Health and longevity in relation to CHD risk factors in a tribal population of India

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Abstract
High prevalence of Coronary Heart Disease (CHD) in parallel with economic development is observed among South Asian Countries. It is very much surprise to observe a tribal population of Kerala (Kurichias), India are having lengthy longevity who are free from age-associated chronic problems. Hence, we conducted a survey to evaluate the prevalence of obesity, central obesity, hypertension, dyslipidemia & smoking habits in a random simple of 410 (225 male +185 female) subjects. The prevalence (age standardized to the world population of Segi 95% CI and the discussion paper of World Health Organization) was: obesity 2.87 (1.22-4.53), central obesity 3.71 (2.27-5.15), hypertension 2.70 (1.92-3.38), hypercholesterolemia 0.71 (0.66-0.76), hypertriglyceridemia 2.60 (1.18-4.02) and low high density lipoprotein cholesterol 1.24 (1.07-1.42). The metabolic and anthropometric measurements in the study sample showed lower compared to other Indian and Western studies. The low prevalence of CHD risk factors in Kurichias could be attributed to the stress free economic activities and intake of coarse variety of grain and leading a healthy longevity.

Keywords: Health, Longevity, CHD, Tribal, dietary, obesity, Lipids.

Introduction
Coronary heart disease (CHD) is one of the leading causes of death both in developmed as well as in developing countries and is a major health problem associated with the adoption of atherogenic dietary habits in majority of the populations.[1] Increased number of developing nations acquire such life styles and experience an increase in the incidence of non-communicable diseases in parallel with economic development.[2] The population most affected are those who have changed from traditional to western life style or have become rapidly industrialized over a short time span.[3] Developing nations such as India are in a state of epidemiological transition with increase in life expectancy, proportion of population above 35 years, as well as the proportion of deaths occuring at older ages which are attributable to non-communicable diseases. Industrialized countries have initiated programmes for preventing cáncer, cardiovascular diseases and degenerative diseases, while developing countries concéntrate on preventing comunicable diseases due to their limited resources. This has led to a rise of non-communicable diseases like CHD in epidemic proportions in developing countries.[1] The World Health Organization estimates that 15% of deaths (1991) to 31% (2015) globally in developing countries are due to cardiovascular diseases.[4-6]

The World Health Organisation has recommended the development of national programmes for prevention and control of cardiovascular diseases. Further, risk factor studies reveal (a) a higher prevalence of coronary risk factors in urban communities as compared to rural (with a notable exception of smoking); (b) higher levels of central obesity associated with dyslipidemia (low HDL-cholesterol, increased total cholesterol - HDL cholesterol ratio, elevated plasma triglycerides; and (c) relatively leftward distribution of systolic and diastolic blood pressures.[5-8] Appropriate, exercise is clearly associated with a favourable risk factor profile, lower prevalence of dislipidemia and reduction of upper-body obesity.[7] Thus, control of obesity and greater ´physical activity are likely to be the most effective means of preventing CHD risk in South Asian populations.[7] Knowledge about prevalence of CHD risk factors is an essential prerequisite to develop an effective programme for primary prevention. Asian community especially among Indian ethnicity, it is interesting to obeserve lengthy period of longevity relatively free from age-associated chronic problems among Indian tribal population though the rise in CHD mortality is plaguing the Asian Community. Even so, the life style patterns of this tribal population are changing drastically due to a close association with the industrial population.[9,10] With this background, it is of paramount importance to study and understand CHD risk factors and life-style related measures among Kurichias, which may be applicable to the other populations in reducing the burden of CHD.

Materials and Methods
The study population were healthy volunteer adult sample of 410 Kurichias of which 225 were males and 185 were females. Objectives of the study were clearly explained to all the subjects before taking their consent to participate in the study. Strict precautions were taken to avoid related individuals.

