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Original Article

Association of family history of cardiometabolic diseases (CMDs) and individual health behaviours: Analysis of CARRS study from South Asia

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ABSTRACT

Objectives: Family history is considered as an important predictor of cardiovascular diseases (CVDs) and diabetes. Available research findings suggest that family history of chronic diseases is associated with perceived risk of disease and adoption of healthy behaviours. We examined the association between family history of cardio-metabolic diseases (CMDs) and healthy behaviours among adults without self-reported CMDs.
Methods: Cross-sectional data of 12,484 adults, without self-reported CMDs, from the baseline survey of Centre for cArdiometabolic Risk Reduction in South-Asia (CARRS) cohort study were analysed.
Results: Family history was positively associated with non-smoking and high fruits & vegetables consumption in the age group of 45–64 years and moderate to high physical activity in the age group ≥65 years after adjusting for sex, education, wealth index, city and body mass index.
Conclusions: Understanding perceived risks and cultural or psychological factors related to family history through ethnographic studies may deepen understanding of these associations.
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What we already know?

- Divergent evidence exists in the literature with regards to the role of family history of a chronic disease and adoption of healthy behaviours.
- The research on these associations are predominantly conducted in high resource settings with little information from low- and middle-income countries.

What this article adds?

- The study reports the association of health behaviour of the individual and history of CMD among family member in a large population-based survey from a low- and middle-income country setting.
- The relationship of health behaviour and family history was varied by age of the individual and type of health behaviour.

Abbreviations: AOR, Adjusted odds ratio; BMI, Body Mass Index; BRFSS, Behavioural Risk Factor Surveillance System; CARRS, Centre for cArdiometabolic Risk Reduction in South-Asia; CEBs, Census Enumeration Blocks; CMDs, Cardiometabolic Diseases; CVDs, Cardiovascular Diseases; DM, Diabetes Mellitus; F&V, Fruits & Vegetables; IPAQ, International Physical Activity Questionnaire; WHO, World Health Organisation.

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1. Introduction

Cardio metabolic diseases (CMDs) such as cardiovascular diseases (CVDs) and diabetes mellitus (DM) are now well recognised as public health concern characterized by their interlinked risk factors such as obesity, hypertension, dyslipidaemia and behaviours such as tobacco smoking, diet and physical activity.[1–3] The health behaviours such as not-smoking, being physically active and consuming adequate fruits and vegetables cluster within family.[4] The health behaviours are formed, sustained and modified within family environment.[5] Therefore, the presence of a CMD among a member of family may influence not just the affected person's health behaviour but also that of other members'. Literature presents mixed evidence for the association of family history of a chronic disease and adoption of healthy behaviours.[6] While a few studies reported that presence of CVDs or diabetes in the family was associated with higher frequency of being physically active[7] or consuming optimum diet,[8] others reported lower frequency or no association with these healthy behaviours.[9,10] Examining this question in a South Asian population, with a high risk of CMD and a family-oriented culture[11,12] may shed some light on this issue.

We did an exploratory analysis using the secondary data from the baseline survey of Centre for cArdiometabolic Risk Reduction in South-Asia (CARRS) cohort study from urban cities of Chennai and Delhi (India) and Karachi (Pakistan) to evaluate the association between self-reported family history of four CMDs (diabetes mellitus, heart disease, hypertension and stroke) with healthy behaviours (i.e., non-smoking, being physically active, and healthy fruits & vegetable consumption) among participants who had no self-reported CMDs.

2. Methods

We used the baseline data of the CARRS cohort study, the details of which has been published previously.[1] Briefly, the CARRS study recruited 16,287 non-pregnant adults (age≥ 20 years) using representative multi-stage cluster random sampling from the urban cities of Chennai, Delhi and Karachi during 2010–11. The study used multistage cluster random (stratified by gender) sampling. The urban wards were the primary sampling units which were randomly selected from urban parts of the three districts. From each ward, Census Enumeration Blocks (CEBs) were randomly selected and from each CEB, 20 households were randomly selected and from each household 1 man and 1 woman were randomly selected using KISH method. The multistage cluster random sampling improves representation of all section of population and less likely to have sampling errors. World Health organisation (WHO)'s STEPS survey also recommends to use multistage cluster random sampling for data collection in large surveys.[13] Data was collected using standardized questionnaire in local languages (Tamil for Chennai, Hindi for Delhi and Urdu for Karachi).[1](Supplementary material) The details of sampling and study tools are published elsewhere.[1,14,15]

Study sample: We excluded participants with self-reported history of diabetes, dyslipidaemia, heart disease, hypertension, kidney disease and stroke, as it would not be possible to disentangle the influence of their own diseases and diseases among family members on their healthy behaviours.

