Obesity, Diabetes, Hypertension, and Vegetarian Status Among Seventh-Day Adventists in Barbados: Preliminary Results

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A population-based sample of Seventh-Day Adventists was studied to determine the relationship between vegetarian status, body mass index (BMI), obesity, diabetes mellitus (DM), and hypertension, in order to gain a better understanding of factors influencing chronic diseases in Barbados. A systematic sampling from a random start technique was used to select participants for the study. A standard questionnaire was used to collect data on demographic and lifestyle characteristics, to record anthropometrics and blood pressure measurements, and to ascertain the hypertension and diabetes status of participants. The sample population consisted of 407 Barbadian Seventh-Day Adventists (SDAs), who ranged in age from 25 to 74 years. One hundred fifty-three (37.6%) participants were male, and 254 (62.4%) were female, and 43.5% were vegetarians. The prevalence rates of diabetes and hypertension were lower among long-term vegetarians, compared to non-vegetarians, and long-term vegetarians were, on average, leaner than non-vegetarians within the same cohort. A significant association was observed between a vegetarian diet and obesity (vegetarian by definition $P=.04$, self-reported vegetarian $P=.009$) in this population. Other components of the study population lifestyle should be further analyzed to determine the roles they may plan in lessening the prevalence rates of obesity, diabetes, and hypertension. (*Ethn. Dis.* 2003;13:34–39)

Key Words: Barbados, Seventh-day Adventists, Vegetarian, Body Mass Index, Obesity, Hypertension, Diabetes

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Introduction

Epidemiological studies indicate that rates of non-insulin dependent diabetes mellitus (NIDDM) have increased among Blacks in North America and the United Kingdom. Similar increases have been observed in the island nations of the Caribbean, and in urban West Africa. In sharp contrast to a 2% prevalence in Nigeria, the age-adjusted prevalence of self-reported NIDDM was 9% in the Caribbean (8.2% in Barbados), and 11% in the United States and the United Kingdom. Disease prevalence across sites was essentially co-linear with obesity.[1–3] Socioeconomic status may also be an indicator of the prevalence of diabetes in some populations. For example, research among Canadian diabetics found that prevalence increased with age, and was associated with lower socioeconomic status.[4] Similar results occurred in a study conducted among Latinos primarily from Puerto Rico.[5]

Although hypertension is usually not included in the list of leading causes of death, it contributes 20% to 40% of all mortality from cardiovascular diseases in the English-speaking Caribbean, and affects more females than males.[6] A study conducted in Barbados in 1993, using a stratified random sample of 460 persons aged 40–79 years, indicated that the prevalence of hypertension, defined as 160/95 mm Hg, was 47% and 43%, for women and men, respectively.[7] Between 1991 and 1995, both the Caribbean survey, and data collections for the International Collaborative Study on Hypertension in Blacks (ICSHIB), a population-based sample of men and women aged 25–74 years, were carried out. The overall age-adjusted hypertension prevalence estimates for Barbados were 21.5% at the 160/95 mm Hg threshold, and 27.9% at the 140/90 mm Hg threshold.[8]

Considerable worldwide research has focused on the frequency of diabetes, increasingly becoming a "Third-World" problem, on cardiovascular diseases, including hypertension, and on the risk and protective factors related to these diseases. In fact, there is growing interest in continually monitoring and comparing distributions of risk factors in diverse and specific populations locally, in order to inform public health professionals and to determine necessary interventions.[9] One such group of interest are the Seventh-Day Adventists. Studies among White Seventh-Day Adventists in California, approximately half of whom were vegetarians, found that, compared to non-vegetarians, the vegetarians had a lower risk for diabetes,[10] coronary heart disease (CHD), and cardiovascular disease (CVD).[11,12] Among African-American Seventh-Day Adventists, a vegetarian diet is associated with lower CVD risk factors, compared to an omnivorous diet; and research among African Adventists found significantly lower serum total cholesterol risk factors for premature CVD.[13]

Most of the lifestyle, general health principles, and dietary practices of Seventh-Day Adventists are derived from White's writings,[14,15] and from subsequent research findings on vegetarian dietary practices and exercise.[16] The use of tobacco, alcoholic beverages, and pork, all of which are considered "unclean," is prohibited. Adventists, whether "born" into the faith or "converted" to the faith, are discouraged from consuming other meats, fish, eggs, hot spices, pepper, and caffeine-containing beverages, and are encouraged to adopt a

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vegetarian diet. However, there is still a range of dietary practices among this population. For example, some are vegans (defined as those using no food of animal origin, ie, no meat, eggs, or dairy products);[17] some are lacto-ovo vegetarians (defined as those not consuming any meat, poultry, or fish, but including dairy products and eggs in their diet);[17] some are semi-vegetarians (defined as those consuming meat less than once per week);[12,16] and some are not vegetarians, consuming meats, fish, eggs, and milk on a daily basis.[16] Before becoming members of the church, usually at age 18 or older, some converts may have had several years of prior exposure to alcohol or tobacco use, or to a diet high in animal products. After converting, many Seventh-Day Adventists adopt a healthier lifestyle and make changes in dietary practices that may include less frequent consumption of animal products. The resulting broad range of current and past animal-product consumption among this group makes them ideal for epidemiological studies seeking to determine the potential health effects of a diet high in animal products, vs a diet relying to a lesser degree, or not at all, on animal products.[16]

