Study on Prevalence and Patterns of Dyslipidemia among Kodavas

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Abstract

Cardiovascular diseases are increasing and dyslipidemia is an important cause. Therefore, it becomes very essential to study these risk factors in the Kodava community, which has been ignored and seem to be predisposed to it due to their life style and food habits.

Methods*: A cross sectional study was designed by conducting ten health camps in and around Mysore. Around 418 subjects (194 men and 224 women) participated in the camps conducted from 1st March 2012 to 31st January 2013. Informed consent forms were signed by all participants and were asked to answer a standardized questionnaire. Plasma samples were analysed for serum lipid profile [(triglyceride, total cholesterol, high density lipoprotein-cholesterol (HDL-C), low density lipoprotein-cholesterol (LDL-C)] and fasting plasma glucose. Anthropometric measurements and blood pressure was recorded.*

Results*: This ethnic group has presented a clinical picture wherein 88.99% of subjects suffer from one or the other form of lipid abnormality. Dyslipidemia was prominently seen in the 41-60 age group subjects; however 25- 40 age group with normal BMI and low body fat percentage also showed high LDL-C and low HDL-C levels.*

Conclusions: *High prevalence of dyslipidemia was observed among the Kodavas and other factors like obesity, diabetes and hypertension magnified the risk of CVD and other metabolic complications. Life style modification and regular health check-up is crucial.*

Keywords- *Dyslipidemia, HDL-C, LDL-C, Mixed Dyslipidemia, Atherogenic Dyslipidemia*

1. INTRODUCTION

Kodava Community is an endogamous, agricultural community with martial traditions from Karnataka, South India. Among the population excessive consumption of pork meat and alcohol is followed traditionally [1,2]. Dyslipidemia is a major metabolic disorder and the cause of cardiovascular diseases (CVD) which is a prime reason for morbidity and mortality worldwide [3]. There is a marked increase in these systemic disorders in economically developing nations. Change in life style and diet has led to increase in life span along with increased burden of cardiovascular and other chronic diseases [4]. According to National Commission on Macroeconomics and Health (NCMH), a Government of India undertaking there would be around 62 million patients with CVD by 2015, among which 23 million patients would be younger than 40 years of age [5]. CVD is usually due to atherosclerosis of large and medium sized arteries and Dyslipidemia has been found to be one of the most important contributing factor[6].

There is no previous study to show the prevalence of lipid disorders in Kodavas and physicians also opine that dyslipidemia and CVD risks are increasing among the Kodava population. Thereforein the present study prevalence of dyslipidemia and associated risk factors were investigated.

2. SUBJECTS AND METHODS

2.1 Study Design

This study was carried out by conducting 10 health camps in and around Mysore. A total of 418 Kodava subjects aged between 25 and 85 attended the camps. Sample number was calculated using creative research system survey software with confidence level of 95% and confidence interval of 4.74 with a population of 15,000 in Mysore and overall population of 1,25,000 according to report of Karnataka unit of Bureau of economics and statistics in 2011. Campaigning for the health camps was done with the help of area associations and Kodava Samaj, Mysore. The subjects were from urban area and educated. They were informed about the study and its purpose, and were asked to sign a consent form. Standardized questionnaire related to their medical history, diet, medications, alcohol consumption, smoking status and physical activity were recorded. This study was approved by Institutional Ethical Committee (IOE), Anthropological Survey of India, Kolkata.

2.2 Anthropometric measurements

Anthropometric measurements like height, weight, waist and hip circumference were taken. Height was measured using Holtain Anthropometric scale and weight was checked without shoes and with light clothing. Waist circumference (WC) was measured using a flexible inextensible tape placed horizontally at the midpoint between the lowest rib and the iliac crest .Hip circumference (HC) was measured at the widest circumference over the major trochanters with the subject standing erect. Waist hip ratio (WHR) was calculated using these measurements.

Total Body- fat percentage, Body Mass Index (BMI), Basal Metabolic Rate (BMR) was measured using Omron fat monitor with the subject standing erect without shoes. Blood pressure was measured using mercury Sphygmomanometer in sitting position.

2.3 Laboratory Analysis

After 10-12 hours fasting, venous blood was drawn in EDTA vacutainers from the subjects by a phlebotomist. The plasma was separated by centrifugation and tested for glucose, High Density lipoprotein-cholesterol (HDL-C), Low Density Lipoprotein- cholesterol (LDL-C), Total cholesterol (TC) and triglyceride (TG) using ERBA kits in automated biochemical analyzer EM360, Transasia.