The data were collected through a direct interview method covering age, habits of smoking, alcohol usage and dietary intake. All the subjects were involved in heavy manual labour. Dietary information was collected, using a 7-day prospective survey. After examination, each person received a 7-day diary to record his daily food intake – its quality, quantity, origin and method of preparation. On the morning of the eighth day, a dietician interviewed each subject for more details and evaluated the quantity of food ingested per day. From the 7-day collection of data, intake of energy and other nutrients were calculated from the food consumption tables based on Gopalan et al.[11]

Blood pressure (BP) was measured at the study site with a random-zero sphygmomanometer as per the procedure of Rose et al.[12] Hypertension was diagnosed according to Kaplan criteria.[13] The physical assessment included height, weight circumferences of the waist and hip according to the method specified by Shimokata et al.[14] The body mass index (BMI) was calculated as BMI = weight in kg/(height in meters)^2 (kgm^{-2}). Obesity was defined as BMI > 25. Waist hip ratio (WHR) was calculated from the circumferences of waist and hip. Central obesity was defined as WHR > 0.85.[15]

Fasting venous blood (5ml) was collected in the morning from all the subjects, and serum was seperated from whole blood by centrifugation at 3000 rpm. Serum cholesterol, high density lipoprotein cholesterol (HDL-C) and triglycerides were estimated according to the procedure of Zlatkis et al,[16] Burnstein et al, [17] Foster and Dunn.[18] Hypercholesterolemia was defined as total cholesterol greater than 244 mg% and hypertriglyceridemia as triglycerides greater than 128 mg%. Low HDL-C was defined as HDL cholesterol less than 35 mg%.[19]

Data were processed for statistical analysis and p-values below 0.05 was regarded as having statistical significance. Age-specific rates were calculated and standardization performed by the direct method against the standard world population of Segi [20] and WHO. [21] Results were expressed as age-standardized rates with 95% confidence intervals.

Result

Serum cholesterol and HDL-cholesterol levels were higher in men while triglycerides were higher in women. A higher systolic BP and lower diastolic BP was observed in males. Both BMI and WHR (central obesity) was higher in men (Table 1). Effects of age on metabolic and anthropometric measurements were tested by one-way analysis of variance for males and females (Table 2). Metabolic and anthropometric measurements did not show significant variation within the age groups in both sexes. Lipid levels, body mass index and WHR were nearly constant in all the age groups in both sexes, while both systolic and diastolic BP showed an increase in older age groups. All the lipid levels, BP and anthropometric measurements were slightly higher in males than in females.

Though alcohol intake and smoking are not prohibited in this population, people were strictly non-alcoholic and only 5 men were smokers (2.86%). Almost all (98%) of the people were chewers of either tobacco or betelnut. Hypertension, central obesity and hypercholesterolemia was more frequent in men, whereas obesity, hypertriglyceridemia and low HDL-C status was more frequent in females (Tables 3 & 4).

Women were found to be taking substantially more fibre, ascorbic acid, dietary fat and less protein, carbohydrate and caloric intake than men in the study group (Table 5).

Table 1: Metabolic and anthropometric measurements of Kurichia study population

Parameter	Males (n=225)	Females (n=185)
Serum Cholesterol (mg%)	168.90 ± 39.90	154.93 ± 37.82
HDL-Cholesterol (mg%)	70.64 ± 17.52	62.65 ± 19.27
Triglycerides (mg%)	91.63 ± 27.61	97.43 ± 31.34
Systolic BP (mmHg)	125.44 ± 13.76	123.95 ± 17.74
Diastolic BP (mmHg)	73.60 ± 17.24	78.55 ± 10.46
Body Mass Index (w/ht^2)	19.44 ± 2.42	19.35 ± 1.90
Waist Hip Circumference Ratio	0.88 ± 0.04	0.82 ± 0.06

