Dyslipidaemia among diabetes and hypertensive patients in a remote rural area of South India, in comparison with ICMR-InDiab study

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INTRODUCTION

Cardiovascular disease (CVDs) is the topmost reason for mortality globally as well as in India. Dyslipidaemia is one of the major modifiable risk factors for CVD along with physical inactivity and behavioural risk factors like smoking and alcohol. High blood cholesterol increases the risk for CVDs and stroke. Globally, nearly one third of the CVDs is attributed to high cholesterol. In total, raised cholesterol was estimated to cause 2.6 million deaths (4.5% of total) and 29.7 million DALYs loss (2% of DALYs loss) globally. Asians tend to have a unique pattern of dyslipidemia with low HDL-C, high portions of small density LDL cholesterol. Unlike the general population, people with diabetes (DM) and hypertension (HT) are at higher risk for CVDs. Few available studies from India, mainly concentrated on prevalence of dyslipidemia among the general population. Even though studies on the general population have epidemiological value, screening the high risk group at the population level have both epidemiological as well as programmatic interest. By this the functioning of the...
existing National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCCS) at the village level could be strengthened. Moreover, high risk population screening is appropriate and cost effective in a ‘highly populated middle-income country’ like India. India is taking earnest steps to prevent and treat Non-Communicable Diseases at population level (NCDs). Through National Health Policy (NHP), India committed to reverse the NCD incidence and through Sustainable Development Goals (SDGs) India is committed to reduce the premature death by NCDs by one third before 2030. At present there is a dearth of data on population-based studies on dyslipidemia among the high-risk individuals (DM and HT) that too from a rural area. The aim of the study was to investigate the prevalence and determinants of dyslipidemia among these high-risk individuals by screening at their door steps, so that appropriate interventions and policy recommendations could be made.

**METHODS**

This was a cross sectional study. This study was conducted in a remote rural area named Chunampet located in South India. Adjoining twenty villages surrounding the Rural Health Training Centre (RHTC) of Pondicherry Institute of Medical Sciences was selected.

**Selection criteria**

Individuals with HT and DM were listed from an electronic data base called Community Health Information Management System (CHIMS), maintained at the RHTC for these twenty villages. These high-risk individuals were approached by house to house visits. Data was collected in a pretested questionnaire. All the eligible individuals were invited to participate (universal sampling method).

Biological samples were collected at their doorstep and transported to the main campus which is an NABL accredited lab. (National Accreditation for Testing and Calibration Laboratories). Sample size was calculated to be 318, assuming the prevalence of common CVD risk factors (HT, DM & Hypercholesterolemia) to be above 25%, absolute precision of 5% and 10% attrition. Data collection was done from August-September 2017. Data was collected with the help of medical interns and medical social workers, under the direct supervision of faculty of the department of community medicine. Data was entered using EpiData software version 3.1 and analysed using Stata 14. In Table 1, mean value of lipids and prevalence of dyslipidaemia were compared with a similar population-based large-scale study among the general population (ICMR-InDiab 2010- Tamilnadu rural population data). We have also used the same definition and classifications as ICMR-InDiab study. Adjusted Odds ratio (aOR) for risk factors associated with hypercholesterolemia, hypertriglyceridemia, low HDL and high LDL were calculated by including those variables which have shown near significance in Chi-square (p<0.2).

**Operational definitions**

normal values for waist hip ratio are <0.85 for women and <0.95 for men and normal values for salt intake per day, per capita of <6 g.

**Current alcoholic**

One who consumes alcohol for at least once in the last one year.

**Dyslipidemia**

Defined based on National Cholesterol Education Programme (NCEP) guidelines, where Hypercholesterolemia is defined as serum cholesterol levels ≥200 mg/dl (≥5.2 mmol/l), hypertriglyceridemia is defined as serum triglyceride levels ≥150 mg/dl (≥1.7 mmol/l), low HDL cholesterol is defined as HDL cholesterol levels <40 mg/dl (<1.04 mmol/l) for men and <50 mg/dl (<1.3 mmol/l) for women, high LDL cholesterol is defined as LDL cholesterol levels ≥130 mg/dl (≥3.4 mmol/l), isolated hypercholesterolemia is defined as serum cholesterol ≥200 mg/dl and triglycerides <150 mg/dl, isolated hypertriglyceridemia is defined as serum triglycerides ≥150 mg/dl and cholesterol <200 mg/dl and isolated low HDL-C is defined as HDL-C ≤40 mg/dl (male) and ≤50 mg/dl (female) without hypertriglyceridemia or hypercholesterolemia. Estimated Glomerular filtration rate (eGFR) was calculated using Chronic kidney disease epidemiology collaboration (CKD-EPI) equation and the participants having eGFR ≤60 ml/min/1.73m² were classified as having CKD. As per American Thyroid Association and American Association of Clinical Endocrinologists (ATA/AACE) guideline, hypothyroidism was classified as TSH (Thyroid stimulating hormone) level in μIU/ml (TSH>10-overt hypothyroidism, 4.5-9.0- highly abnormal TSH, 2.5-4.4- intermediate abnormal and <2.5 as normal). Anaemia is defined as haemoglobin <13 mg/dl for men and <12 mg/dl for women (WHO criteria).

