RESEARCH ARTICLE

COMPARSION OF LIPID PROFILE IN DIABETIC HYPERTENSIVES VS DIABETIC NORMOTENSIVES

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Manuscript Info

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Abstract

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Background: Lipid abnormalities are linked to a higher risk of cardiovascular disease and other morbidity in people with diabetes. Dyslipidemia may signal the onset of Type 2 diabetes in the future. A trio of diminished high density lipoprotein (HDL), increased triglycerides (TG), and increased low density lipoprotein (LDL) is known as "diabetic dyslipidemia". As a result, diabetic dyslipidemia serves as a separate risk factor and predictor for coronary artery disease (CAD).

Aim: To compare Serum lipid profile levels in type-2 diabetics with hypertension (Group 1) and type-2 diabetics without hypertension (Group 2).

Methods: Prospective observational study was undertaken on 200 subjects aged 40-60 years from November 2019 to October 2020 with patients of Type-2 diabetes mellitus (both old and new cases) with hypertension (Group 1) and Type-2 diabetes mellitus without hypertension (Group 2) having any of the complications associated with diabetes and on age and sex matched diabetics without hypertension.

Results:

Mean value of total cholesterol ± standard deviation of Group 1 was 188.92 ± 34.66 mg/dl and that of Group 2 was 190 ± 46.54, the difference between the two groups being statistically not significant (p=0.853). Mean value of triglycerides ± standard deviation of Group 1 was 214.81 ± 78.35 mg/dl and that of Group 2 was 184.04 ± 62.69 mg/dl, the difference between the two groups being **statistically highly significant** (p=0.003). Mean value of LDL ± standard deviation of Group 1 was 104.42 ± 31.26 mg/dl and that of Group 2 was 109.57 ± 39.78 mg/dl, the difference between the two groups being statistically not significant (p=0.309). Mean value of HDL ± standard deviation of Group 1 was 42.98 ± 6.20 mg/dl and that of Group 2 was 43.80 ± 6.47 mg/dl, the difference between the two groups being statistically not significant (p=0.361). Mean systolic and diastolic blood pressure in Group 1 was 127.64 ± 13.41 and 86.20 ± 7.06 mmHg and that of Group 2 was 118 ± 10.80 and 77.52 ± 7.87 mmHg, the difference between the two groups being statistically highly significant

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(p<0.0001). Mean Fasting Blood sugar of Group 1 was 197.80 ± 74.75 mg/dl and that of Group 2 was 177.91 ± 62.52mg/dl the difference being highly statistically significant (p= 0.043).

Conclusion: The findings of this study concluded that there is a positive relationship between type-2 diabetes mellitus and lipid profile. Mean values of total cholesterol, LDL, triglycerides were significantly raised in type-2 diabetics, supporting the hypothesis that dyslipidemia is a significant complication of type-2 diabetes mellitus, which further contributes to the increased risk of multiple organ morbidities in diabetes. A significant difference in mean triglyceride level was found in both groups. There were no significant differences in mean HDL, LDL and cholesterol levels among the two groups as the levels of these parameters were raised to an almost equal extent in both the groups.

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Introduction:-

Diabetes mellitus is a chronic condition that occurs when the body cannot produce enough or effectively use insulin. Compared with individuals without diabetes, patients with type 2 diabetes mellitus have a considerably higher risk of cardiovascular morbidity and mortality, and are disproportionately affected by cardiovascular disease. Most of this excess risk is associated with an augmented prevalence of well-known risk factors such as hypertension, dyslipidemia and obesity in these patients. However the cardiovascular disease in type-2 diabetes mellitus patients cannot be attributed solely to the higher prevalence of traditional risk factors. Therefore other non-traditional risk factors may be important in people with type 2 diabetes mellitus. Cardiovascular disease is increased in type 2 diabetes mellitus subjects due to a complex combination of various traditional and non-traditional risk factors that have an important role to play in the beginning and the evolution of atherosclerosis over its long natural history from endothelial function to clinical events. [1]