2.1. Study measures and definitions

All the data was collected using structured questionnaire.

- Family history status: The participant was asked “has anyone in your family suffered from any of the following diseases (diabetes mellitus, heart disease, hypertension and stroke)?” Family history was marked as ‘present’ if the participant reported presence of at least one CMD (diabetes mellitus, heart disease, hypertension and stroke) in a first-degree relative (parent, sibling and off-spring). The exposure status was further stratified based on (1) relation with the affected family member (none, parents, off-springs and siblings; non-mutually exclusive categories), (2) type of CMD (none, diabetes mellitus, heart disease, hypertension and stroke; non-mutually exclusive categories), and (3) number of CMDs present in their first-degree relatives (zero, one, two, and ≥ three).

Healthy behaviours:

- *Non-smoking status*: People who did not report smoking tobacco at least once a week for the past six months were categorised as non-smokers.
- *Physically active*: People were considered as ‘Physically Active’ if they attained a level of 600 MET-minutes/week through a combination of walking, moderate or vigorous activity for at least 5 or more days in a week, as measured on International Physical Activity Questionnaire (IPAQ) short version.[16]
- *Healthy fruits and vegetable consumption (F&V)*: ‘Yes’ if participants consumed ≥2 servings a day based on their responses to questions in a modified food frequency questionnaire.[15] Although, World Health Organization (WHO) recommends ≥ five daily servings of F&V,[17,18] in CARRS study we found that only 2.2% of the participants consumed ≥5 servings of F&V daily with a mean consumption of 1.96 servings. Further, other studies in India also reported an average consumption of 1.3–1.5 servings per day.[19] Therefore, we used lower cut off of ≥ two servings as healthy behaviour for the purpose this research.

We further defined a combined outcome based on the number of healthy behaviours present in an individual-zero, one, two and three.

***Co-variates*:** Participants were stratified into three age groups (20–44 years, 45–64 years and ≥65 years) and two gender groups (male and female). Three education categories were created based on the highest level of schooling (up to primary, high or secondary schooling, and college graduate or higher). Individuals were categorized according to their employment (employed, student, housewife, retired and un-employed), their household monthly income (<10,000 INR, INR 10,000–20,000, and INR >20,000) and their wealth index (low, medium and high tertiles). Body mass index (BMI) was calculated as ratio of measured weight to the square of measured height (kg/m^2).

***Data analysis*:** We used Stata (version 12 SE) to analyse the baseline data. We used survey set command to account for cluster sampling with ‘wards’ as primary sampling units and accounted for probability of selection using sampling weights.[15] We used descriptive statistics to analyse the distribution of socio-demographic characteristics across family history. Pearson chi-squared test was used to find the association between the healthy behaviours and exposure variables (family history, type of CMD, number of CMDs and relation with the affected member).

We used three different forward step-wise logistic regression models (for each of the three healthy behaviours) and an ordered logistic regression models (for multiple healthy behaviour) to evaluate their association with the family history. First, we ran a model with just exposure and outcome. Participant's age, gender, education, city, wealth index and BMI were added to the models stepwise. We assessed the interaction between all the co-variates and family history by introducing an interaction term. Only age group showed significant interaction for all outcomes. We

computed the predicted probabilities and 95% CIs (using robust standard errors) for each of the healthy behaviours stratified by age groups using final models. Chennai data was excluded from all the models assessing physical activity as data of physical activity was not available.

Ethics: The CARRS study was approved by Institutional ethics committees of Public Health Foundation of India, and All India Institute of Medical Sciences, New Delhi, India; Madras Diabetes Research Foundation, Chennai, India; Aga Khan University, Karachi, Pakistan; and Emory University, Atlanta, USA.

