Differences in Conventional Cardiovascular Risk Factors in Two Ethnic Groups in India

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Background: Studies have been carried out at national and international levels to assess ethnic variations in the prevalence of cardiovascular diseases and their risk factors. However, ethnic variations in the contribution of various risk factors to complex diseases have been scarcely studied.

Objectives: Our study examined such variations in two ethnic groups in India, namely, Meiteis of Manipur (northeast India) and Aggarwals of Delhi (north India).

Methods: Through random sampling, we selected 635 participants from the Meitei community and 181 Aggarwals from the Aggarwal Dharmarth Hospital, Delhi. Patients with coronary artery disease (CAD) and hypertension were identified based on their recent medical diagnostic history. Anthropometric parameters such as height, weight, waist and hip circumferences along with physiological parameters (blood pressures, both systolic and diastolic) and biochemical parameter (lipid profile) were measured for all study participants. Patient parameters were available from the medical reports recorded when patients were first diagnosed.

Results: Among CAD individuals, the Aggarwals showed higher mean values of weight, body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglyceride (TG), low density lipoprotein (LDL), and very low density lipoprotein (VLDL) but had lower high density lipoprotein (HDL) levels than the Meiteis. The same trend for weight, BMI and lipid parameters could be seen among hypertensive individuals. In step-wise regression analysis, SBP, LDL and TG were found to significantly contribute to the risk for CAD in the Aggarwals; whereas in the Meiteis, SBP, VLDL, HDL, TC and LDL were found to significantly contribute to the risk for CAD. In hypertensive Aggarwal participants, SBP, DBP and waist-to-hip ratio were significant contributors for hypertension; whereas SBP, DBP, and height contributed significantly to risk for hypertension among the Meiteis.

Conclusion: We found marked differences in conventional risk factors between the two ethnic groups. In India, as found elsewhere, the presence of substructuring of groups and hence, genetic isolation is high. More research is needed within this context to unveil the conventional risk factors for complex diseases. (*Ethn Dis*. 2012;22[3]:372–376)

Key Words: Cardiovascular Risk Factors, Coronary Artery Disease, Hypertension, Ethnicity, Health

Introduction

There is growing evidence that rates of cardiovascular disease differ between ethnic groups.[1–10] People of Chinese origin are believed to have lower rates of cardiovascular disease than people of European origin and also have a favorable lipid profile.[11,12] Ethnicity is a social construct, a concept that intertwines biological, sociocultural, psychological and behavioral components. All ethnic groups can share a range of phenotypic characteristics due to the shared ancestry; the term ethnicity is typically used to highlight cultural and social characteristics such as language, ancestry, religious traditions, dietary preferences and history.[11]

India is a country with a diversified population background having various ethnic and linguistic groups with stringent mating rules; isolation of populations is still maintained. If genetic epidemiological and association studies are carried out without regard to ethnic and geographic background, this can lead to the heterogeneity of samples and hence, the diffused reliability of the results. Therefore, in our study we attempted to understand the difference in cardiovascular risk factors between two major ethnic groups of India, namely Meiteis of Manipur in northeast India and Aggarwals of Delhi in north India. Aggarwals have a Caucasoid ethnicity and belong to Indo-European linguistic group whereas Meiteis have a Mongoloid ethnic ancestry and belong to Tibeto-Burman linguistic group. The Aggarwal community primarily belongs to the business class leading a sedentary life style and having a vegetarian dietary pattern with high fat consumption. In contrast, Meiteis have a lifestyle with high physical activity and follow a non-vegetarian and less-fatty dietary pattern.

In our study, we examined the ethnic differences in the distribution of conventional cardiovascular risk factors, specifically body mass index (BMI), waist-to-hip ratio (WHR), systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL), low density lipoprotein (LDL), and very low density lipoprotein (VLDL) in patients with complex disorders (ie, coronary artery disease [CAD], hypertension). We hypothe-

We hypothesized that since the genetic and cultural background are different for both groups, cardiovascular risk factors may also differ.

