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Influence of Dietary Habits on Health Risk Factors

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Abstract

Dietary habits play an important role in cardiovascular risks by maintaining health and preventing diseases. The present study aimed to determine the influence of dietary habits on health risk factors. A cross sectional study was conducted to relate physical activity, body mass index, alcohol, metabolic syndrome, stress, age, gender, employment, and education with dietary habits. The results were analysed by Chi Square test with statistically significance of p value <0.05. In results, vegetarianism (59.55%) was found more prevalent than omnivorous (40.46%) in the study population. Females (61.72%; p<0.001), age >50 years (76.08%), low education level (66.50%; p<0.05), upper socioeconomic status (38.76%), unemployment (76.55%; p<0.001), and sedentary lifestyle (65.07%) was found associated with vegetarianism. Contrarily, omnivorous was found related with male gender (66.20%; p<0.001), alcohol consumption (54.93%; p<0.001), insomnia (28.87%), and active lifestyle (38.03%). The prevalence of metabolic syndrome (33.80%; p<0.05), hypertension (51.41%), dysglycemia (27.46%), obesity (56.34%), and dyslipidemia (34.51%) was more in omnivores than vegetarians (metabolic syndrome: 23.92% (p<0.05); hypertension: 43.06%; dysglycemia: 22.01%; obesity: 48.32%; and dyslipidemia: 27.75%).Vegetarianism plays a protective role against metabolic syndrome and its components. Hence, it can be concluded that high risk individuals, once-identified can be encouraged to familiarize themselves with meatless options through recipes, cookbooks, online resources, and classes; and their medical care-givers can enlist the expertise of dietetic professionals in ensuring complete nutrition and providing group or individual instruction on menu planning and related topics.

Key Words: Metabolic syndrome, non-vegetarianism, vegetarianism.
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Introduction

Non communicable diseases (NCDs) are the leading causes of global death by killing more people annually than all other cause combined together (WHO, 2010). The World Health Organization has reported high blood pressure, high blood cholesterol, inadequate fruit and vegetables intake, being overweight or obese, physical inactivity and tobacco use as the most important risks of NCDs (WHO, 2002). Thus, it is well recognized that diet and physical activity play important roles in maintaining health and preventing diseases (WHO, 2004; Koner *et al.*, 2013; Koner and Rajput, 2013).

"Vegetarianism" and "Non-vegetarianism" constitutes the two main groups of a modern diet. Furthermore, vegetarianism encompasses a spectrum of eating patterns: from diets that leave out all animal meats and products (vegan) to diets that include eggs, milk, and milk products (lacto-ovo vegetarian) or even fish in addition to eggs, milk, and milk products (pesco-vegetarian). Vegan diets are gaining popularity in teenagers and youth, especially among females with nutritional choices around taking better care of the earth's resources and the environment, ethical issues about animal care, the use of antibiotics and growth stimulants for the production of animals, the threat of animal-borne diseases, and the health advantages of a plant based diet (Rollin, 2003). In addition, the potential of allergies from dairy products and lactose intolerance have fuelled the popularity of soy-based dairy substitutes. Moreover, epidemiological studies have shown the appropriately planned vegetarian diets are healthy and nutritionally adequate with several health benefits in comparison to omnivorous diets (Davey *et al.*, 2003).

The European Prospective Investigation into Cancer and Nutrition (EPIC) has shown 17% lower risk of fatal ischemic heart disease in vegetarians than in omnivores (Key *et al.*, 2009).The protective effect of vegetarianism against overweight might be contributed to avoidance of major food groups, displacement of calories toward food groups that are more satiating, or reduction in energy intake without increased hunger, and thus further suggests the metabolic advantages of vegetarian diets against NCD associated mortality and morbidity (Barnard *et al.*, 2005).

Although the vegetarian diet appears favourable with respect to chronic disease risk factor profile (Rizzo *et al.*, 2011), deficiencies in certain nutrients have been found. Nutritional research has invariably found vegans to consume less zinc, protein, calcium, fat (including saturated fat), cholesterol, vitamin B12, vitamin D, long-chain n-3 fatty acids, eicosapentaenoic acid,and docosahexaenoic acid (DHA) (Sanders, 1999; Herrmann and Geisel, 2002). Vegans generally have an adequate iron intake and do not experience anemia more frequently, however presumably plant-derived non-haeme iron bioavailability is inferior to animal haeme iron (Sanders,