2.4 Statistical analysis

The data were arranged and checked twice before entering into the excel spread sheet. All the variables result were expressed as mean, percentage and standard deviation. Student's t- test was used to compare the mean. Chi square test was used to compare quantitative data using SPSS version 19. The value $P < 0.05$ was considered significant.

2.5 References and standard values

For serum lipids, we referred to National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III) guidelines.[7] According to these standard guidelines, hypercholesterolemia is defined as TC>200mg/dl, hypertriglyceridemia as TG>150mg/dl, high LDL-C as >100mg/dl and low HDL-C as <40mg/dl for women and <35mg/dl for men. The term mixed dyslipidemia is used if two or more lipid abnormalities co -exist. Atherogenic dyslipidemia indicates hypertriglyceridemia with low HDL-C and elevated LDL-C. All patients were categorized as normal weight, overweight or obese using BMI criteria of NHLBI obesity Initiative.[8] Abdominal obesity was described as waist circumference >80cm for women and >90cm for men.[9] Body fat % >25% for men and >32% for women are considered high according to the American Council on Exercise.[10] Waist hip ratio > 0.85cm for women and >0.9cm men were regarded high.[11] According to American Diabetes Association, fasting plasma glucose above 130mg/dl is considered diabetic.[12] Blood pressure above 130/85 mm of Hg was regarded as Hypertensive.[13]

RESULTS

Figure 1, shows the prevalence of dyslipidemia (88.99%) and only 11% did not have any of the lipid disorders. Our study comprises of 418 subjects,

of which 194 were male and 224 were female subjects.The mean age of the study population as 53. The mean BMI of the study population was 26.08. Among the study population 93 (22.24%) were diabetic and 107 (25.59%) subjects were hypertensive and were on hypoglycaemic and anti-hypertensive drugs respectively (**Table1**).

According to **Figure 2**, high levels of LDL-C and hypercholesterolemia was observed more in women than men. However the prevalence of hypertriglyceridemia and atherogenic dyslipidemia was significantly high in men. **Table 2** describes the comparative analysis of dyslipidemics with normal subjects. High LDL with Hypertriglyceridemia is the most common mixed dyslipidemia along with a new pattern of lipid disorder which includes normal HDL along with high TG or high LDL which is unique and never discussed in any other study (**Table 3 & 4**). Measurement of lipid profile showed that the prevalence of all lipid abnormalities is more pronounced among 41- 60 age group (**Figure 3**), further other alarming observation was high LDL-C and low HDL-C among 25 to 40 age group subjects. Body fat%, waist circumference and obesity were high in women whereas WHR increased in men (Table 5)
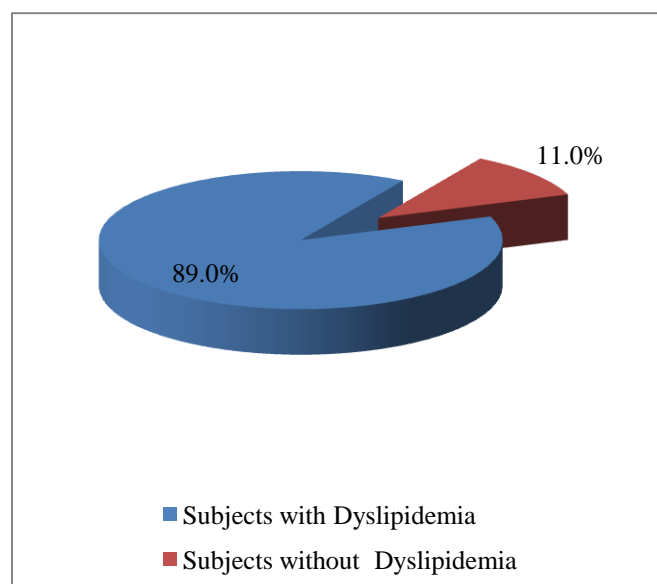