Diabetes mellitus and hypertension are interrelated diseases that strongly predispose an individual to atherosclerotic cardiovascular disease. Hypertension is about twice as frequent in individuals with diabetes, as in those without diabetes. Lifestyle and genetic factors are important factors contributing to both hypertension and diabetes. The prevalence of coexisting hypertension and diabetes appears to be increasing in industrialized nations, because population are aging and both hypertension and type 2 diabetes increase with age. Data obtained from death certificates show that hypertensive disease has been implicated in 4.4% of deaths coded to diabetes, and diabetes was involved in 10% of death coded to hypertensive disease. Indeed, an estimated 35% to 75% of diabetic cardiovascular and renal complications can be attributed to hypertension. [2]

Methods:-

The present one year prospective observational study was undertaken in the postgraduate department of Physiology, Government Medical College and Hospital- Jammu, with effect from November 2019 to October 2020, on 200 subjects aged 40-60 years.

Subjects were selected from Government Medical College and Hospital, Jammu and associated hospitals. The study was conducted on patients of Type-2 diabetes mellitus (both old and new cases) with hypertension without having any of the complications associated with diabetes and on age and sex matched diabetics without hypertension. 200 subjects were selected by random sampling technique. After detailing the purpose and methodology of the study, all subjects found eligible were requested to participate in the study.

Source of Data

(a) Subjects were diagnosed patients of type-2 diabetes mellitus with hypertension (Both outpatient and inpatient).

(b) Controls comprised of the subjects diagnosed with type-2 diabetes mellitus without associated hypertension.

A detailed history was undertaken and clinical examination was conducted on subjects as per proforma. Serum lipid profile measurements were performed by using following standard enzymatic techniques:

a) Serum total cholesterol was measured by fully enzymatic cholesterol oxidase-peroxidase method. [3]

b) Serum triglycerides were measured by fully enzymatic glycerol phosphate oxidase-peroxidase method. [3]
c) Serum HDL cholesterol was measured by autozyme precipitating reagent in conjunction with autozyme cholesterol reagent for enzymatic determination of HDL cholesterol in the supernatant.[3]
d) Serum LDL cholesterol was calculated by Friedewald formula. [4]

Blood pressure:
The blood pressure was recorded by auscultatory method using mercury sphygmomanometer. [5]

Venous plasma glucose was measured by glucose oxidase-peroxidase method. [6]

Glycosylated hemoglobin (HbA1c):
HbA1c test estimated the average level of blood sugar over the past two to three months. It was estimated by Cation exchange resin method using glycol hemoglobin reagent kit procedure from vector biotech Pvt. Ltd., India. A semiautomatic analyzer (ERBA Chem Pro. Inc., TransAsia Biomedical Ltd., India) was used for the estimation of glycosylated hemoglobin (HbA1c). As per the kit, its normal range is between 4.5 to 8.0% and is reliable indicator diabetic control. [7]

Statistical Analysis:
The data was analyzed using computer software Microsoft Excel and SPSS version 20.0 for windows. Data reported was as mean ± standard deviation and proportions deemed as appropriate for quantitative and qualitative variable respectively. The statistical difference in mean value was tested using unpaired 't' test. ANOVA of variance was also performed to evaluate statistical significance in more than two groups. A p-value of < 0.05 was considered statistically significant. All p-values reported were two-tailed.

Funding:
Nil.

Conflict of interest:
Nil.

Results:-
After detailing the purpose and methodology of the study, all subjects found eligible were requested to participate in the study. The present research work was aimed to compare levels of BMI in type-2 diabetics with hypertension and type-2 diabetics without hypertension, so as to compare the derangement in these parameters in both groups.

The demographic profile of the study population in given in (table).

