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A Observational Study of Clinical Association of Uric Acid, Dyslipidaemia and BMI in Young Hypertensives [<45 Years]

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Abstract
Background: *Hypertension is a leading cause of death world-wide. The increased prevalence of hypertension in young is an indicator of explosion of cardiovascular, cerebrovascular and renal diseases in future.Hypertension among young people is common, affecting 1 in 8 adults aged between 20 and 40 years. This number is likely to increasewithlifestylebehavioursandloweringofhypertensiondiagnosticthresholds.Early-lifefactorsinfluence blood pressure (BP) although the mechanisms are unclear; BP tracks strongly within individuals from adolescence through to later life. Higher BP at a young age is associated with abnormalities on heart and brain imagingandincreasesthelikelihoodofcardiovascularevents bymiddleage.However,diagnosisratesarelower, and treatment is often delayed in young patients.*
Methods: *This Prospective Observational study was done from January 2021 to March 2021 in ESIC MCH Sanathnagar. A total of 50 cases male and female were studied based on inclusion and exclusion criteria. All patients were done routine investigations, and uric acid and lipid profile was sent to evaluate the association. Patients height and weight were recorded to calculate BMI. Patients below 12 years, pregnant women and patients with previous cardiovascular, and secondary causes of hypertension were excluded from the study. The study was carried out in all patients fulfilling the inclusion and exclusion criteria.*
Results: *Atotalof50patients27femalesand23malespresentedduringthestudyperiod.Inourstudy therewas female preponderance in the ratio 1:1.1.more patients were in the age group 40-45 years.[23].overweight was significantly noted with BMI >25 in 30 patients >30 in 10 patients. uric acid was significantly increased in 27 patients. lipid abnormalities were noted LDL increased in30 patients; TGL increased in 32 patients; HDL increased in 20 patients.;Total Cholesterol in 25 patients; VLDL increased in 25patients.*
Conclusions: *It was Observed from the study that BMI was significantly high in the patients with hypertension. Further lipid abnormalities were present in overweight patients contributing to hypertension. Uric acid was elevatedinsignificantamountofpatientsbutcould notcomeoutasriskfactorinyounghypertensives. Furtherit is advised to have healthy lifestyle and disciplined diet to avoid hazards ofhypertension.*
Keywords: *hypertension,uric acid,BMI,TGL,LDL,VLDL.*

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I. Introduction

Hypertension in association with other factors like dyslipidaemia and increased uric acid are the major contributors for cardiovascular diseases and account for more than 80% of deaths and disability in developing countries (1,2).

Hypertension remains the most common readily identifiable and reversible risk factor for myocardial infarction, stroke, heart failure, atrial fibrillation, peripheral arterial disease and cognitive decline. The global burden of hypertension is rising due to escalating obesity and population aging is projected to affect about 1/3rd of world's population.

The prevalence of hypertension is increasing most rapidly in developing countries, where poor hypertensiontreatmentandcontrolcontributetothegrowingepidemicofcardiovasculardiseases2.Inrecentyears rapidurbanizationincreasedlifeexpectancy,unhealthydiet,andlifestylechangeshaveledtoanincreasedrateof cardiovascular diseases in south eastasia3.

Itiswidelyacceptedthatcardiovasculardiseaseisassociatedwithhypertensionandincreased LDL,total cholesterol, triglycerides. In contrast a low level of HDL is a risk factor for mortality from cardiovascular diseases4.Epidemiologicalstudieshaveestablishedastrongassociationbetweenhypertensionandcoronaryartery disease5 and is a strong risk factor for the development of chronic kidneydisease.(1-3)

Hypertension among young people is common, affecting 1 in 8 adults aged between 20 and 40 years. This number is likely to increase with lifestyle behaviours and lowering of hypertension diagnostic tools.

Bloodpressureinadulthoodmayalso be determinedbyfactorsoccurringmany yearsearlier6.Barkeret al7 proposed the developmental origins of health and disease hypothesis whereby the lifetime trajectory of BP is programmed in the perinatal period. Although fetal growth restriction may play some role, other factors such as genetic and environmental influences are probably more significant8. This is supported by studies demonstrating higher BP in adolescents whose mothers had experienced hypertensive disorders ofpregnancy(9-11)

Inlongterm,multiplestudieshavedemonstratedincreasedratesofcardiovasculardiseaseandmortality in young people withhypertension(12-14)

The CARDIA longitudinal study has been important in exploring the contribution of early-life risk factors to the development of coronary heart disease in later life using a cohort of 5115 young adults in united states aged 18 to 30 years.(13,15). They showed that elevated BP at baseline was more predictive of coronary artery calcium 15 years later than the risk factor profile at point of follow up.15

