EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 5
Issue: 1
XX-XX
Year: 2018

STUDY TO EVALUATE THE EFFECT OF HIGH FAT INDIAN MEAL ON POST PRANDIAL LIPID PROFILE IN PEOPLE WITH TYPE 2 DIABETES

***Kavita S. Gupta[1], Sabiha A. Vali[2], Sunil Gupta[3] and Dr. Sachin Gathe[4]**

[1]Dept of Dietetics, Sunil's Diabetes Care n' Research Centre Pvt Ltd, Nagpur, India.
[2]Dept of Home Science, Ex Prof and HOD, RTMNU Nagpur University, Nagpur, India.
[3]Dept of Diabetology, Sunil's Diabetes Care n' Research Centre Pvt Ltd, Nagpur, India.
[4]Dept of Clinical Research and Epidemiology, Sunil's Diabetes Care n' Research Centre Pvt Ltd, Nagpur, India.

***Corresponding Author: Dr. Kavita S. Gupta**
Dept of Dietetics, Sunil's Diabetes Care n' Research Centre Pvt Ltd, Nagpur, India.
Mail id: sweetysunil125@yahoo.com

Article Received on 29/10/2017 **Article Revised on 19/11/2017** **Article Accepted on 09/12/2017**

ABSTRACT
Post-prandial hypertriglyceridemia and hyperglycemia may jointly trigger spikes of oxidative stress, causing undetermined risk of atherosclerosis in people with type 2 diabetes(T2DM). We studied the effect of standardized high fat, calorie dense Indian food on lipid profile of people with T2DM and non-diabetics. 44 age, sex and BMI matched subjects [22 T2DM (DM group) and 22 non-diabetics (Non-DM group)] were selected. Postprandial lipid and glucose response was observed at baseline/0hour, 2hr, 4hr and 6hr after a fat tolerance test (FTT) using weight-adjusted Indian meal consisting of 70% fat, 5% protein and 25% carbohydrates. Mean total cholesterol, LDL-C and HDL-C between two groups differed insignificantly at each time point ($P > 0.05$) and across times. Mean triglyceride(TG) was significantly higher across time points in both groups ($P<0.001$) with peak at 4 hour. Mean TG at 4 hr and 6 hr, was significantly higher in DM versus Non-DM with $P=0.033$ and 0.047 respectively. At 6 hr, the mean TG level was close to 2 hr and was still significantly higher than baseline level ($P<0.001$). In Non-DM, mean TG at 6 hour was higher than baseline ($P=0.005$); however, it was close to acceptable level of 150mg/dl, indicating delayed clearance of TG in T2DM at 6hours. **Conclusion:** After high fat meal, post-prandial hypertriglyceridemia peak was seen at four hour, further more, there was significant delay in postprandial TG clearance at six hours. Postprandial hypertriglyceridemia with hyperglycemia, might pose additive cardiovascular risk amongst Indian T2DM.

KEYWORDS: Type 2 Diabetes Mellitus, Postprandial Hypertriglyceridemia, Hyperglycaemia, High Fat Diet, India.

INTRODUCTION
IDF atlas 2017 has estimated that globally 425 million adults have diabetes. The prevalence of diabetes (20-79 years) in South East Asia is 10.1%. India ranks at number two position, with 72.9 million diabetics and is second in the list of top ten countries after China. By 2045, it is estimated that India will become the top most country with highest number of people with diabetes in the World.[1] Diabetes is associated with a characteristic dyslipidemia that is a substantial contributor to risk, and in most patients precedes the onset of hyperglycemia. In fact, it has been suggested that disordered lipid metabolism is in some respects more central to the pathogenesis of T2DM than impaired insulin secretion. [2] Diabetic dyslipidemia is characterized by increased triglycerides, low HDL-C and normal but smaller and denser LDL-C. [3] The impact of LDL-C on atherosclerosis is well established. However, hypertriglyceridemia is also being recognised as one of the risk factors for atherosclerosis in type 2 diabetes (T2DM). Post-prandial hypertriglyceridemia (PPTG) is common in people with T2DM, but is an inadequately addressed entity in clinical practice. [4] Furthermore, Post-prandial hypertriglyceridemia and uncontrolled hyperglycaemia may jointly trigger spikes of oxidative stress causing undetermined risk of atherosclerosis.[5] Conventionally, lipid profile is done in the fasting state and post prandial increase in lipoprotein remain unnoticed. Society is facing a rapid transition of traditional balanced diet to high calorie, fat rich fast food culture in India.[6] This may increase the risk of postprandial rise in atherogenic lipid like triglycerides.[7] High fat meal have also shown to have changes in the LDL and VLDL particle number and pattern as well as their subclass patterns changes.[8] ME Khamseh et.al[9] in their study, concluded that postprandial hypertriglyceridemia and fasting hyperglycemia may be an independent risk factor for early atherosclerosis and