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sized that since the genetic and cultural background are different for both groups, cardiovascular risk factors may also differ.

METHODS

Study Population

Using a random sampling method, our study included data collected from 635 Meitei participants (33 CAD and 602 hypertension cases) and 181 Aggarwal participants (137 CAD and 44 hypertension cases) who received services at the Aggarwal Dharmarth Hospital, Delhi. The CAD and hypertension patients were identified based on their recent medical diagnostic history.

Inclusion criteria for both groups were: aged ≥35 but ≤75 years; for CAD cases, those with only CAD, CAD with diabetes, hypertension or a family history of CAD, myocardial infarction (having received open heart surgery, bypass surgery, angioplasty or stent implantation). Those with rheumatic and or congenital heart diseases were excluded from the study. Details (eg, lipid profile, diabetes status) of all patients were available from their medical reports begun when they were diagnosed with the disease.

Measurements

For both groups, fasting blood samples were drawn after obtaining participants' written informed consent. The complete lipid profile was measured for both ethnic groups at the Thyrocare Laboratory, Delhi. As the first data set was from Manipur, the blood samples were immediately transported to the Delhi laboratory for analysis. Anthropometric parameters, such as height, weight, waist and hip circumferences along with physiological parameters (eg, systolic and diastolic blood pressure), were measured for all participants of both populations.

Statistics

Means and standard deviations were computed. F-value was calculated through Levene's test for equality of variances and *t* test for equality of means was used to compare the means of the two populations based on the equality of variances, with P at ≤.05. Multilinear stepwise regression was applied to find out which parameters significantly contributed to the various disease groups in the two populations. All the analyses were done using SPSS software version 15.

RESULTS

Among CAD individuals, the Aggarwals showed higher mean values of weight, BMI, SBP, DBP, TC, TG, LDL; but lower HDL than those of the Meiteis (Table 1). The same trend for weight, BMI and lipid parameters (except for VLDL, which was found to be significantly higher among hypertensive cases though not among CAD individuals for Aggarwals) could be seen among hypertensive individuals. However, mean value of systolic blood pressure was found to be comparatively higher among the Meiteis. In step-wise regression analysis, SBP, LDL and TG were found to contribute significantly to the risk for CAD in the Aggarwals (Table 2); whereas in the Meiteis, SBP, HDL, TC and LDL were found to contribute to the risk for CAD (Table 3). In hypertensive patients, SBP, DBP and WHR were significant contributors in the Aggarwals; whereas SBP, DBP, and height contributed significantly to risk for hypertension among the Meiteis.

DISCUSSION

In comparing the Meiteis and the Aggarwals, our results show that SBP and not DBP played a significant role in contributing to the risk for CAD among the Meiteis while among the Aggarwals both SBP and DBP were important contributors, though systolic hypertension had the highest contribution. When the effect of lipid parameters was studied, LDL and TG were the significant contributors to CAD among the Aggarwals; however, for the Meiteis, TG had no contribution. Despite the higher mean values of TC and VLDL among the Aggarwals, these were not significant contributors; however, these parameters contributed significantly in the Meiteis.

The pathophysiology behind hypertension seems to be different in the two ethnic groups. Height was found to be a contributing factor in the Meiteis while WHR contributed to the risk in the Aggarwals. Height is a component of BMI and is more genetic whereas WHR may be considered an environmental factor. Therefore, genetic makeup of the Meiteis appears to make them more susceptible to risk of hypertension, while the Aggarwals may be predisposed to hypertension due to their lifestyle and dietary habits. The Aggarwals follow a sedentary lifestyle and consume a vegetarian diet with high fat content; there may be a causal difference in hypertension risk between the two ethnic groups. It is interesting to note that mean WHR was equal in the two ethnic groups (though Meitei women showed comparatively higher WHR) but WHR was a contributing risk factor in the Aggarwals and not in the Meiteis. Studies[13–16] have shown that South Asians have high abdominal obesity predisposing them to higher risk for complex diseases like hypertension; this is in accordance with our findings among the Aggarwals.

