



Comparing community clients of different dietary pattern on their health indicators at a vegetarian festival in Hong Kong

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Abstract

Introduction Vegetarian diets have been found of health benefits and health indicators without early detection of deviation to rule out potential health problems, will lead to actual health problems and non-communicable diseases. This study was to compare participants' indicators with different dietary pattern attending a vegetarian festival in Hong Kong.

Method A cross-sectional design was adopted for this study which took place during the 1st Hong Kong Vegetarian Festival held in October 2013. Survey method and physical measurement was used to collect data.

Results The results showed that the Vegetarian group has significantly less number of non-communicable diseases than the Non-vegetarian groups' (likelihood Ratio $\chi^2=4.294$, $df=1$, $P=0.038$). A t-test indicated that Body Mass Index ($t=-2.706$, $P=0.007$) and Total Cholesterol ($t=0.076$, $P=0.008$) of the two groups differed significantly.

Discussion The results support that eating vegetarian diets properly with balanced nutrients tend to reduce bio-medical risks from nutritional intervention. Health risks screening of focusing indicators allows user-friendly learning of self-health state to alert individuals for proper dietary pattern to prevent actual health problem accordingly.

Conclusion Vegetarian diets may be beneficial as supplementary intervention for seekers of health pursue. Education of nutrition pattern and health indicators assessment plays a pivotal role to promote health in the community as well as the hospital setting.

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Introduction

Non-communicable diseases (NCDs) are commonly found in developed countries and communities world-wide. They include cancer, hypertension, heart diseases and diabetes as health risks leading to premature death (1). Long term treatment adds social and financial burdens to clients, families and governments, as well as impaired quality of life (2).

Screening and early detection of lifestyle-induced disease-risks are vital to the diagnosis and control of NCDs.

In Hong Kong, the NCD mortality rate has been monitored by the Centre for Health Protection (CHP) since 2004 and data shows an increasing trend. In 2016, 44,891 NCD-related death were reported. Cancer, heart disease, hypertension and stroke, and diabetic were under surveillance as common NCDs with the most prevalent being cancer (3). Some indi-

viduals may not be aware of the serious progression outcome of chronic health risks (4). Unhealthy lifestyle and eating pattern, such as risks of alcohol and tobacco use, high saturated fats and sugar consumption, inadequate fruits and vegetables intake, and physical inactivity account for a total to 61% of cardiovascular deaths (1;4).

Among the elderly, the proportion in good health without disability has decreased since 1996 (2). Healthy lifestyle with healthy eating habits can reduce premature death and enhance quality of life with less disease morbidity. Although increasing number of people in Hong Kong are more interested in consuming a vegetarian diet for health reasons (2), there is no existing study exploring the impact of dietary pattern on health risks and NCDs in the region.



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Background

Past studies showed that health risks vary from one NCD to another with some risk factors in common. For example, improper nutrition is an essential factor contributing to obesity, hypertension, heart disease, diabetes and metabolic syndrome. Excessive consumption of red meat, obesity and lack of exercise may lead to colorectal cancer (4;6) breast cancer and triple negative tumors in postmenopausal women (7). Several studies over the past three decades identify a beneficial relationship of vegetable intake to Body Mass Index (BMI) and serum cholesterol level (8) as well as diabetes (9). High serum cholesterol associated with fatty foods is a contributing risk to heart disease (10-12). High levels of red meat intake contribute to obesity and high serum cholesterol and a risk of development of colon cancer and other cancers (13-16).

Early Detection of Deviated Health Indicators

Among the various physical health indicators such as Body Weight, Body Fat% and Total Cholesterol Level (TC), overweight and obesity are strongly related to improper eating habits, and consequently NCDs (14). These screening data can be measured conveniently to identify abnormal trends so that early commencement of nutritional intervention can prevent exacerbation.

Vegetarian Eating Patterns

A vegetarian diet is an evidence-based health practice for prevention and control of common NCDs (6,9,16,17). A well-planned vegetarian menu of vegetables and fruits and plant-based proteins rich in nutrients will be adequate for daily nutrition intake except for Vitamin B12, which may require supplements.

