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Original Article

Physiology Section

Comparison of Demographic Factors and Personal Lifestyle Characteristics with 2020 ISH Guidelines for High Normal Blood Pressure in Relation to Absence and Presence of ECG Diagnosed LVH in Healthy Adults: A Cross-sectional Study

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ABSTRACT

Introduction: Early identification of Left Ventricular Hypertrophy (LVH), a powerful and independent predictor of Cardiovascular Disease (CVD), is a key element for preventing Cardiovascular Events (CVE). High-Normal Blood Pressure (HNBP) was significantly associated with a new-onset Electrocardiogram (ECG) diagnosed LVH. The demographic and personal lifestyle characteristics could be related to HNBP in ECG diagnosed LVH. This relation, if found, can be useful as a factor for early identification of HNBP in relation to ECG diagnosed LVH.

Aim: To compare demographic and personal lifestyle characteristics with HNBP in relation to ECG diagnosed LVH in healthy adults.

Materials and Methods: The cross-sectional study was conducted in AIIMS Raipur (CG) Raipur, Amboli, Maharashtra, India from April 2021 to March 2022 among 95 healthy adult males between 20-39 years with a Blood Pressure (BP) of 130-139/85-89 mmHg and no antihypertensive medications. Permission was obtained from the Ethics committee of AIIMS Raipur (CG). Data was collected from the individuals using health questionnaire, Personal Lifestyle Questionnaire (PLQ), validated anthropometric equipment stature metre for measuring height and weighing machine, a working electronic BP measuring instrument, and ECG. The present study included demographic factors like age, height, weight, Body Mass Index (BMI), educational level, marital status, occupation, and Socio-Economic Status (SES) classified based on Kuppuswamy's classification. The personal lifestyle characteristics included physical activity, use of substances (alcohol, smoking, tobacco, gutkha), and diet. The unpaired t-test, Chi-square test and regression analysis were applied for the analysis of the collected data.

Results: Representation of demographic factors were age (31.9±5.08), height (1.69±0.06), weight (68.3±10.2), BMI (23.8±3.05) in terms of (mean±SD) and SES in terms of n (%) were upper I-7 (7.4), upper middle II-31 (32.6), lower middle III-30 (31.6), upper lower IV-25 (26.3), lower V-2 (2.1). SES classes of modified Kuppuswamy's SES scale had a significant relationship with LVH {p-value <0.05 (0.003)}. All LVH (+) individuals were from the lower middle III SES class {7 (7.4%)}. Daily use of substances (alcohol, smoking, tobacco, gutkha) had a significant association with LVH {p-value <0.05 (0.005)}. Group-IV (35-39 years) (standard coefficient 0.4621059, 95%CI-0.0385065 to 0.4686115; p-value-0.021) had more positive relation than Group-II (25-29 years) (std. coef. 0.4422758, 95% CI-0.0501719 to 0.4566986; p-value-0.015). Primary Educational level (std. coef.-0.2473403, 95% CI-0.8019454 to-0.0982954; p-value-0.013) had a negative relation with SL-LVH (p<0.05).

Conclusion: The study concluded that lower middle III class SES and daily use of substances (alcohol, smoking, tobacco, gutkha), age Group-IV (35-39 years), and primary educational level were the predicted demographic and lifestyle characteristics of HNBP in relation to ECG diagnosed LVH.

Keywords: Electocardiogram diagnosed, High normal blood pressure, International society of hypertension

INTRODUCTION

Essential Hypertension (HTN) is one of the most common modifiable risk factors in the general population, being strongly and independently related to an increased risk of Cardiovascular (CV) morbidity and mortality, independently by age and gender [1]. The Primary prevention of HTN is an attractive approach to reducing CV morbidity and mortality. The heart is a key target organ for HNBP, and the cardiac muscle responds to increased afterload (i.e., systemic BP) by developing hypertrophy. Even a mild increase in ECG voltage that indicates an increase in left ventricular mass could be an early symptom of HTN [2]. LVH is a powerful and independent predictor of CVD in a non hypertensive population, more than twice as likely to suffer premature CVE or death and beyond traditional risk factors. Achievement of LVH regression is possible with lifestyle modifications and antihypertensive therapy (if a trial of lifestyle modification fails to reduce their BP to 130/80 mmHg or less). It is associated with an improvement in cardiovascular prognosis. Early identification of LVH is a key element for preventing CVE in HTN [1,3-6].