The higher level of HDL found in the Meiteis, as compared to the Aggarwals, might be due to a greater consumption of fish. This should protect the Meiteis from cardiovascular disorders but this does not seem to happen; HDL is a significant contributor to cardiovascular risk among Meiteis. This may suggest that the normal standard range for HDL may not be applicable to

Table 1. Statistics of conventional risk factors for CAD and hypertension among the Meitei and the Aggarwal ethnic groups

		Mean		SD				
Disease	**Variables**	**Meiteis**	**Aggarwals**	**Meiteis**	**Aggarwals**	***F***	***t* test**	***P***
		(*n*=33)	(*n*=137)					
CAD	Height, cm	160.84	160.47	8.23	8.55	.76	.23	.82
	Weight, kg	60.84	74.44	11.61	12.73	.03	−5.53	.00
	BMI, kg/m^2	23.51	28.89	3.44	4.59	39.75	−7.49	.00
	WHR	.91 (Men=.91; Women=.89)	.91 (Men=.91; Women=.89)	.07	.08	−.03	.16	.88
	SBP, mm Hg	137.61	145.03	22.23	13.69	5.96	−1.84	.07
	DBP, mm Hg	85.88	89.51	12.40	11.45	2.58	−1.61	.11
	TC, mg/dL	196.10	204.64	45.43	38.49	1.20	−1.09	.28
	TG, mg/dL	160.35	188.43	67.99	66.33	15.56	−2.12	.04
	HDL, mg/dL	48.42	41.07	13.33	8.27	4.65	3.02	.004
	LDL, mg/dL	112.29	141.15	31.18	34.05	19.43	−4.64	.00
	VLDL, mg/dL	32.56	33.40	13.65	19.17	.06	.81	.81
		n=602	*n*=44					
HTN	Height, cm	158.76	158.98	7.71	8.12	.03	.19	.85
	Weight, kg	59.97	69.90	10.26	12.69	1.39	6.09	.00
	BMI, kg/m^2	23.81	27.77	3.81	5.15	41.83	−4.99	.00
	WHR	.91 (Men=.91; Women=.91)	.91 (Men=.91; Women=.89)	.06	.07	.51	.71	.48
	SBP, mm Hg	137.73	135.25	13.22	9.28	1.50	1.22	.22
	DBP, mm Hg	89.90	89.77	8.75	5.21	.01	.09	.93
	TC, mg/dL	177.54	198.82	29.36	31.19	19.10	−4.14	.00
	TG, mg/dL	143.40	166.72	59.03	47.45	5.84	−2.93	.005
	HDL, mg/dL	53.24	42.41	9.94	8.68	44.11	7.48	.00
	LDL, mg/dL	95.71	121.16	25.13	24.10	37.76	−6.37	.00
	VLDL, mg/dL	28.76	33.44	12.13	9.70	5.57	−2.87	.02

CAD, coronary artery disease; HTN, hypertension; BMI, body mass index; WHR, waist to hip ratio; SBP, systolic blood pressure; DBP, diastolic blood pressure; TC, total cholesterol; TG, triglycerides; HDL, high density lipoprotein; LDL, low density lipoprotein; VLDL, very low density lipoprotein.

the Meiteis. Thus, targeting lipid-lowering therapy without considering ethnicity may lead to therapeutic errors. In their review, Scarlett et al suggested considering ethnicity in assessing risk factors, symptoms, and disease, so that correct interventions can be better tailored to specific groups.[17] Lui et al said that since the government still classifies people according to ethnic categories, identifying groups based on some standardized groupings is needed in order to target high risk groups for public health and policy interventions and to uncover the economic, cultural and behavioral contributions to health and disease.[18]

Data based on ethnicity can be useful in clinical practice when differences in disease mechanisms or drug metabolism are discovered to occur among different ethnic groups.[19–22] Certain health outcomes differ sometimes dramatically by ethnic groups, suggesting that factors related to ethnicity may play a role in determining disease risk.[9,23–25] Ethnic differences can help clinicians target new interventional strategies to treat the patients and improve their health outcomes. Information about a patient's ethnic group is imperative for identification, tracking, and investigation of the reasons behind differences in response to treatment in different individuals and groups for any particular disease.

