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NUTRITIONAL, LIFESTYLE AND PSYCHOLOGICAL FACTORS AS PREDICTORS OF CORONARY HEART DISEASE

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Contribution
MM conceived the idea and designed the study. Data collection and manuscript writing was done by MM, AA, and MMB. All the authors contributed equally to the submitted manuscript.

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ABSTRACT

Objective: To explore the association of nutritional, lifestyle, and psychological factors as predictors of Coronary Heart Disease (CHD) and to study if nutritional, lifestyle, and psychological factors predict CHD?

Methodology: It was a case-control study and a sample of (N = 400), patients with chronic heart disease with mean age of 45.67 years, were 200 (men = 126, women = 74) and (controls = 200, men = 112, women = 88) matched with, gender, age, and monthly income, recruited from public sector hospitals by using a purposive sampling technique. A self-structured comprehensive demographic, social, nutritional, and lifestyle factors was prepared for collecting the data. Descriptive statistics, logistic regression analysis, and chi-square were run for data analyses.

Results: Results indicated a significant positive association of CHD with type of food ($p<0.001$), sodium ($p<0.001$), Deserts (halwajat, kheer, cakes, biscuits) ($p<0.001$), desi ghee ($p<0.001$), etc. was found. Physical activity ($p<0.001$), overweight ($p<0.001$), smoking ($p<0.001$), self-reported high blood pressure ($p<0.001$), sodium intake (B= 0.52, $p<0.001$), bakery items (B= 0.26, $p<0.001$), saturated fats (B= 0.57, $p<0.001$), processed meat (B= 0.56, $p<0.001$), appeared as positive predictors of CHD and whole grains (B= -0.23, $p<0.001$), fish (B= -0.44), vegetables (B= -0.56, $p<0.001$), food supplements (B= -0.37, $p<0.001$) emerged as negative nutritional predictors of CHD. Overweight (B= 0.63, $p<0.001$), long working hours (B= 0.47, $p<0.001$), sitting position (B= 0.38, $p<0.001$), stress (B= 0.67, $p<.001$), and anxiety (B= 0.72, $p<0.001$), appeared as positive lifestyle and psychological factors of CHD.

Conclusion: Nutritional, lifestyle, and psychological factors contribute significantly in the development of CHD in patients with chronic heart disease.

Keywords: Nutritional, lifestyle, food, exercise, stress, anxiety, CHD

INTRODUCTION

Pervasive increase of Coronary Heart Disease CHD among different nations is a serious issue these days. Risk factors causing (CHD) have always been a topic of great concern for medical practitioners and researchers. For many years the nutritional and lifestyle factors have been known to be pertinent to the knowledge of CHD onset and progression. More specifically, behavioral pathways are considered the main reason that leads to its development. It is considered an indirect path in which physiological changes can be brought forth in the framework of an unhealthy lifestyle.[1]

Lifestyle factors appear to increase the risk through indirect effects on the physique. It will be not wrong to say that healthy habits are a very important preventable factor of CHD.[2] More pertinently, CHD can be explained by many behaviors which include food habits, lifestyle factors, smoking and alcohol consumption.[3] Lifestyle of a person which may be unhealthy food habits, less physical activity more smoking and many others are established threats for CHD, globally.[4]

Nutrition is important, not only in the development of animals and humans but also in the protection and cure of illness. Furthermore it is also essential to the maintenance of body strength and capabilities.[5] Various consequences of CHD are associated with diet and other related factors. For example, diet containing high cholesterol, excessive use of alcohol, sodium, and saturated fat. All these food types are considered to cause an increase in total serum cholesterol, LDL, HDL, BP, glucose intolerance and obesity etc.[6] Saturated fats, a diet rich in calories, salt and sugar.[3] Nutritional foods like eggs, fried food items, salty snacks, processed and red meat have found to account for 30% of the variance for CHD.[1] All these food types are considered to cause an increase in total serum cholesterol, LDL, HDL, BP, glucose intolerance and obesity etc.[7] It is reported that intake of more fat diet increases the level of LDL, which is taken as bad cholesterol causing the development and growth of subclinical and clinical atherosclerosis.[7] Variations in lipids and lipoproteins are established by the consumption of food full of saturated fats. A diet containing a high level of saturated fats leads to obesity and hypertension.[8] Similarly, diet containing more sodium leads to a rise in BP and hypertension which are established risk factors of CHD.