3. Results

Of the total 16,287 participants (Chennai-6906, Delhi-5364 and Karachi-4017), 3786 (23.2%) with self-reported CMDs were excluded. The final sample for the current analysis consisted of 12,484 (Chennai-5462, Delhi-4012 and Karachi-3010) participants after excluding cases missing the variable F&V consumption ($n = 14$).

3.1. Family history and socio-demographics

Of the 12,484 participants, 4432 (35.5%) had ≥ one first-degree relative with a CMD. A significantly higher proportion of participants from Chennai (45.9%) reported a positive family history as compared to Delhi (31.4%). In Chennai, higher reporting of family history was mostly due to higher reporting of diabetes (30.0%) in the first-degree relatives as compared to other diseases such as hypertension (17.4%). Participants with a family history of a CMD were significantly younger (37.0 [±9.9] years) as compared to those who reported no family history (39.2 [±12.4] years). There was no significant difference in reporting of family history of a CMD between males (34.7%) and females (36.4%). The reporting of family history was significantly higher among the participants with higher education level - those with graduation reported highest proportion (26.5%) of first-degree relatives with a CMD. The reporting of a positive family history was significantly higher among participants in high tertile of wealth index (37.6%) compared to the other tertiles (middle = 36.2%, low = 26.2%). The mean BMI of those who reported a positive family history was significantly higher (25.9 [±5.0] kg/m^2) than those who reported no family history (24.3 [±4.9] g/m^2) (Table 1).

Table 1
Socio-demographic characteristics by family history status among population without CMDs ($n = 12,484$).

Characteristics	Family history status			
	No family history ($n = 8154$)		Positive family history ($n = 4330$)	
	%	95% CI	%	95% CI
Mean age[a], years	39.2	(38.2, 40.2)	37.0	(36.3, 37.7)
Age groups, years				
20-44	69.6	(65.2, 74.0)	78.8	(75.1, 82.4)
45-64	26.2	(22.1, 30.3)	19.9	(16.3, 23.5)
≥65	4.2	(3.3, 5.1)	1.3	(0.8, 1.8)
Sex				
Male	49.0	(43.9, 55.1)	47.2	(41.2, 53.1)
Female	51.0	(44.9, 57.1)	52.8	(46.9, 58.8)
Education status				
Up to primary school	25.5	(23.7, 27.4)	10.7	(9.3, 12.3)
High/Secondary school	61.4	(59.6, 63.1)	62.7	(59.6, 65.9)
College graduate or higher	13.1	(11.5, 14.7)	26.5	(23.1, 30.0)
Employment status[b]				
Employed	50.0	(45.0, 55.0)	50.9	(46.0, 55.8)
Student	2.2	(1.7, 2.6)	3.3	(2.6, 3.9)
Housewife	40.8	(35.6, 46.0)	41.1	(36.1, 46.2)
Retired	3.1	(2.5, 3.8)	1.4	(1.0, 1.8)
Un-employed	3.9	(3.4, 4.5)	3.3	(2.5, 4.0)
Income levels, INR[c]				
<10,000	76.3	(73.9, 78.7)	66.6	(63.1, 70.1)
10,000-20000	14.3	(13.0, 15.5)	18.9	(17.0, 20.8)
>20,000	9.4	(7.8, 11.1)	14.5	(11.4, 17.5)
Wealth index[d]				
Low	43.2	(40.7, 45.7)	26.2	(23.2, 29.3)
Medium	33.6	(31.9, 35.3)	36.2	(33.8, 38.6)
High	23.2	(20.8, 25.6)	37.6	(33.7, 41.5)
City				
Chennai	39.9	(35.7, 44.1)	45.9	(41.2, 50.6)
Delhi	39.6	(34.2, 44.9)	31.4	(26.4, 36.4)
Karachi	20.5	(17.8, 23.3)	22.7	(19.8, 25.6)
Mean BMI[e], Kg/m^2	24.3	(24.1, 24.5)	25.9	(25.6, 26.2)

Note: [a,e] data is in mean format, [b] 1 value missing for employment status variable ($n = 12,483$), [c] 69 values missing for income level variable ($n = 12,415$), [d] 2 values missing for wealth index variable ($n = 12,482$).

