Original Article

Fatty Diet

In-House Prepared High Fat Diet (HFD) Can Cause an Increase in Body Weights of Male Albino Wistar Rats in a Short Period of 2-3 Weeks

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ABSTRACT

Objective: The current study was designed to evaluate the effects of the in-house prepared high fat diet (HFD) on body weights of rats.

Study Design: Comparative, Experimental Study

Place and Duration of Study: The study was conducted at Institute of Basic Medical Sciences (IBMS), Dow University of Health Sciences (DUHS), Ojha Campus, Karachi in a period of 2-3weeks.

Materials and Methods: The study was conducted on 20 male albino Wistar rats which were randomized into 2 groups; each group containing 10 rats. HFD-fed rats were kept on in-house prepared HFD and water ad libitum throughout the study. While control / Non-HFD fed rats were kept on standard diet and water.

Results: SPSS (version 16.0) was used in the study analysis. The mean difference in body weights of rats was analyzed by using ANOVA. The results are expressed as mean ± SD. The results report that there is statistically significant difference (P-value < 0.001) between HFD-fed and non HFD-fed groups.

Conclusion: HFD-fed group gained significant weight when fed an in-house prepared diet in comparison to non HFD-fed group in 2-3 weeks.

Key Words: High fat diet; insulin resistance; obesity; obese rat model; metabolic disorders.

INTRODUCTION

In every era and more in the modern era, improper dietary habits and physical inactivity are considered as a foundation stone for obesity and hence, for many more diseases. Overweight and obesity are the fifth leading risk factors for global deaths.[1] Obesity is a disorder in which excess body fat has accumulated. The condition is a attention seeking disorder as it is a cause of increase morbidity and mortality,[1] Obesity is a leading preventable cause of death worldwide, with increasing prevalence in adults and children, and authorities view it as one of the most serious public health problems of the 21st century.[2] Obesity has reached epidemic proportions globally, with at least 2.8 million people dying each year as a result of being overweight or obese. Once associated with high-income countries, obesity is now also prevalent in low- and middle-income countries.[3]

Use of excessive fat in diet and no exercise makes a person obese which gives birth to lot more diseases like diabetes mellitus type 2 (DM2), fatty liver disease, cardiovascular diseases, etc. Worldwide there has been a large shift towards less physically demanding work, and currently at least 30% of the world's population gets insufficient exercise. This is primarily due to increasing use of mechanized transportation and a greater prevalence of labor-saving technology in homes.[4]

In view of above facts, the need for research in this area is increased markedly. To study the clinical course of common obesity related disease like diabetes type 2, fatty liver disease, cardiovascular disease, etc., animal models are best suited because they are cost effective, time saving and easily available compared to human tissues which is not readily available.[5] Obese animal models are the need of the time for understanding the pathogenesis underlying the obesity and diet related diseases.

The role of increased fat intake in the prevalence of overweight and obesity has been well proven. As most human diseases driven by diet, fatty livers and obesity in rodents is also diet-inducible. Different dietary approaches (likely working by different mechanisms) are available having their own advantages and disadvantages. Body weight of rodents can be increased by feeding a methionine and choline-deficient (MCD) diet, a choline-deficient diet (CD) or a high-fat diet (HFD).[6]

High fat diets (HFD) have shown to produce fatty liver in animals,[7, 8] as well as humans.[9] This special high calorie diet causes significant increase in body weight as well as the body and liver fat in rodent models within days and such a rapid fatty infiltration of liver is associated with hepatic insulin resistance (HIR).[10] In

animals, fatty liver can also developed by methionine choline deficient diet (MCDD), but when the results of both diets are compared, HFD feeding produces only mild steatosis and no liver fibrosis.[6,11,12] while MCD diets cause marked steatosis in 2-4 weeks, but does not make animals insulin-resistant.[13,14] HFD feeding induces HIR which contributes to an increase glucose production which results from breakdown of glucose that is stored as glycogen and the production of more glucose molecules from essential nutrients (gluconeogenesis). Various human and animal studies have proved that peripheral glucose uptake is reduced and endogenous glucose production is suppressed in response to insulin. Obesity, increase plasma Free Fatty Acids and Insulin Resistance develops as a result of HFD and are considered to be risk factors for HS and interestingly, each of these metabolic factors are also characteristic of DM2.[15]

MATERIALS AND METHODS

Animals: The study was done 20 Wistar albino male rats. All procedures of the study are approved by the Institutional Review Board (IRB) of Dow University of Health Sciences.