Table 1:- Patient demographic characteristics:

| Parameters	Group 1	Group 2	P value
Age (years)	**53.65±6.14**	**49.49±6.86**	**<0.0001***
Height (mts)	**1.61±0.10**	**1.63±0.09**	**1.102**
Weight (kgs)	**72.58±12.12**	**68.38±9.78**	**0.008**
Sex M/F	**39/61**	**52/48**	**0.064**

Values in the table are mean ± SD or absolute numbers (percentage). SD = Standard deviation, * statistically significant

Mean systolic and diastolic blood pressure of Group 1 was 127.64 ± 13.41 and 86.20 ± 7.60 mmHg and that of Group 2 was 118 ± 10.80 was and 77.52 ± 7.87 mmHg , the difference between the two groups being statistically highly significant (p<0.0001) (table 2).

Table 2:- Group comparison for blood pressure.

Blood pressure (mmHg)	Mean ± Standard deviation		p-value
	Group 1	**Group 2**	
Systolic blood pressure	127.64 ± 13.41	118.19 ± 10.80	<0.0001
Diastolic blood pressure	86.20 ± 7.06	77.52 ± 7.87	<0.0001

The mean duration of type-2 diabetes mellitus ± standard deviation in group 1 was 5.90 ± 4.48 years in comparison to a mean duration of 4.85 ± 3.63 years in group 2 subjects, the difference being statistically not significant (p=0.070) (fig 1).
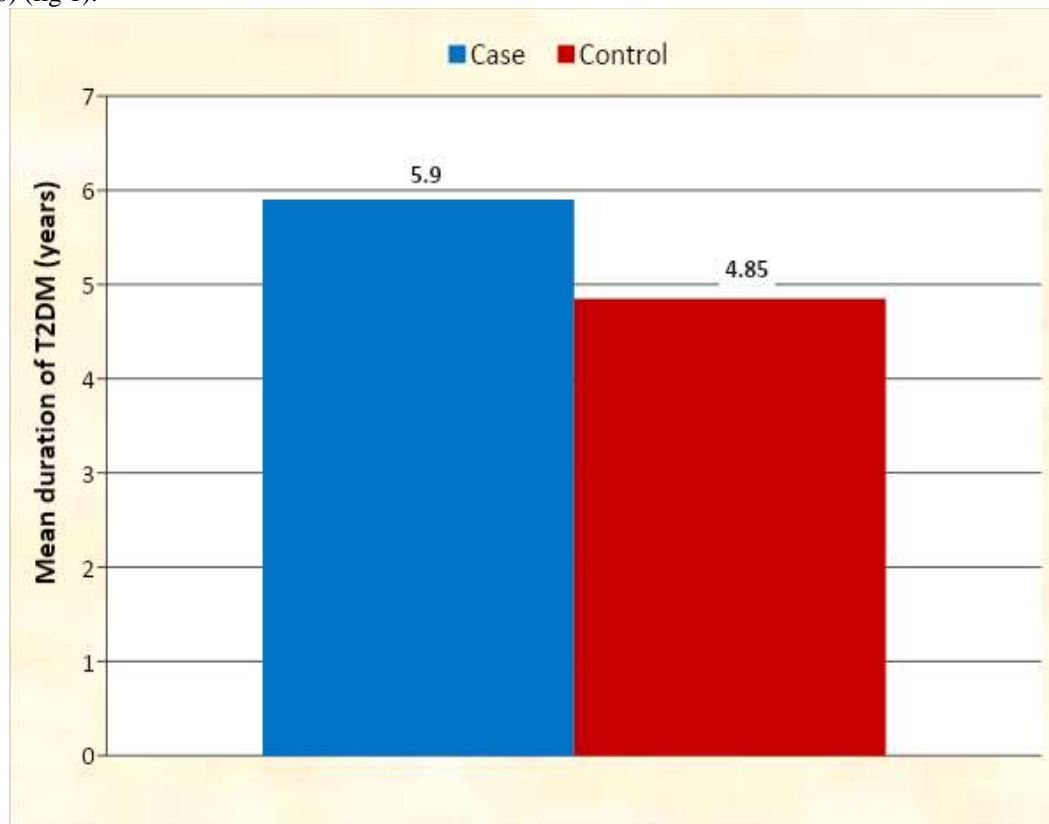
Fig:- Histogram showing mean duration of T2DM in cases and controls.