macrovascular disease in individuals with type 2 diabetes. Similarly, Saxena R. et.al[10] conceptualised that post prandial hypertriglyceridemia (PP-HTG) appears to be the key determinant of oxidative stress in type 2 DM, which along with a compromised antioxidant status may lead to endothelial dysfunction and macro vascular complications. Study have also highlighted that post-prandial exposure to a high-fat meal elevates circulating endotoxin, with T2DM subjects exposed to as much as 119% more circulating endotoxin post-prandial, per high-fat meal. [11] Thus, we intend to evaluate this effect of high fat, calorie rich indian food on various lipid fractions amongst people with type 2 diabetes mellitus.

AIM

To study the effect of standardized high fat, calorie dense Indian food on various lipids, lipoproteins and glucose amongst people with type 2 diabetes and non-diabetics.

MATERIALS AND METHODS

The study was conducted at a tertiary care center, after it's approval from institutional ethics committee. 46 subjects were screened for this interventional study. Two did not give consent due to time constraint. Finally, 22 subjects with known Type 2 diabetes mellitus [Group DM] (Male-11 and Female-11), in the age range 30- 65 years (both inclusive), with history of Type 2 DM of $\geq$ 6 months duration, glycosylated haemoglobin A1c (HbA1c) $\leq$ 8% on a stabilized treatment of MNT and/or non insulin pharmacotherapy for more than three months, non alcoholics, not on any lipid lowering therapy, having fasting triglyceride level as < 200mg/dl, having stable blood pressure (systolic BP$\leq$ 140mm/Hg and diastolic BP $\leq$ 85mm/Hg with/without anti-hypertensive treatment were selected. Subjects not willing to give consent or on insulin or lipid lowering therapy having fasting blood glucose >180mg% or fasting triglyceride level of >200mg/dl or Total Cholesterol >300 mg/dl or Medical history/clinical evidence of familial hyperlipidemia disorder or subjects with history of malignancy in last 3 years or with history of angina, myocardial Infarction (MI) or stroke within 6 months of screening or eGFR <30mL/min1.73m^{2,} or person with history of any endocrinopathy or on thyroid medication or hormone related obesity disorder or history of drug abuse or psychiatric disorder or pregnant or lactating females were excluded. 22 Non-diabetic [Group: Non-DM] (Male-11 & Female-11) were also recruited by purposive sampling method. Written informed consent was obtained from each subject prior to entering the study. The two study groups were matched for age, sex and BMI. Clinical history, examination, demographics and anthropometry data was collected. History of medical complication, like Hypertension, Coronary Artery Disease, Peripheral Vascular diseases, Diabetic Neuropathy and other microvascular diseases was verbally taken. Both groups were recruited for the Oral Fat Tolerance Test (OFTT). Subjects were called at the clinical site with baseline fasting (with 8-14 hours fast) during which water intake was allowed. Before starting the test, they were asked to abstain from exercising during the fasting and post prandial state. The patients arrived at the clinical center at 08:00 – 9.00am. Blood was collected for biochemical parameters at 0 hr/baseline by a phlebotomist. Fat Tolerance Test (FTT) was done by a standardized high fat Indian meal (approximately 0.9-1gm fat/kg body weight) consisting of 70% fat, 5% protein and 25% carbohydrates was formulated and the subjects were asked to consume the meal within 15 minutes. The formulated meal was given to the subjects under supervision. Blood samples were drawn at 0hr/baseline, 2hr, 4hr and 6hr interval. Serum was separated in all the samples by centrifuging it immediately after collection and stored at -20° C for various biochemical estimations. Tests for plasma glucose and lipid profile was performed for all 44 subject in all four time point samples. After the meal, the volunteers rested and consumed no food for next 6 hours, but were allowed to drink water. They were allowed to sit, chat, sleep, watch TV, read and do other light activities. Any kind of strenuous exercises were avoided during the test.