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1999; Koner and Rajput, 2013). A lower tissue concentration of long-chain n-3 fatty acids and vitamin B12 may elevate risk for major depressive disorder among vegetarians (Sanders, 1999; Herrmann and Geisel, 2002). Furthermore, bone mineral density and the risk of bone fracture may be a concern when there is an inadequate intake of calcium and vitamin D. It has been recommended to vegans to show more diversity in their nutrient sources with the B12, calcium, zinc, selenium, vitamin D and DHA fortified foods or supplements (Larsson and Johansson, 2005). Hence, the current study evaluates the socio-demographic, lifestyle and cardiovascular risks in two comparable groups of vegetarians and omnivores to gain more insight into the influences of dietary habits on the health factors.

Materials and methods

Design overview:

This correlational and cross-sectional study was undertaken to determine the relationship between dietary habits and the cardiovascular parameters in a community-based Ex-Servicemen residing in the region of Sultanpur Lodhi, tehsil of district Kapurthala, Punjab (India). The study population was representative of the primary care attendees of the Ex-Servicemen Contributory Health Scheme (ECHS) Polyclinic in the Northern Indiawhich provides free at-the-point-of-access primary care and follow up service solely to the registered retired defence personnel; their family members comprising spouse, children and parents; and those who had attended the polyclinic from Aug, 2013 to Nov, 2013. Institutional ethical committee approval was obtained prior to the study start, and informed verbal consent was taken from all the recruited subjects. Chi Square test was used for statistical analysis with a statistically significance of p value <0.05.

Dietary habits:

"Vegetarianism" was defined on the basis of region's cultural dietary practices which involve eating patterns from diets that leave out all animal meats and products to diets that includes consumption of all edible plant-derived material, honey, milk, and milk products with no eggs, fish or flesh. Omnivores were studied as a single group who ate meat for more than once a month.

Survey Questionnaires:

A structured in-person interview was conducted to record socio-demographic variables and cardio-metabolic risk factors. The regular aerobic physical activity (e.g., brisk walking) of at-least 30 minutes per day for most days of the week was considered adequate (Chobanian *et al.,* 2003). Men alcohol intake is limited to <2 drinks per day; and for women and lighter weight persons, it is limited to <1 drink per day (1 drink = 1/2oz or 15ml ethanol (e.g., 12oz beer, 5oz wine, 1.5oz 80-proof whiskey)) (Chobanian *et al.,* 2003). Subjects who presently use alcoholic beverages and/or exceed their limits were categorised under "Current" group; and those who had never or left their habit of heavy alcohol consumption were counted under "Ex/Never" group. Job strain, social constraints, financial un-stability, health issues, and family distress were included under "stress" which significantly affects the daily life activities. Sleep adequacy was evaluated on the basis of sleep duration (7 to 8 hours), difficulty in initiating and maintaining sleep, and early awakenings. Metabolic syndrome was defined on the basis of consensus statement for Asians Indians with three out of five variables abnormal for the diagnosis: Obesity >25.00 kg/m^2, fasting blood glucose >100mg/dl (>5.6mmol/l), hypertension ≥130/≥85mmHg, triglycerides(TGs) >150mg/dl (>1.7mmol/l) and/or High Density Lipoprotein Cholesterol(HDL-C) <40mg/dl (<1.03mmol/l) in men or <50mg/dl (<1.29mmol/l) in women. It further includes those previously diagnosed with hypertension, high TGs, low HDL-C, impaired fasting glucose (IFG), impaired glucose tolerance (IGT) or diabetes mellitus and being on treatment for these disorders (Misra *et al.,* 2009).

Measurements:

Blood pressure (BP) was measured in the right arm with the subject rested for 5 minutes using a standard mercury sphygmomanometer and suitable calibrated cuff. Height was determined with a wall mounted non-extendable measuring tape with subjects standing in an erect barefoot position, arms by side, and feet together. Weight measurements were taken with each subject standing at the centre of the weighing scale in light clothing with no shoes and socks; and divided on the basis of consensus statement*:* Normal weight (18.00-22.99 kg/m^2), Overweight (23.00-24.99 kg/m^2) and Obesity (>25.00 kg/m^2) (Misra *et al.,* 2009). A antecubital sample was obtained from all the pre-informed individuals after 8–10 hours of fasting to measure blood glucose using Erba glucose kit (GOD-POD method, end point), TGs with Erba triglyceride Des kit (GPO-Trinder method, end point) and HDL-C by cholesterol kit (Phosphotungstic acid method, end point).