Previous research has established that food items like fruits, vegetables, seafood, salads, and whole-grain cereals[9] boiled food, and fish[10] have been found to work as a shield against the beginning of CHD. Therefore, it is not wrong to say that nutrition and CHD are strongly correlated.

Pakistan is mostly an agrarian country and about 64% of its population lives in villages and small towns.[11] Almost every family has some piece of land to cultivate and grow the crops. Each family member is involved in agriculture which keeps them physically active, alert, healthy, and happy. Due to the lack of educational and other career opportunities, the majority of countryside dwellers strive to shift to metropolitan cities. With the advent of industrialization and fast pace urbanization in developing countries like Pakistan has brought about a big change in the country's social dynamics. Urbanization has been established for new changes in the lifestyle which naturally causes stress and stress-related diseases like diabetes, hypertension, and CHD.[12] The most significant causal factor for CHD is a stressful urban lifestyle which is highly demanding and expensive. Lifestyle matters a lot in the health of an individual. Some health behaviors like sedentary lifestyle, bad food choices, use of excessive alcohol and smoking enhance the occurrence of CHD.[13]

Among the preventable risk factors of CHD, smoking is known as a well-established factor, globally.[14,2] Highest percentage of prevalence and consumption of tobacco is the Sindh province and the rate is lowest in Khyber Pukhtun-khua province of Pakistan. The pervasive increase in the consumption of tobacco in Pakistan is alarming concerning diseases associated with it.[15] This threatening situation invites the attention of researchers to explore other lifestyle factors that lead to CHD. Lifestyle features are identified as modifiable and third factors of CHD. Though much research has been conducted addressing nutritional and lifestyle factors leading to CHD but research is scarce in Pakistan. Food preferences and lifestyle in Pakistan are immensely different in comparison to the west and the US. So, there was the need to conduct a study focusing on

the food-related and lifestyle factors causing CHD to develop.

The importance of the psychological factors in developing CHD cannot be denied as depicted by the previous literature.[16] The psychological or mental states of a person significantly affect the physical systems and create the clinical signs of CHD.[17] The literature depicts the contribution of psychological factors in developing and enhancing CHD.[17] Anxiety has been observed as the most significant cause of CHD in many researches.[16] It is established by previous studies that individuals who display a rise in blood pressure response to mental stress were found to be at the threat of future hypertension and afterward CHD as they are grown up.[6] So, it is evident that the adults who take more stress are more vulnerable to CHD from the very initial stages of life. Therefore, it will not be wrong to say that CHD is an emotional disease.

The concept of lifetime risk of CHD related factors is important in public health practice. There is an assessment that at the age of 40 years, 1 in every 5 persons will suffer from CHD for the rest of their lifetime.[18] Thus, it should be the main priority of health researchers to focus on the reduction of HF cases. Nutritional and lifestyle factors like healthy diet, regular exercise, not smoking, and maintaining healthy weight have been established to have positive effect on HF and coronary artery disease[19] hypertension and diabetes mellitus.[20]

In Pakistan, control of CHD has had inadequate success. Very less data is available regarding CHD risk factors existing within the indigenous population. Hence, insufficient research data available from merely a few studies conducted on Pakistani population is limited only to biological and behavioral risk factors of CHD. Studies carried out in Pakistan on risk and protective factors have significant gaps in knowledge about the role of nutritional and lifestyle and psychological factors. So, it is extremely important to reveal the role of diet and lifestyle in causing CHD. Moreover, many researchers think that established factors in many cases do not determine CHD completely.[21] Nutritional and lifestyle related factors account for a large portion of variance in the incidence of CHD, pointing towards a need for carrying out research to uncover the major role of these factors prevalent within the native population. Therefore, the current project was carried out to explore the association between modifiable lifestyle factors and the full life threat of CHD in two populations with and without CHD men and women.

METHODOLOGY

A case control study was carried out on a sample of (N = 400), patients with chronic heart disease with mean age 45.67, were 200 (men = 126, women = 74) and (controls = 200, men = 112, women = 88) were taken from outdoor departments of 3 public sector hospitals and purposive sampling technique was used for data collection.