**RESULTS**

The total sample size achieved was 303. Mean values of all lipids among the high risk were increased significantly (p<0.01). Risk of hypercholesterolemia was three times more among these high-risk patients than normal patients (Prevalence ratio (PR) 2.9 (2.3-3.7)). The risk of hypertriglyceridemia was 1.3 times higher, the risk of high LDL Cholesterol was 3.3 times higher, the risk of high cholesterol HDL ratio was 1.5 times higher and the isolated hypercholesterolemia was 3.6 times higher among the high-risk population. On the other hand, isolated hypertriglyceridemia was 30% less likely and isolated low HDL was 40% less likely among high risk populations.
Details of lipid profile and prevalence of dyslipidaemia in comparison to ICMR-InDiab study is given in Table 1. Female gender [low HDL- aOR 2.1(1.1-4.2)], [high LDL- aOR 2.2(1.3-3.7)] and hypothyroidism [hypercholesterolemia- aOR 10.1(1.1-89)] were directly associated and underweight [hypercholesterolemia- adjusted Odds ratio (aOR)- 0.4(0.2-0.9)], [hypertriglyceridemia- 0.4(0.1-1.0)], and anaemia [hypertriglyceridemia aOR- 0.5(0.3-0.8)] were inversely associated with dyslipidaemia. Association between dyslipidaemia and its related risk factors are shown in Table 2.

Table 1: Mean values and proportions of lipids and dyslipidaemia in a remote rural area of South India, in 2018 among high risk individuals in comparison with InDiab study.\textsuperscript{12}

| Lipid profile | Hypertension only N=102 | Diabetes only N=76 | Hypertension and diabetes N=125 | All N=303 | InDiab TN Rural N=463 | t test mean difference, p value* |
|---------------|-------------------------|--------------------|--------------------------------|-----------|-----------------------|-------------------------------|
| Total cholesterol | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) | Mean SD |
| High density lipoprotein | 45 (23) | 44 (21) | 43 (14) | 44 (19) | 40 (12) |
| Low density lipoprotein | 131 (43) | 123 (38) | 126 (38) | 127 (39) | 98 (30) |
| Triglycerides | 128 (60) | 170 (120) | 160 (103) | 152 (97) | 114 |

| Cholesterol HDL ratio | 4.9 (1.6) | 5.0 (1.6) | 5.2 (2.1) | 5 (1.8) | 4.4 (1.5) |

| Dyslipidaemia | Proportions (95% CI) | Prevalence ratio* |
|---------------|----------------------|-------------------|
| Hypercholesterolemia | 43 (34-53) | 51 (40-63) | 46 (37-55) | 47 (41-52) | 16.0 |
| Hypertriglyceridemia | 32 (24-42) | 43 (33-55) | 44 (35-53) | 40 (35-46) | 29.6 |
| Low HDL cholesterol | 74 (64-81) | 68 (57-78) | 65 (56-73) | 69 (63-74) | 67.6 |
| High LDL cholesterol | 44 (35-54) | 43 (33-55) | 42 (33-51) | 43 (37-49) | 13.2 |
| High cholesterol HDL ratio | 58 (48-67) | 61 (49-71) | 59 (50-68) | 59 (53-65) | 39.7 |
| Isolated hypercholesterolemia | 25 (17-34) | 22 (14-33) | 17 (11-25) | 21 (17-26) | 5.8 |
| Isolated hypertriglyceridemia | 14 (08-22) | 14 (08-25) | 14 (09-22) | 14 (11-19) | 19.4 |
| Isolated low HDL | 30 (22-40) | 24 (15-35) | 24 (17-32) | 26 (21-31) | 41.0 |

* t test and prevalence ratio between All (HT, DM, both) and InDiab values, S- SD was not reported in InDiab study and hence significance could not be calculated.