Table 2. Step-wise regression analysis for the risk factors of CAD and hypertension among the Aggarwals

Groups	**Variables**	***R*^{2}**	***P***
CAD	SBP	.334	.00
	LDL	.057	.00
	TG	.027	.001
HTN	SBP	.72	.00
	DBP	.025	.006
	WHR	.018	.019

See Table 1 for abbreviations.

CONCLUSION

National and international studies have been conducted to determine ethnic differences in the prevalence of

Table 3. Step-wise regression analysis for the risk factors of CAD and hypertension among the Meiteis

Groups	Variables	R^2	*P*
CAD	SBP	.329	.00
	VLDL	.015	.003
	HDL	.009	.00
	TC	.011	.004
	LDL	.004	.046
HTN	SBP	.478	.00
	DBP	.02	.00
	Height	.006	.001

See Table 1 for abbreviations.

In comparing the Meiteis and the Aggarwals, our results show that SBP and not DBP played a significant role in contributing to the risk for CAD among the Meiteis while among the Aggarwals both SBP and DBP were important contributors.

cardiovascular diseases, complex disorders and their risk factors in both developed and developing countries.[26–28] Because of the many subgroups of ethnicities within a nation, studies are needed to help direct the development of effective preventive strategies that may stem the rising toll of diseases. To our knowledge, our study is the first of its kind that sheds light on the different conventional cardiovascular risk factors for ethnic subgroups in India. Ethnicity should be considered in all large-scale studies to better understand and respond to the wide variations in the pathogenesis of disease among the various ethnic groups. This social construct has potential utility ranging from elucidation of disease etiology to applications in clinical settings, to targeting specific groups for prevention and intervention on a public health scale.