Data from 2003-2010 NHANES show that over half of the 30% of US adults more than 18 years who have hypertension have uncontrolled hypertension and are unaware that they have elevated blood pressure.16

Hypertension and lipid profile :

Hypertension and dyslipidaemia are important risk factors for cardiovascular disease. Coexistence of hypertension and dyslipidaemia is often observed in daily clinical practice, and this empirical observation is consistent with baseline characteristics of clinical study participants.17-20

Population-based epidemiological studies have also reported that gradual increases in blood pressure (BP) or prevalence of hypertension are associated with increases in blood lipid levels21-23. One possible explanation for these relationships is that hypertension and dyslipidaemia share common pathophysiological etiologies, such as obesity and the resulting dysregulation of adipocytokine release from adipose tissue24 .

Furthermore, dyslipidaemia adversely affects functional and structural arterial properties and promotes atherosclerosis.25-27 These changes may impair BP regulation, which, in turn, predisposes individuals with dyslipidaemia to development of hypertension.

Dyslipidaemia and hypertension occur together more often than can be explained by chance; however, the precise nature of this relationship remains unclear.

Atherogenicdyslipidaemiascouldleadtohypertensionbyseveralmechanisms.First,atherosclerosiscan result in structural changes in large conduit arteries, leading to reduced elasticity20 Second, endothelial dysfunctionduetolipidabnormalities,21-23resultinginreducednitricoxideproduction,release,andactivityand abnormalvasomotoractivity,couldmanifestashypertension24.Endotheliumdependentvasodilationisimpaired by elevated total cholesterol (TC) levels25. Third, lipid-mediated damage to the renal microvasculature could manifestashypertension,illustratedbyanassociationbetweenlipidabnormalitiesandearlyrenaldysfunction26. Finally, dyslipidaemia and hypertension represent 2 of several components of the metabolic syndrome that may share common mechanisticpathways.27,28

Currentstudies indicatethatthelipidprofilesroutinelyreportedbyhospitallaboratories 0maynotdiffer substantially between patients with CVD and healthy subjects. Recent findings suggest that the evaluation of subfractions/subpopulations of the individual lipoproteins is likely to be of much greaterrelevance.

Low density lipoprotein (LDL) and high-density lipoprotein (HDL) particles are known to be heterogeneous, with the subfractions defined based on particle size and density. Based on the gel electrophoresis LDL particles have been classified into seven subfractions (LDL 1–7). At least ten subfractions of HDL exist (HDL 1–10; though the most recent methods allow for the differentiation of as many as 26 subfractions).

Anti-atherosclerotic effects of HDL appear to be mediated by two subfractions: HDL 2 and 3 (the so-called large particle HDL subpopulation) [3]. Heterogeneity of LDL and HDL particles is also associated with their various bioactivity levels. Subfractions LDL 1 and 2 (large LDL particles) have been associated with onlya moderate risk of CVD, whereas small dense LDL (sdLDL) subfractions (LDL 3–7) increase the risk up to 4-fold [29-31].ThesubfractionoflargerHDLparticles(HDL2)mightberesponsiblefortheclinicallybeneficialeffects that have been generally associated with HDL cholesterol [3]. On the other hand, the HDL 3 subfraction, and mostly other subpopulations of smaller HDL particles (intermediate and small HDL) may even have an undesirableatherogeniceffectwithoutinhibitinginflammation–howeverthereare stillmanyoppositeresultson this issue.

The described biological differences are likely to be the result of the fact that sdLDLs (subpopulations 3–7) easily penetrate vascular walls, undergo oxidation, and have a lower affinity for the LDL receptor;

conversely, small dense HDL particles contain scarcely any apolipoproteins (Apo) AI and AII, are less effective in the reverse cholesterol transport from peripheral tissues to the liver and may be catabolised more rapidly and lose their endothelium-protective properties.

Several processes may be involved in structural and functional changes in LDL and HDL. Inflammation and oxidative stress, which often accompany an atherosclerotic CVD, seem to be particularly important. A shift in balance in favour of one LDL or HDL atherogenic subfraction can play a role in developing obesity, metabolic syndrome, insulin resistance, and consequently – diabetes mellitus [32-35] as well as in developing hypertension.