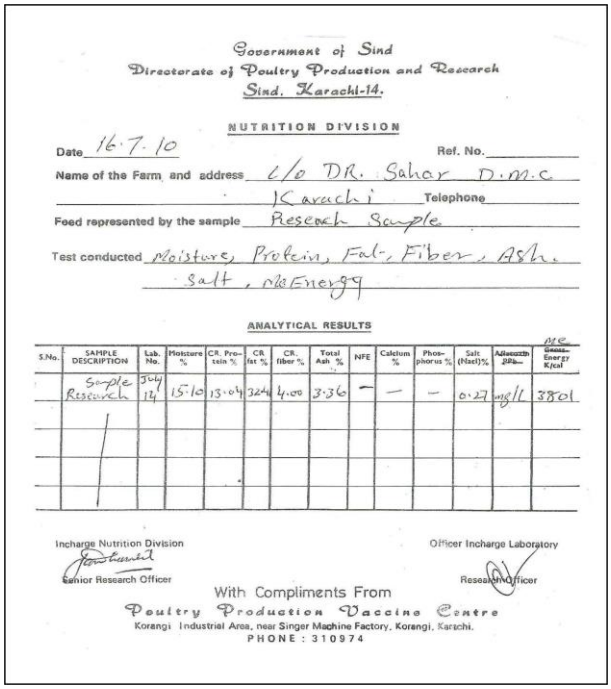
Methodology: Six-eight weeks old (average body weight 160 ± 20gms) twenty albino rats were taken from central animal facility of DUHS. A group of five rats were housed in a single clear sided plastic cage as the maximum capacity of the animal cage is 5-6 rats. All rats were kept at room temperature 30 ± 1^{0}C with a 12 hour light and dark cycle and were given balanced in-house prepared diet and water ad libitum, before any dietary manipulation. One week before the beginning of the experiment, the rats were kept under observation for assessment of their health condition to rule out diseased rats. Each rat in a cage was given a specific color in order to maintain identity. All rats were weighed on a digital scale at the beginning of the experiment and weekly until sacrificed.

Control rats (n=10) were given free access to water and in-house prepared standard diet while the other rats were kept on in- house prepared HFD for 4 weeks. Body weight of all rats was noted weekly.

Preparation of high fat diet: The special high calorie diet was prepared in Animal House Facility, DUHS. The diet has beef tallow, cheese and butter as the major ingredients. In-house prepared high calorie diet was composed of 32% calories as fat, 13% calories as proteins and rest of the percentage is of carbohydrate and fiber. The HFD was analyzed by Poultry Research Institute (PRI). The HFD composition formula and diet analysis report by Poultry Research Institute is given below:

Table No.I: HFD composition formula

Ingredients	Diet (g/kg)
Butter	100
Yeast	1
Cheese	200
Beef tallow	250
Normal diet*	400
Vitamin mineral mix	60
Methionine	3
NaCL	1
Total	1000



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Date 16.7.10 Ref. No.