Mean Fasting Blood sugar of Group 1 was 197.80 ± 74.75 mg/dl and that of Group 2 was 177.91 ± 62.52 mg/dl, the difference being highly statistically significant (p= 0.043). Mean HbA1c of Group 1 was 9.15 ± 2.18 % and that of Group 2 was 9.15 ± 2.18 %, the difference being statistically not significant (p= 0.179) (table 3).

Table 3:- Group comparison for blood sugar and HbA1C.

Variables	Mean ± Standard deviation		p-value
	Group 1	**Group 2**	
Fasting blood sugar (mg/dl)	197.80±74.75	177.91±62.52	0.043
HbA1c (%)	9.15 ± 2.18	8.72 ± 2.33	0.179

Fig: Histogram showing mean values of total cholesterol, triglycerides, LDL, HDL in Group 1 and Group 2 subjects.

Table 4:- Group comparison for lipid profile.

Lipid profile	Mean ± Standard deviation		p-value
	Group 1	**Group 2**	
Total cholesterol (mg %)	188.92 ± 34.66	190.00 ± 46.54	0.853
Triglycerides (mg %)	214.81 ± 78.35	184.04 ± 62.69	0.003
LDL (mg %)	104.42 ± 31.26	109.57 ± 39.78	0.309
HDL (mg %)	42.98 ± 6.20	43.80 ± 6.47	0.361

Mean value of total cholesterol ± standard deviation of Group 1 was 188.92 ± 34.66 mg/dl and that of Group 2 was 190 ± 46.54, the difference between the two groups being statistically not significant (p=0.853).

Mean value of triglycerides ± standard deviation of Group 1 was 214.81 ± 78.35 mg/dl and that of Group 2 was 184.04 ± 62.69 mg/dl, the difference between the two groups being statistically highly significant (p=0.003).

Mean value of LDL ± standard deviation of Group 1 was 104.42 ± 31.26 mg/dl and that of Group 2 was 109.57 ± 39.78 mg/dl, the difference between the two groups being statistically not significant (p=0.309).

Mean value of HDL ± standard deviation of Group 1 was 42.98 ± 6.20 mg/dl and that of Group 2 was 43.80 ± 6.47 mg/dl, the difference between the two groups being statistically not significant (p=0.361).

Discussion:-

Diabetes mellitus manifests in two forms: Type-1 and Type-2. Type-1 or insulin dependent diabetes mellitus (IDDM) is due to insulin deficiency caused by immune destruction of B cells of islet of pancreas. Type-2 diabetes was previously referred to as non-insulin dependent diabetes or adult onset diabetes. It is a term used for individuals who have insulin resistance and usually have relative insulin deficiency. At least initially and often throughout their life time, these individuals do not need insulin treatment to survive. Both the types of diabetes mellitus affect various organs of our body and major side effects of diabetes mellitus are due to its microangiopathic and macroangiopathic complications, which effect eyes, kidneys, nerves, heart, blood vessels and the lungs.[8]

Many patients with type-2 diabetes mellitus are obese and obesity itself causes some degree of insulin resistance. Patients who are not obese by traditional weight criteria may have increased percentage of body fat distributed predominantly in the abdominal region. Ketoacidosis seldom occurs spontaneously in this type of diabetes. When seen, it usually arises in association with the stress of another illness such as infection. This form of diabetes frequently goes undiagnosed for many years because the hyperglycemia develops gradually and at earlier stages is often not severe enough for the patient to notice any of the classic symptoms of diabetes. Nevertheless, such patients are at increased risk of developing macrovascular and microvascular complications. The risk of developing this form of diabetes increases with age, obesity and lack of physical activity. It occurs more frequently in women prior to gestational diabetes mellitus and in individuals with hypertension or dyslipidemia and its frequency varies in different racial/ethnic subgroups. [9]

