

Coronary Heart Disease Risk Factors in Indian College Students

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Abstract: *College students undergo transition from adolescence to adulthood and are more likely to adopt lifestyles, promoting coronary heart disease (CHD) risks. Besides being second most populous country in the world, India is home of 253 million adolescents. The present scenario of India, indicating that the young people of this country are endanger of CHD-related disease risks. The existing risk factors among youth, strongly predict the long-term CHD risk in future. The aim of the present review is to demonstrate all the scientific evidence conducted among college student of India to behold the profundity of CHD exposure among youth. This review highlights the need for improved interventional strategies for better risk assessment and increased awareness among young Indian. Different cross sectional studies provide the evidence of the persistence of CHD risk factors in this college going students. But mostly they are modifiable risk factors for diabetes, hypertension and CHD, and widely prevalent among student's community of India. Eighty percent of these CHD risks can be modifiable. Thus community based approach will be beneficial in this diverse country to prevent CHD. Increased screening should take pivotal part in concurrence with education to successfully identify and manage CHD risk.*

Keywords: College Students; India; Coronary Heart Disease; Obesity; dyslipidemia

1. Introduction

Despite being a largely preventable disease the cardiovascular disease (CVD) is the leading cause of death in industrialized nations [1, 2, 3]. India is facing a double burden of both communicable disease and NCDs. Furthermore, it is the second most heaving country in the world, two-thirds of its residents are <35 years of age [4, 5, 6]. In spite of having significant persistence of CHD risk factors among younger population of the world, but still it is under rated [7, 8, 9, 10]. In India, 53 % of all death is mostly due to many chronic diseases, out of which 29% were due to cardiovascular disease (CVD) alone [11]. Last 30 years of research reveals that the incidence of obesity is more than double in children and more than triple in adolescent people [12]. These continuous gain in weight carry forwarded and exacerbated in young adulthood [13]. For younger adults, as they become obese, the disease occurrence related to heart, increases by 2-4% respectively [14]. 35% of college students are most likely to become overweight [15], and this surplus weight ultimately leads to dyslipidemia [16] metabolic syndrome [17] diabetes [18]. There are many modifiable risk factors in CHD. Smoking, obesity, physical inactivity, hypertension, hyperlipidaemia and faulty dietary habits are important among them [19]. Study shows that changes in life style, dietary modification and medical therapy can decrease the CHD risks significantly [20-25].

Reports from western countries exhibit that, majority (>50%) of young adults have at least one CHD exposure. This situation has markedly imparted on long term existence of heart disease risks among human [26]. As multiple CHD risks existing among adolescence, therefore it is tracking forward to adulthood as well [27-30]. The World Health Organization (WHO), American Heart Association (AHA) & the National Heart, Lung, and Blood Institute's (NHLBI's) 2012ExpertPanel already emphasizes the primordial anticipation against CHD should begin at childhood and adolescence [31, 32]. The childhood obesity and overweight are devoting as crucial nutritional problem

in the under developed nation and thereby influencing the mass of youth, producing an increased burden of incurable complications [33, 34]. Hypertension during the early stage of life is the prevailing indicator of adult blood pressure and ultimately increasing mortality from CVD, which need specific fighting strategy to reduce its consequences in the community [35]. Studies from different part of urban India reported high incidence rate of obesity and overweight, persisting among day-pupil and these will ultimately lead to increase CHD risks during young adult stage of life [36-41].

Despite there is screening recommendations for all adults aged above 20 years of age [42, 43], but still they are usually undiagnosed due to faulty mind set [44], additionally the mass of youth are not concern of their risk existence [45]. Several study reports have speculated that the proficiency and concern about CHD are key stones for intercepting several CHD like chronic diseases [46-48]. As the atherosclerosis commenced during adulthood therefore most of the aetiological factors can be better overcome if detected early. Thus increased concern about the CHD risks among adolescence is crucial for complete eradication of the disease from youth [49-52]. Therefore, it is necessary to implement proper evaluation system in tandem with nutrition education and behavioural management among the target population. Report showcase that the early disclosure and interventions are crucial as 80% of CVD incidence can be preventable through proper dietary and lifestyle modification [53]. College students are an understudied population in India, especially when emphasis is on CHD, there is very few scientific work and no review work yet published. Thus the aim of the present review is to showcase all the scientific evidence conducted among college student of India to behold the profundity of CHD exposure among them. Furthermore, successful community based prevention or treatment strategies adapted by other population of the world will be discussed with a focus on how to lower the CHD risk factors by implementing the same in India.

