

Prevalence of Cardiovascular Disease Risk Factors in an Indigenous Vedda Community in Sri Lanka: Do These Communities Need a Targeted Health Promotion Strategy?

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Abstract

Background: The indigenous population in Sri Lanka called “Veddas” estimated to be around 0.05% of the total population in the island. This population is unique that they used to live mostly in jungles with primitive lifestyles. The objective was to study the cardiovascular risk factors in this indigenous (Vadda) community.

Methods: A descriptive cross-sectional study was carried out with convenience sampling method, by inviting all adults (> 18 years) in the indigenous village Pollebedda. Height, weight and blood pressure was measured, and fasting blood samples were analyzed for glucose, lipids and haemoglobin. Data were analyzed using SPSS (version 22)0.

Results: Response rate was approximately 39%. Out of total 121 participants 47 were males and 74 were females. The mean age was 44.29 ±14.75 years and 12 were elders > 65 years of age. In the sample 17.3% were obese (BMI>27.5) while 24.8% were overweight (BMI 23-27.5). The crude prevalence of diabetes, hypertension and raised total cholesterol were 7.2%, 12.4% 7.7% respectively. Prevalence of low HDLC (< 40mg/dL in men, < 50 mg/dL in women), high LDLC (>160 mg/dL) and elevated triglycerides (>150mg/dL) were 75.2%, 7.7% and 25.6% respectively. Isolated hypertriglyceridemia was present in 20.5%.

Conclusions: There is a rising trend of obesity and diabetes in this indigenous community compared to previous study. This highlights that the indigenous peoples in Sri Lanka share the relatively high rates of coronary artery risk factors observed among other indigenous groups around the world. Changes in lifestyle and diet, poverty, poor health seeking behavior and limited access to health care due to limitation in transport are possible risk factors for this trend which needs to be further evaluated. A local and global initiative is required to control cardiovascular disease risk factors among indigenous groups.

Background

Indigenous population in Sri Lanka is a unique population by the name of “Veddas”. They are traditionally forest dwellers. Total Vadda population in Sri Lanka is estimated to be around 0.05% of the total Sri Lankan population (22.5 million). Currently traditional Vadda populations are found in Eastern, North Central, Sabaragamuwa and Uva Provinces. Two of the main indigenous populations live in Dambana (Uva province) and Pollebedda which belongs to Mahaoya divisional secretariat in Ampara District in Eastern Province. According to government statistics there is a population of 2070 in Pollebedda village (2009) and out of which about 521 people belonging to 175 families are from the indigenous population.¹⁵ Adult population (>18 years of age) in Pollebedda is 60%¹⁵ which is around 312.

Studies on health of indigenous populations in Sri Lanka area limited. Their unique lifestyles and origins may incur a different set of risk factors for cardiovascular disease. One study carried out in an indigenous population in 1991, found that hypertension was rare and obesity was absent which was attributed to high levels of physical activity.¹ The low prevalence of coronary heart disease was due to favorable coronary risk profile.¹ According to a survey in 2006, the prevalence of diabetes in rural Sri Lankans is estimated to be 8.7% compared to national prevalence of 10.3%.¹⁰ Earlier study in 2004 involving 4 provinces has shown that there were marked regional differences in the prevalence of diabetes and obesity.⁴ A study done in an indigenous population in Pollebedda (2013) revealed that prevalence of diabetes was 2.1%.¹³ Ancient traditional lifestyle with high level of physical activity involving hunting and natural diet may have been protective in terms of development of diabetes. The risk of changing lifestyle which is evident even in these communities which may contribute to different set of risk factors.

We therefore carried out a health survey in an indigenous population living in Pollebedda an indigenous village situated about 320km from Colombo in eastern province focusing mainly on cardiovascular disease risk factors.

Our objective was to study the prevalence of obesity, diabetes, hypertension and dyslipidemia among a selected indigenous (Vadda) population of Sri Lanka.

Methods

Descriptive cross-sectional study was carried out with a convenience sampling method due to the small size of the population. All adult residents (> 18 years) of the indigenous community were invited for a health screening programme through the head of the indigenous society and the medical officer of health of the region. Total number of participants were 121. The response rate was around 39% considering the approximate total adult indigenous population of 312. Pregnant mothers, individuals currently suffering from acute illnesses and those with difficulties in communication were excluded. Validated interviewer administered questionnaire was administered after obtaining informed written consent.