The seventh report of the Joint National Committee (JNC 7) introduced a new classification in 2003 that includes the term "pre HTN" for those with BP. BP Classification of JNC 7 is Normal (<120 and <80 mmHg), Pre HTN (120-139 or 80-89 mmHg), Stage 1 HTN (140-159 or 90-99 mmHg) and Stage 2 HTN (≥160 or ≥100 mmHg). This new designation intended to identify those individuals in whom early intervention by adopting healthy lifestyles could reduce BP, decrease the rate of progression of BP to hypertensive levels with age, or prevent HTN entirely [4]. The term "pre HTN" introduced

by JNC 7 report gets modified. The International Society of Hypertension (ISH) introduced a recent classification of BP [4].

To reduce the global burden of raised BP, the ISH has developed worldwide practice guidelines for managing HTN in adults aged 18 years and older. Recommendations for office BP measurement are: 1) Conditions: quiet room with a comfortable temperature. Before measurements: Avoid smoking, caffeine, and exercise for 30 minutes; empty bladder; remain seated and relaxed for 3-5 minutes. Neither patient nor staff should talk before, during, and between measurements; 2) Positions: sitting: arm resting on table with mid-arm at heart level; back supported on a chair; legs uncrossed and feet flat on the floor; 3) Device: validated electronic (oscillometric) upper-arm cuff device. Lists of accurate electronic devices for office, home, and ambulatory BP measurement in adults, children, and pregnant women are available at www.stridebp.org. Alternatively, a calibrated auscultatory device (aneroid or hybrid as banned mercury sphygmomanometers in most countries) with 1st Korotkoff sound for Systolic Blood Pressure (SBP) and 5th for diastolic with a low deflation rate can be used; 4) Cuff: size according to the individual's arm circumference (smaller cuff overestimates and larger cuff underestimates BP). For manual auscultatory devices, the inflatable bladder of the cuff must cover 75%-100% of the individual's arm circumference. For electronic devices, use cuffs according to device instructions; 5) Protocol: At each visit, take three measurements with one minute between them. Calculate the average of the last two measurements. If the BP in the first reading is <130/85 mmHg, no further measurement is required; 6) Interpretation: whenever possible, consideration of a single office visit should not be for the diagnosis. Usually, 2-3 office visits at 1-4-week intervals (depending on the BP level) are required to confirm the diagnosis of HTN. The diagnosis might be made on a single visit if BP is ≥180/110 mmHg and there is evidence of CVD. If possible and available, confirmation of the diagnosis of HTN should be by out-of-office BP measurement. This recent classification of HTN followed in the present study, based on office BP measurement. It includes normal BP (<130/<85 mmHg), HNBP (130-139/85-89 mmHg), grade 1 HTN (140-159/90-99 mmHg), and grade 2 HTN (≥160/≥100 mmHg). HNBP intends to identify individuals who could benefit from lifestyle interventions and receive pharmacological treatment if compelling indications exist [7].

Major risk factors for pre HTN are lower education, a sedentary lifestyle, and alcohol use [8]. Pre HTN individuals' LVMI values and LVH prevalence are intermediate between normal and sustained HTN individuals. On average, the detection of abnormal values is relatively low [3]. HNBP was significantly associated with new-onset ECG LVH [9]. There is a well-known fact that lifestyle characteristics are associated with HTN. There is also a strong relationship between HTN and ECG-diagnosed LVH. However, there are very few studies comparing demographic factors and lifestyle characteristics with HNBP in relation to LVH, which is said to be a powerful and independent risk factor for CVE.

The study intends to compare demographic factors and lifestyle characteristics with HNBP in relation to the absence and presence of ECG-diagnosed LVH. Also, to access and predict lifestyle characteristics, priority should be given to lifestyle modification and demographic indices: Age, height, weight and BMI dependent onset of ECG-diagnosed LVH among healthy adults.

MATERIALS AND METHODS

The present cross-sectional study was conducted in the Department of Physiology AIIMS Raipur (CG) Raipur, Amboli, Maharashtra, India. Raipur Municipal Corporation divides Raipur city, the capital of Chhattisgarh, into ten zones, among which zone 8 {ward no. 1) Veer Savarkar Nagar, ward no. 2) Pt. Jawaharlal Nehru, ward no. 19) Dr. APJ Abdul Kalam, ward no. 20) Ramakrishna Paramhansa, ward no. 21) Shaheed Bhagat Singh, ward no. 69) Madhavrao Sapre, ward no. 70). Sant Ravidas} were randomly selected to recruit participants, and a single sample of the target population was selected. The duration of the study was April 2021 to March 2022. The Institute's Ethics Committee AIIMS Raipur (CG) approved the study (IEC Proposal No.: AIIMSRPR/IEC/2021/712). The participants gave informed written consent.