3.2. Family history and healthy behaviours

Participants with a positive family history of a CMD had a significantly higher proportion of non-smokers (89.3% vs. 85.9%) and a lower proportion of healthy F&V consumption (43.7% vs. 47.9%). In Delhi and Karachi, participants who reported a family history of a CMD were more physically active (but not statistically significant) as compared to those who didn't report a family history (86.3% vs. 84.3%) (Table 2).

Types of CMDs in family history and healthy behaviours

When stratified by the type of disease present in the family, we found a significantly higher proportion of non-smokers (89.2% vs. 86.7%) and participants with healthy F&V (48.5% vs. 44.5%) among those who had family history of hypertension as compared to those without. Those who reported a positive family history of heart disease were significantly more likely to be non-smokers (90.0% vs. 86.9%) as compared to those with no family history. Participants with family history of diabetes were significantly more likely to consume healthy F&V (49.9% vs 43.9%) per day when compared to those without the family history. None of the healthy behaviours differ significantly across family history of stroke (Table 2).

Number of CMDs in family history and healthy behaviours

When the healthy behaviours were stratified by the number of diseases present in the family, we found that people who have only one disease in a family member are slightly more likely to be non-smokers (89.8%) when compared to those with more than three diseases (87.9%) in family. The proportion of participants consuming healthy F&V was significantly higher among those with a higher number of CMDs in their family whereas physical activity among participants didn't differ significantly with the number of diseases in the family (Table 2).

Relationship with affected relative(s) and healthy behaviours

Participants with a history of CMDs in their parents (31.9%) were significantly more likely to be non-smokers (89.1% vs. 86.2%) and consume ≥2 F&V (48.4% vs. 43.7%) when compared to those without parental history. Participants with a disease in their sibling (6.6%) are significantly more likely to be non-smokers (90.7% vs 86.8%) and less likely to be physically active (81.7% vs 85.9%) when compared to those without the disease in their siblings. None of the healthy behaviours showed any significant difference among those with (0.2%) and without a disease in their off-springs (Table 2).

3.3. Logistic regression analysis of association of family history and healthy behaviours

Table 3 depicts association of healthy behaviours among people with a family history of CMDs after adjusting for covariates stratified by age groups. The 'non-smoking' was found to be positively associated with the family history in the younger age group of

Table 2
Prevalence of three healthy behaviours by family history status of CMDs ($n = 12,484$).

Risk factors	Overall (%)	Healthy behaviours		
		Non-smokers (%)	Physically active (%)	F & V ≥ 2 servings/day (%)
Overall		87.1	85.6	45.2
Family history status				
Positive history	35.5	89.3	84.3	43.7
No family history	64.5	85.9	86.3	47.9
Type of disease in family				
Hypertension				
Yes	16.6	89.2	83.4	48.5
No	83.4	86.7	86.1	44.5
Heart disease				
Yes	7.1	90.0	84.4	49.1
No	92.9	86.9	86.8	44.9
Diabetes Mellitus				
Yes	22.2	88.6	85.5	49.9
No	77.8	86.7	85.7	43.9
Stroke				
Yes	1.9	88.6	84.8	43.8
No	98.1	87.9	85.7	45.2
Number of diseases in family				
One	25.4	89.8	84.4	46.1
Two	8.3	88.1	83.2	51.5
Three & Four	1.8	87.9	87.4	56.5
Relation with family member				
Parents	31.9	89.1	84.6	48.4
Siblings	6.6	90.7	81.8	47.3
Off-springs	0.2	100.0	87.0	47.3

Table 3
Multivariate logistic regression models of association of healthy behaviours with family history status of CMD ($n = 12,484$).