If dyslipidaemia is causally associated with the development of hypertension, evaluation of the lipid profile in normotensive patients would allow early targeted pharmacological intervention in susceptible patients. This approach could extend the time period before hypertension develops, or avoid hypertension (and its associatedcomplications)altogether.Thisapproachwouldbelikelytoresultin substantialgainsinpublichealth, since hypertension is one of the greatest epidemiological challenges in Poland, Europe and around theworld.

Based on the data from NATPOL 2011 and POLSENIOR 2011 registries, there are nearly 11 million people affected by hypertension in Poland, and in the elderly population, this percentage can be as high as 75%. Moreover, hypertension is still undiagnosed in 30% affected patients and ineffectively treated in 36% of cases.

BMI AND HYPERTENSION:

Due to industrialization and urbanization, the standard of living continues to rise particularly in developing countries. This led to weight gain and obesity, which are posing a threat to the health of citizens. Obesity is perhaps the most prevalent form of malnutrition in developing countries, both among adults and children. Studies have demonstrated that obesity is related to elevated systolic blood pressure and diastolic blood pressure elevation, dyslipidaemia, diabetes, etc(36-38)

Obesity, its attendant health consequences and consequent health burden, is expected to reach epidemic proportions in developing countries like India39. A study in Delhi revealed even higher prevalence(32-50%) of over weight body mass index(BMI >25) among adults belonging to high income group as compared with 16.2-20% in those belonging to high income group as compared to middle income group.

BMI,calculatedasweightinKG/heightinmeterssquared,ismostwidelyusedtoestimatetheprevalence of obesity or underweight within a population. The relationship between BMI and blood pressure has also been reported among Asian populations. India in a process of rapid economic development and modernization with changing life style factors has an increasing trend of hypertension especially among urbanpopulation.

It is important from a public health perspective to have data on the characteristics and health of a population and health of different sub-groups in the population because of racial \ethnic disparities in terms of long-term health consequences. It is necessary to identify individuals and population at risk.

SeveralstudieshavebeendoneindifferentpartsofIndiaonfactorsaffectingcardiovascularfunctions40. Obesity or excess relative weight is found to be associated with increased risk of disease morbidity and mortality41.

BMIiswidelyacceptedasoneofthebestindicatorofnutritionalstatusinadults.(42-45).Theimportance of BMI and skinfolds has been recognized for estimating cardiovascular disease risk factors, particularly due to their positive association with hypertension.(46) Linear regression showed BMI and waist circumference as important predictors of hypertension.47 Many investigators have earlier reported significant positive correlation of BMI with SBP andDBP.(48-53)

Hypertension and uric acid:

Hypertension in adults is the most common form of cardiovascular diseases. The prevalence of hypertension grows higher with aging, resulting in an increase in morbidity and mortality through various events such as myocardial infarction, heart failure, stroke, and renal failure.

Hyperuricemia has been proposed to have an association with hypertension in various studies. Serum uric acid(UA) levels were demonstrated to be an independent predictor for developing hypertension. Regardless of the different ethnic origins, a continuous relationship between serum UA and blood pressure was observed in African-American and whites as well as in Asians including Koreans.

Hypertensionistheleadingcauseofprematuredeathandcardiovasculardiseases(CVD)worldwide.The prevalence of CVD and hypertension has not decreased throughout the last decades, and CVD is still responsible for nearly 33% of all globaldeaths.

The first report of the association between serum UA (SUA) and hypertension dates back to 1879, by Frederick Akbar Mahomed 54. Since then, numerous studies have confirmed this strong association [55–71]. SeveralmechanismshavebeenproposedtoexplainthepotentialroleofSUAinthedevelopmentofhypertension, including UA-mediated kidney afferent arteriolopathy, renin-angiotensin-aldosterone system (RAAS) activation, oxidative stress, inflammation, and endothelial dysfunction [72-84]. However, the precise pathophysiologic patterns remain elusive

For determining the causal role of serum UA in the development of hypertension, Mazzali et al. demonstratedanelevationinserumUAfollowedbyanincreaseinBPviaacrystalindependentmechanisminrat models. Reduction of serum uric acid was associated with a decrease in BP through the regulation of renin- angiotensin and nitric oxidesystem.

II. Methods

ThepresentProspectiveobservationalstudywasdoneinDepartmentofgeneralmedicineinESICMCH from January 2021 to March 2021. A total of 50 cases of young hypertensives were studied during the period based on inclusion and exclusion criteria. All patients were done routine investigations like CBP,Lipid profile,serum eletrolytes . Special investigations like uric acid were done in all enrolled patients. Patients BMI was measured by recording his weight and heightsimultaneously.