Data as Mean ± SD

Table 2: Anthropometric and Metabolic measurements by age in males and females

Parameter	Males					Females				
	19-39 (n=43)	40-54 (n=86)	55-69 (n=57)	70 & above (n=39)	F-value	19-39 (n=39)	40-54 (n=61)	55-69 (n=45)	70 & above (n=40)	F-value
Cholesterol (mg%)	161.98 ± 25.39	162.65 ± 30.59	167.74 ±41.83	166.33 ±42.72	0.78	147.35 ±28.92	150.47 ±26.27	158.96 40.47	166.38 ± 48.67	1.02
HDL-Cholesterol (mg%)	64.69 ±8.27	81.11 ±16.96	68.04 ±20.96	61.99 ±7.51	0.59	58.09 ±15.33	63.20 ±20.01	67.17 ±23.25	65.09 ±15.42	0.95
Triglycerides (mg%)	86.86 ±20.02	94.38 ± 23.67	97.93 ±27.61	81.17 ±38.66	0.71	91.41 ±27.37	91.19 ±30.44	102.10 ±33.58	105.12 ±30.57	0.62
Systolic BP (mmHg)	118.00 ±6.79	125.60 ±14.02	127.50 ±11.45	131.25 ±18.16	0.76	112.50 ±8.29	112.50 ±21.55	126.00 ±13.92	132.80 ±16.22	0.86
Diastolic BP (mmHg)	72.00 ±6.78	76.30 ±8.26	80.83 ±10.17	80.50 ±6.38	1.39	68.75 ±5.45	80.20 ±10.11	83.40 ±10.60	0.48 ±8.62	
Body Mass Index (w/ht^2)	18.03 ±1.45	19.55 ±1.73	20.16 ±3.75	18.64 ±1.31	1.08	19.13 ±0.75	21.13 ±1.62	19.90 ± 1.86	18.47 ±1.78	0.94
Waist Hip Circumference Ratio	0.85 ±0.03	0.88 ±0.03	0.91 ±0.04	0.86 ±0.04	1.07	0.78 ±0.03	0.84 ±0.05	0.83 ±0.05	0.80 ±0.06	0.55

Data as Mean ± SD

Table 3: Age groups in relation to the Prevalence of obestiy, central obestiy, hypertension and dyslipidemia

Age Groups	Obesity		Central Obesity		Hypertension		Hyper-cholesterolemia		Hypertri-glyceridemia		Low HDLC	
	M	F	M	F	M	F	M	F	M	F	M	F
19-39	1 (2.86)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(3.57)	0(0)	0(0)
40-54	1(1.43)	2(4.76)	3(4.28)	2(4.76)	2(2.86)	1(2.38)	0(0)	0(0)	1(1.43)	1(2.38)	0(0)	1(2.38)
55-69	2(4.76)	3(8.75)	4(9.52)	3(8.57)	4(9.52)	1(2.84)	2(2.38)	0(0)	2(4.76)	2(5.71)	1(2.38)	2(5.71)
70 & above	0 (0)	1 (3.33)	2 (7.14)	1 (3.33)	1(3.57)	2(6.67)	2(3.57)	2(3.33)	1(3.57)	1(3.33)	0(0)	1(3.33)
Total	4(2.29)	6(4.44)	9(5.14)	6(4.44)	7(4.00)	4(2.96)	4(1.14)	2(0.74)	4(2.29)	5(3.70)	1(0.57)	4(2.96)

Results expressed as number of subjects with age and gender specific crude prevalence.

Table 4: Obesity, central obesity, hypertension and dyslipidemia Prevalence

Variables	Crude Prevalence	Age-standardized prevalence	95% confidence intervals
Obesity	3.23	2.87	1.22-4.53
Central Obesity	4.87	3.71	2.27-5.15
Hypertension	3.55	2.70	1.92-3.48
Hypercholesterolemia	0.97	0.71	0.66-0.76
Hypertriglyceridemia	2.90	2.60	1.18-4.02
Low HDLC	1.61	1.24	1.07-1.42

Table 5: Analysis of 7-d weighed dietary records

Parameter	Males (n=70)	Females (n=50)
Total Energy (Kcal/d)	2645.00 ± 275.50	2192.17 ± 356.22
Protein (g/d)	66.49 ± 8.76	58.32 ± 10.29
Fat (g/d)	15.97 ± 6.81	19.86 ± 8.83
Fibre (g/d)	31.19 ± 10.22	37.63 ± 12.11
Carbohydrate (g/d)	432.90 ± 89.30	398.71 ± 99.32
Ascorbic Acid (mg/d)	69.24 ± 13.21	79.34 ± 22.44