2. Data Synthesis

Relevant published articles were summarized by performing computerized literature searches of different authentic data bases using key words; College Students, India, Coronary Heart Disease, Obesity, dyslipidemia. Potential studies with original data were selected and incorporated their important findings into conclusion regarding the current scenario on CHD among college students of India.

Prevalence of CHD risk factors in college students of India

Metabolic Syndrome (MS)

Indian, as an ethnic group, there is significant high risk for MS and central obesity, both forerunners of diabetes, CHD and other “life style” disorders [54-56]. Indian study shows that in development of MS among college students, overweight and obesity plays significant role [57], whereas the rates of obesity and overweight have increased rapidly among Indian adolescents, typical college going students transitioning from adolescence to young adulthood [58]. Prevalence of MS among college students observed from different part of India varies from 5-18.3 % [57-65], which is relatively high compared to other countries [66-70]. In this case one important reason for such heterogeneity in the prevalence of MS is the use of different criteria and definitions of MS in various studies. The World Health Organization (WHO), International Diabetic Federation (IDF) and the National Cholesterol Education Program Adult Treatment Panel III (ATP III), all of them have provided various definitions of MS. In the year 2009 although a joint interim statement was published by IDF task force on epidemiology and prevention, National heart lung and blood institute, American Heart Association, World Heart Federation, International Atherosclerosis Society and International Association for the Study of Obesity. But still none has solved the problem yet [65]. As for example, one of the largest epidemiological study conducted among Chennai urban and rural area [61], consisting of 26001 subjects having >20 years of age were screened for MS. The

prevalence of MS was ranged from 5.1-8.9% among the 20-29 years of aged people. Anyhow this study did not use the IDF consensus definition with ethnicity specific cut offs where as some used it for Indian populations. Most important findings of above studies are that the low level of high-density lipoprotein (HDL) was the most common and abdominal obesity was the least common constituent of MS in this particular age group [57-65]. Significant difference was observed between the prevalence of MS adolescents from low to high socio-economic strata [65].

Obesity or Overweight

As previously discussed, this is global problem and it is steadily affecting many developing countries, particularly in urban settings. Globally the prevalence of overweight is 42 million, among which 31 million lives in developing countries [71]. College students are highly vulnerable to obesity now a day. As living away from home, transitioning to independent living and they are thus making their own food choices, irregular routines and attracted to new lifestyle, which often results in imbalanced diet [72]. The prevalence of obesity is also high among Indian college going students, varies from 10 to 56 % [15, 54-65, 72, 73]. The prevalence of central obesity is even more alarming among these students [54-65, 72, 73]. Deshpande et al shows highest prevalence (68%) of abdominal obesity among them [73]. Women are mostly affected than men [54-65, 72, 73].

Abnormal biochemical parameters among College Students of India

Persistence of different CHD risk factors among young adulthood can be the result of pathological changes during childhood. Report says only 20% of CHD incidence among youth, is linked with non-atherosclerotic components [74]. Results from some cross-sectional studies from different parts of India, that have assessed CHD risk in college students and adolescence groups exhibit a frightful pervasiveness among young with abnormal risk factor profiles (Table 1).

Table 1: CHD risk factor prevalence in college students¹

Authors (ref)	TC (≥200 mg/dL)	LDL-C (≥100 mg/dL)	HDL-C (<40M, <50Fmg/dL)	TGs (≥150 mg/dL)	Glu (≥100 mg/dL)	BP (≥130/85 mm Hg)	WC (≥102M ≥88Fcm)
Ibrahim RM et al (15), (N=406)%	-	-	-	-	-	-	-
Male (N=212)	19.8	20.7	16.9	22.6	17.9	16	-
Female (N=196)	3.5	2.5	4	6.6	2.5	1	-
Das et al (59), (N=397) %			28.7	14.9	7.8	13.9	25.7
Male (N=162)	-	-	16	20.4	6.2	24.7	8
Female (N=235)	-	-	37.4	11.1	8.9	6.4	37.9
Bhagat et al. (65), (N=611)%	-	-	-	18.8	16.9	15.1	38.8
Puri et al [75], (N=2502)%	23	10	25	18	-	-	-
Shiju TM et al (N=683) [76], %	26.5	-	-	22.2	-	43	-

¹BP, blood pressure; CHD, coronary heart disease; F, females; Glu, glucose; HDL-C, HDL cholesterol; LDL-C, LDL cholesterol; M, males; TC, total cholesterol; WC, waist circumference; -, data not reported or not reported in this format.

