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RESEARCH ARTICLE

RELATIONSHIP OF HDL LEVELS WITH NUMBER OF HEAVY MEALS PER DAY IN OFF SPRINGS OF PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

Background: Patients with Diabetes mellitus (DM) develop low levels of High Density Lipoprotein (HDL) during the initial progression of disease. This study was aimed to analyze the relation of HDL with number of heavy meals per day in off springs of patients with type 2 DM. A large number of pathologies such as type 2 DM, obesity, Insulin resistance and Metabolic syndrome are associated with low and dysfunctional HDL
Methods: A total of 120 cases and 120 controls completed the study. Cases and Controls were divided into three groups based upon the intake of number of heavy meals per day. **Results:** In group I, mean HDL of cases was 31.54± 7.96 where as that of controls was 49.58 ± 6.24. Similarly in group II, mean HDL of cases was 21.85 ± 4.52 where as that of controls was 49.28 ± 6.92. In group III, mean HDL of cases was 21.08±5.50 and of controls was 46.69± 4.57. **Conclusions:** There is a positive, significant and inverse relationship of HDL and number of heavy meals per day in the off springs of patients with type 2 diabetes mellitus; higher levels of HDL being associated with lesser intake of heavy meals and vice versa.

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INTRODUCTION

This study was aimed to analyze the relation of HDL with number of heavy meals per day in off springs of patients with type 2 DM

HDL core consists of cholesteryl Ester and Triglycerides. This core is surrounded by an amphipathic layer of free cholesterol, Apo lipoproteins and phospholipids (Eva *et al*., 2009). The principle function of HDL particles is to transport from peripheral cells to liver (Bruce *et al.,* 1998). HDL particles express the following actions (Rashid S *et al*., 2009):

- Anti-atherogenic action
- Anti –inflammatory action
- Anti- oxidative action
- Anti platelet aggregatory action
- Improvement of endothelial function.

High and functional HDL has been found to be associated with a low risk of incidence of a number of pathologies including type 2 diabetes mellitus, obesity, metabolic syndromes and cardiovascular risks (Gordon Rifkind, 1989, Ford *et al*., 2002; Hoang *et al.,* 2007).

Certain factors such as exercise and intake of omega- fatty acids and fibres have been observed to increase HDL levels in the blood (Durstine *et al*., 2001, Schaefer *et al*, 1981). Insulin resistant states have also been associated with low HDL concentration in the blood (Haskell WL *et al.,* 1984; Despres *et al*., 2000, Haffner *et al.,* 1990).

Many studies have been aimed to study the relationship between type 2 diabetes mellitus and lipoproteins. In one such study it will observe that small HDL particle size as well as low levels of HDL in the blood were associated with type 2 diabetes mellitus, hyperinsulinemia and hypertriglyceridemia (Ginsberg HN, 2000). Increased VLDL and Apo lipoprotein- B has been observed in patients with type 2 diabetes mellitus (Evans *et al.,* 1999). Certain enzymes such as hepatic lipase can induce overt catabolism of HDL resulting in its abnormal form (Syvanne *et al.,* 1995).

Obesity is one of the major risk factors in development of Type 2 Diabetes Mellitus. It poses a threat to the cardio metabolic

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health. Individuals can be classified as Normal, overweight or obese depending upon their Body mass index (BMI).

There are many studies relating obesity and sedentary lifestyle for chances of developing diabetes. Obesity, which is an insulin resistant state, is also characterized by increased fasting plasma insulin as well as increase response of insulin to oral glucose load. A lower risk of diabetes has been observed in individuals who have a BMI of < 21kg/m^2 (O'Rahilly, 2009). Similarly, other studies relate weight loss and increased physical activity to a decreased risk of development of T2DM in those individuals who are an increased risk of diabetes (Pan *et al*, 1997).

Certain studies revealed increased risk in subjects with a BMI of >24kg/m^2, which is well below the obesity standards. Thus, even men of average weight are substantially more likely to develop diabetes than men with a BMl <23.0 kg/m^2 (Ohlson *et al*, 1988, Fujioka *et al* 1991, Deibert, DeFronzo, 1980, Schutz, Tremblay, 1981). According to an estimate by the World Health Organization (WHO) in the year 2005, four hundred million adults were found out to be obese among a total of 1.6 million over weight adults. In India approximately 11% individuals are considered to be overweight, out of which around 2% have been observed to be obese. Females have been observed to be more obese than males especially in the developing countries (WHO, Low, 2009). On the other hand, studies done by the International obesity task force (IOTF) on children worldwide revealed that as many as one fifty five million children are either overweight or obese. Around 10-25% among these are overweight whereas around 2-10% are obese.