STATISTICAL METHODS

The descriptive statistics like mean and standard deviation for each study parameter were obtained for the study groups. The statistical significance of difference of each parameter between two groups at each time point and across time points was tested using *t-test of independent samples and repeated measure ANOVA*. Paired analysis was performed using Tukey's post-hoc test. The analyses were performed using SPSS ver 20.0 (IBM Corp.) software and the statistical significance was tested at 5% level.

RESULTS

The mean age, BMI, S. Creatinine and eGFR of patients were homogeneous across two groups as indicated by insignificant p-values ($p > 0.05$) in **Table 1**. However, Waist Hip Ratio (WHR), blood glucose, and HbA1c were significantly higher in DM group compared to Non-DM group ($p < 0.0001$). In other words DM group had higher central obesity and had high glycosylated hemoglobin A1c as compared to Non-DM group. The mean blood glucose in DM group was significantly higher than Non DM group at baseline, 2 hr, 4hr and 6 hr ($P < 0.001$) **(Fig.1).** Mean total cholesterol (**Fig 2),** LDL-C (**Fig 3),** HDL-C **(Fig 4)** between two groups differed insignificantly at each time point ($P > 0.05$) and when studied across time they revealed insignificant difference in both the groups.

The mean TG between two groups differed insignificantly at baseline and 2hr; however, at 4 hr and 6 hr, TG was higher in DM versus Non-DM group, which was statistically significant with P=0.033 and 0.047 respectively. **(Fig 5).** Across time points in Non DM group, the mean difference of TG was statistically

significant with P < 0.001. Pair wise analysis in this group revealed that the difference between all the time pairs was statistically significant (P < 0.05), except 2 hr and 4hr (P=0.127). In DM group, the mean difference of TG across times was significant with P < 0.001. Paired analysis revealed that the difference between all the time pairs was significant, except between 2 hr and 6 hr (P=0.99). In other words, in this group, at 6 hr, the mean TG level (209.59 mg/dl) was close to 2 hr (208.73 mg/dl), but still significantly higher than the baseline level (130.14 mg/dl) (P<0.001)(**Fig 6**). In Non-DM group also, the mean TG level at 6 hr (164.77 mg/dl) was significantly higher than baseline (121.73mg/dl) level with P=0.005; however, it was close to acceptable level of 150 mg/dl, as compared to that of DM group **(Fig 6).** Similarly, the mean change in TG between baseline and 4 hr in Non DM group (109.45 mg/dl) differed significantly from that of DM group (154.77 mg/dl) with P=0.048 **(Fig 7)**. However, the mean change between 4 hr and 6 hr in Non DM group (66.41 mg/dl) insignificantly differed from that of DM group (75.32 mg/dl) with P=0.697.

Table-1 Baseline Characteristics.

Characteristic	No DM	DM	P-value*
Number	22	24	
Age (years)	47.14 ± 6.12	48.92 ± 10.30	0.485
BMI (kg/m2)	24.1 ± 3.02	25.78 ± 3.84	0.113
WHR	0.93 ± 0.07	1±0.09	< **0.0001 (S)**
Serum Creatinine (mg/dl)	0.80 ± 0.15	0.82 ± 0.18	0.684
eGFR	103.7 ± 16.22	97.92 ± 20.79	0.299
SGPT (IU/ml)	27.04 ± 26.17	25.75 ± 13.81	0.833
HbA1c (%)	5.34 ± 0.23	7.21 ± 0.76	< **0.0001 (S)**
Hb (%)	13.65 ± 1.70	13.39 ± 1.76	0.61