Inclusion criteria:-1.all young hypertensives less than 45 years 2.all newly detected hypertensives

Exclusion criteria:-1.patients less than 12 years 2.pregnant women 3.all young hypertensives with previously diagnosed cases of secondary hypertension. 4.all young hypertensives with previous history of cad,ckd,etc.

The statistical software SPASS was used to analyse the data and Microsoft word and excel have been used to generate graphs, figure etc.

III. Results

Of all the patients 23[46%] were males and 27[54%] were females with female preponderance. The patientsenrolledweremoreintheagegroup40-45around23[46%]followedbyagegroupbetween35-40around 9[18%]. It was observed that BMI was normal in 10 [20%] of patients. Overweight patients with BMI over 25 were 30[60%]. Obesity with BMI over 30 were 10[20%]. Uric acid was increased in 27[54%] of patients. Lipid profile was done in all enrolled patients. It was observed that TGL and LDL increased in 32[64%] and 30[60%] patients respectively. Total cholesterol in 25[50%], VLDL in 25[50%], and HDL in 20[40%]patients.

Table 1
Gender Distribution
In Table 1 there is a depiction of female preponderance with females 27 vs males 23 in the ratio F:M [1:1.1]

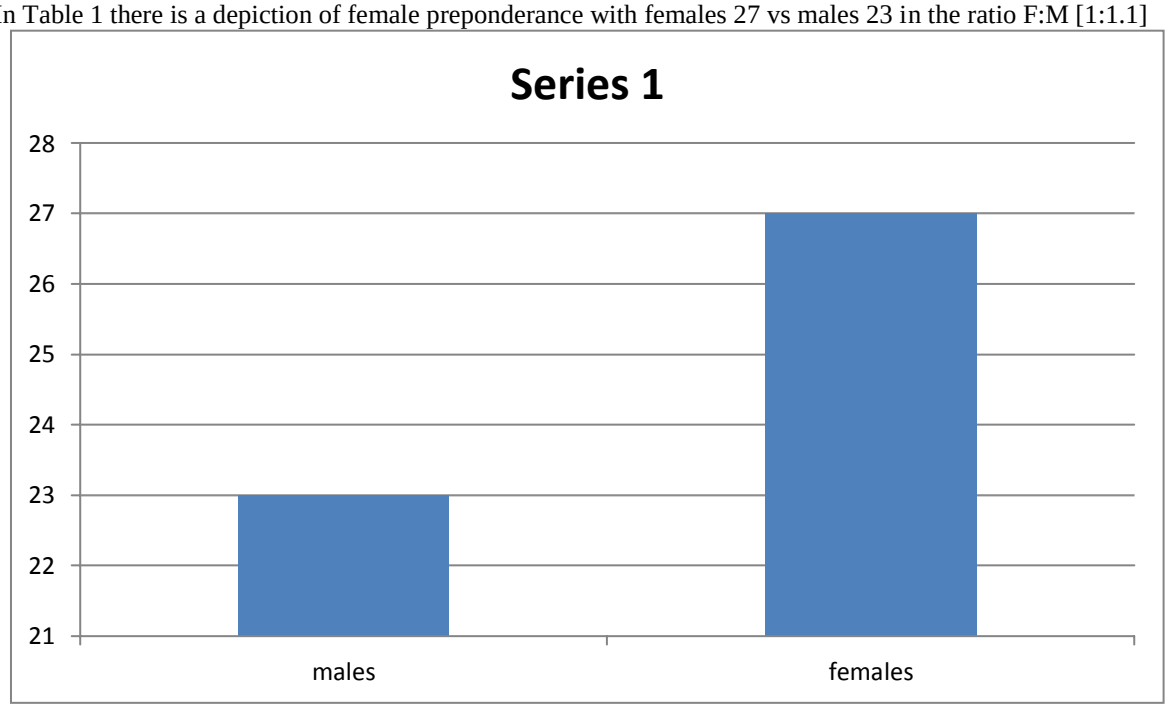


Table 2
Age Group
In table 2 the young hypertensives were more in the age group 40-45yrs followed by patients in the age group between 35-40 years.

