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Original Article

Diabetes Mellitus Type 2 and role of GINSENG as a Prevention and Control.

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Abstract:

Introduction: Diabetes is one of the most challenging diseases of this era. Improper dietary habits and sedentary life style are considered as the foundation stone for metabolic disorders including diabetes. Intake of large amount of animal fat leads to insulin resistance (IR) and oxygen radical formation.IR leads to increase glucose level in blood resulting in diabetes mellitus.

Objectives: This experimental study was intended to correlate high fat diet resulting in weight gain to diabetes and emphasized the role of ginsenoside in reducing body weight and blood glucose level by both increasing insulin secretion as well as increasing the sensitivity of insulin receptors.

Methodology: This is an experiment study on animal model, conducted at DUHS during the year 2017. It comprises of 50 male Albino Wister rats. They were divided into 5 groups for study purpose. Group1 was put on normal balanced diet and serve as control, while other 4 groups were treated with different diet. The animals were sacrificed after 12 weeks; blood sugar was monitored weekly for 12 weeks and finally at the end of experiment, there blood sugar level were estimated. Statistical analysis was done by using SPSS 16, using ANOVA test to evaluate the significance among groups. P-Value < 0.05 was considered as significant.

Results: The collected data was interpreted as Mean ± S.D. The results revealed that high fat diet increases blood glucose level, remarkably increase body weight as well as liver weight. By the administration of ginseng root extract significant decrease in body weight, liver weight and blood glucose levels was observed in dose dependent manner.

Conclusion: The results of this study revealed that high fat diet (HFD) is a major cause of metabolic syndrome including diabetes. It can be prevented by changing life style and introducing ginseng as anti-diabetic agent in obese.

Key Words: Diabetic mellitus, body weight, Ginsenoside

Introduction:

This Diabetes is one of the most challengeable diseases of this era, prevalence is increasing day by day.[1] Improper dietary habits and sedentary life style are considered as the foremost factor for metabolic disorders including diabetes[2]. Intake of large amount of animal fat leads to insulin resistance (IR) and oxygen radical formation. IR leads to increase sugar levels in blood resulting in diabetes mellitus[3]. Obesity is the alarming global problem leading to hyperglycemia which is the root cause of many diseases like neuropathy, nephropathy and retinopathy resulting in Am-

putation, renal failure and loss of vision respectively[4]. Deeply fried foods or junk food are main sources of fatty accumulation in body which covers the receptors for insulin[5]. Insulin cannot enter in muscles so without insulin glucose present in blood stream also is not usable for organs[6]. Therefore, level of blood glucose increases rapidly but due to intracellular deficiency, muscles, tissues and organs; the signaling, for hunger, to brain is continuous and consequently person appetite increases[7]. These cascade reactions resulting in more fatty deposition as there is impaired utilization and improper distribution of glucose or energy. Improper dietary habit and physical inactivity are considered the major risk for diseases like nonalcoholic fatty liver disease (NAFLD) and insulin resistance (IR)[8]. Insulin is the principle factor for the entry of glucose in cell. It binds with its receptor present on cell surface[9]. As it binds then gates open for glucose entry. Intracellular glucose undergoes metabolism resulting in ATP formation, providing energy for cellular function. In obesity receptors are not functioning properly so there is depletion of glucose inside the cell as well as high blood glucose levels[10].