Vegetarian diets may be categorized as: (a) a lacto-ovo-vegetarian diet in which dairy products and eggs but no meat, poultry, or seafood are consumed; (b) a lacto-vegetarian diet in which dairy products but not eggs, meat, poultry, or seafood are consumed; (c) an ovo-vegetarian diet in which eggs but no dairy products, meat, poultry, or seafood are consumed; (d) vegan in which no animal products, including meat, fish, poultry, eggs, and dairy products are consumed and in which honey is avoided too (18;19).

Non-vegetarian diets are defined as diets in which any meat or fish are consumed.

Research Questions

The aim of the current study was to compare health indicators of the different dietary patterns of those attending a vegetarian festival in Hong Kong. The re-

search questions are posed to assess the impact of dietary pattern on focused-upon health indicators of recruited participants:

1. What are the demographic and socio-economic characteristics of vegetarians and non-vegetarians attending the 2013 Hong Kong VEGFEST?
2. Is there any difference in the number of NCDs reported by vegetarians and non-vegetarians at the festival?
3. What is the prevalence of obesity and high serum cholesterol among both vegetarians and non-vegetarians?
4. Is there any difference in BMI, Body Fat% and Total Cholesterol (TC) among both vegetarians and non-vegetarians?

Methods

A cross-sectional design and survey method with physical measurement of participants' health indicators was used for this study. The study took place during the 1st Vegetarian Festival held on 14 October 2013 organized in Hong Kong for health promotion in the community by the Hong Kong Macao Conference and Hong Kong Adventist Hospital of Seventh-day Adventists. The number of visitors to the festival was estimated to be 4,000. Different health activities of games as well as healthy foods and products for sale, and health education promotion were displayed at different booths by the community vendors for visitors' information and participation.

Procedure

Ethical approval of this research was granted by the Administration Council of Hong Kong Adventist College and Hong Kong Adventist Hospital (20). Three Health Screening Booths were designed for visitors with interest to investigate their individual health indicators and response to our invitation to participate in the study. Inclusion criteria of participants required the ability to read or follow simple instructions and explanation in Chinese. The participants were required to read a short paragraph stating clearly the study aim and they were asked to sign a consent form. The collected data were anonymous, although participants were informed that the data analysis and report would be published. The duration of the health indicator measurement procedure was about 30 minutes. The nature of this study was also explained verbally to participants and their questions were answered.



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The procedure for completion included two stages:

1. The first part was to measure three health indicators including BMI, Body Fat%, and TC as variables of health concern. BMI and Body Fat% were measured by Tanita Body Composition Analyzer SC331S based on international comparison of Resting Energy Expenditure Prediction Models for reliability of basal metabolic rate and relevant measured variables (21). TC was obtained using a finger-pricked method by Accutrend Roche 11418262 with an accuracy range of mean systematic differences between -3.6% and +2.6% (22).
2. The second part was to have participants fill in questionnaire of demographic information, including any past and current NCDs diagnosed by doctor.

The expected sample size of this study was at least 64 participants recruited from each group of the two different dietary patterns, which could achieve a power size of 0.8 corresponding to a medium effect size of 0.5 (23). Convenience sampling was used to seek participants with two different dietary patterns attending the vegetarian festival. Data analysis was done with chi-square and independent sample t-test (23).

Using SPSS Version 22, the vegetarian and the non-vegetarian group's mean BMI, Body Fat percentage and TC were compared by an independent sampled two-tailed t-test. Chi-square analysis was used to identify

any significant difference in the participants' demographic and socio-economic characteristics within the dietary patterns. A logistic regression analysis was used to identify demographic variables of significance.

Results

A response rate 94.8% of was obtained. A few participants were not counted because of incomplete information obtained while others did not wait at the right booth to follow the procedure. The satisfactory response rate was due to the clear explanation given to participants that their participation would help investigate any differences in health status and eating patterns in order to promote community health. It might be speculated that participants' interest in their personal health indicators measured for reference contributed to participation as did voluntary consent obtained in a comfortable environment and a piece of healthy wheat bread awarded to them at the completion of the survey procedure.

Participants' Characteristics

79 vegetarians and 158 non-vegetarians participated in the study. The majority of the participants were female (82.7%) (see Table 1) and above the age of 40 (86.4%), and half of them (53.5%) had secondary school education. With respect to socio-economic characteristics (see Table 1), the largest groups were housewives (32.4%), retired persons (23.1%) and clerks (15.3%).