Hypertension is present in more than 50% of patients with diabetes mellitus and contributes significantly to both microvascular and macrovascular disease in type-2 diabetes mellitus. Indeed the risk for cardiovascular disease is four fold higher in patients with both diabetes mellitus and hypertension as compared to normotensive non diabetic controls. [10]

In the present study, the mean age in group 1 was 53.65 ± 6.14 years and that of group 2 was 49.49 ± 6.86 years, the difference being statistically highly significant (p<0.0001).

The observation of the physical parameter of mean age of the present study is in agreement with the observation made by **Han TS et al., (1998)**[11] and **Sosenko JM et al., (1993)**[12] who reported that as mean age in population advances, the number of people with diabetes and hypertension also increases.

In our study the mean total cholesterol in Group 1 subjects was found to be 188.92 ± 34.66 mg% and in Group 2 subjects was 190 ± 46.54 mg%, the difference between the two groups being statistically not significant (p=0.853). The mean triglyceride level in Group 1 subjects was found to be 214.81 ± 78.35 mg% and in Group 2 subjects was

184.04 ± 62.69 mg%, the difference between the two groups being statistically significant (p=0.003). The mean LDL level in Group 1 subjects was found to be 104.42 ± 31.26 mg% and in Group 2 subjects was 109.57 ± 39.78 mg%, the difference between the two groups being statistically not significant (p=0.309). The mean HDL in Group 1 subjects was found to be 42.98 ± 6.20 mg% and in Group 2 subjects was 43.80 ± 6.47 mg%, the difference between the two groups being statistically not significant (p=0.361).

The above observation showed that the mean total cholesterol in both cases as well as controls was more with slightly higher values in diabetic hypertensives compared subjects with type-2 diabetes only. 60% of cases had normal cholesterol (<200 mg %), 28% of cases had borderline high cholesterol (200-239 mg %) and 12% cases had high cholesterol levels (>240 mg %). The cholesterol levels among the controls was normal in 53% subjects and 47% had borderline high cholesterol levels. The mean triglyceride levels were also found to be higher in both groups, with the difference in the mean triglyceride level in the two groups being statistically significant (p=0.003). The levels of LDL varied among both groups, 22% of cases had normal LDL levels (<100 mg %), 50% of cases had above optimal LDL levels (100-129 mg %), 28% cases had borderline high LDL levels (130-159 mg %). The LDL levels among the controls was found to be within normal range in 15% subjects whereas 75% controls had above optimal and 10% had borderline high LDL levels. The mean HDL levels in both groups was within normal range (40-60 mg %). 44% of cases had low HDL levels (< 40 mg %) and 20% controls had HDL levels lower than normal range.

Our observations are somewhat similar to the results obtained by **Sultana R (2010),**[13] who reported that there was a sharp and definite increase in the percentage of serum lipids having > 200 mg% cholesterol, >150 mg% triglycerides and >150,g% low density lipoproteins few years after onset of diabetes mellitus.

Our results are also in accordance with **Lily J (2000)**[14] who reported that lipid levels increased among the subjects with type-2 diabetes mellitus and these levels were higher in poorly controlled diabetics and hypertensives.

Our results are in agreement with **Stec et al., (2000)**[15] who reported that there was a significant increase in total cholesterol, triglycerides, LDL cholesterol in both men and women after the onset of diabetes mellitus.

Nema RS et al., (2009)[16] reported that the mean value of total cholesterol increased in subjects with type-2 diabetes mellitus. These results are somewhat similar to results obtained in our study.

Our observations are in agreement with **Ozder A (2014)**[17] who reported that the total plasma cholesterol increased during the course of diabetes mellitus.