Table 2: Association between dyslipidaemia and its related risk factors among high risk individuals in a remote rural area of south India in 2018.

| Variables | Total | Hypercholesterolemia N (%) | Hypertriglyceridemia N (%) | Low HDL N (%) | High LDL N (%) |
|-----------|-------|-----------------------------|-----------------------------|---------------|----------------|
| BMI       |       | aOR (95% CI)                | aOR (95% CI)                | aOR (95% CI)  | aOR (95% CI)  |
| Underweight | 37 | 10 (27) | 0.4 (0.2-0.9) | 05 (14) | 0.4 (0.1-1.0) | 21 (57) | 1.0 (0.4-2.4) | 10 (27) | 0.4 (0.2-1.0) |
| Normal     | 87   | 47 (54) | Ref | 31 (36) | Ref | 51 (59) | Ref | 39 (45) | Ref |
| Overweight | 52   | 19 (37) | 0.4 (0.2-0.9) | 29 (56) | 1.8 (0.8-3.9) | 43 (83) | 2.4 (0.9-6.1) | 18 (35) | 0.5 (0.3-1.1) |
| Obese      | 127 | 65 (51) | 0.7 (0.4-1.5) | 56 (44) | 1.0 (0.5-1.9) | 93 (73) | 1.4 (0.7-3.0) | 63 (50) | 1.1 (0.6-1.1) |
| Age (years) |       |       |       |       |       |       |       |       |
| 30-40     | 43   | 20 (47) | Ref | 21 (49) | Ref | 29 (67) | Ref | 17 (40) | - |
| 41-50     | 72   | 38 (53) | 1.2 (0.6-2.8) | 36 (50) | 1.1 (0.5-2.4) | 51 (71) | 0.8 (0.3-2.2) | 34 (47) | - |
| 51-60     | 86   | 42 (49) | 1.0 (0.5-2.3) | 34 (40) | 0.8 (0.3-1.7) | 65 (76) | 1.1 (0.4-2.9) | 37 (43) | - |
| 61-70     | 75   | 33 (44) | 0.1 (0.4-2.2) | 24 (32) | 0.8 (0.3-1.8) | 51 (68) | 0.8 (0.3-2.2) | 32 (43) | - |
| ≥71       | 27   | 08 (30) | 0.5 (0.2-1.7) | 06 (22) | 0.5 (0.2-1.8) | 12 (44) | 0.4 (0.1-1.3) | 10 (37) | - |

Continued.
This was one of the very few studies done in remote rural areas of South India. It was a unique study in the following ways, first, it is a population based screening programme at grass root level (village level), second it is done among the high risk group, third this high risk group could be routinely accessed through NCD clinic under NPCDCS in PHCs, fourth, this study compares the dyslipidaemia prevalence among these high groups with the existing data in details and provides valuable information for clinical management, public health and primary care physicians.

Our study has shown the mean values of lipids and dyslipidaemia are few folds higher among DM and HT individuals when compared to normal, this justifies the screening among high risk populations. Our study has shown the mean values of lipids and dyslipidaemia are few fold higher among DM and HT individuals when compared to normal, this justifies the screening among high risk populations. It was a unique study in the following ways, first, it is a population based screening programme at grass root level (village level), second it is done among the high risk group, third this high risk group could be routinely accessed through NCD clinic under NPCDCS in PHCs, fourth, this study compares the dyslipidaemia prevalence among these high groups with the existing data in details and provides valuable information for clinical management, public health and primary care physicians.

### DISCUSSION

This was one of the very few studies done in remote rural areas of South India. It was a unique study in the following ways, first, it is a population based screening programme at grass root level (village level), second it is done among the high risk group, third this high risk group could be routinely accessed through NCD clinic under NPCDCS in PHCs, fourth, this study compares the dyslipidaemia prevalence among these high groups with the existing data in details and provides valuable information for clinical management, public health and primary care physicians.
CONCLUSION

Dyslipidaemia was higher among the DM and HT participants in a remote rural area of South India.