*Obtained using t-test for independent samples

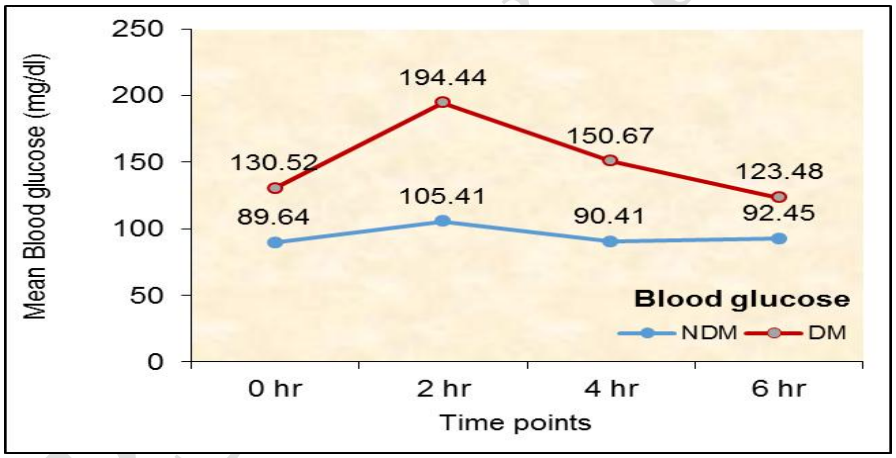

Figure 1: Mean blood glucose (mg/dl) at different time lines in DM and Non-DM group.

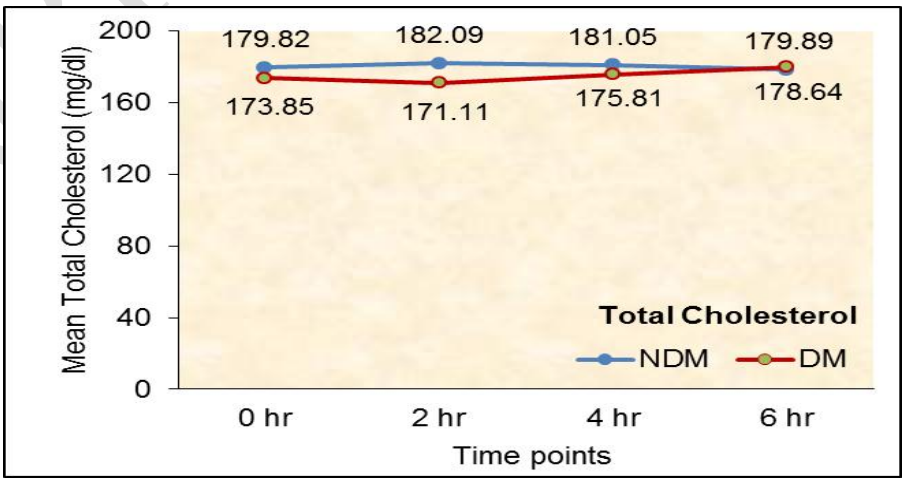

Figure 2: Mean Total Cholesterol (mg/dl) at different time points in DM and Non-DM group.

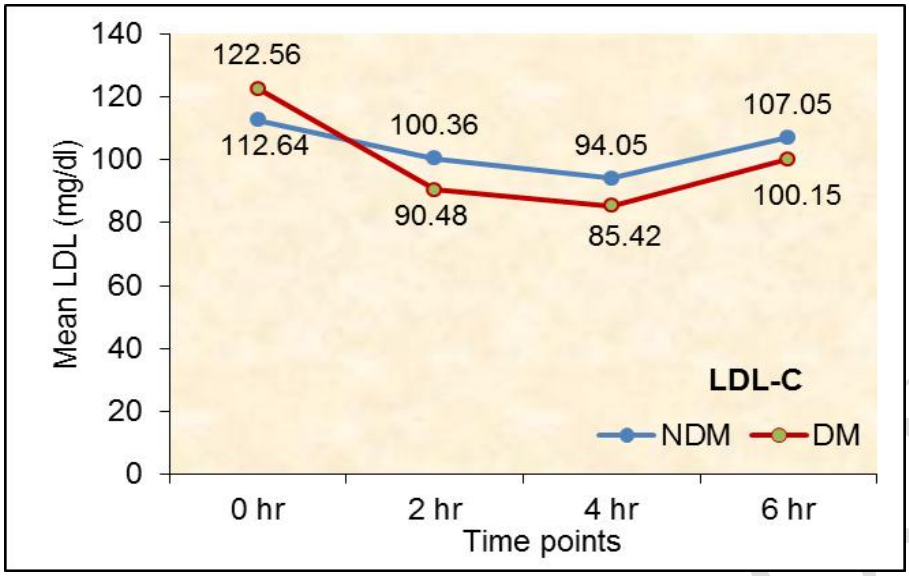

Figure 3: Mean LDL Cholesterol (mg/dl) at different time points in DM and Non-DM group.