Sample size calculation: Calculation of the sample size from the formula=$Z_{1-\alpha/2}$ ^{2}p (1-p)/d^2 using a 95% confidence level, 5% margin of error, and design effect of 1 based on the prevalence of HNBP of 6.62%. A qualitative variable in this study had a formula for identifying the proportion of HNBP in a population. It should use for sample size=$Z_{1-\alpha/2}$ ^{2}p (1-p)/d^2 {$Z_{1-\alpha/2}$=standard normal variate at 5% type 1 error (p-value <0.05) is 1.96., p=Expected proportion in population based on previous studies or pilot studies (prevalence)=6.62% (0.0662), d=Absolute error or precision}=1.962×0.0662 (1-0.0662)/0.052=94.92 [10,11]. Thus, the total study population was determined to be 95 healthy adult males.

Inclusion criteria: Apparently, healthy adults with a BP of 130-139/85-89 mmHg and not on any antihypertensive medications, age group between 20-39 years were included in the study.

Exclusion criteria: Individuals with a history of recent surgeries, with normal BP, i.e., <130/85 mmHg. Presently diagnosed unknown or known case of primary/secondary HTN or known history of antihypertensive medications, hypertrophic cardiomyopathy based on the echocardiographic findings, any other co-morbidities like a known history of Diabetes Mellitus, Obesity, Chronic Obstructive Pulmonary Disease (COPD)/Asthma, kidney disease, and thyroid dysfunction, Ischaemic heart disease, arrhythmias, Congenital, infective, valvular heart disease, pericardial effusion, Congestive heart failure, and any other acute illness.

The participants were explained about the procedure, investigations, and examination.

Study Procedure

Anthropometric measurements and questionnaires: Age (years), Standing height (cm), weight (kg) recorded and BMI calculated using the formula of BMI=weight in kg/height in m^2 [12]. Validated anthropometric equipments {stature meter for measuring height (cm), weighing machine for measuring weight (kg)}; Questionnaires used were a health questionnaire and Personal Lifestyle Questionnaire (PLQ) in this study [13,14]. A detailed medical history was taken from all participants using a health questionnaire. A lifestyle questionnaire was given to participants to collect the information for evaluation of demographic factors and personal lifestyle characteristics. The PLQ includes demographic factors, educational level, marital status, occupation, SES according to the modified Kuppuswamy's SES scale [15], and Personal lifestyle characteristics, physical activity, use of substances (Alcohol, Smoking, Tobacco, Gutkha), and diet.

Blood Pressure (BP) measurement and interpretation: According to the 2020 ISH Global HTN Practice Guidelines, BP measurement was done [7]. The device used was a validated electronic (oscillometric) upper-arm cuff. BP was measured in a sitting position with arm resting on a table with mid-arm at heart level, back supported on a chair, legs uncrossed, and feet flat on the floor, neither patient nor staff talking before, during, and between measurements. The participants were instructed to avoid smoking and caffeine and exercise for 30 minutes before the procedure. Then they were relaxed for 35 minutes. Implementation of cuffs was according to device instructions for electronic devices. This was done in a single visit with three measurements with one minute between them. The average of the last two measurements was calculated. Suppose the BP of the first reading was <130/85 mmHg; there was no further requirement for BP measurement. The recorded BP of participants provides their specific BP numbers and the BP goal.

Classification of the participants based on 2020 ISH HTN guidelines is

- Normotensive (<130/<85 mmHg),
- High normal BP (130-139/85-89 mmHg),
- Hypertensive (≥140/≥90 mmHg) individuals.

The present study excludes normotensive and hypertensive individuals [7]. The numbers of participants recruited are 95 healthy adult males.