Other studies have reported that adherence to dietary recommendations, including lowering cholesterol and saturated fatty acid intake, minimizes the metabolic risk factors associated with cardiovascular disease,[18,19] while an increased intake of dietary fiber can lower cholesterol and improve glucose tolerance. Research among vegetarians has found them to have lower blood pressure, lesser prevalence rates of diabetes and hypertension, and lower serum total and low-density lipoprotein (LDL) cholesterol concentrations.[20]

To date, virtually no such data exist for Caribbean Adventists who are vegans, lacto-ovo vegetarians, or semi-vegetarians. Given the increasing prevalence of chronic diseases in the region, it is important to determine whether a vegetarian diet ("vegetarian" as used in this study includes diets of vegans, lacto-ovo-vegetarians, and semi-vegetarians) is associated with lower prevalence rates of diabetes, hypertension, and obesity among this group. The purpose of this study among Seventh-Day Adventists in Barbados was to determine the prevalence rates of diabetes, hypertension, and obesity of this population, and how these rates are affected by a vegetarian diet.

Table 1. Frequency of each variable

Variable	Number of Respondents by Gender					
	Male	%	Female	%	All	%
Subjects	153	37.6	254	62.4	407	100.0
Diabetes	8	5.2	35	13.8	43	10.6
Hypertension	29	19.0	80	31.5	109	27.8
Vegetarian status						
Self-report	49	32.2	62	24.5	111	27.4
By definition	75	49.0	102	40.2	177	43.5
Overweight	73	48.0	161	63.6	234	57.5

METHODS

Study Description

The Barbados study is a cross-sectional survey of the health and dietary status of a sample of Seventh-Day Adventists residing in Barbados.

Study Variables

The outcome variables of interest were diabetes, hypertension, obesity, and dietary status. Diabetes and hypertension were ascertained by self report, according to physician diagnosis, and by measuring fasting blood glucose levels and blood pressure measurement, respectively. Measures of obesity, calculated as the body mass index (BMI), were classified as normal weight, overweight, and obese, according to WHO criteria. Vegetarian status was ascertained by self report, and classified as self-reported vegetarian (SRV), based on those who replied affirmatively to the question: "Are you a vegetarian?" All other participants were classified as non-SRV. Self reported vegetarians of 5 years or more were categorized as long term, according to Melby, Goldflies, and Toohey.[21] The complement was considered in this study to be short term. Those participants who reported consuming meat or poultry less often than one day per week were deemed to be vegetarians;[16] while those who consumed meat or poultry one or more days per week were categorized as non-vegetarian by definition (non-VBD). The independent variable was gender.

Selection Criteria

Participants were eligible for selection, irrespective of race or ethnicity, or their vegetarian or health status, strictly on the basis of being a baptized member of the church, being on the church's membership roster, and being between the ages of 18 and 74.

Table 2. Frequencies, chi-square and *P* values for dietary/disease status variables

Variable	Male	Female	Totals	Chi-Square	*P* Value
SRV >5 yrs	27	22	49	7.3	.007
SRV <5 yrs (including non-vegetarian)	125	231	356		
Veg. by definition	75	102	177	3.05	.081
Non-vegetarian	78	152	230		
Diabetic	8	35	43	7.2	.007
Non-diabetic	145	219	364		
Hypertensive	29	80	109	7.7	.006
Non-hypertensive	124	174	298		

Sampling

The sample was chosen from a total of 4,757 baptized Seventh-Day Adventist members between the ages of 18 and 74 years, who were registered in 49 churches across the island of Barbados. The list from each church was ordered by date of baptism; and age was determined by date of birth. A systematic sampling from a random start technique was used to select participants for the study, with a sampling fraction of one in 7, to ensure representation of all churches, including those with smaller congregations, and representation by years of baptism. Six hundred eighty individuals (680) were selected for the study, of whom 455 participated. One of these individuals was ineligible due to age, and the other 8 individuals were volunteer interviewers. The remaining 407 individuals participated in the study.

Recruitment

Letters were sent to 680 individuals, inviting their participation in the study; a total of 446 responses were received from individuals between the ages of 18 and 74 years. Recruits who met the criteria and who decided to participate in the study were provided with an identification letter and directed to attend nearby centers on a designated day. Transportation was provided where necessary. All participants were required to fast overnight before their appointments. Each participant gave informed consent after the purpose of the study was carefully explained.

Data Collection

Questionnaire

The instrument used to collect the data was a 55-item questionnaire that was pre-tested at a local Seventh-Day Adventist church with adults aged 18–74 of both genders. All necessary changes were made prior to administering the questionnaire to study participants. Survey items included health habits, nutrition/food frequency, vegetarian status, family history of diabetes and hypertension, and demographic variables. The instrument also included a section in which to report anthropometric measures, and record blood pressure, fasting plasma glucose and lipid profile.