Behaviours	Age group (years)	Crude OR (95%CI)	Adjusted OR (95% CI)			Predicted probabilities of healthy behaviours using model III[c] % (95% CI)
			Model I[a]	Model II[b]	Model III[c],*	
Non-smokers						
	20–44	1.15 (0.95–1.39)	1.18 (0.97–1.44)	1.02 (0.82–1.28)	1.09 (0.85–1.40)	88.9 (88.1–89.7)
	***p*-value**	0.15	0.09	0.82	0.50	
	45–64	1.82 (1.44–2.30)	1.84 (1.45–2.33)	1.56 (1.22–1.99)	1.37 (1.05–1.79)	84.2 (82.4–86.0)
	***p*-value**	<0.001	<0.001	<0.001	0.02	
	≥65	1.32 (0.62–2.80)	1.22 (0.56–2.68)	1.10 (0.48–2.49)	1.27 (0.43–3.70)	91.2 (88.1–94.3)
	***p*-value**	0.47	0.61	0.83	0.66	
Physically active**						
	20–44	0.75 (0.62–0.93)	0.76 (0.61–0.93)	0.93 (0.75–1.16)	0.99 (0.76–1.29)	86.0 (84.4–87.6)
	***p*-value**	0.009	0.01	0.54	0.95	
	45–64	0.90 (0.70–1.16)	0.89 (0.70–1.14)	1.02 (0.78–1.32)	0.92 (0.68–1.24)	85.4 (83.6–87.3)
	***p*-value**	0.42	0.36	0.90	0.58	
	≥65	1.74 (0.75–4.04)	1.70 (0.73–3.99)	2.05 (0.85–4.94)	3.91 (1.18–12.9)	84.2 (79.5–88.8)
	***p*-value**	0.20	0.22	0.11	0.03	
Fruits & Vegetables ≥ 2 servings/day						
	20–44	1.10 (0.96–1.25)	1.10 (0.96–1.25)	0.88 (0.77–1.02)	0.87 (0.74–1.03)	46.0 (43.7–48.3)
	***p*-value**	0.17	0.18	0.09	0.10	
	45–64	1.47 (1.22–1.77)	1.49 (1.23–1.79)	1.14 (0.94–1.39)	1.14 (0.91–1.44)	49.5 (44.9–50.3)
	p-vale	<0.001	<0.001	0.17	0.26	
	≥65	1.33 (0.69–2.60)	1.35 (0.68–2.67)	1.12 (0.56–2.24)	0.73 (0.30–1.79)	36.8 (28.9–44.6)
	***p*-value**	0.39	0.39	0.74	0.50	

Notes.
* sample for model III ($n = 9484$), ** total sample for model III for physical activity ($n = 5165$).
[a] Adjusted for sex.
[b] Adjusted for sex, education status, city and wealth index.
[c] Adjusted for sex, education status, city, wealth index and BMI.

20–44 years, however the association was not significant. Participants aged 45–64 years with a family history of CMD are 37% more likely to be non-smoker when compared to those without family history after adjusting for sex, education, city, wealth index and BMI (AOR = 1.37, 95% CI = 1.05–1.79). No significant association was found between family history and smoking in the older age group (≥65 years). It was found in the adjusted analysis that physical activity was not significantly associated with family history in the younger and middle age groups. However, participants in the age group ≥65 years with a first-degree relative suffering from a CMD were almost 4 times more likely to be physically active (AOR = 3.91, 95% CI = 1.18–12.9) when compared to those who do not have a first degree relative suffering from a CMD. Family history was not found to be associated with healthy F&V consumption in the younger (20–44 years) and older age group (≥65 years). Participants with a positive family history in the middle age group of 45–64 years were 0.14 times less likely to consume ≥2 servings of F&V per day (AOR = 1.14, 95% CI = 0.91–1.44) when compared to

those without family history. However, the association was not found to be significant (Table 3). Participants with a positive family history had a 1.09 times greater odds of adopting all three healthy behaviours at once when compared to those without the family history. However, we didn't findthe association to be significant ($p = 0.22$) in the model adjusted for all the co-variates (See Fig. 1).

4. Discussion

4.1. Family history of CMD and healthy behaviours

In this large survey of representative adults of three metropolitan cities in South Asia, one-third (34.5%) of the participants without self-reported CMD, reported one or more CMDs among first-degree relatives. We found that family history of a CMD was associated with higher odds of being a non-smoker, physically inactive and having healthy F&V consumption. However, the association was inconsistent and varied by age group and type of CMDs present in the family member. For instance, family history was not significantly associated with any of the healthy behaviours in the younger population (20–44 years). However, family history was positively associated with being non-smoker in the middle age group population (45–64 years) and with physical activity in the older age group (≥65 years). This association of healthy behaviours with family history in older group, not in younger age is interesting. Possibly, young adults might feel that they are less vulnerable to disease risk and are more influenced by peers rather than family members.[20] However, ethnographic understanding of healthy behaviours and influence of family history needs to be explored further.

