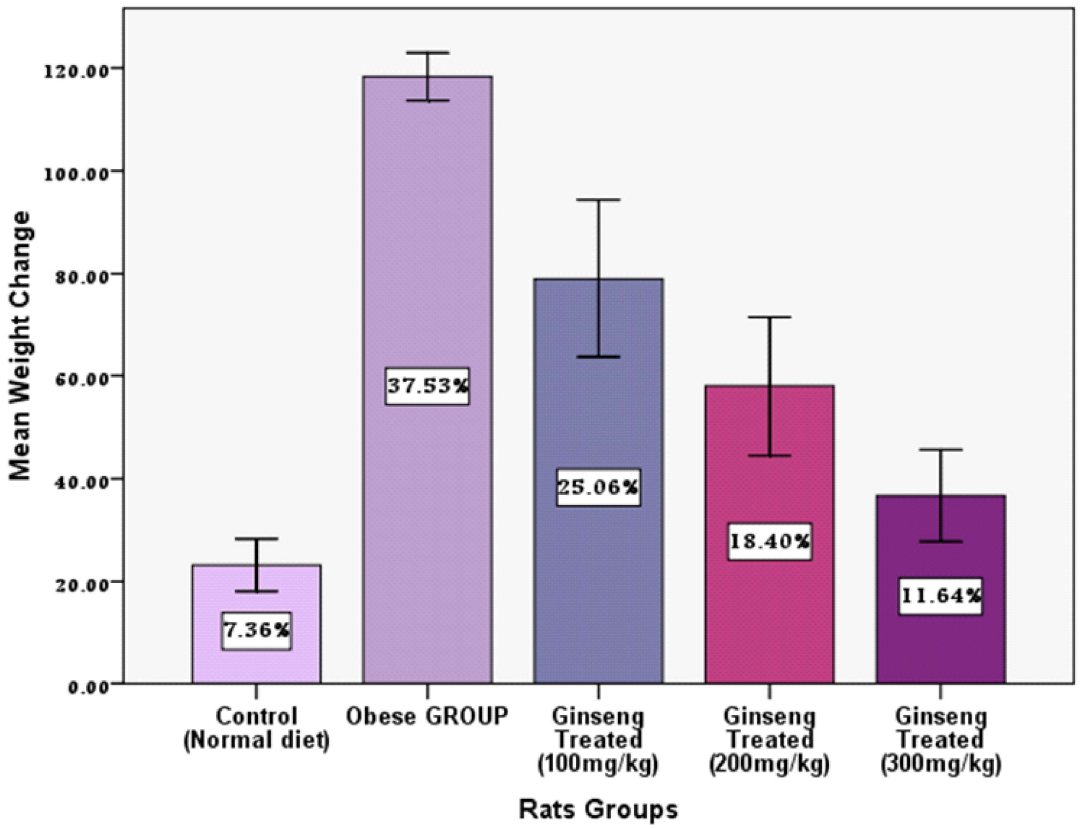

Fig 1. Change in weight in different groups.

It was also noted that fat increased the blood glucose level but ginseng acts as anti-hyperglycemic. It reduced its concentration and brought glucose levels near to normal.

The results revealed that high fat diet increased fatty droplets in hepatocytes, with remarkable increase in body weight, liver weight as well as liver size.

Discussion

Obesity is the root cause of many diseases. We have to fight against obesity for the prevention of diseases. Life style modification and ginseng are known to reduce blood glucose level and fatty deposition in liver. In this study we determined the effect of life style and ginseng on obesity.

There are many studies which focus on fats, the sources which increases fatty accumulation in cells like in this study[15]. Rats of group 2 that were the obese control group, gained significant weight (p- value = 0.0001). Chiefly, this study shows the effect of deep fried food and junk food in human[16]. In this era life style modification is in dire demand.

There are many other studies like the study done by Hall in 2017 in which carbohydrates are responsible for weight gain in contrary to our focus[17]. Excess food either carbohydrates like sweets, sugar beverages or cold drinks are also responsible for fatty accumulation but fats are focused in this study.

This is an animal study in which rats are used for experimental purpose, there are many studies in which rats are used as it belongs to mammals and its structure and functions are similar to humans, similar study was done by Benito in 2011[18]. Animal models give results in short time and these results are helpful for human treatment.

Ginseng is an herb widely used for the treatment of hyperglycemia, hyperlipidemia, hepatotoxicity, and obesity in china for many years as work done by Shalaby in 2013[19]. It has different parts: roots, stem, leaves, and flower used by researcher Qiu[20]. Ginseng roots were used for making its extract like the studies done by Sun[21]. Other parts also used by other researchers. However, ginseng root extract proved to be more potent than other parts as evidenced by the study of Pyo[22]. Chinese used ginseng in traditional medicine for a long time, some herbal medicine also has ginseng as a principle part. There is a dire demand to use ginseng in allopathic medicine.

The result of this study shows that Ginseng root extract reduced the fat contents significantly (p-value is 0.0001) from body by increasing fat metabolism in liver resulting in decreased in body weight, similar studies done by Cho in 2006[23]. Reducing body weight and fat deposition can lead to a better life with less chances of coronary artery diseases.

The study of Goda in 2008 shows there is no effect of ginseng on weight reduction in contrary to my study[24]. Other factors are also responsible for weight reduction like exercise, and quantity of food intake. Healthy life style included not only ginseng root extract but with proper healthy diet and exercises.

Using ginseng in the diet as salad or cooked vegetable, increases our metabolism and prevents the fatty deposition in liver. Reduction in weight of liver as well as size of liver by ginseng significantly that is p value is less than 0.0001. Fatty liver also reversed to its normal weight by depletion of fatty contents from hepatocytes like the studies done by park in 2009[25].

Conclusion

The results of this study revealed that HFD is a major cause of obesity and it should be prevented by introducing ginseng as anti-obesity in our life. This study concluded that ginseng root extract proves to be more potent as anti-obesity, anti-hyperlipidemic, anti-hyperglycemic, and anti-oxidant. It can be used for the treatment of obesity in humans.

Conflict of Interest

Authors have no conflict of interest and no grant/funding from any organization.

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