Electrocardiographic measurement and interpretation: A trained laboratory technician, blinded to the research subject, measured ECG at a paper speed of 25 mm/sec, at a 10 mm/mV gain. The device used for measuring ECG record was An ECG device Model: SE1200 antielectroshock type class I of EDAN Medical India Private Ltd. The participants underwent standard supine 12-lead ECG after a minimum 5-minute rest at the baseline examination for the diagnosis of LVH based on the ECG-LVH criterion. The ECG-LVH standards applied are Sokolow-Lyon voltage and Cornell Product for diagnosing LVH. The present study measured ECG parameters, The Sokolow-Lyon (SL) voltage (S in V1+R in V5/V6) and Cornell voltage (CV: S in V3+R in a VL) on three consecutive heartbeats. The present study measured the QRS duration on three consecutive heartbeats from lead II (or lead I, III, or a VF if the measurement of QRS duration is difficult from lead II). The SL-LVH of each participant from the measured value of relevant ECG, defined as ≥35 mm (3.5 mV) was calculated. Similarly, The Cornell voltage Product (CP) from each recording of individual ECG as the CV (+0.8 mV in men) ×QRS duration, defined as 2440 mm×ms (≥244 mV×ms) [16,17] was calculated. Interpretations were evaluated based on SL-LVH and CP-LVH criteria.

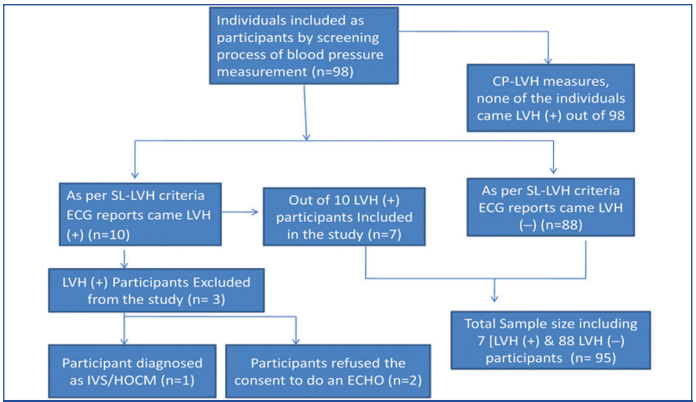
Twelve lead ECG report LVH values of 98 recruited participants were calculated based on Sokolow-Lyon (SL-LVH) and Cornell Product (CP-LVH) ECG-diagnosed LVH criteria. As per SL-LVH criteria, 10 participants' ECG reports came LVH (+), and none of the individuals came LVH (+) as per CP-LVH criteria. There were no other abnormalities in the 12 lead ECG reports. Two participants refused to consent to do an Echocardiogram (ECHO). The ECHO of the remaining LVH (+) 8 participants has done in the Department of Cardiology, AIIMS Raipur, to rule out the differential diagnosis of LVH. Exclusion of one participant was done based on the diagnosis of Inter-Ventricular Septal (IVS) Thickness, based on the ECHO report from the study. Three individuals out of 10 LVH (+) subjects were not involved in the study as two refused to give consent to do ECHO, and one was diagnosed with IVS hypertrophy which comes under the exclusion criteria of this study. Out of 98 individuals, three were eliminated, 7 were LVH (+), and 88 were LVH (-). Thus, the final sample size is 95 {LVH (+), n=7 and LVH (-), n=88}.

STATISTICAL ANALYSIS

For the comparison of continuous data (age, height, weight, BP), a test used was an unpaired t-test. For comparison of the categorical data (BMI, SES Class, use of substances), a test used was the Chi-square test. To determine the strength of the relationship, a test used was regression analysis between one dependent variable and a series of independent variables. A p-value <0.05 was considered statistically significant. The statistics software STATA/SE 12.0 was used to perform statistical analyses.

RESULTS

[Table/Fig-1] shows the final sample size is 95 {LVH (+), n=7 and LVH (-), n=88}. [Table/Fig-2] shows the frequency distribution with the percentage of demographic factors and personal lifestyle characteristics of all participants (n=95). The parameters assessed to check were demographic factors, educational level, marital status, occupation, and personal lifestyle characteristics physical activity and diet. Participants with higher educational levels are 83 (%), married 76 (%), and last 12 months participation minimum of 30 minutes of physical exercise {3-4 times per week 40 (%) and not at all 42 (%)}.