Figure 1: Distribution of Dyslipidemia among the Kodavas

Table 1: Overall Clinical characteristics of Kodava subjects

| Parameter	Mean±SD
Age years	53.56 (11)
BMI kg/m2	26.08 (3.66)
Body Fat %	32.60 (6.49)
Waist circumference, cm	89.62 (10.38)
Waist hip ratio, cm	0.90 (0.08)
Total Cholesterol, mg/dl	180.44 (39.40)
LDL Cholesterol, mg/dl	124.18 (30.21)
HDL, mg/dl	46.19 (11.22)
Triglyceride, mg/dl	164.78 (99.66)
Fasting glucose , mg/dl	113.9 (42.29)
Systolic Blood Pressure	133 (0.43)
Diastolic Blood Pressure	83 (13.32)
Diabetes Mellitus %	93 (22.24)
Hypertension %	107 (25.59)
Smokers	9.5%
Alcohol intake	48.86%

Standard deviation in parenthesis
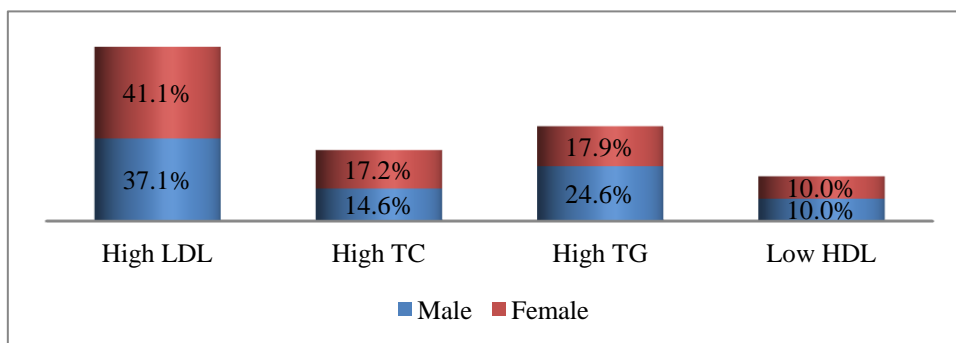
Figure 2: Gender wise distribution of Dyslipidemia

Table 2: Comparative study of dyslipidemic with normal subjects

Characteristic	Dyslipidemia (n=372)	Normal subjects (n=46)	P value
Sex Male Female	179(48.11) 193(51.88)	15(32.60) 31(67.39)	0.000* 0.000*
Age 25-40 41-60 60-85	47(12.63) 230(61.82) 95(25.53)	7(15.21) 19(41.30) 20(43.47)	0.000* 0.000* 0.000*
BMI <25 25-30 >30	145(38.97) 177(47.58) 50(13.44)	24(52.17) 18(39.13) 4(8.69)	0.000* 0.000* 0.000*
Body fat per cent >32 for women >25 for men	304(81.72)	38(10.21)	0.000*
Type 2 diabetes	105(28.22)	16(34.78)	0.000*
Hypertension	148(39.78)	17(36.95)	0.000*
Smoking Smoker Non smoker	32(8.60) 340(91.39)	3(6.52) 39(84.78)	0.000* 0.000*
Alcohol Intake	179(48.11)	22(47.82)	0.000*
Physical activity	255(68.54)	31(67.39)	0.000*

Percentage in parenthesis   *p value <0.05

Table 3: Means of lipoprotein values and its distribution amongst men and women

Variables	Both(n=418)		Male(n=194)		Female(n=224)		P value
High LDL	124.18	78.22%	133.79	79.89%	136.06	76.78%	0.401
Hypercholesterolemia	180.44	31.81%	223.22	31.44%	228.69	32.14%	0.164
Hypertriglyceridemia	164.78	42.58%	265.31	53.09%	222.58	33.48%	0.04*
Low HDL	46.19	20.09%	30.86	21.64%	30.6	18.75%	0.018*

According to National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III) guidelines