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REFERENCES

1. Walker ARP. The epidemiology of ischaemic heart disease in different ethnic populations in Johannesburg. *S Afr Med J*. 1980;57:748–52.
2. Crews DE. Obesity and diabetes. In: Zane NWS, Takeuchi DT, Young KNJ, eds. *Confronting Critical Health Issues in Asian and Pacific Islander Americans*. Thousand Oaks, Calif: Sage Publications. 1994;174–208.
3. Wild SH, Laws A, Fortmann SP, et al. Mortality from coronary heart disease and stroke for six ethnic groups in California, 1985 to 1990. *Ann Epidemiol*. 1995;5:432–439.
4. Chambless L, Heiss G, Folsom A, et al. Association of coronary heart disease incidence and carotid arterial wall thickness and major risk factors: The atherosclerosis risk in communities (ARIC) study 1987–1993. *Am J Epidemiol*. 1997;146:483–494.
5. Bhopal R, Unwin N, White M, et al. Heterogeneity of coronary heart disease risk factors in Indian, Pakistani, Bangladeshi and European populations: cross-sectional study. *BMJ*. 1999;319(7204):215–220.
6. Anand SS, Yusuf S, Vuksan V, et al. Differences in risk factors, atherosclerosis, and cardiovascular disease between ethnic groups in Canada: the Study of Health Assessment and Risk in Ethnic groups (SHARE). *Lancet*. 2000;356:279–284.
7. *Strong Heart Study Data Book: A Report to American Indian Communities*. National Institutes of Health, November 2001.
8. Bild DE, Bluemke DA, Burke GL, et al. Multi-ethnic Study of atherosclerosis: objectives and design. *Am J Epidemiol*. 2002;156:871–881.
9. Jha AK, Varosy PD, Kanaya AM, et al. Differences in medical care and disease outcomes among Black and White women with heart disease. *Circulation*. 2003;108:1089–1094.
10. Mak KH, Chia KS, Kark JD, et al. Ethnic differences in acute myocardial infarction in Singapore. *Eur Heart J*. 2003;24:151–160.
11. Harland J, Unwin N, Bhopal R, et al. Low levels of cardiovascular risk factors and coronary heart disease in a UK Chinese population. *J Epidemiol Community Health*. 1997;51:636–42.
12. Woo KS, Chook P, Young RP, Sanderson JE. New risk factors for coronary heart disease in Asia. *Int J Cardiol*. 1997;62(suppl 1):639–42.
13. Williams DR. Race and health: basic questions, emerging directions. *Ann Epidemiol*. 1997;7:322–333.
14. Mckeigue PM, Ferrie JE, Pierpoint T, Marmot MG. Association of early onset coronary heart disease in south Asian men with glucose intolerance and hyperinsulinemia. *Circulation*. 1993;87:152–161.
15. Mckeigue PM, Shah B, Marmot MG. Relation of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in south Asians. *Lancet*. 1991;337:382–386.
16. Mckeigue PM, Pierpoint T, Ferrie JE, Marmot MG. Relationship of glucose intolerance and hyperinsulinemia to body fat patterns in south Asians and Europeans. *Diabetologia*. 1992;35:785–791.
17. Lin SS, Kelsey JL. Use of race and ethnicity in epidemiologic research: concepts, methodological issues, and suggestions for research. *Epidemiol Rev*. 2000;22(2):187–202.
18. Lui ET. The uncoupling of race and cancer genetics. 6th Biennial Symposium on Minorities, the Medically Underserved & Cancer. *Cancer*. 1998;83:1765–1769.
19. Miller BA, Kolonel LN, Bernstein L, et al. *Racial/Ethnic Patterns of Cancer in the United States, 1988–1992*. Bethesda, MD: National Cancer Institute; 1996.
20. Kaufman JS, Cooper RS. Considerations for use of racial/ethnic classification in etiologic research. *Am J Epidemiol*. 2001;154:291–298.
21. Foster MW, Sharp RR. Race, ethnicity, and genomics: social classifications as proxies of biological heterogeneity. *Genome Res*. 2002;12:844–850.
22. Burchard EG, Ziv E, Coyle N. The importance of race and ethnic background in biomedical research and clinical practice. *N Engl J Med*. 2003;348(12):1170–1175.
23. Wild SH, Laws A, Fortmann SP, et al. Mortality from coronary heart disease and stroke for six ethnic groups in California,

1985 to 1990. *Ann Epidemiol*. 1995;5(6): 432–439.

24. Liao Y, McGee DL, Cooper RS. Mortality among US adult Asians and Pacific Islanders: findings from the National Health Interview surveys and the National Longitudinal Mortality Study. *Ethn Dis*. 1999;9(3):423–433.
25. Chambless L, Heiss G, Folsom A, et al. Association of coronary heart disease incidence and carotid arterial wall thickness and major risk factors: The atherosclerosis risk in communities (ARIC) study 1987–1993. *Am J Epidemiol*. 1997;146(6):483–94.
26. Reddy KS, Yusuf S. Emerging epidemic of cardiovascular in the developing countries. *Circulation*. 1998;97:596–601.
27. Boutayeb A, Boutayeb S. The burden of non communicable diseases in developing countries. *Int J Equity Health*. 2005;4(1):2.
28. Institute of Medicine. *Promoting Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health*. www.iom.edu/Reports/2010/Promoting-Cardiovascular-Health-in-the-Developing-World-A-Critical-Challenge-to-Achieve-Global-Health.aspx. April 30, 2012.

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