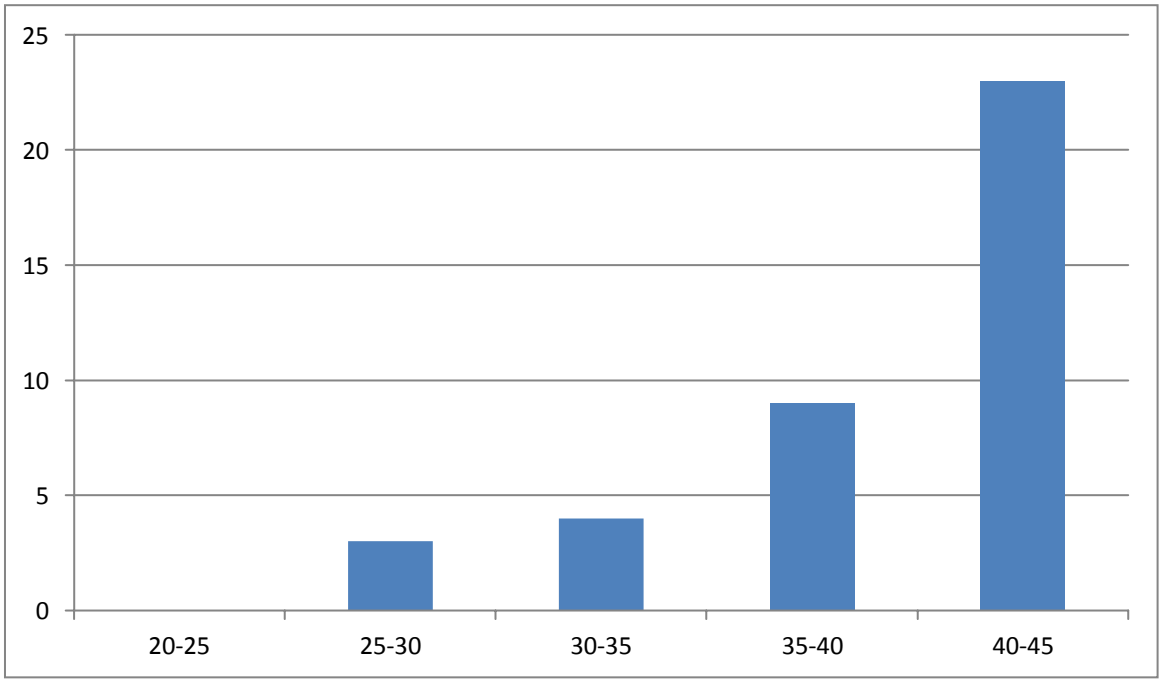


Table 3
BMI
In Table 3 the patients with BMI in young hypertensives was depicted..

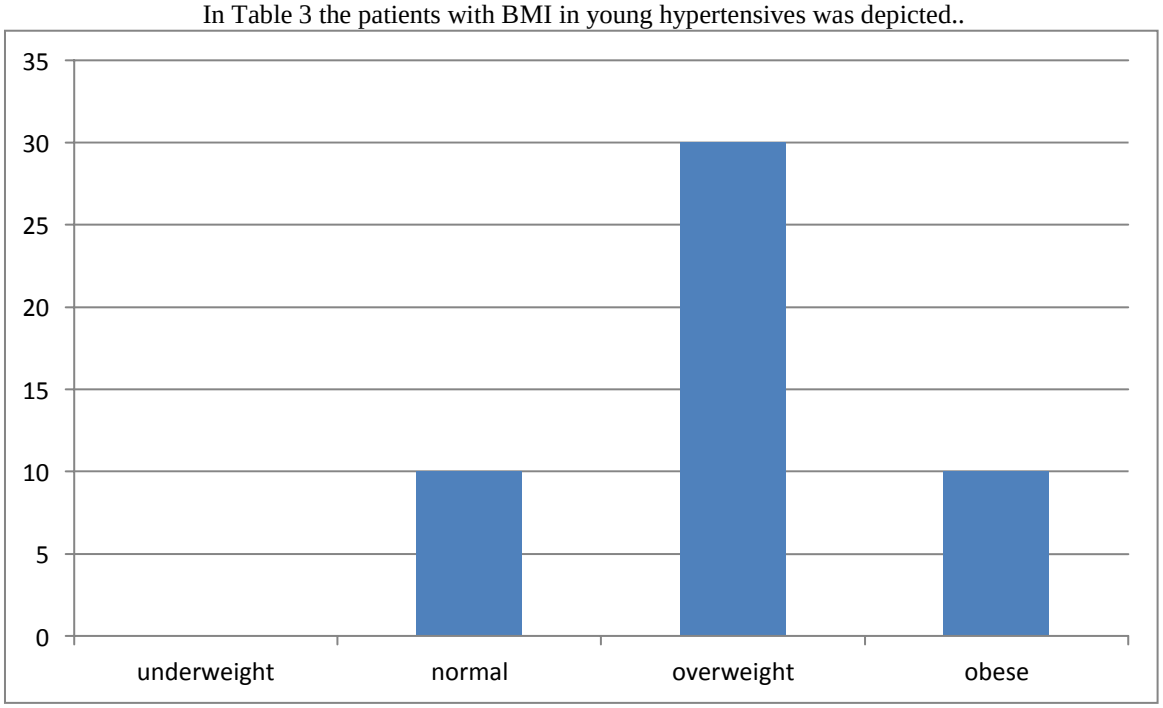


Table 4
Uric acid levels
In this table the patients with increase in uric acid were depicted.