This experimental study was intended to correlate high fat diet resulting in weight gain to diabetes and emphasized the role of Korean red ginseng (KRG) root extract or ginsenoside in reducing body weight and blood glucose level by both increasing insulin secretion as well as increasing the sensitivity of insulin receptors[11]. Ginseng is an herb which is easily found in Asia. The most important ingredient in ginseng is ginsenoside[12]. Ginsenoside is a glycosylated saponins found in the roots of ginseng plant. The dried form of Korean red ginseng (KRG) rich in saponins (panaxadiol and panaxatriol) was used in past for the prevention of many diseases like diabetes, hypertension, cancer, tumors, metabolic stress and liver toxicity. KRG alters the plasma and liver lipid concentration[13]. Ginsenoside has its action over AMP-activated protein kinase (AMPK) that converts ATP into AMP[14]. It decreases glucose absorption from intestine, decreasing plasma glucose level. Increase in mitochondrial biogenesis uptake of glucose by muscles. Fatty oxidation occurs in adiposities. It stimulates pancreatic beta cells to release more insulin[15]. It decreases gluconeogenesis by liver as down regulating the-genes-responsible-for enzymes of gluconeogenesis[16].

Objective:

To evaluate the effects of high fat diet (HFD) in prevention and developing of diabetes type 2.

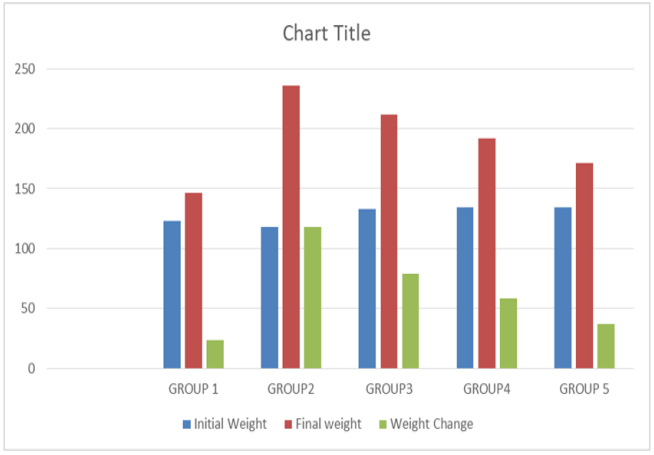
Methodology:

This experiment was designed to study the morbid anatomy of animal model. It was conducted at animal house of Dow University of Health Sciences, Karachi. 50 male Albino Wistar rats weighing 100 -120 grams plus minus 10 grams were selected for the study. They were divided into 5 groups. Group1 was on normal balanced diet (control), Group 2 was on high fat diet (HFD), Group 3 on HFD plus ginsenoside 100 mg/kg body wt., Group 4 on HFD plus ginsenoside 200mg/kg body wt. and Group 5 on HFD plus 400mg/kg body. The animals were sacrificed after 12 weeks; blood was drawn weekly for 12 weeks for the estimation of blood glucose levels.

Statistical analysis was done by using SPSS 16, using ANOVA test to evaluate the significance among groups. P-Value < 0.05 was considered significant. Post hoc Dunnette t test was applied to compare the groups.

Results:

This experimental study on animal model was done by measuring weight of rats weekly for 12 weeks. Change in weight was calculated by the help of initial and final weight. There was significant increase in weight in group 2 due to fatty diet without ginseng. Group 3, 4 and 5 demonstrate decrease weight due to ginsenoside in dose of 100, 200, and 400 mg/kg body weight respectively as shown in fig 1.



Graph 1: Initial, final and change in weight of rats during study.

Table 1. Mean of Random blood sugar of rats groups								
Rats	**n**	**Mean**	**Standard Deviation**	**Standard Error**	**95% Confidence Interval for Mean**		**Minimum Value**	**Maximum Value**
					Lower Bound	**Upper Bound**		
GROUP 1	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
GROUP 5	10	69.4000	5.08156	1.60693	65.7649	73.0351	64.00	82.00

ANOVA represents significant p value so post hoc Dunnett t test was applied

Table2. Analysis of variances of Random blood sugar of rats groups					
Random blood sugar	**Sum of Squares**	**Degree of freedom**	**Mean Square**	**F- test**	**P- value**
Between Groups	39994.600	4	9998.650	16.557	.000
Within Groups	27175.400	45	603.898		
Total	67170.000	49			