[Table/Fig-1]: The total study population included was 95 healthy adult males {LVH (+) N=07 and LVH (-) N=88}.
IVS: Inter Ventricular septum; HOCM: Hypertrophic obstructive cardiomyopathy; LVH: Left ventricular hypertrophy; ECHO: Echocardiogram; ECG: Electrocardiography

Personal lifestyle characteristics	n (%)
Educational level*	
Secondary	16 (16.8)
Higher	79 (83.2)
Marital status*	
Married	72 (75.8)
Single	23 (24.2)
Occupation*	
Employed	94 (98.9)
Unemployed	1 (1.05)
Physical activity* 30 minutes Daily walk (Last 12 months participation)	
3 to 4 times per week	38 (40)
1 to 2 times per week	10 (10.5)
1 to 2 times per month	7 (7.4)
Not at all	40 (42.1)
Diet*	
Adequate intake of fruits and vegetables	
Yes	93 (97.9)
No	2 (2.11)
Breakfast	
Yes	81 (85.3)
No	14 (14.7)
Snack in between meals	
Yes	41 (43.2)
No	54 (56.8)

[Table/Fig-2]: The frequency distribution of demographic factors and personal lifestyle characteristics.
*=The frequency distribution of all participants (n=95) in each variable shown in percentage {n(%)}

The comparison of HNBP (SBP and DBP) within each personal lifestyle characteristic was insignificant. The comparison of SBP within each variable, i.e., Educational level (p-value-0.237), marital status (p-value-0.641), occupation {(employed/ unemployed) n (%) 94 (98.9)/1 (1.05) was not adequate to determine p value}, physical activity (p-value-0.479), and diet (p-value-0.501) and DBP with Educational level (p-value-0.535), marital status (p-value-0.866), occupation 94 (98.9)/1 (1.05) was not adequate to determine p-value], physical activity (p-value-0.058), and diet (p-value-0.237), snack in between meals (p-value-0.135)}.

[Table/Fig-3] shows the linear regression of demographic factors with SL-LVH. age Group-I (20-24 years) was taken as the reference variable. Indicator variables age Group-II (25-29 years) and Group-IV (35-39 years) had a positive relation with SL-LVH. Group-IV (35-39 years) (std. coef. 0.4621059, 95% CI 0.0385065 to 0.4686115; p-value=0.021) and Group-II (25-29 years) (std. coef. 0.4422758,

95% CI 0.0501719 to 0.4566986; p-value=0.015) had a positive relation. Higher education level was taken as a reference variable. Primary educational level (std. coef.-0.2473403, 95% CI-0.8019454 to-0.0982954; p-value=0.013) had a negative relation with SL-LVH (p<0.05).

Indicator variables	Std. Coef. (beta)	(95% CI)		p-value
Age groups (y)				
Group-II (25-29)	0.4422758	0.0501719	0.4566986	**0.015***
Group-III (30-34)	0.2948158	-0.0458835	0.3874181	0.121
Group-IV (35-39)	0.4621059	0.0385065	0.4686115	**0.021***
BMI				
Overweight	0.1317115	-0.0365602	0.1792308	0.192
Educational level				
Illiterate	-0.0455101	-0.6102926	0.3772881	0.64
Primary	-0.2473403	-0.8019454	-0.0982954	**0.013***
Secondary	0.1120347	-0.0729234	0.2432547	0.287
Marital status				
Single	0.0222555	-0.1191374	0.1462847	0.839
Occupation				
Unemployed	0.0923485	-0.3887814	0.861591	0.454
SES class				
Upper middle II	0.0168187	-0.1874407	0.2061838	0.925
Lower middle III	-0.3538283	-0.4054311	0.0076944	0.059
Upper lower IV	0.1054449	-0.150799	0.275919	0.561
Lower V	-0.033441	-0.4446729	0.3229581	0.753

[Table/Fig-3]: The relationship between demographic factors and Sokolow-Lyon voltage criteria in left ventricular hypertrophy (SL-LVH).
The test used was Linear Regression Analysis.* represents the level of significance (p-value <0.05). 95% CI: 95% Confidence interval; Std. Coef. (beta): Standard co-efficent (beta); BMI: Body mass index; SES: Socio-economic status

[Table/Fig-4] shows the relation between lifestyle factors and Sokolow-Lyon LVH using linear regression analysis. There is no relation found within personal lifestyle characteristics parameters and SL-LVH {Physical activity (30 minutes daily walk (last 12 months participation)), (1 to 2 times per week and 3 to 4 times per week (p-value=0.521), 1 to 2 times per month and 3 to 4 times per week (p-value=0.562), Not at all and 3 to 4 times per week (p-value=0.689), diet (inadequate and adequate intake of fruits and vegetables) (p-value=0.532), eating breakfast and no breakfast (p-value=0.281), taking snack in between meals and no snack in between meals) (p-value=0.919)}.