Table 4: Prevalence of mixed dyslipidemia

| 2 factors	Both	Percentage	Male	Percentage	Female	Percentage
High TG and High LDL	161	38.51%	91	46.91%	70	31.25%
High TC and High LDL	133	31.81%	61	31.44%	72	32.14%
High TG and High TC	78	18.66%	36	18.56%	42	18.75%
High TG and Low HDL	47	11.24%	29	14.95%	18	8.04%
High TC and Low HDL	9	2.15%	1	0.52%	8	3.57%
High LDL and Low HDL	53	12.67%	27	13.92%	26	11.61%
High TG and normal HDL	131	31.33%	74	38.14%	57	25.45%
High LDL and normal HDL	274	65.55%	128	65.98%	146	65.18%
High TC and Normal HDL	124	29.66%	60	30.93%	64	28.57%
3 Factors						
High LDL+ High TG+ Low HDL	38	9.09%	22	11.34%	16	7.14%
High LDL+ High TG+ Normal HDL	123	29.42%	69	35.57%	54	24.11%
High TG+ High TC +High LDL	78	18.66%	36	18.56%	42	18.75%
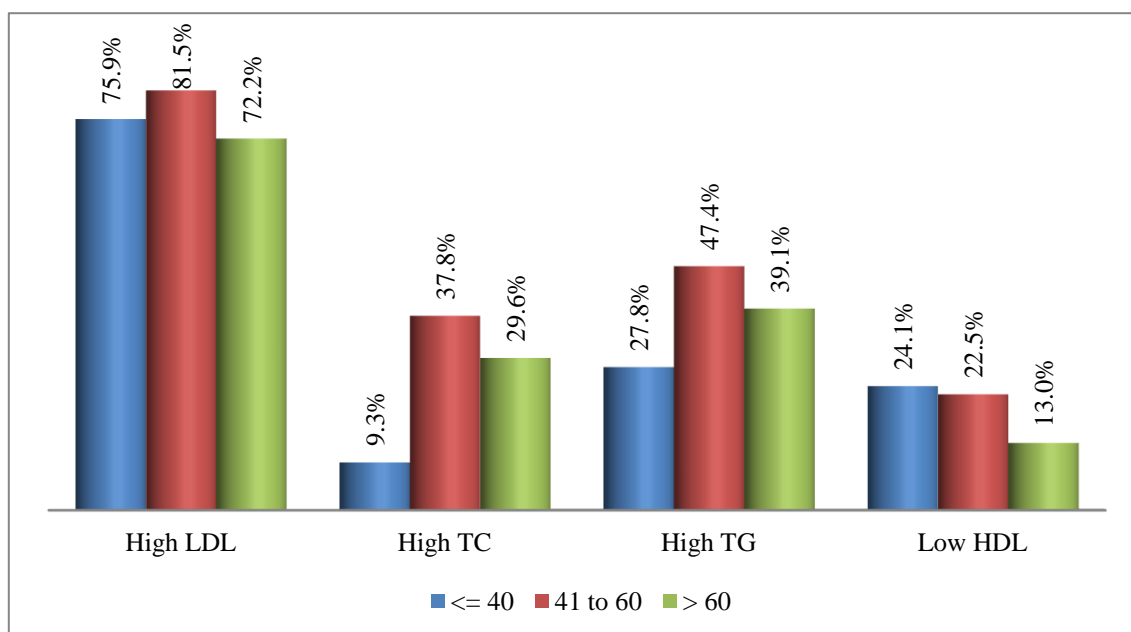
Figure 3: Age-wise distribution of dyslipidemia