Inclusion criteria for CHD patients was established as (a) those who were diagnosed as CHD patients by medical specialists and had been currently receiving medical treatment for the last six months. They must be able to read and write the questionnaires and those who give their consent to take part in the current study. Patients suffering from some other chronic sickness (a) liver disease (b) renal disease (c) malignant disease including cancer and depression were disqualified to be included in the present study.

Control group was matched to each participant suffering from CHD for age (up to 3 years younger or older) and other demographic variables of gender, monthly scheduled income and working hours. Control group was also recruited from the hospitals like CHD group and controls were either the visitors found in the hospital premises or non-blood relatives of the patients diagnosed with CHD (Table 1). They were taken from the hospital building, were not employees of the hospital, were not suffering from any disease, had no previous, current or family history of CHD, took part in the present study.

Table 1: Demographic characteristics of the sample

Variables	CHD patients		Controls	
	f	%	f	%
N	200		200	
Gender				
Male	126	63.5	112	56
Female	74	37.5	88	44
Education				
Uneducated	48	24	26	13
Matric	93	46.5	54	27
MA/MSc	61	30	120	60
Occupation				
No job	46	23	32	16
Job	120	60	136	68

Business	34	17	22	11
New in city				
Yes	106	53	64	32
No	94	47	136	68
Nature of job				
Permanent	36	18	94	47
Contractual	84	42	42	63
Family history of CHD				
Yes	138	69	36	18
No	62	31	164	82

f = frequencies, % = percentages

A self-structured comprehensive demographic and social variables firm was prepared by the researchers covering the complete nutritional factors like low fat dairy items, vegetables, consumption of nuts and legumes, whole grains, cereal fibers, whole grains, fruits, salads, yogurt/curd, sodium, deserts, bakery items, red-meat and processed foods, intake of fish/seafood, chicken, saturated fats, processed meats, artificial sweet beverages, homemade shakes, spicy food, boiled or fried food, oil, desi ghee etc.

The demographic and social information form also contained lifestyle factors like exercise (at least 30 minutes per day), walking (at least 30 minutes per day), overweight (BMI >30), ever smoker never smoker throughout life span, consumption of alcohol (at least 3 times in a week), cycling (at least 30 minutes per day), sleeping pills (at least 3 times in a week), any sport (at least 30 minutes per day), sitting position (at least 3 hours continuously), long working hours (at least 10 hours per day), use social networking sites/ yes no, self-reported high blood pressure, medical check-up (at least once in a year), stress and anxiety of the research project.

CHD was taken as criterion or dependent variable in the current research and was dichotomized into two groups based upon their being CHD patients and non-CHD or control group and were coded as: non-CHD or controls = 0, and the CHD patients were coded as = 1.

Food related factors like intake of fast food, red meat, boiled food, fried food, fish/seafood, processed (frozen packed) food, vegetables, salads, yogurt/curd, sodium, deserts (halwajat, kheer, cakes, biscuits), homemade shakes, food supplements, low fat dairy item, nuts and legumes, cereal fiber, whole grains, artificial sweet beverages, oil (especially

Olive oil), desi ghee , processed meats, artificial sweet beverages, homemade shakes, spicy and salty food were taken as independent variables predicting CHD and computed as categorical variables measured by nominal scale in the current research.

Lifestyle related factors like exercise (at least 30 minutes per day), walking (at least 30 minutes per day), overweight (BMI >30), ever smoker, never smoker throughout life span, consumption of alcohol (at least 3 times in a week), cycling (at least 30 minutes per day), sleeping pills (at least 3 times in a week), any sport (at least 30 minutes per day), sitting position (at least 3 hours continuously), long working hours (at least 10 hours per day), use social networking sites/ yes no, self-reported high blood pressure, medical check-up (at least once in a year) were also taken as independent variables predicting CHD in research participant and were computed as categorical variables and were assessed by nominal scale in the present study.

Stress and anxiety were measured by using depression, anxiety and stress scale (DASS) by Lovibond and Lovibond (1995).[22] It is 42 items scale and every subscale contain 14 items. In the current study, items related to stress and anxiety were obtained with due permission of the authors. Stress and anxiety were also taken as independent psychological variables with rating of continuous scale in the current research.