Table 1. Demographic characteristics of Vegetarians and Non-vegetarians attending the health screening activities of the 1st Vegetarian Festival in Hong Kong Numbers (N) and Percentage (%) within Dietary Pattern

Dietary Pattern		Vegetarians (N=79)		Non-vegetarians (N=158)		Total (N=237)	
Gender	Male	7/79	8.9%	34/158	21.5%	41/237	17.3%
	Female	72/79	91.1%	124/158	78.5%	196/237	82.7%
Age	Adults ≤ 60	60/79	75.9%	104/158	65.8%	164/237	69.2%
	Elder > 60	19/79	24.1%	54/158	34.2%	73/237	30.8%
Education	≤ Secondary	21/79	26.6%	111/158	70.3%	133/237	56.1%
	> Secondary	58/79	73.4%	47/158	29.7%	104/237	43.9%
Income (Monthly)	< \$15,001	38/79	48.1%	77/158	48.7%	115/237	48.5%
	> \$15,000	41/79	51.9%	81/158	51.3%	122/237	51.5%
Religion	Buddhist	41/79	51.9%	41/158	25.9%	82/237	34.6%
	Christian	14/79	17.7%	52/158	32.9%	66/237	27.8%
	Other	24/79	30.4%	65/158	41.1%	89/237	37.6%

Numbers (N) and Percentage (%) within Dietary Pattern



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Just less than half had a monthly income below \$15,000 (46.2%). The distribution of religions was: Buddhists (32.4%), Christian (37.4%) and without religious belief (32.9%). About half of the participants' economic status is average as indicated by their monthly income. There was no difference in income among the vegetarians and non-vegetarians (see Table 1).

Chi-square analysis showed no significant difference in the participants' demographic and socio-economic characteristics within the dietary patterns, which provides more homogenous subjects for comparison and less of other confounding effect. Moreover, with reference to the logistic regression model constructed to further identify any significant impact of the demographic variables besides dietary pattern, none of them was indicated to exert this influence (see Table 2).

Table 2. Logistic regression model with all demographic factors (N=237)

Variable	Factor	Odds Ratio	95% CI	p-value
Gender	Female	0.45	(0.17, 1.32)	0.13
Age	≤ 60y	0.57	(0.22, 1.51)	0.25
Education	≤ Secondary	0.95	(0.36, 2.75)	0.92
Monthly income	≤ \$15,000	0.68	(0.25, 1.76)	0.43
Religion	Buddhism	1.45	(0.46, 4.76)	0.53
	Others	0.78	(0.23, 2.63)	0.69
Dietary Pattern	Vegetarians	0.31	(0.07, 1.03)	0.08

Non-communicable diseases

Table 3 shows the number of vegetarian and non-vegetarian participants reporting their diagnosed NCDs. These included cancer, hypertension, high serum cholesterol, heart disease, stroke, diabetes and others as indicated were grouped for analysis. 21 participants reported one or more NCDs. Of these, 33% (79/237) were vegetarians and 67% (159/237) were non-vegetarians. Of the participants, the vegetarian group had a significantly lower reported number of NCDs compared to the non-vegetarian group (likelihood Ratio $\chi^2=4.294$, $df=1$, $P=0.038$).

Table 3. Count and % of Diseases within Dietary Pattern (N=237)

Dietary Pattern	Vegetarians (n=79)	Non-vegetarians (n=158)
without Disease	96.2% (76/79)	88.6% (140/158)
with Disease	3.8% (3/79)	11.4% (18/158)

*Likelihood Ratio $\chi^2=4.294$, $df=1$, $P=0.038$

Health Indicators

The prevalence of obesity found in our study was 24.9% (see Table 4) which is broadly consistent with the obesity rates of 28.6% (24) and 20.7% (25) from two other regions in Hong Kong.

Table 4. Surveillance of Participants' Overweight and Obesity (N=237)

Body Mass Index Grading	BMI				Total
	<18.5	18.5-22.9	23-25	>25.0	
	Underweight	Normal	Overweight	Obesity	
Count	22	112	45	56	235
% of Total	9.4%	47.7%	19.1%	23.8%	100%

(Missing data =2)

The participants with borderline to high serum cholesterol level was 28.3% (see Table 5) which was lower than 44.7% (24) reported by the Hong Kong Department of Health.