Table 5: Abnormality in anthropometry measurements

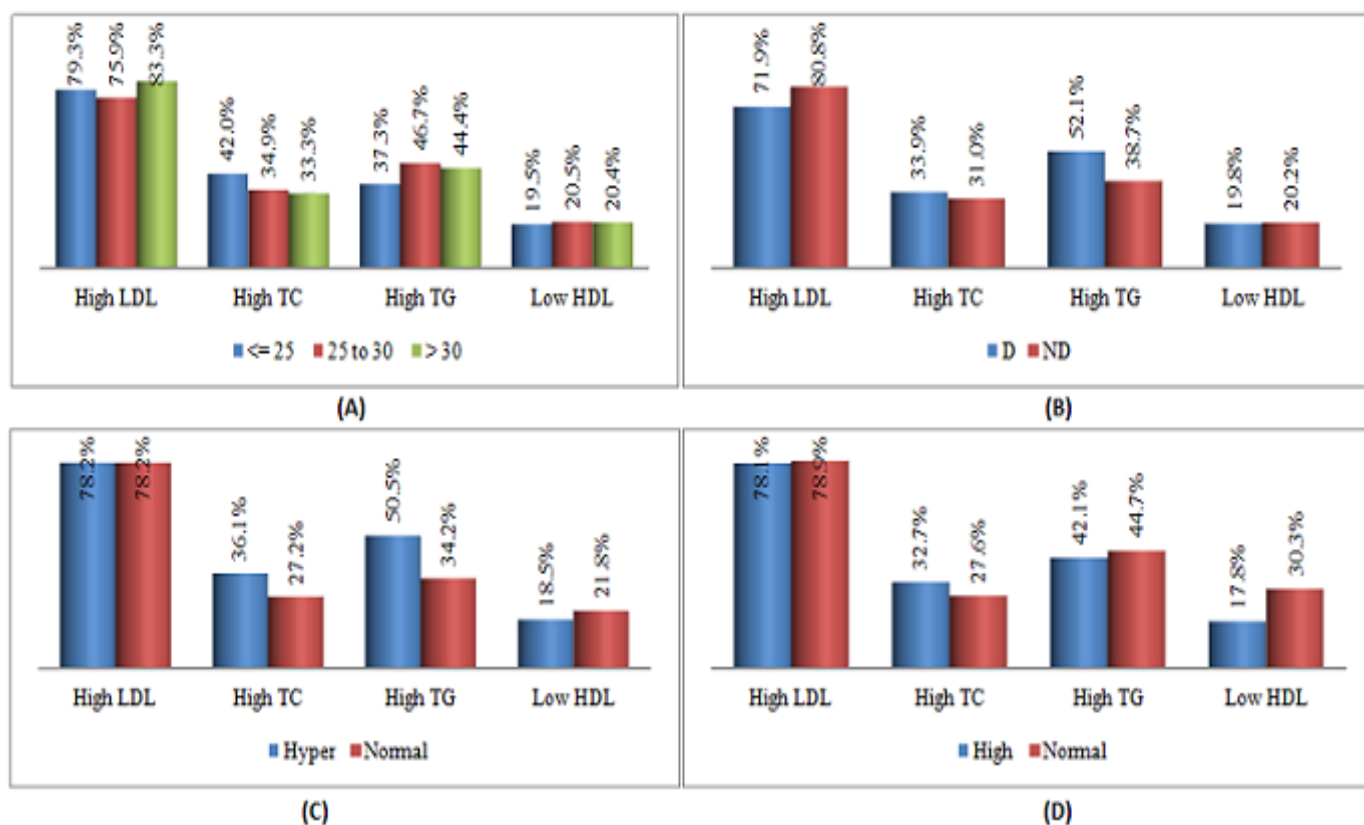| Variables	Both(n=418)	Men(n=194)	Women(n=224)	P value
Body Fat per cent	34.41(81.81)	29.63(75.77)	38.02 (87.05)	<0.000*
Waist circumference, cm	93.52(72.48)	97.26(64.94)	90.86(79.01)	<0.000*
Waist Hip Ratio, cm	0.946(89.30)	0.9701(81.95)	0.9159(55.80)	<0.000*
BMI kg/m2 >25 and <30	27.12(46.65)	27.06(46.39)	27.18(46.87)	<0.546
BMI kg/m2 >30	32.56(12.91)	31.17(4.63)	32.98(20.08)	<0.027*

Figure 4: A) Prevalence of dyslipidemia among Normal, Obese and Morbid obese subjects. B) Prevalence of dyslipidemia among diabetics (D) and non- diabetics (ND) C) shows the incidence of dyslipidemia among hypertensive (hyper) and Normal subjects. D) Prevalence of dyslipidemia among high body fat% (High) and Normal.

Even though the occurrence of dyslipidemia augmented in overweight and obese subjects high LDL-C and hypercholesterolemia was detected even in normal weight subjects. A marked increase in triglyceride levels was seen among type 2 diabetic (51.61%) and hypertensive patients. Body fat% did not have any marked effect on lipid disorders (Figure 4).

4. DISCUSSION

Lipid disorders are associated with consumption of diet containing excess of trans fats with high calories, sedentary lifestyle and familial history. Dyslipidemia or impaired lipid profile includes lipid disorders such as hypertriglyceridemia, hypercholesterolemia, high LDL-C, low HDL-C,

atherogenic dyslipidemia and mixed lipid disorders. Studies have shown that prevalence of dyslipidemia is more in co-morbid conditions like diabetes, hypertension and obesity.

The present study aims to investigate the prevalence, pattern and awareness of dyslipidemia and associated risk factors among Kodava population. Literature survey has shown that such type of

community studies on dyslipidemia in south India is limited. Therefore most of the data in our study has been compared with the population study.

Among the 418 study subjects, 53.5% were females, 13% of subjects were less than 40 years and 27.5% were 60 or more years of age. The findings of this study showed that the prevalence of dyslipidemia was high and 88.99% subjects suffered from at least one of the lipid abnormalities. The causes for high prevalence of Dyslipidemia in this community can be linked to their food habits which consist of consumption of pork meat, trans fats and alcohol. The awareness rate was low among the population and it was 13.15% only. Further this study has helped in diagnosing the dyslipidemia condition in more than 75% of the subjects who require therapeutic intervention, dietary and lifestyle modifications.