Results

All patients (N=351) were divided on the basis of dietary practises: vegetarianism (N=209; 59.55%) and non-vegetarianism (N=142; 40.46%). Table 1 shows 03.35%, 20.57%, 40.67% and 35.41% of subjects who practices vegetarianism were in 20-35years, 36-50years, 51-65years and >65years of age group; and those who were omnivores had 04.22%, 26.05%, 37.32% and 32.39% for the same age groups, respectively. This shows subjects younger than 50 years preferred omnivorous meals; and those older than 50 years opted for vegetarian food. A statistically significant males and females practice non-vegetarianism (66.20%; p<0.001) and vegetarianism (61.72%; p<0.001), respectively. Subjects with no/little, primary, secondary and graduation had 33.01%, 33.49%, 27.75% and 05.74% vegetarianism; and 27.46%, 26.76%, 42.25% and 03.52% of them were omnivores for the same education categories, respectively. It shows a statistically significant subjects with low level of education (66.50%; p<0.05) preferred vegetarian meals as compared to subjects with higher education level (45.77%; p<0.05). Similarly, vegetarianism and non-vegetarianism practiced

more by subjects belonging to upper (38.76%) and middle socioeconomic status (66.90%), respectively. Furthermore, a statistically significant employed and unemployed individuals opted for omnivorous (38.73%; p<0.001) and vegetarian meals (76.55%; p<0.001), respectively.

Table 2 depicts that 28.23%, 23.44% and 48.32% of vegetarians were in normal, overweight and obesity ranges; and those with omnivorous habits had 40.55%, 39.38% and 20.08% for the same groups, respectively. It shows a higher prevalence of obesity (56.34%) and normal weight (28.23%) was recorded in omnivores and vegetarians, respectively. A statistically significant omnivores were found under the effects of alcohol consumption (54.93%; p<0.001), while statistically significant vegetarians prefer to avoid alcoholic beverages (96.17%; p<0.001). Similarly, adequate sleep was reported among vegetarians (73.20%), and insomnia in omnivores (28.87%). Furthermore, active and sedentary lifestyle was found associated with omnivorous (38.03%) and vegetarian habits (65.07%), respectively. Stress levels was reported approximately the same among vegetarians (18.66%) and omnivores (18.31%) subjects, and thus shows no relation of stress levels with dietary habits.

Table 3 reveals a higher prevalence of statistically significant metabolic syndrome in omnivores (33.80%; p<0.05) than vegetarians subjects (23.92%; p<0.05). Furthermore, omnivores subjects were observed with a higher prevalence of hypertension (51.41%), dysglycemia (27.46%), obesity (56.34%), and dyslipidemia (34.51%) than vegetarians individuals (hypertension: 43.06%; dysglycemia: 22.01%; obesity: 48.32%; and dyslipidemia: 27.75%). Figure 1 further compares the metabolic syndrome and its components among vegetarian and omnivores subjects.

Discussion

This survey appears to be the first attempt to comprehensively analyse influence of dietary habits on cardiovascular health in the study area with representative population sample >20 years old. The current study reported the predominance of vegetarianism (59.55%) than non-vegetarianism (40.46%) in the study population. A national survey has projected that India (40%) constitutes the largest number of vegetarians globally with varying community rates of 55% among Jain and Brahmins community, and low frequency among Muslims (3%) and coastal states residents; and further reported India with the lowest rate of meat consumption in the world (accessed from http://en.wikipedia.org/wiki/ Vegetarianism_by_country; on March 3, 2014). However, vegetarianism rates in western countries are comparatively much lower worldwide with 3.20% in USA and 9% among UK (UK Food Standards Agency, 2009; Vegetarian Times, 2009). Health, ethical, environmental, and spiritual beliefs including rejections of killing animals and concerns for animal welfare are the most important motives for choosing a vegetarian diet (Fox and Ward, 2008).

A higher prevalence of non-vegetarianism among young subjects (30.27%), and vegetarianism in subjects older than 50 years (76.08%) in the current study (Table 1) was found similar to Beezhold *et al* (2010). Furthermore, a statistically significant females (61.72%; p<0.001) were observed practicing vegetarianism more frequently than males (66.20%; p<0.001) in the present study. Similarly, Crowe *et al.* (2013) and Michalak *et al.* (2012) found majority of vegetarians to be younger and females. This could be contributed to overall higher concern about the health status, financial and moral aspects of meat consumption among females (Beardsworth and Keil, 1991).