Descriptive statistics, chi-square and logistic regression techniques of analyses were run to analyze the data for testing the hypotheses. Chi square test of association is employed when the data is in the form of observed frequencies. Logistic regression models were carried out if the outcome variable is dichotomous and dummy coded like in the current research project where patients of CHD were coded as yes = 1, and normal controls were coded as non-CHD no = 0.

RESULTS

Table 2: Nutritional items (per week at least 2 servings) associated with CHD

Type of food	CHD patients	Controls	P-value
N	**200**	**200**	-
Fast food	88.5% (177)	44.5% (89)	0.001
Red meat	62% (124)	79% (94)	0.001

Boiled food	17.5% (35)	21.5% (55)	0.050
Fried food	87% (174)	52.5% (105)	0.001
Fish/seafood	23.5% (47)	39% (78)	0.001
Processed (frozen packed) food	87.5% (175)	39.5% (79)	0.001
Spicy and salty food	82% (164)	46% (92)	0.001
Processed meats	87.5% (175)	39.5% (79)	0.001
Vegetables	68% (136)	79% (158)	0.001
Salads	34.5% (69)	71% (142)	0.001
Yogurt/curd	53.5% (107)	92.5% (185)	0.001
Sodium	94% (188)	64.5% (129)	0.001
Deserts (halwajat, kheer, cakes, biscuits)	76% (152)	67% (134)	0.001
Homemade shakes	44.5% (89)	63.5% (127)	0.001
Food supplements	19% (38)	34% (74)	0.001
Low fat dairy item	62% (124)	86.5% (173)	0.001
Nuts and legumes	32.5% (65)	47% (94)	0.001
Cereal fiber	58% (116)	43.5% (87)	0.001
Whole grains	70.5% (141)	64% (128)	0.010
Artificial sweet beverages	68% (136)	55% (110)	0.010
Oil (especially Olive oil)	21% (42)	60% (120)	0.001
Desi ghee	63% (126)	29% (58)	0.001
Homemade shakes	44.5% (89)	63.5% (127)	0.001

Chi-square test was carried out to analyze the data presented in Table 2. The results show a significant difference between CHD patients and normal control group on consumption of fast food, red meat, boiled food, fried food, fish/seafood, processed (frozen packed) food, processed meats, vegetables, salads, yogurt/curd, sodium, deserts (halwajat, kheer, cakes, biscuits), homemade shakes, food supplements, low fat dairy item, nuts and legumes, cereal fiber, whole grains, artificial sweet beverages, oil (especially

Olive oil), desi ghee, artificial sweet beverages, homemade shakes, Spicy and salty food (p < 0.05, p < 0.001).

Table 3: Lifestyle factors associated with CHD

Physical activity	CHD patients	Controls	P-value
N	200	200	-
Exercise (at least 30 minutes per day)	12.5% (25)	43% (86)	0.001
Walking (at least 30 minutes per day)	38% (76)	77% (154)	0.001
Cycling (at least 30 minutes per day)	14% (28)	53% (106)	0.001
Any sport (at least 30 minutes per day)	11.5% (23)	58.5% (117)	0.001
Sitting position (at least 3 hours continuously)	83.5% (167)	29.5% (59)	0.001
Overweight (BMI >30)	26.5% (53)	2% (4)	0.001
Current smoker	56% (102)	13% (26)	0.001
Ever smoker	32.5% (65)	34% (68)	0.001
Never smoker	16.5% (33)	63% (126)	0.001
Consumption of alcohol (at least 3 times in a week)	21.5% (43)	6% (12)	0.001
Sleeping pills (at least 3 times in a week)	91.5% (183)	21% (42)	0.001
Long working hours (at least 10 hours per day)	95% (190)	52% (104)	0.001
Use social networking sites/ yes no	88% (176)	34.5% (69)	0.001
Self-reported high blood pressure	91.5% (183)	25.5% (51)	0.001
Complete medical check-up (at least once in a year)	65.5% (131)	37% (74)	0.001
New in big city	84% (168)	34% (74)	0.001
Stress	57.5% (115)	37.5% (75)	0.001
Anxiety	42% (84)	22.5% (45)	0.001

Then Chi square test of association was employed to explore the nature of association of both groups on lifestyle factors. Results given in Table 3 shows significant differences between patients with CHD and control normal individuals on lifestyle factors including exercise, walking, ever smoking, never smoking, consumption of alcohol, cycling, playing any sports, to remain mostly in sitting position, long working hours, using social networking sites/devices, self-reported high blood pressure, stress and anxiety ($p < 0.01$).