Data as Mean ± SD

Discussion

The Kurichia population, known to be relatively free from coronary heart disease, displayed lower values of blood pressure, BMI, WHR, serum cholesterol, triglycerides and high levels of HDL-cholesterol when compared with other Indian,[8,23-27] Asian,[28] middle east[29] and western data.[27-33] A positive correlation was characterised between serum cholesterol levels and the risk of CHD and negative correlation with high density lipoprotein cholesterol levels in earlier studies.[30] People

with a cholesterol level greater than 300 mg% have four times increased risk of coronary heart disease than people with < 200 mg%.[25] A WHO expert committee has stated that populations with a mean cholesterol of 175 mg% or less have no major effect on CHD risk.[34] In the present study only 6 people (4 men, 2 women) were observed to have cholesterol greater than 200 mg% indicating that coronary risk was minimal in this population. Low levels of HDL-C are independent predictors of CHD and high levels of HDL-C appear to be effective in preventing CHD.[27] Only 5 (1 male + 4 females) had a HDL-C below 40 mg%, while 12 (7males + 5 females) had HDL-C greater than 80 mg%. Nicholson et al (36) have documented a high life expectancy in families with elevated HDL-C levels. The results of the present study coincide with the findings in the quoted study.

The low prevalence of cigarette smoking and lack of alcohol intake among the Kurichias suggest that they may have been more health-conscious than the other populations. The prevalence of dyslipidemia, obesity, central obesity and hypertension in Kurichia population is lower than that of other populations.[25,37] Fernando et al[38] observed that 15% of the subjects were hypercholesterolemic in their study. Similar percentages of hypercholesterolemia were observed elsewhere. [22] Prevalence of hypercholesterolemia in the present study is only 1%. The prevalence of low HDL-cholesterol is 9% in a European population,[39] 13% in a Srilankan community[38] and only 2% in our study sample. The observed 3% of hypertriglyceridemia in Kurichias is lower as compared to Asian and Western studies.[30,31,36] Low HDLC and / or hypertriglyceridemia in the presence of normal cholesterol with central obestiy are thought to be associated with Syndrome X. They have been implicated as a cause for high rate of CHD in South Asians,[7] but elevated HDL-C levels and normal cholesterol and triglyceride levels observed in this population may offer protection against CHD.[35]

Two Indian studies on rural and industrial workers observed a 24% and 42% prevalence of hypertension respectively.[25] Couderc et al[40] found 22% of his study group were hypertensives and 13% were obese. While Fernando et al[38] found in his study that 16% were hypertensive, 10% obese and 17% centrally obese in a Srilankan community. In our study sample, 3% were hypertensives, 3% obese and 4% had central obesity. Research reports from various communities show an age related rise in blood pressure but hypertension is not an invariable accompaniment of aging, as lifestyle changes associated with development may lead to increase in levels of blood pressure.[25,41] Although Hughes and Cruikshank[42] imply that hypertension does not make a significant contribution to CHD in South Asians. Fernando et al[43] reported an association between hypertension and CHD. The prevalence of hypertension and obesity in this study is lower compared to other Indian populations.[44]

The average intake of diet in Kurichias show that these people are meeting the requirements prescribed by ICMR.[45] Though Kurichia is a tribal population, their energy intake, fibre, protein, vitamin C and carbohydrate is higher than that observed in other Indian populations.[26] Research results emphasize the key role of obesity, hypertension, dyslipidemia and smoking as risk factors for coronary heart disease and diabetes. The causes for CHD in developing countries is same as in the developed world. It has been shown that preventive programmes can reduce coronary mortality in developed countries.[38,46] But even in the absence of modern medicaments and preventive programmes, Kurichias have low CHD risk and enjoy healthier longevity than any other tribe or caste group of India. This could be attributed to the stress-free economic activities and intake of coarse variety of grain. The Kurichias´ staple diet includes vegetables like *Nymphaea nouchali, Hydrocotyle, Roxburguia and roots like Ceropegia and Elaeocorpus.* The leafy and root vegetables they consume have beneficial influence on cardiac protection, aging process, and diabetes mellitus.[47] Thus, balanced nutritional status of this community with centuries of interaction with the backdrop of rich forest ecosystem and undulating terrain may be serving this population to lead a healthy life.

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