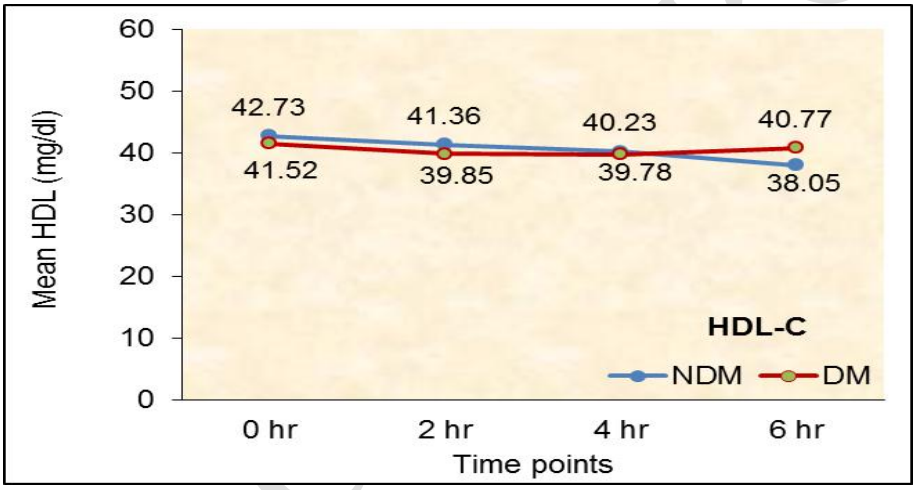

Figure 4: Mean HDL Cholesterol (mg/dl) at different time points in DM and Non-DM group.

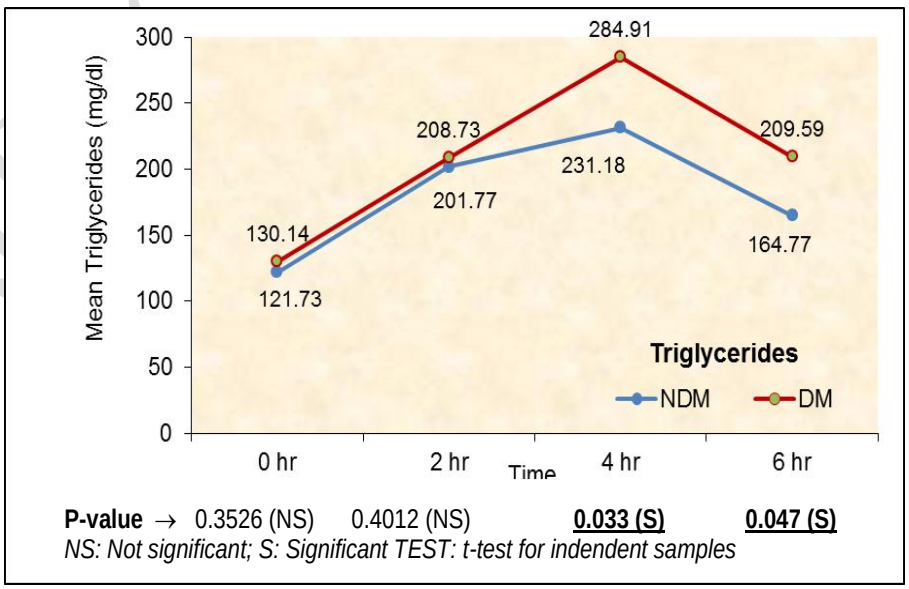

Figure 5: Mean Triglycerides(mg/dl) at different time lines in DM and Non-DM group.