Name of the Farm and address c/o DR. Sahar D.M.C Karachi Telephone

Feed represented by the sample Research Sample

Test conducted Moisture, Protein, Fat, Fiber, Ash, Salt, ME Energy

ANALYTICAL RESULTS

S.No.	SAMPLE DESCRIPTION	Lab. No.	Moisture %	CR. Protein %	CR. fat %	CR. fiber %	Total Ash %	NFE	Calcium %	Phosphorus %	Salt (Nacl)%	Aflatoxin PPB	ME Gross Energy K/cal
	Sample Research	304/14	15.10	13.04	3.24	4.00	3.36	—	—	—	0.27	mg/L	3801

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Statistical Analysis: The difference in body weights of control and HFD fed rats were statistically analyzed by using ANOVA. A P-value of < 0.001 was considered as statistically significant. Analyses were conducted by using SPSS for windows versions 16.0. Means were taken for each variable.

RESULTS

The current study was designed to evaluate effects of high fat diet on weight of body. The body weight of rats showed a significant increase throughout the experiment in HFD fed group in comparison to control group. The following table of body weights gives the clear picture of the trends followed by both group during 2-3weeks.

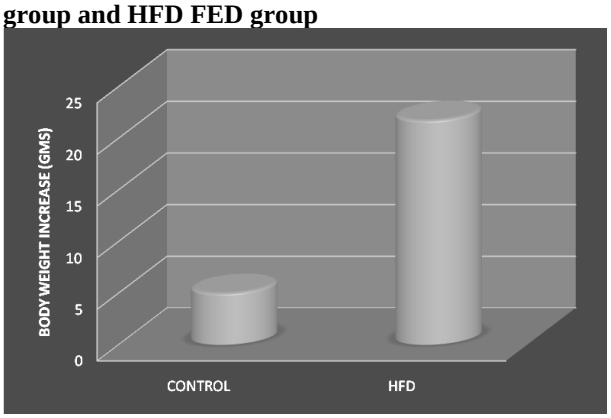
The control rats showed a sight increase in bodyweight approximately 3-4 gms per week. Other rats were fed a palatable diet rich in saturated fats (32% fats) and the rats were kept on this special diet throughout the experiment till they were sacrificed. The HFD rats gained approximately 20-25 gms per week.

Table No.2: Mean Body Weight of Rats During the Experimental Period

GROUPS	Body weight 1st week	Body weight 2nd week	Body weight 3rd week	Body weight 4th week
	GMS	GMS	GMS	GMS
A	230.25 ± 8.41	234.5 ± 8.00	238.85 ± 7.97	243.2 ± 8.31
B	254.65 ± 8.10	275.4 ± 10.51	280.3 ± 10.92	285.2 ± 11.48
P-VALUE	0.001	0.001	0.001	0.001

Table 2: Results represented as mean ± S.D; abbreviations denote: A-Control group, B- HFD fed group (P value at 0.001 is significant)

Table No.3: Graphical comparison between control group and HFD FED group



DISCUSSION

We have entered into an era of modernization in which our lives have become more comfortable with the advent of machines. But, on the other hand, life is heading towards more stress, unhealthy eating and physical inactivity. All these ill-habits have sown seeds for stress-related diseases like cardiovascular diseases, diabetes, fatty livers and many more. The present study is more focused on the cost-effective way of making rats obese. The blend of dietary manipulation and chemicals was used to make a perfect experimental model of DM2 as done previously by many renowned scientists.[16, 17, 18] It is the known fact that introduction of HFD in meals of rats create an animal model with glucose intolerance and IR.[6-8,19] In this study, beef tallow, butter and cheese was used to increase body weight of rats. The ingredients used to formulate HFD are comparable with the fat diets used in previous study for this purpose (Srinivasan K, et al 2005).[16] The HFD fed animals have shown an increase in blood glucose as well as an increase in body weight within a period of 2-3 weeks. The rats given HFD gained 20-25 gms more weight as compared with control rats which gained 4-5 gms per week. The reason for the significant increase in body weight is consumption of high calorie diet and deposition of fat throughout the body as a consequence. This mechanism almost simulates the way the humans develop DM2. This method of induction of DM2 is used by many researchers to create diabetic models as it is simple, time saving and economical. [16, 5, 20]

CONCLUSION

It is concluded from the study that the in-house prepared high fat diet can increase body weight of rats in a period of 2-3 weeks.

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