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REFERENCES

1. WHO. Noncommunicable diseases country profiles, 2018. Available at: https://apps.who.int/iris/handle/10665/2. Accessed on 22 April 2021.
2. Ministry of Health and Family Welfare GOI. National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS), 2017. Available at: https://main.mohfw.gov.in/Major-Programmes/non-communicable-diseases-trauma/NCCDII/National-Programme-for-Prevention-and-Control-of-Cancer-Diabetes-Cardiovascular-diseases-and-Stroke-NPCDCS. Accessed on 22 April 2021.
3. Mendis S, Puska P, Norrving B, WHO. Global atlas on cardiovascular disease prevention and control, 2011. Available at: https://apps.who.int/iris/handle/10665. Accessed on 22 April 2021.
4. Bilen O, Kamal A, Virani SS. Lipoprotein abnormalities in South Asians and its association with cardiovascular disease: Current state and future directions. World J Cardiol. 2016;8(3):247-257.
5. Tripathy JP, Thakur JS, Jeet G, Chawla S, Jain S, Pal A, Prasad R. Burden and risk factors of dyslipidemia results from a STEPS survey in Punjab India. Diabetes Metab Syndr. 2017;11(1):21-7.
6. Pranav CR, Kumar AS, Anuj K, Vishnupriya S, Reddy B. Distinct Patterns of Association of Variants at 11q23.3 Chromosomal Region with Coronary Artery Disease and Dyslipidemia in the Population of Andhra Pradesh, India. PLoS One. 2016;11(6):153720.
7. The United Nations Development Programme. sustainable Development goals, 2015. Available at: https://www.unpd.org/content/dam/unpd/library/corporate/brochure/SDGs_Booklet_Web. Accessed on 22 April 2021.
8. WHO. World health statistics 2016: monitoring health for the SDGs, sustainable development goals, 2016. Available at: https://apps.who.int/iris/handle/1066598. Accessed on 22 April 2021.
9. Ministry of Health and Family Welfare- GOI. National Health Policy 2017, 2018. Available at: https://mohfw.gov.in/sites/default/files/9147562941489753121.pdf. Accessed on 22 April 2021.
10. Epidata Association. Epidata Software. 2014. Available at: https://www.epidata.dk/about.htm#about. Accessed on 22 April 2021.
11. StatCorp LP. Stata data analysis and statistical Software. Spec Ed Release. 2007;10:733.
12. Joshi SR, Anjana RM, Deepa M, Pradeepa R, Bhansali A, Dhandania VK, et al. Prevalence of dyslipidemia in urban and rural India: the ICMR-INDIAB study. PLoS One. 2014;9(5):96808.
13. Newtonraj A, Selvaraj K, Purty AJ, Nanda SK, Arokiaraj MC, Vincent A, et al. Feasibility and outcome of community-based screening for cardiovascular disease risk factors in a remote rural area of South India: The Chunampet rural-Cardiovascular health assessment and management program. Indian J Endocrinol Metab. 2019;23(6):628-34.
14. WHO. The STEPS Instrument and Support Material, 2016. Available at: http://www.who.int/chp/steps/instrument. Accessed on 22 April 2021.
15. Expert Panel on Detection, Evaluation, Treatment of High Blood Cholesterol in Adults, Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). JAMA. 2001;285(19):2486-97.

16. International Diabetes Federation. The IDF consensus worldwide definition of Metabolic Syndrome, 2006. Available at: https://www.idf.org/component/attachments/attachm ents.html?id=705&task=download. Accessed on 22 April 2021.

17. Parikh RM, Mohan V. Changing definitions of metabolic syndrome. Indian J Endocrinol Metab. 2012;16(1):7-12.

18. Levey AS, Stevens LA, Schmid CH, Zhang YL, Castro AF, Feldman HI, Kusek JW, et al. A new equation to estimate glomerular filtration rate. Ann Intern Med. 2009;150(9):604-12.

19. Garber JR, Cobin RH, Gharib H, Hennessey JV, Klein I, Mechanick JI, et al. Clinical practice guidelines for hypothyroidism in adults: cosponsored by the American Association of Clinical Endocrinologists and the American Thyroid Association. Thyroid. 2012;22(12):1200-35.

20. WHO. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity, 2011. Available at: https://apps.who.int/iris/handle/10665/8. Accessed on 22 April 2021.

21. Rastgooye HA, Solhjoo M, Tavakoli MH. Correlation Between Subclinical Hypothyroidism and Dyslipidemia. Iran J Pathol. 2017;12(2):106-11.

22. Hussain A, Elmahdawi AM, Elzeraidi NE, Nouh F, Algathafi K. The Effects of Dyslipidemia in Subclinical Hypothyroidism. Cureus. 2019;11(11):6173.

23. Saric MS, Jurasic MJ, Sobic S, Kranjcic B, Glivetic T, Demarin V. Dyslipidemia in subclinical hypothyroidism requires assessment of small dense low density lipoprotein cholesterol (sdLDL-C). Rom J Intern Med. 2017;55(3):159-66.

24. Denzer C, Karges B, Nake A, Rosenbauer J, Schober E, Schwab KO, et al. Subclinical hypothyroidism and dyslipidemia in children and adolescents with type 1 diabetes mellitus. Eur J Endocrinol. 2013;168(4):601-8.

25. Asranna A, Taneja RS, Kulshreshta B. Dyslipidemia in subclinical hypothyroidism and the effect of thyroxine on lipid profile. Indian J Endocrinol Metab. 2012;16(2):347-9.

26. Pearce EN. Hypothyroidism and dyslipidemia: modern concepts and approaches. Curr Cardiol Rep. 2004;6(6):451-6.

27. Udovic M, Pena RH, Patham B, Tabatabai L, Kansara A. Hypothyroidism and the Heart. Methodist Debakey Cardiovasc J. 2017;13(2):55-9.

28. Indian Council of Medical Research. National Ethical Guidelines for Biomedical and Health Research Involving Human Participants, 2017. Available at: https://www.icmr.nic.in/sites/default/files/guidelines /ICMR_Ethical_Guidelines_2017.pdf. Accessed on 22 April 2021.

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