4.2. Family history of CMD and non-smoking

Contrasting evidence exists in the literature on the association between family history of CMDs and smoking. For instance, family history status of CVD and diabetes was found to be associated with current smoking among US adult population (≥18 years).[21,22] In contrast, family history of CVD was not found to be associated with smoking among adult (≥18 years) population from Oregon and older adult (≥ 50 years) population from Sweden and Poland.[7,8]

4.3. Family history of CMD and physical activity

With respect to physical activity, analysis of Behavioural Risk Factor Surveillance System (BRFSS) data of Oregon showed a positive association between family history of CVD and physical activity.[7] A randomized controlled trial conducted on the Dutch Caucasian population (≤75 years) during 2007 reported a positive influence of family history of diabetes on the physical activity levels when individuals were communicated with the familial risk of diabetes.[23] On the contrary, Tamragouri et al reported that people with a positive family history of a CVD were less likely to be physically active. Another study among American Indian and Alaska Native population during 2001 reported that people with family history of heart disease or stroke were less physically active.[10] However, other studies among Western population from Sweden and US reported no influence of family history on physical activity levels.[9,24]

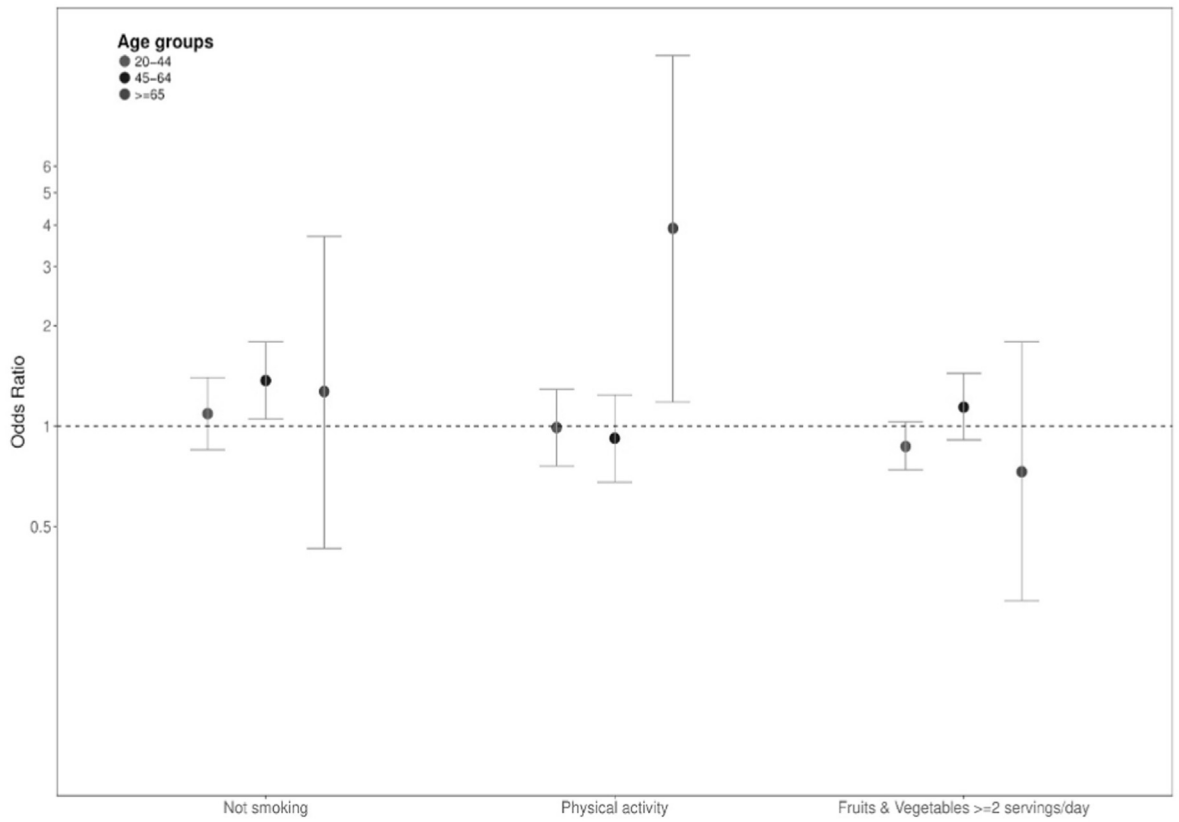

Figure 1. Dot plot for odds ratio of three healthy behaviours with family history as compared to those without the family history.