Indicator variables	Std. Coef. (beta)	(95% CI)		p-value
Physical activity				
30 minutes daily walk (Last 12 months participation)				
1 to 2 times per week	-0.0879972	-0.3062604	-0.1564369	0.521
1 to 2 times per month	0.0744443	-0.1800152	-0.3289038	0.562
Not at all	-0.0603009	-0.1903282	-0.1265117	0.689
Diet				
Inadequate intake of fruits and vegetables	0.081338	-0.3212749	-0.6173197	0.532
Breakfast	0.1378105	-0.0848847	-0.2880249	0.281
Snack in between meals	0.0123294	-0.1200673	-0.1330741	0.919

[Table/Fig-4]: The relationship of personal lifestyle variables with Sokolow-Lyon Voltage criteria in left ventricular hypertrophy (SL-LVH).
The test used was linear regression analysis. The level of significance (p-value <0.05)
95% CI: 95% Confidence interval; Std. Coef. (beta): Standard co-efficent (beta)

[Table/Fig-5] shows characteristics of factors like age, height, weight, BMI, HNBP, SES class related to SL-LVH, and use of substances (alcohol, smoking, tobacco, gutkha), used daily (once/twice), monthly (once/twice) or >3 months were affecting ECG findings specifying SL-LVH. There were no significant differences in age (p-value=0.358), height (p-value 0.670), weight (p-value 0.193), BMI (p-value=0.199), HNBP {SBP (p-value=0.324) and DBP (p-value=0.705)}, or use of substances (p-value=0.986), except daily use of substances (p-value=0.005), expressed in terms of mean±SD and n (%) between SL-LVH (+) and (-) groups. The study population with normal BMI is 60 (63.2%) and overweight is 35 (36.8%), out of which 6 (6.3%) and 1 (1.05%) are LVH (+), respectively. SES classes have a significant p-value <0.05 (0.003). All LVH (+) individuals are from the lower middle III SES class {7 (7.4%)}. LVH (-) individuals of upper I, upper middle II, lower middle III, upper lower IV and lower V are 7 (7.4%), 31 (32.6%), 23 (24.2%), 25 (26.3%) and 2 (2.1%), respectively. Daily use of substances has a significant p-value <0.05 (0.005). Out of 7 LVH (+), participants using alcohol, smoking, tobacco, or gutkha are 5 (5.3%), and no use of any substances is 2 (2.1%).

Variables	SL-LVH		p-value
	LVH (+)	LVH (-)	
	mean±SD (n=7) n (%)	mean±SD (n=88) n (%)	
Age	30.1±5.7	32±5	0.358
Height	1.7±0.1	1.69±0.1	0.670
Weight	63.4±11.9	68.7±10.1	0.193
BMI			
Normal	6 (6.3)	54 (56.8)	0.199
Overweight	1 (1.05)	34 (35.8)	
High normal blood pressure			
SBP	133±4.9	134.4±3.3	0.324
DBP	85.6±1.3	85±3.7	0.705
SES class			
Upper I	0 (0)	7 (7.4)	0.003*
Upper middle II	0 (0)	31 (32.6)	
Lower middle III	7 (7.4)	23 (24.2)	
Upper lower IV	0 (0)	25 (26.3)	
Lower V	0 (0)	2 (2.1)	
Use of substances			
Alcohol, smoking, tobacco, gutkha	5 (5.3)	41 (43.2)	0.986
No use of any substance	2 (2.1)	47 (49.5)	
Daily (once/twice)			
Yes	5 (5.3)	20 (21.05)	0.005*
No	2 (2.1)	68 (71.6)	
Monthly (once/twice)			
Yes	0 (0)	14 (14.7)	0.253
No	7 (7.4)	74 (77.9)	
>3 month			
Yes	0 (0)	8 (8.4)	0.405
No	7 (7.4)	80 (84.2)	

[Table/Fig-5]: Comparison of absence and presence of left ventricular hypertrophy according to Sokolow-Lyon Voltage criteria for LVH (SL-LVH) with demographic, personal lifestyle factors and High Normal Blood Pressure (HNBP) (n=95).
For the comparison of continuous data, a test used was an unpaired t-test where applicable. For comparison of the categorical data, a test used was the Chi-square test.
*=a p-value <0.05 was considered statistically significant.
LVH: Left ventricular hypertrophy; (+), Present; (-), Absent; BMI: Body mass index; Normal 18.524.9, Overweight ≥25.0029.99; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; SES: Socio-economic status

DISCUSSION

The present study shows that daily use of substances (alcohol, smoking, tobacco, gutkha) among personal lifestyle characteristics related to ECG-diagnosed LVH. SES, specifically lower middle III class, age Group-IV (35-39 years), and higher educational level among demographic factors, are related to ECG-diagnosed LVH.