Ibrahim et al, [15] stated that the most prevalent risk factors in a sample of 406 medical college students were fasting glucose, cholesterol levels, LDL levels, BP and WC. All of the factors are higher among male participants. They concluded that 18% of their male participants and 3% of the female participants had risk factors related to diabetes,

hypertension and CVD [15]. But there was no significant association between the anthropometric measurements and biochemical parameters with that of pre-hypertension and pre-diabetes [15].

Das et al, [59] assessed the prevalence of metabolic syndrome criteria in 397 colleges going students (aged 18 to 24 years) and observed that 14.9% had elevated TGs and 28.7% had low HDL cholesterol and 25.7 % had WC above normal criteria. Das et al stated that poor metabolic profile of male students as revealed in Table 1; indicates they can naturally progress to early onset of CVD if not addressed in time [59]. Considering low HDL cholesterol level and WC, female are also facing the same in this study [59]. Similar observation was observed in study conducted by Puri et al, where female participants had significantly higher level of TC and low HDL cholesterol [75].

Prevalence of Tobacco and Alcohol consumptions

Smoking is one of the predominant risk factors of CHD, causes one of every four deaths from CVD [77]. Current prevalence rate of smoking among college students of India varies from 6 to 32% [15, 65, 78,]. Further 7 to 50% students were passive smokers, as most of the students stay in the college hostel, and sharing rooms with smokers, end up being victims of passive smoking [15, 65, 78]. Other than smoking, oral use of smokeless tobacco (ST) has now been popular among high school, college students, and adults in India [79]. Present status of ST consumption in India is 33 % for men and 18 % for women [79]. Consumption of tobacco has been estimated to directly cause 10% of all CVD worldwide [79]. Consumption of alcohol is another predisposing risk factor of CHD [80], very common practice among college going students as well. Current prevalence rate of alcohol consumption among college student varies from 79 to 25% [15, 65, 80-82], which is very much alarming and indicative towards having consistent CHD risk factors among this age group.

Faulty Dietary Habit

Report shows that dietary practice of having low in saturated fats and high in fruits and vegetables minimize the number of new cardiac events up to 73% [83]. But the picture is different in case of college going students of India. Experts are speculating that probably in India before the age of eighteen years' students are mostly influenced by parental instructions and family norms, controlling/monitoring their eating pattern and physical activity. Beyond twenty-five

years of age their studies are over and they become mature enough to take their own decisions about their lifestyles. As a result, the 18-25 years of age become vulnerably transitioning age, exposure to a range of choices regarding food, makes the youth more susceptible to unhealthy lifestyle patterns [15, 65, 78].

On the other hand, the young generation of India have influence on 'Western cultures'; including the type of diet that Westerners eat [3]. The Western cuisine is characterized typically by high consumption of red and processed meats, high fat dairy products, refined sugar & grains, and an excess of salt & fried foods, in replacement of fruits and vegetables, lean proteins, and fibre [3]. Thus it serves to increase an individual's blood sugar and cholesterol, while simultaneously depriving them of essential nutrients [84]. Most Indian diet has traditional dietary pattern, consist mainly of vegetables and very few animal products, but now it's clear that the infiltration of the Western diet has had remarkably large consequences on the health of this nation [84, 85].

Report says the use of sugar among human has increased nearly by 20% from 1970-2005, contributing almost 500 kcal/day [86]. Study conducted by Johnson et al exhibits that the teenagers are eating more sugar than any other age group (549 kcal/day) [87], and this carry on into young adulthood too [88]. Furthermore, these improper food choices predispose to the high incidence of CHD risks in the college going students [89-92].