Table 4: Nutrition related factors predicting CHD

Variable	B	SE	LL	OR	UL
Constant	-15.34	5.42			
Sodium intake	.52	.26	1.14	1.65	2.01
Bakery items intake	.26	.14	0.96	1.20	1.46
Saturated fat intake	.57	.18	1.21	2.63	3.24
Processed meat	.56	.29	1.30	2.76	3.48
Desi ghee	.21	.12	0.67	1.28	1.62
Whole grains	-.23	.11	0.83	1.26	1.84
Fish/sea food	-44	.17	1.69	2.24	3.31
Vegetables	-56	.25	1.75	2.18	2.91
Food supplements	-37	.10	0.82	1.32	1.67

R^2 = 61.54 (Hosmer & Lemeshow); .56 (Cox & Snell); .69 2(Negelkerke); Model x (8) = 24.80; OR= odds ratio; LL=lower limit, UL=upper limit, SE=standard error, B=regression coefficient

Logistic regression analysis was run to observe the nutritional factors as predictors of CHD in the participants (Table 4). The results show that coefficient of sodium intake is .52 and OR is 1.65. The coefficient is positive which indicate the positive nature of prediction of CHD by adapting the above-mentioned lifestyle factors. Therefore, as sodium intake increases, chances of CHD in a person will also enhance by 1.65 times. Further, bakery items, saturated fats, processed meat, Desi ghee emerged as positive predictors of CHD. Next, the OR for fish/sea food is -.44 and OR is 2.24 which indicates that with the increase of fish/sea food intake the chances of suffering from CHD would decrease in a person by 2.24 times. The coefficient of vegetables is -.56 and OR is 2.18 which means that as vegetable intake would increase in a person, chances of suffering from CHD would decrease by 2.18. Lastly, the coefficient of food supplements

intake is -.37 and OR is 1.32. So, with the increase of food supplements, chances of CHD in a person would decrease by 1.32 times (Table 4).

Table 5: Lifestyle related factors predicting CHD

Variable	B	SE	LL	OR	UL
Constant	-14.70	4.68			
Over-weight	.63	.45	1.20	1.80	2.79
Long working hours	.47	.25	.79	1.03	1.62
Sitting position	.38	.19	.74	.93	1.41
Exercise (at least 30 minutes daily)	-.42	.23	1.32	1.79	2.42
Walking (at least 39 minutes daily)	-.53	.39	1.45	1.87	2.53
Stress	.67	.49	1.02	1.76	2.90
Anxiety	.72	.56	1.60	2.32	2.91

R^2 =66.23, Hosmer & Lemeshow), .74 (Cox & Snell), .67 (Negelkerke). 2Model x (21)= 51.60; LL= lower limit; UP= upper limit;

Binary logistic regression analysis was carried out to explore the lifestyle factors as predictors of CHD. Table 5 shows the results of numerous lifestyle factors as being overweight, long working hours, remain in sitting position appeared as positive predictors and doing exercise, daily walking appeared as significant negative predictors of CHD. Table 5 also shows psychological factors of stress and anxiety as predictors of CHD and results indicate that the coefficient of stress is .67 and OR is 1.76. Therefore, as stress level would increase, the chances of suffering from CHD would increase by 1.76 times and lastly, the coefficient of anxiety is .72 and the OR is 2.32 this indicates that as anxiety level would increase in a person the chances of suffering from CHD by 2.32 times.