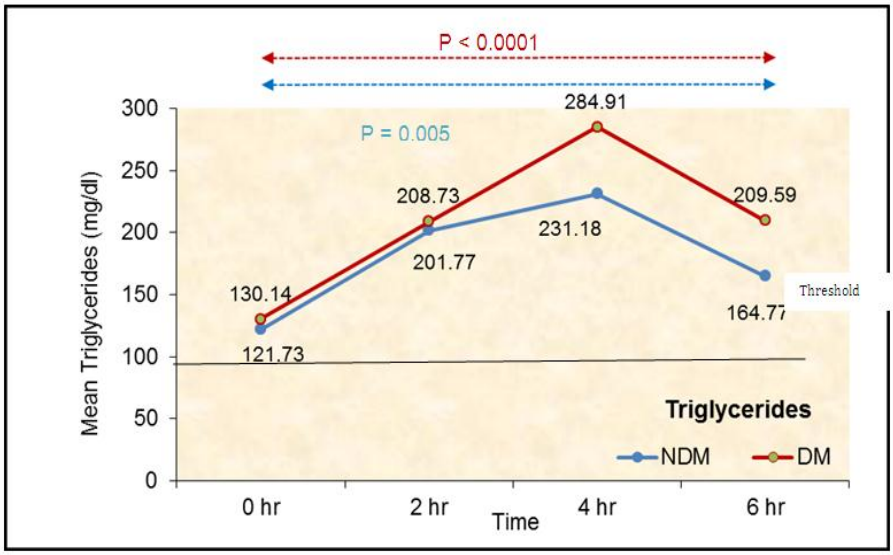

Figure 6: Mean Triglycerides(mg/dl) at different time lines in DM and Non-DM group.

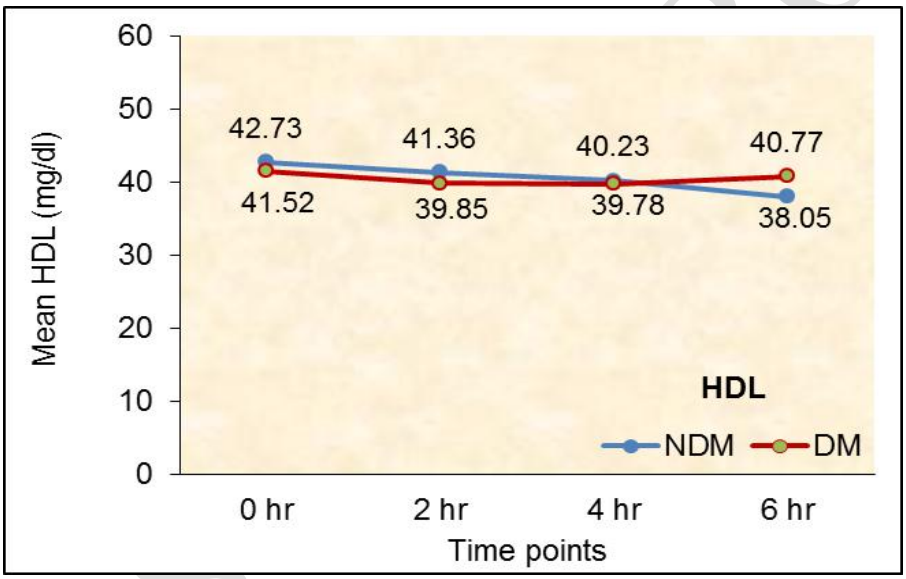

Figure 7: Mean Triglycerides (mg/dl) change from zero to 4 hrs in DM and Non-DM group.

DISCUSSION

Postprandial dysmetabolism in people with type 2 diabetes is characterised by postprandial hypertriglyceridemia and postprandial hyperglycemia.[12] It is common but less percieved clinical entity. V. Kumar et al; (2009)[13] in his study found significant postprandial hypertriglyceridemia and significant delay in postprandial triglyceride clearance following a standardized fat meal challenge in patients with type 2 diabetes mellitus. Persistent postprandial hypertriglyceridemia may result in a pro-atherogenic environment leading to atherosclerosis and macrovascular disease in type 2 diabetes subjects, he added. Our study has also shown statistically significant increase in postprndial triglyceride levels at 2 and 4 hours after high fat meal in people with type 2 diabetes as well as in those without diabetes. Though, the baseline and 2 hour TG was insgnificantly higher in DM group, the postprandial rise in TG from baseline to 4 hours was significantly higher in DM group versus Non-DM group. The highest peak of TG was seen at four hours and thereafter it started falling down in both the groups. Importantly, there was delayed TG clearance at 6 hours in DM group, which reached the value near to it's 2 hour level versus that observed in nondiabetic cohort, which touched near the baseline level at six hours. This indicates that people with T2DM remain in hypertriglyceredemic state for a longer duration than nondiabetics. There was no significant change in levels of total cholesterol, LDL-cholesterol & HDL-cholesterol in both the group during FTT at all-time points. As expected, the post prandial hyperglycemia was evident in DM group and not in non-DM group.

CONCLUSION

Postprandial hypertriglyceridemia occurs after ingestion of high fat meal in diabetics and non-diabetics. The increase is at it's peak at four hours followed by fall at

6hrs. Type 2 diabetics showed significantly higher rise in PPTG at 4 hours and slower fall at 6 hours compared to non-diabetics. Post-prandial hyperglycemia at two hours and hypertriglyceridemia at fours might pose additive cardiovascular risk amongst Indian type 2 diabetics versus non-diabetics. Multicentre population specific studies on this concept are the need of the hour.