The commonly-used indicators of socio-economic status in epidemiological surveys have been education, occupation and income. The present study found a statistically significant association of vegetarianism with low education level (66.50%; p<0.05), unemployment (76.55%; p<0.001) and upper socioeconomic status (38.76%). Contrarily, Michalak *et al*. (2012) found higher practising of vegetarianism by subjects with advanced degree. Furthermore, Hoek *et al.* (2004) observed vegetarianism predominates in individuals with higher education levels and higher socioeconomic status. On the other hand, Key *et al.* (1999) noticed variations in the level of education were small and inconsistent in both groups. Johansson *et al.* (1999) reported that white collar workers with at least 13 years of education had higher intakes of fruits, vegetables and fibres, and lower fat intake than blue-collar workers and those with less than 13 years of education.

A statistically significant association of alcohol with omnivores (54.93%; p<0.001) than vegetarians (96.17%; p<0.001) in the present study (Table 2) was found consistent with various other studies (Key*et al*., 1999; Michalak *et al*., 2012; Crowe *et al*., 2013). Moreover, the current study noticed active lifestyle among omnivores (38.03%), and sedentary lifestyle in vegetarians (65.07%), respectively. However, Key *et al.* (1999) and Beezhold *et al*. (2010) have shown a contrary finding of high exercises levels among vegetarians. On the other hand, Agrawal *et al.* (2013) observed sedentary lifestyle has weak association with the dietary covariates.

The present study observed no significant relation of stress levels with dietary habits. Conversely, Michalak*et al*. (2012) reported that vegetarians displayed elevated prevalence rates for depressive disorders, anxiety disorders and somatoform disorders. Furthermore, Bardone-Cone *et al*. (2012) has shown that having a history of an eating disorder is associated with greater likelihood of having been (or currently being) vegetarian, and have been primarily motivated by weight-related reasons. On the other hand, Beezhold *et al*. (2010) has found that the vegetarian diet profile does not appear to adversely affect mood despite low intake of long-chain omega-3 fatty acids.

Vegetarians (73.20%) take more adequate amount of sleep than omnivores (28.87%) in the current study. It has been proposed that eating of readily digestible foods including mostly raw, whole, organic fruits, vegetables, seeds, nuts and seaweeds will improve health; and provide restful sleep by allowing the body system to rest, regenerate, rebuild and repair the other vital areas of the body instead of consuming most of the body energy for meat digestion (accessed from: http://thecoolvegetarian.com/blog/2011/04/how-to-get-a-great-night-sleep/; March 3, 2014).

A statistically significant metabolic syndrome was observed in omnivores (33.80%; $p<0.05$) than vegetarians subjects (23.92%; $p<0.05$) in the present study **(Table 3)**. Furthermore, the current study noticed that omnivores subject have a higher prevalence of hypertension (51.41%), dysglycemia (27.46%), obesity (56.34%), and dyslipidemia (34.51%) than vegetarians (hypertension: 43.06%; dysglycemia: 22.01%; obesity: 48.32%; and dyslipidemia: 27.75%). Similarly, Rizzo *et al.* (2011) has shown TGs, glucose, BP, waist circumference, and body mass index were significantly lower in vegetarians than omnivores after adjusting for age, sex, ethnicity, smoking, alcohol intake, physical activity, and dietary energy intake. Conversely, Shang *et al*. (2011) has suggested that the vegan diets did not decrease the risk of metabolic syndrome compared with pesco-vegetarian, lacto-vegetarian and non-vegetarian diets.

This shows several positive health-related outcomes in vegetarians might be influenced by factors that include dietary factors (e.g., reduced weight, increased potassium, and high fiber intake), non-dietary factors (e.g., physical activity), avoidance of harmful practices (e.g., smoking and excessive drinking), and being more "health conscious" (Bedford and Barr, 2005). Vegetarian diet being rich in vegetables, fruit, grains, dietary fiber, and nuts includes antioxidants (e.g., tocopherols, ascorbate, carotenoids, saponins, and flavonoids) and phytochemicals that lowers blood cholesterol, prevents the oxidation of LDL-C and reduce the risk of heart disease. Furthermore, consumption of a potassium-rich vegetarian diet with low sodium levels has natriuretic effect, and thus lowers age-related rise in BP. Proposed physiological mechanisms that may mediate the effects of a vegetarian diet include modulation of baroreceptor sensitivity, direct vasodilatory effects, changes in catecholamine and renin–angiotensin–aldosterone metabolism, improvement of glucose tolerance with lower insulin levels, and lower blood viscosity in vegetarians (Suter *et al.*, 2002).