In India young adults consume more solid fats, added sugars, and sodium, along with improper/irregular intakes of fruits and vegetables, whole grains, and fiber [15, 44, 64, 65, 93-95]. Results from few cross-sectional studies from different parts of India, that have assessed common dietary habits of college going students and adolescence groups show an alarmingly faulty dietary practices of young adults in India [Table 2]. Studies conducted in several part of India as well as other regions confirm that consuming food other than home cooked food is directly related to a higher proportion of overweight/obesity in adolescent age groups [96-98].

Table 2: Common dietary practices among college students of India¹

Authors (ref)	Soft drink (>500-ml/week)	Junk Foods (weekly)	Salty/Processed food intake (weekly)	Fruits (≥3-6 times a week)	Vegetables (≥3-6 times a week)	Non vegetarian Food (≥3-6 times a week)	Frequency of intake outside foods (weekly)
Ibrahim RM et al (15), (N=406)%	-	35.8	-	12	12	-	52.7
Nair LM et al (65), (N=970)%	28.04	71.23	64.32	39.79	79.58	55.46	-
Male (N=496)	41.7	75.2	-	-	79	58.5	-
Female (N=474)	13.7	67.1	-	-	80.1	52.1	-
Gupta et al (44) (N=452), %	3.09	55.53	-	57.74	84.29	-	-
Male (N=247)	3.64	54.25	-	56.68	87.44	-	-
Female (N=205)	2.43	57.07	-	59.02	80.48	-	-
Kulkarni et al (93), (N=120)%	26.67	-	-	43	-	-	-
Deshpande et al (94), (N=138)%	-	-	-	42	42	-	42
Rustagi et al (95), (N=430)%	23.72	32	53	40.23	40.23	-	-

-, data not reported or not reported in this format.

In this regard the AHA issued scientific declaration and endorsed reduction in sugar consumption in response to limit the consequences of obesity, dyslipidemia, and CHD risks

[87]. India is home of 253 million adolescents [15, 99]. Now a day one of the fastest-growing sectors in India is the food processing industry, accounts for about 50-60% of the

consumption of edible sugar, salt and fats [15, 99]. About 85% of food products consumed by Indian are processed in factory [100]. Here children are one of the soft targets for food industries. Here companies are influencing their dietary preferences and let them choose more processed food than the home made one. It is also laying the foundation for taste preferences and brand loyalty that can last into adulthood too [101, 102].

Physical and sedentary activity

According to WHO, in southeast Asia, nearly three-quarters of adolescents are insufficient in terms of their physical activity level, which means they do not engage in at least 60 minutes of moderate-to-vigorous-intensity physical activity every day [15, 103]. Sedentary activities are increasing day by day. Adequate physical activity is not only helping to maintain a healthy body weight, development of healthy bones, muscles, and organs, but also exercise can ward off mental health conditions such as anxiety and depression which are common among young people of India [15]. One noticeable health effect of physical activity observed among youth is that it lowers the levels of other NCD risk behaviours such as tobacco and alcohol use among Indian [15].

According to WHO, adequate physical activity can reduce the burden of many diseases [104]. An estimated 2 million deaths are caused due to inadequate physical activity [104]. Ibrahim et al [15] and Ismail et al [105] shows that 30 % of the college going students had the habit of regular physical activity. Study conducted in Uttar Pradesh, Ahmedabad, Gujrat shows that 15.2% of the students exercised daily and 56.3% exercised weekly, which is comparatively lower than previous two studies [106, 107]. Long hours of sedentary work and low physical activity was reported in other two studies, conducted among university students [22-62%] [108, 109]. According to Rustagi et al [95], 35.8% students were having exercise routine at least 30 min/day for 5 or more days, while occasional or nil physical activity was reported for 42.6% students. In terms of doing sedentary activity about 25.6% spends more than 4 hrs per day. They observed an increasing trend of doing sedentary activity more than of doing exercise on a daily basis among these students [95]. One meta-analysis study shows that people who spends more time in having sedentary behaviours have greater odds of having metabolic syndrome, thus reducing sedentary behaviours is very much crucial for the prevention of metabolic syndrome [110]. During continuation of sedentary activity if there are any break, which can be of standing up, walking down the hall, and others. Reports are there indicating this practice can lead to lower the CVD risk factors significantly [111, 112].