Singh G and Kumar AK (2012)[18] reported that dyslipidemia was very common in diabetics, especially raised LDL levels. These observations are similar to observations in our study.

Similar results were reported by **Bhambhani GD et al., (2015)**[19] who documented that LDL levels are higher in diabetic group, indicating that diabetics were more prone to dyslipidemia which can lead to cardiovascular disorders.

Kansal S and Kamble TK (2016)[20] reported that along with other lipid abnormalities, LDL levels were significantly increased in pre-diabetic individuals, these findings being in accordance to our study results.

Our observations are in accordance with the results of **Albai O et al., (2017),** [21] who reported that the level of Triglycerides along with total cholesterol and LDL, were significantly higher in diabetes mellitus.

Similar results are shown by **Uttra KM** et **al., (2011)** [22] who reported that dyslipidemia is a complication of diabetes mellitus and raised triglycerides are the commonest.

Again, our study is in agreement with **Zeqollari A et al., (2014)** [23] who concluded that diabetic patients had statistically significant higher levels of triglycerides. In their study they observed that every patient had at least one type of dyslipidemia and 37.2% had combined dyslipidemia.

In our study, the mean HbA1c level of Group 1 patients was 9.15 ± 2.18 and the mean HbA1c level of Group 2 patients was 8.72 ± 2.33, the difference between the two groups being statistically insignificant (p=0.179).

These results showed that there was increase in the mean value of HbA1c among subjects of both groups during the course of type-2 diabetes mellitus
Similar results were shown by **Parmar D et al., (2013)**[24] who reported that along with cholesterol, triglycerides and other lipid parameters, HbA1c levels were significantly increased in type 2-diabetics.

Our results are in accordance with the results of **Kolhar U and Priyanka P (2017)**[25] who also concluded that mean values of HbA1c were much higher in type-2 diabetics.

Sherwani SI et al., (2016)[26] also concluded that the mean levels of HbA1c in type 2-diabetics came out to be more than the normal range, which is also in agreement with the results obtained in our study.

Our results are in accordance with the observations of **Nicholas J et al., (2013)**[27] who reported that mean value of HbA1c was more in diabetics and raised levels of HbA1c increased mortality risk in diabetics.