On the other hand, the relatively high fat content and the absence of fibres in meat products typically makes them high energy dense foods that enhances intracellular lipid storage, impairs insulin metabolism, and increases insulin resistance. Indeed, non-diabetic individuals following an omnivorous diet who then begin a diet omitting animal products have demonstrated increased insulin sensitivity with tendency to lose weight over both the short and long term (Barnard *et al.*, 2005). Moreover, the Chicago Western Electric Study (Bujnowski *et al.*, 2011) indicated that an association between animal protein intake and obesity contributing to insulin resistance might be aggravated by the specific amino acids and fat found particularly abundant in meats which, in turn, increases the respiratory quotient and reduces fat oxidation.

Limitations include the cross-sectional design, the small sample size, and the lack of a validated measure for assessing differential aspects of vegetarianism. However, the use of a relatively homogenous population of vegetarians and omnivores enabled to minimize the potentially confounding lifestyle differences in the present study. Hence, the future research should be on a larger sample and wider range of individuals to enable casual inferences between diet and cardiovascular risk.

Conclusions

Vegetarianism plays a protective role against metabolic syndrome and its components. Hence, high risk individuals, once-identified can be encouraged to familiarize themselves with meatless options through recipes, cookbooks, online resources, and classes; and their medical care-givers can enlist the expertise of dietetic professionals in ensuring complete nutrition and providing group or individual instruction on menu planning and related topics.

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Table 1. Comparisons of the socio-demographic variables in all the study subjects*

Category	Vegetarians(209)	Omnivores (142)	χ^2 value
AGE (years)			
20-35	03.35 (07)	04.22 (06)	1.74
36-50	20.57 (43)	26.05 (37)	
51-65	40.67 (85)	37.32 (53)	
>65	35.41 (74)	32.39 (46)	
SEX			
Male	38.28 (80)	66.20 (94)	<0.001
Female	61.72 (129)	33.80 (48)	
EDUCATION			
No/Little	33.01 (69)	27.46 (39)	<0.05

Primary	33.49 (70)	26.76 (38)	
Secondary	27.75 (58)	42.25 (60)	
Graduation	05.74 (12)	03.52 (05)	
SOCIO ECONOMIC STATUS			
Middle	61.24 (128)	66.90 (95)	1.16
Upper	38.76 (81)	33.10 (48)	
OCCUPATION			
Homemaker or Retired	76.55 (160)	61.27 (87)	<0.001
Employed	23.44 (49)	38.73 (55)	

*parentheses represent absolute number of subject

Table 2. Comparison of the lifestyle risk factors among vegetarians and omnivores subjects*

Category	Vegetarians(209)	Omnivores (142)	χ^2 value
BODY MASS INDEX			
Normal	28.23 (59)	26.76 (38)	1.54
Overweight	23.44 (49)	16.90 (24)	
Obesity	48.32 (101)	56.34 (80)	
ALCOHOL CONSUMPTION			
Yes	03.83 (08)	54.93 (78)	<0.001
No	96.17 (201)	45.07 (64)	
SLEEP ADEQUACY			
Adequate	73.20 (153)	71.14 (101)	0.18
In adequate	26.79 (56)	28.87 (41)	
PHYSICAL ACTIVITY			
Adequate	34.93 (73)	38.03 (54)	0.35
In adequate	65.07 (136)	61.97 (88)	
STRESS LEVELS			
Significant	18.66 (39)	18.31 (26)	0.04
Insignificant	81.34 (170)	81.69 (116)	

*parentheses represent absolute number of subjects

Table 3. Comparison of the metabolic syndrome and its components in all the study subjects*

Category	Vegetarians (209)		Omnivores (142)		χ^2 value
	Normal	Diseased	Normal	Diseased	
Metabolic Syndrome	76.08 (159)	23.92 (50)	66.20 (94)	33.80 (48)	<0.05
Obesity	51.67 (108)	48.32 (101)	43.66 (62)	56.34 (80)	2.17
Hypertension	56.94 (119)	43.06 (90)	48.59 (69)	51.41 (73)	2.35
Dyslipidemia	72.25 (151)	27.75 (58)	65.49 (93)	34.51 (49)	1.81
Dysglycemia	77.99 (163)	22.01 (46)	72.53 (103)	27.46 (39)	1.37

*parentheses represent absolute number of subjects