There is no relation found within personal lifestyle characteristics parameters and SL-LVH {physical activity (30 minutes daily walk (Last 12 months participation), (1-2 times per week and 3-4 times per week, 1-2 times per month and 3-4 times per week, not at all and 3-4 times per week), diet (inadequate and adequate intake of fruits and vegetables), eating breakfast and no breakfast, taking snack in between meals and no snack in between meals)}, and demographic factors {marital status (single/married), occupation (unemployed and employed)} and SL-LVH.

There was no relationship found between HNBP (SBP and DBP) within each personal lifestyle characteristic. Also, there was no relation between age, height, weight, BMI, HNBP (SBP and DBP), and use of substances except for daily use of substances seen between SL-LVH (+) and (-) groups. Electrocardiographic assessment of LVH remains the first choice technique and represents an easy-to-perform, widely available, specific, repeatable, established prognostic value, and cost-effective method to assess the presence of LVH in the setting of clinical practice of HTN [1,6]. ECHO is much more sensitive than ECG to detect LVH, although ECG-LVH is a highly specific indicator for the condition [1,4].

There is a well-known fact that lifestyle characteristics are associated with HTN. There is also a strong relationship between HTN and ECG-diagnosed LVH. Still, there are very few studies on the relationship between HNBP and lifestyle characteristics and the impact of HNBP on ECG-diagnosed LVH, a decisive and independent risk factor for CVE [3,9].

Takase H et al., concluded that both SokolowLyon voltage and Cornell product are novel predictors of the future development of HTN in the general population [2]. The risk of HTN increases even below the SokolowLyon voltage threshold and Cornell product defined for LVH. Findings in this study suggest that the amplitude of voltage in ECG is closely associated with future BP and is an important marker for managing BP [Table/Fig-4]. Univariate Cox proportional hazard regression analyses for future development of HTN {Sokolow-Lyon voltage, mV (Hazard Ratio (95% CI) 1.64 (1.52-1.77) (p-value <0.0001), Cornell product, mm.ms/100 (Hazard Ratio (95% CI) 1.04 (1.03-1.05) (p-value <0.0001) [2]. Ueda H et al., concluded that even high normal BP was significantly related to the presence of new-onset ECG diagnosed LVH [9].

Based on the above-supporting studies [1,2,4,6] in the present study, ECG-diagnosed LVH criteria was taken as the principal marker of LVH caused by HNBP. The Echocardiography (ECHO) was done on ECG-diagnosed LVH (+) participants according to ECG-diagnosed LVH criteria to rule out any other diagnosis of LVH other than HNBP.

Owiredu EW et al., concluded that the prevalence of pre HTN is high among apparently healthy Ghanaian adults (49.0%) [8]. Lower educational levels, a sedentary lifestyle, and alcohol consumption are the predominant risk factors for pre HTN in Kumasi [8]. In the present study, daily use of substances is the factor that can prioritise lifestyle modification to minimise the HNBP in relation to LVH. Avoidance of using substances may prevent the early onset of LVH. The demographic factors which can predict LVH are age Group-IV (35-39 years), higher educational level, and SES, specifically in the Lower middle III class.

Personal lifestyle characteristics like physical activity (30 minutes daily walk for last 12 months), use of substances except for daily use of substances and diet (adequate use of fruits and vegetables, breakfast, snack in between meals) were not related to HNBP and ECG diagnosed LVH. Demographic factors such as height, weight, BMI, marital status, and occupation are unrelated to ECG-diagnosed LVH.

In the present study, the relationship of demographic factors age Group-IV (35-39 years), higher educational level, SES Lower middle III class according to Modified Kuppuswamy's Classification [15], and lifestyle characteristics, Daily use of substances such as alcohol, smoking, tobacco, and gutkha with HNBP in relation to ECG diagnosed LVH was present. The present study can be used in the future for clinical assessment of demographic and lifestyle characteristics related to HNBP in relation to the absence or presence of ECG diagnosed LVH.

Further future studies can be carried out on the demographic and lifestyle characteristics related to HNBP in relation to the absence and presence of ECG-diagnosed LVH so that lifestyle modification can prevent CVE caused by LVH related to HNBP.