ACKNOWLEDGEMENT

Acknowledging Dr Dhananjay Raje, Head Data Analysis Group, MDS Bio-Analytics for statistical support.

REFERENCES

1. IDF Diabetes Atlas 8th edition (2017).
2. Anabtawi, A., Moriarty, P.M. & Miles, Pharmacologic Treatment of Dyslipidemia in Diabetes: A Case for Therapies in Addition to Statins, J.M. Curr Cardiol Rep, 2017; 19: 62. https://doi.org/10.1007/s11886-017-0872-8
3. David R. Sullivan and Barry Lewis, Laboratory Assessment of Lipoproteins in Diabetes, A.J. Jenkins et al. (eds.), *Lipoproteins in Diabetes Mellitus*, Contemporary Diabetes, DOI 10.1007/978-1-4614-7554-5_1, © Springer Science+Business Media New York 20.
4. James H. O'Keefe, and David S.H. Bell, Postprandial Hyperglycemia/Hyperlipidemia (Postprandial Dysmetabolism) Is a Cardiovascular Risk Factor (Am J Cardiol 2007; 100: 899–904).
5. Siu-WaiChoi[a]Iris F.F.Benzie[a]Shuk-WoonMa[a]J.J.Strain[b]Bernadette M.Hannigan[b];Acute hyperglycemia and oxidative stress: Direct cause and effect? Free Radical Biology and Medicine, 1 April 2008; 44(7): 1217-1231; https://doi.org/10.1016/j.freeradbiomed.2007.12.005
6. P. K. Nigam,Serum Lipid Profile: Fasting or Non-fasting?Indian J Clin Biochem. 2011 Jan; 26(1): 96–97. doi: 10.1007/s12291-010-0095-
7. James H. O'Keefe, MD, Neil M. Gheewala, MS, Joan O. O'Keefe*;* Dietary Strategies for Improving Post-Prandial Glucose, Lipids, Inflammation, and Cardiovascular Health (J Am Coll Cardiol 2008; 51: 249–55) © 2008 by the American College of Cardiology Foundation.
8. Alison Harte, MadhusudhanVarma, GyanendraTripathi, et al; Post-prandial high fat intake leads to acute exposure to circulating endotoxin in type 2 diabetes mellitus subjects ; *Endocrine Abstracts*, 2012; 28: OC3.2
9. ME Khamseh, K Soltani, J Rafiee et al, International Journal of Endocrinology and Metabolism, The Association of Carotid Intima-Media Thickness and Postprandial Dyslipidemia in Patients with Type 2 Diabetes, Volume 5, Issue 1, January 2007; 5-8.
10. Saxena R, Sri Venkata Madhu, Rimi Shukla, Keshav M. Prabhu et. al; Postprandial hypertriglyceridemia and oxidative stress in patients of type 2 diabetes mellitus with macrovascular complications ,Clinica Chimica Acta 2005; 359: 101–108. Elsevier B.V. doi:10.1016/j.cccn.2005.03.036.
11. Dara A. Al-Disi, Nasser M. Al-Daghri', Nasiruddin Khan, Assim A. Alfadda, Reem M. Sallam, Mohammed Alsaif, Shaun Sabico, Gyanendra Tripathi and Philip G. McTernan; Postprandial Effect of a High-Fat Meal on Endotoxemia in Arab Women with and without Insulin-Resistance-Related Diseases; *Nutrients* 2015; *7*: 6375-6389; doi:10.3390/nu7085290
12. Wojczynski Mary K, Stephen P Glasser, Albert Oberman, Edmond K Kabagambe, Paul N Hopkins, Michael Y Tsai, Robert J Straka, Jose M Ordovas and Donna K Arnett; High-fat meal effect on LDL, HDL, and VLDL particle size and number in the Genetics of Lipid- Lowering drugs and diet network (GOLDN): an interventional studyLipids in Health and Disease 2011; 10: 181 http://www.lipidworld.com/content/10/1/181
13. V Kumar, SV Madhu, G Singh, JK Gambhir, Post-Prandial Hypertriglyceridemia in Patients with Type 2 Diabetes Mellitus with and without Macrovascular Disease; 2009.