Height was measured to the nearest 0.5 cm and weight were measured to the nearest 100mg using calibrated equipments by trained nurses adhering to the WHO guidelines.^{5,9} Body mass index (BMI) was calculated (kg/ m²) and risk stratification was done according to WHO risk categories for Asians.²²

Blood pressure was measured in seated position after resting using Omron IA2 digital blood pressure monitor by the investigators at the site. Each measurement was done twice.⁶

Fasting venous blood was drawn and collected into sodium fluoride/potassium oxalate, plain and EDTA tubes by trained phlebotomists for analysis of blood glucose, lipid profile and full blood count. Blood samples were transported to Medical Research Institute, Colombo at 4°C on the same day (within 8-10 hours of collection) and was centrifuged, serum separated and frozen. Full blood count was analyzed on the same day. Fasting plasma glucose was measured in AU480 Beckman Coulter fully automated biochemistry analyzer by hexokinase method. Lipids were measured by enzymatic method in the same analyzer. Participants with fasting blood glucose more than 100 mg/dL and normal hemoglobin were further screened with HbA_{1c}.

Diagnoses were based on the following criteria:

Diabetes was diagnosed according to American Diabetes Association guidelines (ADA), based on fasting plasma glucose (FPG) level of ≥ 126 mg/dl or on insulin or oral hypoglycemic drugs within the past 4 weeks. FPG ≥ 100 mg/dl but < 126 mg/dl was considered as Impaired Fasting Glucose (IFG).¹⁰

Hyperlipidemia was defined according to the National Cholesterol Education Program Adult Treatment Panel -III guidelines; high total cholesterol (> 240 mg/dL) low HDLC (< 40 mg/dL in men, < 50 mg/dL in women), high LDLC (> 160 mg/dL)^{2,3} and high triglyceride (> 150 mg/dL).

According WHO guidelines for Asians, the following cutoffs were taken.

Obesity- BMI > 27.5

Overweight- BMI 23-27.5

Hypertension was diagnosed in those with $> 140/90$ mmHg on both occasions.

Follow up visits were arranged in the Base Hospital Mahaoya to all participant who were diagnosed to have diabetes, hypertension and dyslipidemia. Data analysis was done using SPSS-version 22.

Results

There were 121 participants and 47 were males and 74 were females. The age range was 18 to 90 years (median 43 years; mean 44.29 ± 14.75). Twelve participants were over 65 years of age (9.9%).

Obesity

Out of the total 121, 22 (17.3%) were obese (BMI > 27.5) while 30 (24.8%) were overweight (BMI 23-27.5). None of the elders were obese.

Diabetes

Due to some participants not in fasting state and errors in collecting blood, only 111 samples were received for FPG analysis. There were 8 individuals with diabetes (7.2%) and 2 individuals with impaired FPG.

Hypertension

Blood pressure was recorded from 113 participants as some participants did not get their blood pressure checked after the period of rest. There were 14 participants with hypertension (12.4%).

Hyperlipidemia

Similarly, as some participants were not in fasting state only 117 samples were analyzed. 7.7% had high total cholesterol (>240 mg/dL) while 75.2% had low HDLC (< 40mg/dL in men, < 50 mg/dL in women), 7.7% had high LDLC (> 160 mg/dL). Participants were unaware of their treatment with statins. 25.6% had elevated TG levels(>150mg/dL) while 20.5% had isolated hypertriglyceridemia.

Among the obese (BMI>27.5) subjects (22), lipid analysis was done in 20 and 18 (90%) of them had some kind of dyslipidemia. Out of the non obese (99) lipid analysis was done in 97. Only 66 (67%) of non-obese subjects assessed had dyslipidemia. The difference was not statistically significant(p=0.057).

Table 1 and table 2 summarizes these findings and compares with the results from other studies (same population in 2013 though different sampling technique had been used, rural health study and a nation wide study carried in 2005-2006 Sri Lanka Diabetes and cardiovascular study: SLDCS).

Table 1
Comparison of BMI, FPG and Blood pressure with other studies.