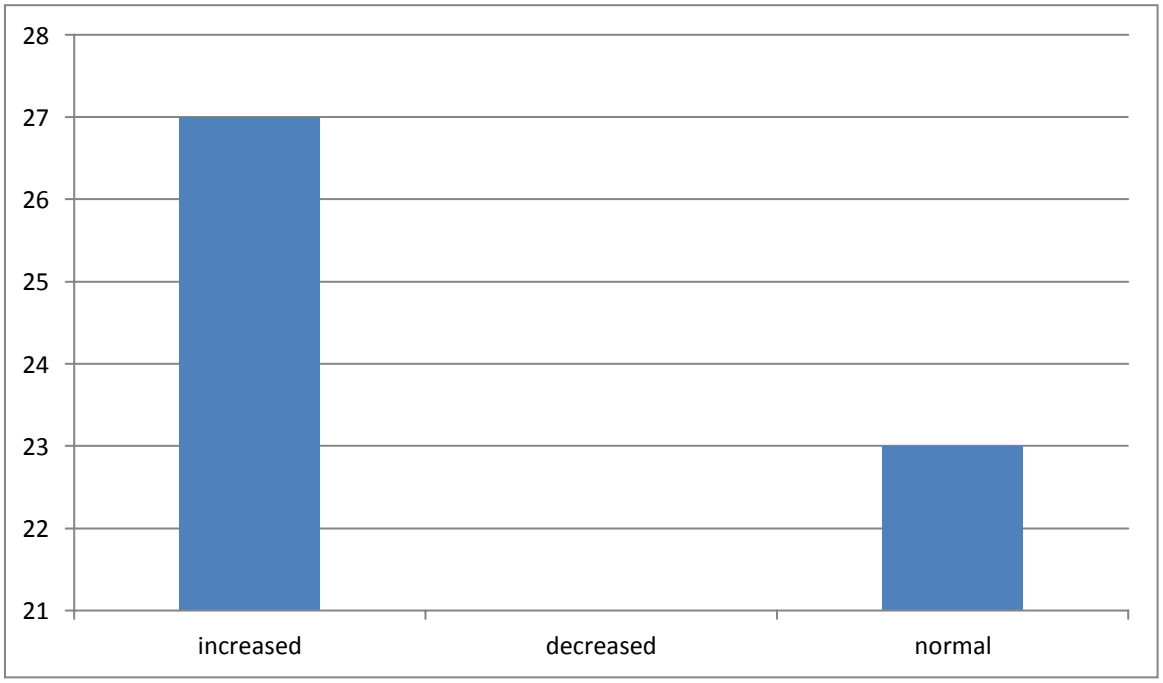
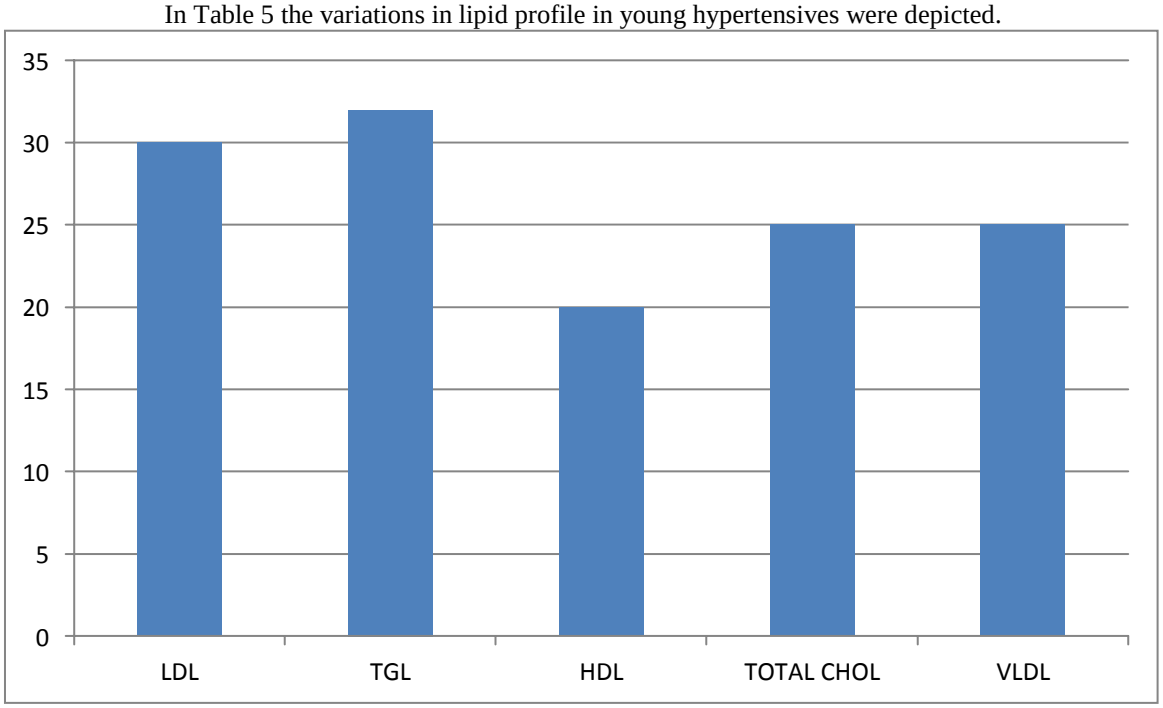