DISCUSSION

Very little attention has been given in the role of nutritional and lifestyle factors in developing CHD in Pakistan. Both factors represent the 3rd cluster of modifiable risk factors associated with high blood pressure and CHD. Profuse empirical research is available, approving the relationship of CHD with nutritional and lifestyle factors.[8]

Findings of the current research support the basic thesis that food related, and lifestyle factors are associated with CHD in patients with CHD and normal controls. All hypotheses of the study were

supported. Supporting the first hypothesis, nutrition related factors such as sodium, deserts (halwajat, cakes, biscuits), fast food, red meat and processed food, fried processed food, saturated fats, artificial sweet beverages, homemade shakes, spicy and salty food were found to be significantly associated with CHD and low fat dietary items, vegetables, nuts and legumes, cereal fiber, whole grains, fruits, salads and yogurt/curd were found to be significantly and negatively associated with CHD. In Pakistan, generally used deserts are gajar ka halwa, laddu, kheer, sweets, cakes and custard have high level of fat contents.[8] high level of fat and cholesterol is present in dairy products having milk carbohydrates and animal proteins were found to be correlated with CHD initiation because they have the tendency to block the arteries providing blood to heart. Protective effect of, fish, salads, raw cereals, vegetables, and fruits were significantly associated with CHD in Pakistani people.[23] It is explored that two servings of fish per week reduces mortality rate by 50% among those who eat 30grams or less of fish per day in comparison to those who do not eat fish at all.[24]

Additionally, lifestyle factors of overweight, current smoker, consumption of alcohol, sleeping pills, sitting position, long working hours, using social networking sites, self-reported high blood pressure, not getting medical checkup, stress and anxiety turned out to be significant positively correlated with CHD and exercise, walking, never smoker and playing any sports were found to be significantly and negatively associated with CHD.

Supporting the second hypothesis, many nutritional items like sodium intake, bakery items, saturated fat, processed meat and Desi ghee appeared as strong predictors of CHD and consumption of fish/sea food, vegetables and food supplements appeared as significant negative predictors of CHD in the current research. Desi ghee has high level of cholesterol is generally used for food preparation in Pakistan and few other South Asian countries is associated with CHD. This finding is comparable with earlier researches which suggest diet containing more sodium, total fat, sugar, animal products, saturated fat, eggs, whole cream milk, and meat culminate in weight gain, increases the quantity of cholesterol and develops the risk of CHD.[25] In the current research desi ghee, saturated fats like butter, and consumption of white sugar and sweet dishes appeared as significant risk factors of CHD.

Similarly, lifestyle factors including being overweight, long working hours, sitting position, stress and anxiety appeared as strongest predictors of CHD

and daily walk and exercise appeared as weaker predictors of CHD. Additionally, a very significant variable gaining impetuous is active lifestyle which has been extensively explored in connection to different heart diseases. The advantages of physical activity in decreasing heart diseases are well known.[6] The study found that suitable level of physical activity of two to four hours per day to be significantly protective factor of CHD.

Protective or healthy effects of physical activity and bad effect of sedentary lifestyle (Wang, 2004) have been explored by researchers. Sedentary lifestyle and physical activity have been associated with fluctuation in blood pressure and development of hypertension.[26,27] On the other hand, aerobic exercise is coupled with a boost in high density lipoproteins (HDL), and reduction in blood pressure rate, low density lipoprotein (LDL), and stress. It is also believed that 30 to 60 minutes of light to heavy aerobic exercise are pertinent for people suffering from different heart diseases on several days of the week.[28]

Finally, it is earnest to note that intake of expensive dietary items in a country like Pakistan is dependent upon household size and the income level. Joint family system is a common tradition of Pakistan where earning people are few and their dependents are many. It becomes difficult for them to provide highly expensive food items to all family members. Some dietary items are high in prices e.g. fruits and fish are not in the easy access of general population. Furthermore, some nutritious food items accessible seasonally or are in the reach of people differently depending from region to region. In Pakistan, fish and eggs are consumed in a large quantity during the winter season and mostly in coastal areas. It is important to keep in mind the seasonal, regional, economic and sociocultural inequalities in the intake of these dietary items common within the native people, it is suggested that previous researches examining the relationship of food CHD be tailored by keeping in mind these dissimilarities. All the evidence reported by past research holds similar findings to that of the results found for the current study.

CONCLUSION

CHD has significant positive association with deserts, artificial sweet beverages, processed and salty foods, desi ghee, and negative association with salads, homemade shakes, cereal fiber, whole grains, low fat diary items and food supplements. In

context to lifestyle factors, CHD was found to be significantly and positively correlated with no exercise, no sports, remain in sitting position, current smoker, consumption of alcohol, overweight, sleeping pills, self-reported high blood pressure, stress and anxiety. In addition, exercise, daily brisk walk, cycling, never smoker and complete medical checkup had negative association with CHD.

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