3. Discussion

Future perspective of Population-based nutrition interventions in college students

The present scenario of India, indicating that the young people of this country are endanger of NCD-related disease risks [15]. It is very common that for an individual, once any behavioral pattern is established, it often persists throughout life and is hard to change [15, 44, 65]. Research has

documented that adolescence stage in life is the appropriate time for appropriate intervention [95]. Teenagers develop personal lifestyles and start making individual choices. Many of their lifestyle choices are related to risk factors for non-communicable diseases, such as cigarette smoking, alcohol consumption, diet patterns, development of obesity etc. [113]. These faulty behaviors can result in disease outcomes such as obesity, cancer, hypertension, type 2 diabetes, which are among the leading causes of death in developing and developed countries [113].

Recognizing the importance of this problem, a resolution was endorsed by the World Health Assembly to address the needs of the youth in the context of NCDs [114]. The world health organization has already warned to developing and developed countries, about the increasing NCDs among adolescents as a major health problem [115]. This particular age group has importance to the community as the fact that many serious diseases in late adulthood have their roots in early adulthood or adolescence [113]. Again it is easier to implement healthy behavior of individuals at a young age rather than to modify it at later ages or after the onset of disease [113].

The primordial prevention strategies to eliminate CHD risks from the juvenile can be very successful, if proper risk factors assessment takes place in collaboration with nutrition education and management. Our country need to approach population-based intervention on college campuses. It is one of the advantageous strategy in management of existing CHD risks. Modification in lifestyle is one of the major component for better result [116]. Conducting intervention studies, at universities or colleges, opens up windows towards improving healthy eating behavior, where fate of these youth population is yet to form. Thus it is one preventable approach to target CHD before the disease progression takes place.

There are few example in western countries, where specific community based approach plays crucial role in sustainable reduction of CHD risks from the coterie [26]. In the year 1980, one population-based approach was conducted in the island nation of Mauritius to lower CHD exposure among the studied population. There the fatty acid combination of edible oil was altered to obtain high amounts of polyunsaturated fats in the diet. As a result, the average serum total cholesterol was reduced from 225 mg/dL in 1987 to 182 mg/dL in 1992. Thus it decreases the hypercholesterolemic state of the target people from 25% to 6% in male and from 22% to 5% in female [117, 118]. This cost effective approach can easily be applicable to any juvenile community of India. Mostly the universities, college campuses can be utilized to setup such project, effective in reducing CVD exposure among youth.

In one report stated by World Heart Federation, exhibit that if sodium intake is reduced by one gram per day, then there would be 50% reduction in number of individuals need of treatment for hypertension, universally. Furthermore, there will be 16 to 22 % reduction in death due to stroke and CHD [119]. Another important target can be the college cafeterias, as they are the most influencing tastemaker for college students on day to day life. Thus they can be a health

representative, provide guidance how to choose healthy foods and better lifestyle [120]. With proper interrogation the same fount can be used to implement nutrition education and management among youth [121]. Research shows that the nutrition information given to the students may encourage them to rethink & modify the eating habit and life style as well [122]. Moreover, not only the college students but also the school going students are needed to monitor properly against the persisting CVD risks and current lifestyle behaviour among them. As there are strong evidences of pediatric roots of CHD, but still there are few health awareness programme especially targeted to the school going children of India [123-126], which should be emphasized more in numbers. Also there is very few existing scientific examinations to observe the direct effect of such school based programme, targeted to promote health beneficial approach against development of CHD risks [123-126].

4. Conclusion

This review highlights the need for improved interventional strategies for better risk assessment and increased awareness among young Indian. Different cross sectional studies provide the evidence of the persistence of CHD risk factors in this college going students. But mostly they are modifiable risk factors for CHD. Primary prevention of the CHD diseases can be best achieved by reducing risk factors in the community and it will better benefit the whole community, as young generation are the best representative of it. Thus there is an urgent need to spread awareness amongst the youth of the nation about the importance of early recognition of risk factors of CHD which will give them more years free of morbidity in a very cost effective manner. More studies are needed to observe this population critically for better evaluation. India is very diverse country, having different socioeconomic strata, cultural and dietary habits, extent of education, and ethnicity, and therefore, it is hard to implement wide-spread strategies to prevent CHD risks among youth, thus future research needs to be conducted to identify the most beneficial process of evaluating large numbers of young adults. Increased screening should take pivotal part in concurrence with education to successfully identify and manage CHD risk.

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Conflict of Interest

The author declares no conflicts of interest.

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