MATERIALS AND METHODS

Sample Collection

Blood samples were collected in a fasting state from healthy subjects in EDTA vials kept in ice, centrifuged immediately and plasma was stored at -20°C until assayed. All basal parameters like Fasting blood glucose, Insulin, Glycosylated Hemoglobin (HbA1c) and were estimated in the sample Blood samples for plasma glucose were collected in potassium oxalate/ sodium fluoride vials.

Ethical Approval

The study was approved by the institutional ethics committee as per ICMR guidelines. Written informed consent was obtained from all subjects who wished to participate in the study. In case of children less than 18 years, consent was obtained from one of the parents and verbal assessment of the child was also done.

Inclusion and Exclusion Criteria

All non-diabetic children and grandchildren of the index cases were included in the study. Subjects diagnosed with diabetes or other systemic disorders and pregnant women were excluded. Controls comprised normal subjects without a family history of diabetes in two generations. The controls were normal in all aspects except for minor ailments. Details of medical history were collected and physical examination including anthropometry was performed. Height was measured with a Stadiometer to the nearest centimeter and weight was also measured. BMI was calculated as weight (kg) divided by the square of the height in meters. A value of 25 or more was considered as overweight for the adult population for BMI. For children and adolescents up to 18 years cut-offs recommended by the International Obesity Task Force (IOTF) were used (Cole *et al.,* 2000).

Size

One hundred and twenty one subjects with family history of DM volunteered for the study and were enrolled as cases and one hundred twenty one matched subjects without family history of DM were enrolled as controls.

Statistical Analysis

The statistical analysis was carried out using SPSS version 16 software and the technique applied was student t-test to compare continuous data in two groups. Log transformation was applied to the skewed data. A chi square test was done to evaluate the difference in frequency between the two groups.

RESULTS

A total of 120 cases and 120 controls completed the study. Cases and Controls were divided into three groups based upon the intake of number of heavy meals per day. Group I included forty cases and forty controls who would take only one heavy meal per day. Group II included another forty cases and forty controls who would take two heavy meals per day and lastly Group III included another forty cases and controls who would take as many as three heavy meals per day. These three separate groups were evaluated for various parameters especially HDL. In group I, mean HDL of cases was 31.54± 7.96 where as that of controls was 49.58 ±6.24. In group III , mean HDL of cases was 21.08± 5.50 and of controls was 46.69 ± 4.57.

Table 1. Mean HDL of Cases and Controls in group I

	Mean HDL	Min-Max
Cases	31.54 ± 7.96	8 - 49
Controls	49.58 ± 6.24	31 - 66

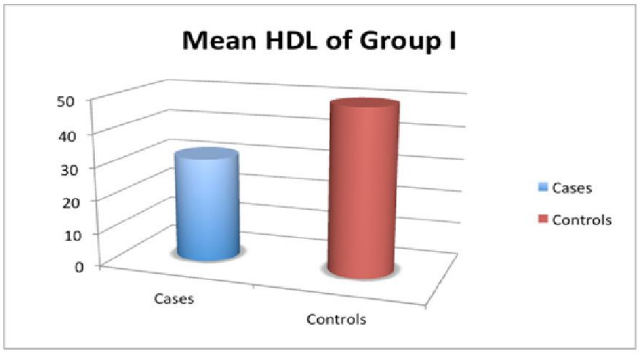

Figure 1. Mean HDL of Cases and Controls in group I

Similarly in groupII, mean HDL of cases was 21.85± 4.52 where as that of controls was 49.28 ± 6.92.

Table 2. Mean HDL of Cases and Controls in group II

	Mean HDL	Min-Max
Cases	21.54 ± 4.52	19 - 46
Controls	49.28± 6.92	20 - 69

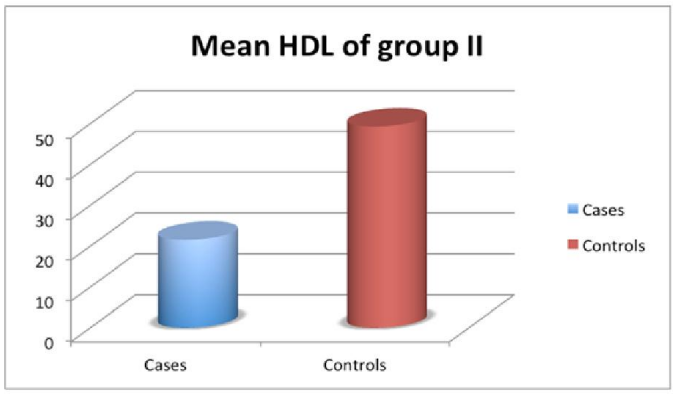

Figure 2. Mean HDL of Cases and Controls in group II

In group III, mean HDL of cases was 21.08± 5.50 and of controls was 46.69 ± 4.57.