Table 5. Surveillance of Participants' Total Cholesterol Level (N=237)

Total Cholesterol Grading	Total Cholesterol			Total
	<5.18	5.18-6.2	>6.21	
	Optimal	Borderline High	High	
Count	163	52	19	234
% of Total	69.7%	22.2%	8.1%	100%

(Missing data =3)

The vegetarian group and non-vegetarian group's mean BMI, Body Fat% and TC were compared by an independent sample two-tailed t-test using SPSS Version 22 with the results displayed in Table 6.

Table 6. Differences of mean health indicators among the Vegetarians and Non-vegetarians (N=237)

Total Cholesterol Grading	Health Indicators	Vegetarians (SD)	Non-vegetarians (SD)	Statistic	p-value
Total Cholesterol Grading	BMI	22.0790 (3.22)	23.4530 (3.85)	t = -2.706	0.007
	Body Fat%	25.5883 (7.00)	27.4184 (7.59)	t = 0.076	0.74
	Cholesterol	4.7387 (0.72)	5.0463 (0.82)	t = -2.662	0.008

Significant results marked in **bold**



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Discussion

The results of this study support that vegetarian diets correlate negatively with the development of NCDs. More in-depth studies with well controlled designs are required to confirm this result. Previous research suggests that well-planned and balanced vegetarian diets may help to effectively prevent common NCDs (3) and thus to provide beneficial effects for obesity, cancer, heart disease, and diabetes (16). The beneficial effects may include reduction of oxidative stress and decrease in inflammation markers such as C-reactive protein, as well as protection from atheroma formation (26); lower TC from 7.2% to 26.6% and Low-Density Lipoprotein (LDL) from 8.7% to 35% (27); reduction of cardiovascular disease development from 17.9% to 6.1% among 55 years of age (25;26); improvement of some diet risk factors of abdominal obesity, blood pressure, serum lipid profile, and blood glucose (27,28,29,30). These benefits may improve heart disease risk-factors (26,27). Consequently, vegetarians may have a reduced risk of developing and dying from ischemic heart disease (17,31,32).

In our study, the vegetarians' BMI and TC were significantly lower when compared with the non-vegetarians'. This may be due to more plant-based diets including whole grains and cereals, legumes, vegetables and fruits which are free from saturated fats. A previous systematic review and meta-analysis strongly suggest the effectiveness of vegetarian diets in the reduction and management of body weight. The health benefits of vegetarian diets were shown in a systematic review covering 15 clinical trials with 17 intervention groups suggest a mean weight change of -3.4 kg (95% CI -4.4 to -2.4; $P < 0.001$) (6); in another review a significantly lower ischemic heart disease mortality of 29% as discernable from seven studies with a total of 124,706 participants (17).

TC composed of High-Density Lipoprotein (HDL) is a good fat reducing atherosclerosis; and Low-Density Lipoprotein (LDL) is prone to blocking blood vessels. TC should not be higher than its normal range, which is usually due to excessive saturated fat intake from meat diets. The Body Fat% of the participants in our study, however, indicated no significant difference between the two different dietary pattern groups, though it was higher for the non-vegetarians (27.4% as compared to 25.6% for vegetarians). It is customary for Chinese people to prepare vegetables by adding cooking oil and this could conceal additional dietary fats. If it is shown to be the case, health policies should be recommended for healthy cooking with less cooking oil for public consumption. For prevention of NCDs in both vegetarians

and non-vegetarians, it is important to monitor and detect deviations in BMI and TC for early prevention. Our recruited study-participants were divided into vegetarians and non-vegetarians and sampled from the 1st Vegetarian Festival in Hong Kong. The health benefits of consuming a vegetarian diet were supported by a significantly lower number of NCDs, lower BMI and TC as compared to non-vegetarian diets intake.