Limitation(s)

There is a comparison between a limited range of systolic and diastolic HNBP and not between normotensive and HNBP individuals. In the present study, seven subjects were LVH (+) according to the Sokolow-Lyon criteria, but none were LVH (+) with the Cornell product criteria.

CONCLUSION(S)

The present study concluded that there was a significant relationship present between SES (Lower middle III class) and daily use of substance in relation to the absence and presence of the ECG-diagnosed LVH. Age Group-IV (35-39 years) and Group-II (25-29 years) had a positive relationship with the ECG diagnosed LVH when compared to Group-I (20-24 years). Primary educational level had a negative relation with the ECG-diagnosed LVH compared to higher educational level.

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REFERENCES

[1] Miceli F, Presta V, Cioni B, Canichella F, Figliuzzi I, Ferrucci A, et al. Conventional and new electrocardiographic criteria for hypertension mediated cardiac organ damage: A narrative review. JCH (Greenwich). 2019;21(12):1863-71.
[2] Takase H, Sugiura T, Murai S, Yamashita S, Ohta N, Dohi Y. Use of electrocardiography to predict future development of hypertension in the general population. Medicine (Baltimore). 2016;95(17):e3483.
[3] Cuspidi C, Facchetti R, Bombelli M, Tadic M, Sala C, Grassi G, et al. High normal blood pressure and left ventricular hypertrophy electrocardiographic findings from the Pamela population. Hypertension. 2019;73:612-19. Doi: 10.1161/HYPERTENSIONAHA.118.12114.
[4] Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL JR, et al. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. Hypertension. 2003;42(6):1206-52.
[5] Tanaka K, Tanaka F, Onoda T, Tanno K, Ohsawa M, Sakata K, et al. Prognostic value of electrocardiographic left ventricular hypertrophy on cardiovascular risk in a non-hypertensive community-based population. AJH. 2018;31(8):895-901.
[6] Mule' G, Nardi E, Guarneri M, Cottone S. Electrocardiography for assessment of hypertensive heart disease: A new role for an old tool. JCH. 2016;18(9):843-45.
[7] Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, Prabhakaran D, et al. Internation society of hypertension global hypertension practice guidelines. Hypertension. 2020;75(6):1334-57.
[8] Owiredu EW, Dontoh E, Selma ES, Essuman, Bazanfara BB. Demographic and lifestyle predictor of prehypertension: A cross-sectional study among apparently healthy adults in Kumasi, Ghana. Hindawi BMRI. 2019;2019:1764079. https://doi.org/10.1155/2019/1764079.
[9] Ueda H, Miyawaki M, Hiraoka H. High-normal blood pressure is associated with new-onset electrocardiographic left ventricular hypertrophy. Journal of Human Hypertension. 2015;29(1):09-13.
[10] Echeverria RF, Carbajal HA, Salazar MR, Riondet B, Rechifort V, Quaini M. Prevalence of high normal blood pressure and progression to hypertension in a population sample of la plata. Medicina (B Aires). 1992;52(2):145-49.
[11] Charan J, Biswa T. How to calculate sample size for different study designs in medical research? Journal of Psychological Medicine. 2013;35(6):121-26.
[12] World Health Organization. Obesity: Preventing and Managing the Global Epidemic. Report of a Who Consultation (Who Technical Series 894). Geneva, Switzerland Who; 2000. 894.
[13] Health Questionnaire: Https://www.dostaleyecare.com/images/Medical_History_Questionnaire_1-19-13.pdf.
[14] Lifestyle Questionnaire: Https://peresourcesbank.co.uk/wp-content/uploads/2017/07/Lifestyle-Questionnaire.pdf.

[15] Modified Kuppuswamy Scale | PSM Made Easy [Internet]. [cited 2021 Mar 2]. Available from: http://www.ihatepsm.com/blog/modifiedkuppuswamy-scale. 8.
[16] Casale PN, Devereux RB, Alonso DR, Campo E, Kligfield P. Improved sex-specific criteria of left ventricular hypertrophy for clinical and computer interpretation of electrocardiograms: Validation with autopsy findings. Circulation. 1987;75(3):565-72.
[17] Buchner S, Deb K, Haimerl J, Djavidani B, Poschenrieder F, Feuerbach S, et al. Electrocardiographic diagnosis of left ventricular hypertrophy in aortic valve disease: Evaluation of ECG criteria by cardiovascular magnetic resonance. JCMR. 2009;11(1):18.

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