Table 5
Lipid levels
In Table 5 the variations in lipid profile in young hypertensives were depicted.



IV. Discussion:

Hypertension is recognized globally as a major risk factor for CVD, stroke, diabetes, and renal diseases.16 About 80% of hypertensive persons have comorbidities such as obesity, glucose intolerance, abnormalities in lipid metabolism, among other.

In this study, we have investigated the relationship between hypertension in young and lipid profile, BMI, and uric acid levels in ESIC medical college and hospital, sanathnagar.

Results of this study which was done in population of 50 revealed that there was female preponderance (54%) over male population. The patients enrolled were more in the age group 40-45 were around 46% and between 35-40 around were 18%

Lipid profile done in our study group revealed that TGL and LDL were increased in 32 patients (64%) and 30 patients (60%) respectively. Total cholesterol was increased in 25 patients (50%), VLDL increased in 25 patients (50%) and HDL was deranged in 20 patients (40%).

A study done by Piotr Chruście et al, , which revealed a positive correlation between the total HDL and HDL-3 concentrations a tendency to develop hypertension, seem surprising (despite relatively small effect size) – suffice it to mention the definition of metabolic syndrome, in which increased BP (defined as values ≥ 130/85 mm Hg) often coexists with lipid metabolism disorders in the form of increased fasting triglycerides concentrations (> 150 mg/dl (1.69 mmol/l)) and decreased HDL cholesterol concentrations.[85]

Ontheotherhand,therearestudiesavailablesuggestingthatinhealthyindividualsdifferentriskfactors, including obsesity, smoking, diabetes and hypertension might impair HDL functions, and increase the level of large (including HDL 3) and intermediate HDL what might have pro-atherogenic effect. And the observed increase of HDL-C should not be considered as a potentially protective effect in those patients[86-90].

InourstudyBMIwasobservedinthestudypopulationandweobservedthatBMIwasnormalin10 [20%]ofpatients.OverweightpatientswithBMIover25were30[60%].ObesitywithBMIover30were10[20%].

In a long-term prospective study (The john Hopkins precursors study), men who were overweight or obese in early adulthood or middle age were at higher risk of hypertension later in life. Overweight or obesemen wereconsistentlyathigherriskofhypertensionacrosstheentireperiodoffollow-up.Obesityinyoungadulthood conferred a 3-fold risk of hypertension, even after they accounted for change in lifestyle factors over the life course.Menwhowere ofnormalweightinearlyadulthoodbutwhobecameoverweightorobese inmidlife were twice as likely to develop hypertension as men who maintained a normalweight

Thisstudyexaminedyoungadultsandtrackedtheirbodyweightandbloodpressurethroughmiddleage and draws strength from very high response rates, adjudication of incident hypertension diagnosis, and repeated measures of blood pressure and lifestyle factors over 46 years. Unlike other studies, they estimated individual trajectoriesofweightoverthelifecourseusingrandomeffectsmodelsthatallowedeachpersontohavetheirown intercept and slope rather than being assigned a populationaverage.

Uric acid has demonstrated a crucial role in the pathogenesis of hypertension and kidney disease progression. Possible pathophysiological mechanisms involve RAAS upregulation, kidney afferent arteriolopathy, endothelial dysfunction, oxidative stress, and systemic inflammation.