Implication for Health Practice

Consuming natural and plant-based diets, whole grains and cereals, legumes, adequate amounts of vegetables and fruit can be beneficial for health (32, 33). Health habits such as complying to healthy lifestyle and eating, abstaining from smoking and alcoholic drinking have been shown to be associated with lower risks of NCDs and enhanced quality of life. A vegetarian menu, when properly designed and prescribed by dietitians in collaboration with doctors' treatment regime in a hospital, may provide supplementary health effects for hospitalized clients as well as those with ill health in the community.

The barriers for non-vegetarians in selecting vegetarian foods may be due to their subjective experience of meat tasting more delicious. This was supported by Lea and Worsley (2003), who found that individual healthy dietary choices and persistent eating patterns might not be achieved spontaneously and instantly (34). In their study of 601 randomly selected South Australians, a main barrier for the subjects to consume vegetarian diets were their enjoyment of eating meats and they were reluctant to change to vegetarian eating habits. Therefore, more effort should be placed on promoting the consumption of vegetarian foods or at least more fruits and vegetables. From the results of our study, vegetarian diets seemed beneficial as indicated by the lower number of reported NCDs for the vegetarian group, significantly lower BMI and TC obtained from the preliminary health screening measures as compared with the non-vegetarian group.

Health indicators for screening

BMI and TC are convenient and sensitive indicators for monitoring improper or excessive nutrition (4). They are reliable for early detection of overweight and obesity associated with type 2 diabetes and cardiovascular health problems. Most importantly, the health indicators for screening purpose of relevant biomedical risks allow user-friendly initial screening or alert purposes (4). This information alerts individuals to take precautions and implement proper eating pattern before health problems occur.

Prevention is always better than cure and research has



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indicated the therapeutic use of a vegetarian diet as effective for treating overweight and obesity in a short term (<1 year) or longer term (>1 year) (6). A vegan diet with structured group support and behavioral therapy compared to the National Cholesterol Education Program diet may result in significantly greater weight loss in one or two years (27). It is important for dietitians to identify client preferences along with the therapeutic use, monitoring and motivation evaluation of a nutrient-dense vegetarian diet for adults seeking management of overweight or obesity (16).

More innovative and strategic health education to train and develop participants' interest of evidence-based nutrition guidelines are necessary to change improper eating behaviors. This remains a challenge for those with existing NCDs to maintain healthy eating habits and achieve optimum nutrition. Regular and adequate daily intake of fruits and vegetables must be emphasized as good sources of antioxidants which are rarely found in meats (35). For more aggressive management, doctors may prescribe vegetarian diets to patients with hypertension, hyperglycemia and hyperlipidemia (36;37).

The increasing rise of NCDs in the community of Hong Kong should not be overlooked. Their prevention and control is a pivotal issue for the local government and healthcare organizations. They should develop and implement health policies allowing the public to experience and enjoy well-being. Positive outcomes (such as the absence or delayed onset of NCDs) can sustain a healthy workforce and enhance the income and general well-being of the society for better quality of life.

Limitation

Several limitations should be pointed out in this study. First, the design captured a group of participants to report their dietary pattern and diagnosed NCDs. These participants might not be representative in general. Second, the sample size was limited compared to other large cohort designs with more effective isolation of confounding variables such as a diabetic group (29). Third, the Body Fat percentage of the vegetarian group and non-vegetarian group was not significantly different because specific lifestyle factors such as hidden fat arising from Chinese oily vegetarian cooking style, inadequate regular exercise to burn excessive fat, and sweet foods and drinks with high calories may play a role too. For future studies, a control of confounding variables or a clinical trial design would likely lead to more convincing support for a vegetarian diet as a strategy for preventing and managing NCDs.

Conclusion

This study recruited participants of different dietary patterns during the 1st Vegetarian Festival in Hong Kong. One group complied broadly with vegetarian dietary practice and the other was a non-vegetarian group. The focused health indicators were valid and convenient measures to assess nutrition risks to related NCDs. A challenge is to develop public education programs, which sustain healthy eating habits and subsequent NCDs reduction. Providing timely measurement of indicators for health risks is crucial for early control of lifestyle induced diseases.

Authorship Credit

Conception and Design: PC, AT, AS

Acquisition of Data: PC

Analysis and Interpretation of Data: PC

Drafting, Revising and Final Approval of the Article: PC, AT, AS

Conflicts of interests

None declared.



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