4.4. Family history of CMD and diet

Similarly, contrasting evidence can also be found in the association of family history of CMD and healthy diet intake. A cross-sectional study among African American population (≥18 years) conducted in 1997 in North Carolina reported a positive association of family history of diabetes and F&V consumption.[8,10] In contrast, among American Indian and Alaska Native population (≥18 years), a study found no association between family history of heart attack, stroke and diabetes and F&V consumption.[10]

4.5. Reasons for conflicting data from various studies

The contrasting evidence could be because adoption of a healthy behaviour depends on perceived higher risk of the disease, beliefs regarding healthy behaviours and motivation to adopt such behaviours as explained by the health belief model given by Sheeran and Abraham.[25] This theory entails five key components for guiding health seeking behaviours-perceived susceptibility of the person towards illness (vulnerability to illness), perceived severity of the disease, motivation to be concerned about health issues, perceived benefits of the preventive action and perceived barriers to action.[26] The health beliefs and motivation to action are conditioned by the socio-demographics (age, gender, income etc.) and psychological factors (will-power, peer pressure). A systematic review of 25 studies examining CVD risk perception and behaviours reported that participants did not perceive an increased self-risk of diabetes when a family member was affected and therefore did not adopt the healthy behaviours.[27] Family history of CVDs was not considered to be as big a threat as compared to the family history of cancer in a study by Walter et al, who interviewed 30 patients (≥18 years) with a family history of either cancer, heart disease or diabetes from Cambridgeshire general practices to study perceptions of family history of diseases.[9,28] Further, studies suggest that young adults might be less influenced by the family history of CVD, and their behaviours might be affected more by psychological factors such as acceptance and reinforcement of their peers rather than family.[16] However, behaviour of older adults are more likely to be affected by the family history as reported in our study. Another explanation for contrasting evidence might be that although the participants may be adopting healthy behaviours but those are not sufficient to meet the recommended levels.[24] Literature also suggests that people who were aware of their family history of diseases considered their own health to be poorer and reported less preventive behaviours.[10]

4.6. Strengths and limitations of the study

Our study has several limitations which should be considered while interpreting these findings. First, the data was taken from a cross-sectional study and hence causal inferences cannot be drawn from the results. Second, both the exposure and the outcome data were self-reported and are subject to recall errors. For instance, the participants with higher education reported higher number of family history which is possibly due to higher awareness and recall in this group. The questions on exposure and outcome were independent of each other and less likely to have influenced each other, hence the recall errors are likely to be random rather than systemic, and therefore, would possibly pull the effect size towards null and the true estimate may have been underestimated. Third, death of a relative due to CMD may have stronger influence on healthy behaviour. But the information on survival of the relative with CMD was not collected and therefore was not included in the analysis. Fourth, the information on total number of affected relatives was not available. Hence, we were not able to quantify the number of affected relatives on healthy behaviours. Finally, few intermediate variables such as heritability of CMDs, risk awareness, and risk perception, that may explain the association between family history and health behaviours, however were not measured in the CARRS study and therefore their relationship could not be ascertained.

Our study had several strengths. To the best of our knowledge, this is the first study in South Asia reporting the association of family history on healthy behaviours. The information was collected from a large representative sample of adults in three major cities of Chennai, Delhi and Karachi. CARRS collected detailed information on presence of four CMDs in all the first-degree relatives. The study used standardized protocol and data collection tools across all sites with stringent quality assurance and quality control.

5. Conclusion

The exploratory analysis of association between family history and healthy behaviours suggest that presence of CMD in family may influence healthy behaviours among South-Asian urban adults. Identifying and discussing family history of CVD may be an important motivating factor for promoting healthy lifestyle behaviours. Further ethnographic exploration are required to understand-risk awareness, perception, cultural or psychological factors that influence the association of family history and healthy behaviours.

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Data availability

The data that support the findings of this study are available from the Corresponding author (RS), upon reasonable request.

Declaration of conflicting interest

The Authors declare that there is no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ihj.2022.05.004.

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