In our study Uric acid was increased in 27[54%] of patients. In comparison to other studies

Kahn et al., 1972 [4] 3829 Normotensive Israeli men aged ≥ 40 y at the enrolment 5 y Serum uric acid was significantly associated with the incidence of hypertension.

Selby et al., 1990 [6] 1900 950 Hypertensive and 950 Normotensive American Multi-ethnic cohort 6 y Serum uric acid(SUA) was an independent risk factor for development of hypertension.

Huntetal.,1991[7]1482Americanadultsbelongingto98multigenerationalpedigreesassociatedwith the occurrence of coronary death, stroke death, or hypertension 7 y Serum uric acid was associated with an increased risk ofhypertension.

Jossa et al., 1994 [8] 619 Normotensive Italian men enrolled in the Olivetti Heart Study 12 y There was an independent positive association between serum uric acid levels and development of hypertension.

Dyer et al., 1999 [9] 4195 American black and white adults aged 18–30 y at the enrollment in the CARDIA study 10 y SUA was a predictor of 10-year incidence of hypertension.

Taniguchi et al., 2001 [10] 6356 Japanese men aged 35–60 y, without hypertension and diabetes at the enrollment 10 y SUA was associated with an increased risk for hypertension after adjustment for known risk factors.

Nakanishi et al., 2003 [11] 2310 Japanese male office workers aged 35–59 y who did not have hypertension, impaired fasting glucose, Type II diabetes, or past history of cardiovascular disease at study entry 6 y After controlling for potential predictors of hypertension and diabetes, the relative risk for hypertension compared with quintiles of SUA was progressively increased.

Nagahamaetal.,2004[12]4489Japanese adultswhodidnothave hypertensionandwere notcurrently using antihypertensive medication 3 y Hyperuricemia predicted development of hypertension after multivariate analysis.

Sundströmetal.,2005[13]3329FraminghamStudyparticipants(meanage48.7y;55.6%women)free of hypertension, myocardial infarction, heart failure, renal failure, or gout 4 y Age- and sex-adjusted rates of hypertension incidence increased progressively from 9.8% for the lowest quartile to 15.6% for the top quartile of SUA.

Perlstein et al., 2006 [14] 2062 Healthy adult men 22 y SUA independently predicted the development of hypertension in age-adjusted and multivariable models.

Mellenetal.,2006[15]9104Americanblackandwhiteadultsaged45to64yandwithouthypertension at baseline 9 y Higher serum uric acid was associated with greater risk of hypertension in the overall cohort after multivariateadjustment.

V. Conclusion:

ItwasObservedfromthestudythatBMIwassignificantlyhighinthepatientswithhypertension.Further lipid abnormalities were present in overweight patients contributing to hypertension. Uric acid was elevated in significant amount of patients but could not come out as risk factor in young hypertensives. Further it is advised to have healthy lifestyle and disciplined diet to avoid hazards of hypertension. Our results may contribute to the accumulation of evidence that dyslipidaemia increases risk of hypertension in Asian populations. From a clinical perspective, the importance of strict BP management in patients with dyslipidaemia was indicated. Clinical trials thatexaminewhethertreatmentofdyslipidaemiareducestheriskofdevelopinghypertensionareneededtoverify the results of this observationalstudy.

Almost one in three adults suffers from hypertension, with an increasing burden of disease worldwide. The most challenging consequence of hypertension is the so-called hypertension-mediated organ damage. It remainspartiallyunexplainedwhysomepatientsdevelophypertension-mediatedorgandamageandothersdonot. ApartfromefficientBPcontrolstrategies,otherCVriskfactorscouldplayasynergisticeffectwithhypertension leading to organ damage and CVD development. One of those CV risk factors is without a doubt is SUA. In fact, UA and hypertension are intimately associated. Several mechanisms for this association have been proposed, includingRAASregulationandsystemicendotheliopathy.Anti-hypertensivedrugshavebeenshowntoinfluence SUA levels and, in turn, most hypouricemic agents have demonstrated an effect on BP values. In addition, pharmacological drug classes used to treat other CV risk factors, such as diabetes, have also shown to exert an effect on SUA levels. A holistic approach to prevent and treat CV risk factors appears of critical importance. Large controlled studies on the effect of long-term anti-hyperuricemic agents on BP and CV risk reduction are warranted, with a specific focus in the highest risk population such as patients with gout and high SUAlevels.

DECLARATIONS
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Ethical approval: approved

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