	Current study (2017)			In 2013 ¹⁴			Rural health study ¹⁶	SLDCS (2005-2006) ^{10,11,12}			
	Male	Female	Total	Male	Female	Total	2014	Prevalence >20 years		Rural	Urban
Indigenous population >18 years							>20years				
Sex	Male	Female	Total	Male	Female	Total	Male	Female	Male	Female	
BMI 23-27.5 (Overweight)	21.7%	26.6%	24.8%	15%	19.6%	28.2%	20.4%	26.2%	30.6%	34.8%	
BMI >27.5 (Obese)	10.8%	21.3%	17.3%	2.5%	3.9%		4.7%	8.7%	16.4%	20.7%	
Hypertension (>140/90)	6.8%	15.9%	12.4%	NR	NR	16.7%	22.6%	23.2%	26.8%	26.5%	
Diabetes	6.9%	7.3%	7.2%	2.5%	1.9%	13.5%	Overall 8.7%		Overall 16.4%		
Impaired fasting glucose	2.3%	1.5%	1.8%	7.5%	3.9%	NR	Overall 11%		Overall 13.6%		

Table 2
Comparison of lipid levels with National data

	Current study (2017)	SLDCS ¹³ (2005-2006)
	Pollebedda >18 years	Prevalence >20years
High serum cholesterol	7.7%	20%
High LDL	7.7%	23.4%
Low HDL	75.2%	53.9%

Though a true comparison is not possible due to different timelines and differences in sampling techniques, there was no statistically significant difference between the diabetes prevalence of the Pollebedda indigenous population in 2013 and 2017(p>0.05). Similarly, the diabetes prevalence of the indigenous population in the current study is not significantly lower than the national prevalence(p>0.05).

Discussion

The results suggest that the indigenous people have a different risk factor profile for cardiovascular disease (i.e. comparable rates of obesity and lower rates of DM, hypertension and dyslipidemia except HDL levels) compared to those living in urban and rural areas. One likely explanation for this could be the changes in life styles resulting in increasing rates of over-weight and obesity, while the prevalence of

diabetes and hypertension have lagged behind. If this hypothesis is correct, this population group would face higher rates of these diseases in the near future.

In Sri Lanka, the prevalence of obesity, overweight, hypertension and diabetes are higher in urban than rural areas. A study done in 2012 in Kaluthara district showed that obesity was more prevalent in urban areas and among rich people.⁷ SLDCS data in 2005-2006 showed that diabetes prevalence was significantly higher in the urban population compared with rural; 16.4% vs. 8.7% ($P < 0.001$). A study done in 2012 in Kaluthara district has shown that diabetes was more prevalent in urban areas and among rich and affluent people, which indicated that Sri Lanka was in the early stage of the epidemic.⁸

The projected diabetes prevalence in Sri Lanka for the year 2030 is 13.9%.¹⁰ Though there are differences in the prevalence according to regions and social strata, Sri Lanka as well as the entire world will experience a marked rise in obesity and diabetes in the future. Rural and indigenous communities may lose their immunity against such trends as suggested by recent studies.

Although the response rate is around 39%, our data shows that the current rates of obesity and diabetes in indigenous people have increased compared to the study in 2013 in Pollebedda.¹⁴ Rising trends of Diabetes in our population warrants further studies into risk factors particular to this population. Contributing factor may be change in dietary pattern consist of more carbohydrates as appose to the traditional diet consisting high fiber and high protein.¹⁵ Particularly in the Vedda community this may be due to change in life style which earlier consist of traditional hunting but now predominantly farming and having access to high calorie food.¹⁵

Rising trend of both diabetes and obesity in our population raises possibility of obesity as a cause of the diabetes epidemic even in this community. Though this study was from a single Vedda community, it is compatible with global trend seen with regards to cardiovascular risk factors in indigenous populations. Although there's genetic variations among different indigenous populations around the world due to evolution and anthropological factors, evidence is there to indicate that there is definitely a rising trend in cardiovascular risk factors in indigenous communities. Studies from several countries show that the indigenous communities have higher prevalence rates of obesity and diabetes than the national average.

Prevalence of obesity and diabetes in Australian indigenous aboriginal population (2.5% of total population) are 27% and 7% compared to national prevalence of 22% and 4%, respectively.¹⁸ Similarly, in New Zealand Maori indigenous population (15% of total population), the prevalence of obesity and diabetes are 42% and 8% compared to national prevalence of 27% and 5%, respectively.¹⁸ In USA, in indigenous American Indians and Alaskans (1.7% of total population), the prevalence of obesity and diabetes are 42% and 15% compared to national prevalence of 33% and 8%, respectively.¹⁸ Furthermore, population surveys in these 3 countries have shown that compared to non indigenous population, indigenous population shows higher rates of unhealthy dietary habits and sedentary behavior patterns.¹⁸ In Malaysia, Orang Asli indigenous population (0.6% of total population), the prevalence of obesity and diabetes are 16.8% and 4.6% compared to national prevalence of 17.7% and 20.8%, respectively.²⁰ There is a rise in the prevalence of cardio metabolic risk factors in indigenous tribes in Malaysia when compared to 20 years ago where urbanization has been implicated as a possible cause.²⁰