Table 3: Post Hoc Multiple Comparisons Dunnett t Test of Random blood sugar						
(I) group	**(J) group**	**Mean Difference (I-J)**	**Std. Error**	**p value**	**95% Confidence Interval for Mean**	
					Lower Bound	**Upper Bound**
GROUP2	GROUP 1	74.50000*	10.98998	.000	46.6811	102.3189
GROUP3	GROUP 1	17.10000	10.98998	.348	-10.7189	44.9189
GROUP4	GROUP 1	17.80000	10.98998	.314	-10.0189	45.6189
GROUP 5	GROUP 1	-4.90000	10.98998	.976	-32.7189	22.9189
GROUP3	GROUP2	-57.40000*	12.01973	.000	-86.8740	-27.9260
GROUP4	GROUP2	-56.70000*	12.01973	.000	-86.1740	-27.2260
GROUP 5	GROUP2	-79.40000*	12.01973	.000	-108.8740	-49.9260

Blood Glucose Level:

Blood was drawn from tail of rats weekly and random blood sugar was checked by using glucometer. Finally, at the end of 12th week blood was drawn from cardiac puncture to measure blood glucose levels. Mean glucose levels of each rat was noted then mean glucose level of each group was also calculated. (Table 1). Table 2 and 3 showed variation in different groups and multiple comparisons of these groups by post hoc analysis respectively.

The collected data was interpreted as Mean ±SD. The results revealed that high fat diet increases blood glucose level, remarkably increase body weight. By the administration of ginseng root extract significant decrease in body weight and blood glucose levels were observed in dose dependent manner. Ginsenoside had a prompt effect on reducing body weight by reducing fat contents of body as well as blood glucose level by increasing entry of glucose in cell.

Discussion:

Metabolic syndrome like diabetes, obesity and cardiovascular diseases are more common in this modernized era. Fatty diet, less exercise and stresses are the seeds of metabolic syndrome.[17] Sedentary life styles are responsible for fatty changes in liver causing non-alcoholic fatty liver disease (NAFLD) and insulin resistance (IR), both leads to diabetes mellitus (DM)[18]. High fat diet increases blood glucose level as shown by the experiment of Ikemoto[19], a finding observed in this study as well where rats feed HFD showed hyperglycemia. But in the studies of Musselman[20] carbohydrates are more responsible for increasing blood glucose level as well as triglyceride level as compare to high fat diet. Diabetes is one of the most common and most flourishing disease to be prevented and cured. It is estimated that in next twenty years Pakistan will be 4th having highest number of Diabetic patients and therefore preventive efforts including use of herbal products are desirable[21]. Ginseng widely used in traditional herbal medicine for the cure of diabetes.[22] We focused, like other researcher[23,24], on prevention of diabetes, therefore experimental animal chosen were non diabetic and feed HFD with or with ginseng. We observed preventive effects of ginseng against fatty liver changes and blood glucose. A dose dependent beneficial effects of ginseng identified similar to other study[24]. There are many studies which highlighted the importance of ginseng as it improves quality of life[25]. The use of ginseng in human is safe as it is easily absorbed, metabolized and distributed, without giving any harmful effects. Literature shows that ginseng is beneficial for the treatment of diabetes as well[26]. Even extract of ginseng leaves are beneficial for the management of diabetes as shown by Chang-Hwa Jung et al[27]. For current study rats were used, however comparable results have been shown when mice are used[28]. Ginseng when used in humans for prolong period of time has no deleterious or harmful effects[29].

Conclusion:

The study provides evidence that Ginsenoside has anti-obesity and anti-hyperglycemic effects. The results of this study revealed that HFD is a major cause of metabolic syndrome including diabetes. It can be prevented by changing life style and introducing ginseng as anti-diabetic agent and for the control of obesity. However, experimental studies using other parts of ginseng plant like flower, stem, leaves and fruit are desirable, results if found identical to current study will further increase our confidence.

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