References:-

1. **Martín-Timón I, Sevillano-Collantes C, Segura-Galindo A, Del Cañizo-Gómez FJ.** Type 2 diabetes mellitus and cardiovascular disease. World J Diabetes 2014; 5(4): 444-470.
2. **Epstein M, Sowers JR.** Diabetes mellitus and associated   hypertension, vascular disease and nephropathy. Hypertension 1995; 26:869-79.
3. **Cox RA, García-Palmieri MR**. Cholesterol, Triglycerides, and Associated Lipoproteins. In: Walker HK, Hall WD, Hurst JW, editors. Clinical Methods: The History, Physical, and Laboratory Examinations, 3rd edition. Boston: Butterworths 1990; p.153.
4. **Friedwald WT, Levy RS, Fredrickson DS**. Estimation of concentration of low density lipoprotein cholesterol in plasma, without use of preparative ultracentrifuge. Clin Chem 1972; 18:499-502.
5. **Ghai CL.** Textbook of Practical physiology, 8th ed. Jaypee Brothers Medical publishers, Delhi, India 2012; 168-73.
6. **McMillin JM.** Blood Glucose. In: Walker HK, Hall WD, Hurst JW, editors Clinical Methods: The History, Physical, and Laboratory Examinations, 3rd edition. Boston: Butterworths 1990; p. 662.
7. **Reynolds TM, Smellie WS, Twomey PJ**. Glycated hemoglobin (HbA1c) monitoring. Brit Med J 2006; 333(7568): 586-8.
8. **American Diabetes Association**. Report of the expert committee on the diagnosis and classification of diabetes mellitus. America: Clinical Practice Recommendation. 2002; p. 5.
9. **Kumar and Clark.** Diabetes mellitus and other disorder of metabolism. In: Clinical medicine, Kumar and Clark (eds). 5th ed. WB Saunders, Edinburgh, Scotland 2002; p. 1074.
10. **Stamler J, Vaccaro O, Neaton JD, Wentworth D.** Diabetes, other risk factors, and 12-yr cardiovascular mortality for men screened in the multiple risk factor intervention trial. Diabetes care. 1993; 16(2): 434-44.
11. **Han TS, Al-Gindan YY, Govan L, Hankey CR, Lean MEJ.** Associations of BMI, waist circumference, body fat, and skeletal muscle with type 2 diabetes in adults. Acta Diabetol 2019; 56(8): 947-54.
12. **Sosenko JM, Kato M, Soto R, Goldberg RB.** Plasma lipid levels at diagnosis in type 2 diabetic patients. Diabet Med. 1993; 10(9): 814-9.
13. **Sultana R.** Impact of duration of type-2 diabetes mellitus on lipid profile. Gomal J Med Sci 2010; 8(1): 57-59.
14. **Lily J.** Diabetic dyslipidemia. In: Medicine update. 2000; 10: 547.
15. **Stec, Silbershatz, Tofler, Matheney, Sutherland, Lipinska et al.** Association of fibrinogen with cardiovascular risk factors and cardiovascular disease in the Framingham Offspring Population. J Circulation. 2000; 102: 1634-38.
16. **Nema RS, Al-kadhum MA, Ali BM.** Serum lipid profile in type-2 diabetes mellitus in male and female: J al-qadisiyah for pure Sci 2009; 14(1): 1-9.
17. **Ozder A.** Lipid profile abnormalities seen in T2DM patients in primary health care in Turkey: a cross-sectional study. Lipids health dis 2014; 13(1):183.
18. **Singh G, Kumar AK.** A study of lipid profile in type-2 diabetic Punjabi population. J Exerc Sci phys 2012; 8(1): 7-10.
19. **Bhambhani GD, Bhambhani RG, Thakor NC.** Lipid profile of patients with diabetes mellitus: a cross sectional study. Int J Res Med Sci 2015; 3(11): 3292-5.
20. **Kansal S, Kamble TK.** Lipid Profile in pre-diabetes. J Assoc Physicians India 2016; 64(3): 18-21.
21. **Albai O, Timar B, Roman D, Timar R.** Characteristics of the lipid profile in patients with diabetes mellitus and chronic kidney disease. Rom J Diabetes Nutr Metab Dis 2017; 24(3): 237-45.

22. **Uttra KM, Devrajani BR, Shah SZA, Devrajani T, Das T, Raza S et al.** Lipid profile of patients with diabetes mellitus (A multidisciplinary study). WASJ 2011; 12(9): 1382-84.
23. **Zeqollari A, Spahiu K, Vyshka G, Cakerri L.** Lipid profile in diabetes mellitus type-2 patients in Albania and the correlation with BMI, hypertension and hepatosteatosis. J Family Med Community Health 2014; 1(4): 1018.
24. **Parmar D, Vidja K, Ghugare B.** Impact of duration of diabetes and age on lipid profile and glycemic control in Type-2 Diabetic patients. Int J Res Med. 2013; 2(1):69-72.
25. **Kohler U, Priyanka P.** Study of serum lipid profile in type-2 diabetes mellitus patients and its association with diabetic nephropathy. Int J Adv Med 2017; 64(6): 1513-16.
26. **Sherwani SI, Khan HA, Ekhzaimy A, Masood A, Sakharkar MK.** Significance of HbA1c Test in Diagnosis and Prognosis of Diabetic Patients. Biomark Insights. 2016; 11: 95-104.
27. **Nicholas J, Charlton J, Dregan A, Gulliford MC.** Recent HbA1c values and mortality risk in type 2 diabetes. Population-based case-control study. PLoS One. 2013; 8(7):e68008.