Analysis of lipid profile showed abnormal increase in most of the study subjects. The special concern was about the prevalence of high LDL-C among 78.22% of the subjects, which is very high than reported in the urban Asian north Indian population (51.6%) [14]. Hypercholesterolemia is found in 31.81% of subjects which is low compared to Kerala study (37%)[15]. Hypertriglyceridemia was prevalent among 42.58% of subjects, which is comparable to Chennai study (41.10%)[16] and Urban Asian North Indian population (42.12%)[14].Low HDL-C was found in just 20.09% of the subjects which is less when compared with that reported on Gujarat diabetic rural subjects (35.7%)[17] and urban Asian Indians in North India (37%)[14]. The most common mixed dyslipidemia was hypertriglyceridemia with

high LDL-C observed in 38.51% of subjects comparable to the study on Gujarat rural diabetic subjects(39.1%)[17]. The common opinion about women is that due to estrogen hormone they are protected from CVD risk called "female advantage". But in the present findings LDL-C (41.1%) and cholesterol levels (17.9%) was high in women than men. This may be related to estrogen deficiency among urban women caused due to stress and lifestyle modifications. This report is comparable to the study done on urban slum population of North India [18]. Further high prevalence of dyslipidemia was observed among 41-60 age group which is similar to Warangal study [19]. Younger subjects below 40 age group showed high LDL-C (75.92%) and low HDL-C (24.07%) comparable to study done on young Indian adults (77.6%)[20], and the cause may be linked to dietary habits and sedentary life style observed among most of the young individuals. Hypertriglyceridemia is predominant in Type 2 diabetes through the Insulin action pathway [21]. This is noticeably observed in our study where there is distinct raise in triglyceride levels in diabetics (51.61%) comparable to the study on Gujarat rural diabetic subjects [17]. Even in 52.33% hypertensive subjects the occurrence of hypertriglyceridemia along with hypercholesterolemia is very high when compared to the study done on North West Indians (11.8-18.8%) [22]. The results of our study clearly showed that Kodava population stand apart from other studies because they had immense influence of western culture, lifestyle and food habits of English people, as Britishers made Kodagu as their abode during their rule in India [23].

Abdominal obesity assessed by waist circumference is found in 72.48% of the study subjects, which is similar to urban Asian North Indian study (70%) [14] but substantially higher than Chennai study (46.6%)[24]. Further women have higher waist circumference (42.34%) than men (30.14%) similar to the study conducted on Urban Asian North Indians.[14] Based on BMI the prevalence of obesity was found in 59.56% of subjects which is comparable to the reports from Jaipur (55.5%) [25] and Baloor Mangalore study (58.9%) [26]. High body fat % was seen in 81.81% of subjects, and was higher among women (46.65%) than men (35.16%). This is lower when compared to the study reported on the Urban Asian North Indian population (total 84.5%, men 67.2% and 100% women).[14] Central obesity defined by high WHR was seen in 67.90% of subjects, which is lesser than Kerala study (85.6%) [15]. Lipid disorders were prominent among the overweight and obese subjects with BMI >25.Even the subjects with BMI<25 also showed dyslipidemia with high LDL-C and hypercholesterolemia.. This is alarming and suggests that there is a need for awareness programs in this population for the prevention and control of Dyslipidemia.

Our study showed greater prevalence of high LDL-C and hypertriglyceridemia among 41-60 age groups. Women are at equal risk for CVD like men. Atherogenic dyslipidemia with low HDL-C found in most of the south Indian population was found only in 9.09% of the study subjects, which is a positive outcome of the study. 38.51% of subjects suffer from combined Dyslipidemia with high LDL-C and triglyceride. A new dyslipidemia pattern, which is never been observed in this type of studies, is high LDL-C with normal levels of HDL-C and high TG with normal levels of HDL-C. This condition prevailed in greater percentage of Kodava subjects. Further studies are required to assess whether they have an advantage over other dyslipidemics. Thus the findings of our study revealed that among Kodava population factors such as sex, age and co-morbid conditions like diabetes, hypertension and obesity contributed 85% for the cause of dyslipidemia and another 15% may be hereditary and is under investigation.

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