More recent study involving Canadian First Nations communities (indigenous population) in 2018 showed that poor education, racism, difficulty accessing routine health care and not having access to a primary health care provider are some of the risk factors associated with higher rates of cardiovascular disease.¹⁹ Furthermore, it was revealed that greater the burden of socioeconomic hardship, the greater the burden of cardiovascular risk factors for a given community.¹⁹ In a central Australian aboriginal community in 2009, depression and unemployment were identified as risk factors for having increased risk for cardiovascular disease.²⁰

In Sri Lanka; these scattered groups of indigenous populations are undergoing demographic transition (9.9% elders above 65 years in our study vs. 8.1% nationally). Furthermore, they experience greater socio economic hardship due to social isolation and poverty.¹⁵ Poor health care seeking behavior and limited access to health care due to limitation in transport are clearly identified in these communities, particularly as these communities are among the poorest in the country with most families having a household income of less than Rs.5000/= per month.¹⁵ In Australia as well cardiovascular risk factors in indigenous communities were associated with psychological factors and socioeconomic indicators.²¹

A comprehensive strategy involving identification of unique risk factors, implementation of culturally appropriate preventative measures and improving accessibility to health care is highly recommended to prevent exponential rise in risk factors for cardiovascular diseases such as obesity and diabetes in these indigenous communities. Because it is clearly evident that Sri Lankan indigenous community is also following the global trend of increasing cardiovascular risk factors in indigenous populations. Potential local strategy would be implementing a separate health promotion strategy in the districts with indigenous communities, targeting prevention of cardiovascular risk factors using dietary modifications and physical activities which is acceptable to their cultures.

As studies from several countries indicate that the indigenous populations are increasingly susceptible to develop obesity and other coronary artery risk factors preventative strategies targeting indigenous communities are coming to the focus of discussion in other countries as well.¹⁷

Conclusions

There is a rising trend of obesity and diabetes in this indigenous community compared to previous study. This highlights that indigenous peoples in Sri Lanka share the relatively high rates of coronary artery risk factors observed among other indigenous groups around the world. A local and global initiative is required to control cardiovascular disease risk factors among indigenous groups through a targeted health promotional strategy.

List Of Abbreviations

ADA- American Diabetes Association

BMI- Body mass index

EDTA-Ethylene-diamine-tetra acetic acid

FBC- Full blood count

FPG- Fasting plasma glucose

HDLC-High density lipoprotein cholesterol

LDLC- Low density lipoprotein cholesterol

MRI-Medical research institute

SLDCS- Sri Lanka diabetes and cardiovascular study

TG-Triglyceride

Declarations

Ethics approval and consent to participate

Ethical approval was taken from the ethics review committee of the Faculty of Medicine, University of Colombo and Medical Research Institute Ethics review committee. Informed written consent was taken from all the participants.

Consent for publication

All authors read the final manuscript and approved and given consent for publication.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

No competing interests.

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Authors contribution

CD, CN and SJ designed the study. PK refined the methodology and organized data collection. GK and PH was involved with analysis of blood samples and interpretation of biochemical analysis. CD, LW, CN, SJ were involved with data collection and CD and LW did data analysis. SJ did overall supervision. CD and SJ did final editing of the manuscript.