Table 3. Mean HDL of Cases and Controls in group III

	Mean HDL	Min-Max
Cases	21.08 ± 5.50	20 - 42
Controls	46.69 ± 4.57	42 - 54

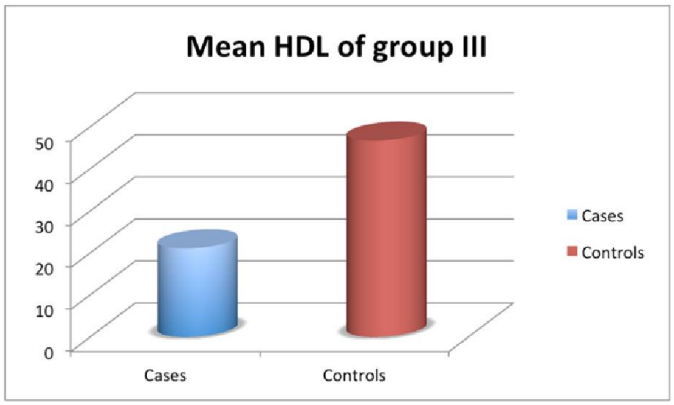

Figure 3. Mean HDL of Cases and Controls in group III

On statistical analysis, p value was calculated to be 0.034. Since p<0.05 was considered to be significant, p value for comparison between cases and controls on the basis of heavy meals per day was statistically significant.

DISCUSSION

The main aim of study was to observe the relationship, if any, between HDL levels at the number of heavy meals per day in off springs of patients with type 2 diabetes mellitus. To the best of our knowledge no such study has been done previously. Frequency of meals is an important aspect of nutrition, with profound effects on human health and lifespan. Excessive energy intake is associated with an increased incidence of chronic diseases including diabetes and is a leading cause of disability and death in Western countries (Visscher *et al*, 2001). A hypoenergetic diet is crucial for both the prevention and treatment of type 2 diabetes. It is usually consumed as five or six small meals per day. Eating more frequently is presumed to reduce hunger and thus reduce energy intake and body weight. However, the effects of meal frequency on human health and longevity are unclear (Mattson, 2005).

Observational trials in humans indicate that eating more often than three times a day may play a role in overweight and obesity (Howarth *et al*, 2005) and that frequent eating predisposes to a higher energy intake by increasing food stimuli and difficulty controlling energy balance (Duval K *et al*, 2008). In a randomised controlled study, more frequent eating was not related to a greater reduction in energy intake or body weight (Bachman Raynor, 2012). In type 2 diabetic patients it has been demonstrated that it may be more beneficial for glycemic control to eat one larger instead of two smaller meals, provided the diet is rich in fibre (Fernemark *et al*, 2013). Periods of fasting between meals may be even more important than the composition of the diet. In one experimental study, the timing of meals led to increased insulin sensitivity and decreased body weight in spite of the high fat content of the consumed diet (Sherman *et al*, 2012). The distribution of the meals is another important factor. Eating meals later in the day may also adversely influence the success of a weight loss therapy. This difference in weight loss success was not explained by differences in caloric intake, macronutrient distribution or energy expenditure (Garaulet M *et al*, 2012). A potential mechanism explaining this difference is that the timing of food intake can influence the circadian system (Garaulet Madrid, 2010). The circadian system must continuously adapt to and synchronise our physiology with the environment (Bienertová-Vasků *et al*, 2010).

In our study, in group I, mean HDL of cases (31.54 ± 7.96) was markedly lower than the mean HDL of controls (49.58± 6.24). In group II, mean HDL of cases (21.85 ± 4.52) was again considerably lower than mean HDL of controls (49.28 ± 6.92).This trend between cases and controls was observed in the group III as well where mean HDL of cases (21.08 ± 5.40) was again significantly lower than mean HDL of controls (46.69± 4.57). Also, after doing statistical analysis using SPSS software, p value was significant (p=0.034), p< 0.05 was considered to be significant. This further validated the significance of number of meals on the level of HDL. Thus, keeping the above results in view, it can be safely assumed that there is a positive, significant and inverse relationship of HDL and number of heavy meals per day in the offsprings of patients with type 2 diabetes mellitus; higher levels of HDL being associated with lesser intake of heavy meals and vice versa.

Declaration of Interest

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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