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Author's information

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References

1. Mendis S. Coronary heart disease and coronary risk profile in a primitive population. *Trop Geogr Med.* 1991 Jan-Apr;43(1-2):199–202.
2. Expert Panel on Detection, Evaluation, and 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 May;285(19):2486–97.
3. Stone NJ, Robinson JG, Lichtenstein AH, Bairey Merz CN, Blum CB, Eckel RH, et al.; American College of Cardiology/American Heart Association Task Force on Practice Guidelines. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation.* 2014 Jun;129(25 Suppl 2):S1–45.
4. Wijewardene K, Mohideen MR, Mendis S, Fernando DS, Kulathilaka T, Weerasekara D, et al. Prevalence of hypertension, diabetes and obesity: baseline findings of a population based survey in four provinces in Sri Lanka. *Ceylon Med J.* 2005 Jun;50(2):62–70.
5. Huxley R, Barzi F, Stolk R, Caterson I, Gill T, Lam TH, et al.; Obesity in Asia Collaboration (OAC). Ethnic comparisons of obesity in the Asia-Pacific region: protocol for a collaborative overview of cross-sectional studies. *Obes Rev.* 2005 Aug;6(3):193–8.
6. Recommendation for indicators, international collaboration, protocol and manual of operations for chronic disease risk factor surveys. *European Health Risk Monitoring(EHRM).* October 2002. <http://www.thl.fi/publications/ehrm/product2/title.htm>
7. De Silva AP, De Silva SH, Haniffa R, Liyanage IK, Jayasinghe KS, Katulanda P, et al. A cross sectional survey on social, cultural and economic determinants of obesity in a low middle income setting. *Int J Equity Health.* 2015 Jan;14(1):6.
8. De Silva AP, De Silva SHP, Liyanage IK, Rajapakse LC, Jayasinghe KS, Katulanda P, et al. Social, cultural and economical determinants of diabetes mellitus in Kalutara district, Sri Lanka: a cross sectional descriptive study. *Int J Equity Health.* 2012 Dec;11(1):76. Available from: <http://www.equityhealthj.com/content/11/1/76>
9. World Health Organization. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. *World Health Organization: Geneva, WHO. Tech Rep Ser (World Health Organ).* 1995;854:424–38.
10. Katulanda P, Constantine GR, Mahesh JG, Sheriff R, Seneviratne RD, Wijeratne S, et al. Prevalence and projections of diabetes and pre-diabetes in adults in Sri Lanka—Sri Lanka Diabetes, Cardiovascular Study (SLDCS). *Diabet Med.* 2008 Sep;25(9):1062–9.
11. Katulanda P, Ranasinghe P, Jayawardena R, Constantine GR, Rezvi Sheriff MH, Matthews DR. The prevalence, predictors and associations of hypertension in Sri Lanka: a cross-sectional population based national survey. *Clin Exp Hypertens.* 2014;36(7):484–91.

12. Katulanda P, Jayawardena MA, Sheriff MH, Constantine GR, Matthews DR. Prevalence of overweight and obesity in Sri Lankan adults. *Obes Rev.* 2010 Nov;11(11):751–6.
13. Katulanda P, Katulanda GW, Dissanayake HA, Wjerathne S, Constantine GR, Sheriff MH, et al. Lipid levels in Sri Lankan adults: An analysis from Sri Lanka Diabetes and Cardiovascular Study. *Archives of Diabetes and Endocrine System.* 2018;1(2):33–8.
14. Vidanalage CK, Adhikariwattage D. Obesity and Diabetes in an indigenous “Vedda” population of rural Sri Lanka. *Sri Lanka Journal of Diabetes. Endocrinol Metab (Seoul).* 2016;6(2):12–5.
15. De Silva P, Punchihewa AG. Socio- Anthropological Research Project on Vedda Community in Sri Lanka. University of Colombo; 2011. pp. 291–324.
16. Senarath U, Senanayake S, Pathirana S, Karunaweera N, Weerasinghe MC, Gunawardena NS, et al. Health in rural Sri Lanka: A cross-sectional survey of three rural districts. *Ceylon Med J.* 2019 Sep;64(3):103–10.
17. Stoner L, Stoner KR, Young JM, Fryer S. Preventing a Cardiovascular Disease Epidemic among Indigenous Populations through Lifestyle Changes. *Int J Prev Med.* 2012 Apr;3(4):230–40.
18. Lucero A.A, Lambrick D.M, Faulkner J.A, Fryer S, Tarrant M.A, Poudevigne M, Williams M.A, Stoner L. Modifiable Cardiovascular Disease Risk Factors among Indigenous Populations. *Advances in Preventive Medicine.* 2014; ID 547018. <https://doi.org/10.1155/2014/547018>.
19. Anand SS, Abonyi S, Arbour L, Balasubramanian K, Brook J, Castleden H, et al. Pictou Landing First Nation; Canadian Alliance for Healthy Hearts and Minds First Nations Research Group. Explaining the variability in cardiovascular risk factors among First Nations communities in Canada: a population-based study. *Lancet Planet Health.* 2019 Dec;3(12):e511–20.
20. Phipps ME, Chan KK, Naidu R, Mohamad NW, Hoh BP, Quek KF, et al. Cardio-metabolic health risks in indigenous populations of Southeast Asia and the influence of urbanization. *BMC Public Health.* 2015 Jan;15(1):47.
21. Brown A, Carrington MJ, McGrady M, Lee G, Zeitz C, Krum H, et al. Cardiometabolic risk and disease in Indigenous Australians: the heart of the heart study. *Int J Cardiol.* 2014 Feb;171(3):377–83.
22. WHO expert consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. 2004; 363: 157-63.