Data Collection Procedures

Interviews

The interviews were conducted by trained teams consisting of 5 interviewers; 2 individuals to take anthropometric measurements; 2 blood pressure technologists; and 2 phlebotomists. All subjects were interviewed during 6 consecutive Sundays in October and No-

Table 3. Gender specific levels for anthropometric measures (25+) by vegetarian status

Veg. Status	Gender	*N*	Height (cm)	Weight (kg)	BMI (kg/m²)	Waist (cm)	Hip (cm)	WHR
SRV ≤5 yrs	Male	22	172.0 ± 6.6	73.0 ± 10.5	24.7 ± 3.4	82.6 ± 9.1	97.9 ± 5.9	0.8 ± 0.1
	Female	40	161.8 ± 6.9	73.0 ± 19.9	27.9 ± 7.7	84.5 ± 13.3	105.8 ± 13.9	0.8 ± 0.1
	All	62	165.4 ± 8.3	73.0 ± 17.0	26.8 ± 6.7	83.8 ± 12.0	103.0 ± 12.3	0.8 ± 0.1
SRV >5 yrs	Male	27	171.4 ± 7.5	70.5 ± 9.8	24.1 ± 4.1	80.4 ± 8.2	96.7 ± 5.9	0.83 ± 0.1
	Female	22	162.8 ± 7.3	69.5 ± 18.4	26.0 ± 5.6	81.7 ± 14.0	103.1 ± 12.1	0.8 ± 0.1
	All	49	167.6 ± 8.5	70.0 ± 14.1	25.0 ± 4.9	81.0 ± 11.0	99.6 ± 9.6	0.8 ± 0.1
SRV (all)	Male	49	171.7 ± 7.0	71.6 ± 10.1	24.4 ± 3.8	81.4 ± 8.6	97.2 ± 5.8	0.8 ± 0.1
	Female	62	162.2 ± 7.0	71.7 ± 19.3	27.3 ± 7.0	83.5 ± 13.5	104.8 ± 13.3	0.8 ± 0.1
	All	111	166.4 ± 8.4	71.7 ± 15.8	26.0 ± 6.0*	82.6 ± 11.6	101.5 ± 11.3	0.8 ± 0.1*
Non-SRV	Male	100	173.53 ± 6.8	74.93 ± 12.21	24.9 ± 3.7	83.5 ± 8.97	99.1 ± 6.9	0.8 ± 0.1
	Female	191	161.0 ± 7.0	71.2 ± 15.5	27.5 ± 6.1	85.2 ± 13.9	104.4 ± 11.8	0.8 ± 0.1
	All	291	165.3 ± 9.1	72.5 ± 14.5	26.6 ± 5.5*	84.6 ± 12.4	102.6 ± 10.6	0.8 ± 0.1
VBC	Male	75	172.5 ± 7.5	72.1 ± 10.7	24.3 ± 3.7	81.4 ± 8.4	97.7 ± 6.0	0.8 ± 0.1
	Female	102	161.9 ± 6.7	70.7 ± 18.2	27.0 ± 6.8	83.2 ± 14.2	103.9 ± 13.2	0.8 ± 0.1
	All	177	166.4 ± 8.8	71.2 ± 15.4	25.8 ± 5.8*	82.4 ± 12.1	101.3 ± 11.2	0.8 ± 0.1*
Non-VBD	Male	78	173.4 ± 6.2	75.4 ± 12.3	25.1 ± 3.7	84.1 ± 9.3	99.2 ± 7.2	0.9 ± 0.1
	Female	152	160.9 ± 7.1	71.7 ± 15.1	27.8 ± 6.0	85.9 ± 13.4	104.9 ± 11.3	0.8 ± 0.1
	All	230	165.0 ± 9.0	72.9 ± 14.3	26.9 ± 5.5	85.3 ± 12.2	103.0 ± 10.5	0.8 ± 0.1

* Approached statistical significance (*P*=.066 and .095)

Table 4. Prevalence of obesity, diabetes, and hypertension among SRVs and VBDs (25+)

		Study Popul		SRV >5 yrs		SRV <5 yrs		All SRV		Non-SRV		VBD		Non-VBD	
Study Variable	Gender	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Overweight ≥25 kg/m²	M	71	47.7	10	37.0	12	54.5	22	44.9	49	49.0	32	42.7	39	50.0
	F	161	63.4	14	63.6	24	60.0	38	61.3	123	64.4	61	59.8	100	65.8
	Total	232	57.0	24	49.0	36	58.1	60	54.1	172	59.1	93	52.5	139	60.4
Obesity >30 kg/m²	M	10	6.5	1	3.7	1	4.5	2	4.1	8	8.0	3	4.0	7	9.0
	F	71	28.0	2	9.1	13	32.5	15	24.2	56	29.3	24	23.5	47	30.9
	Total	81	19.9	3	6.1	14	22.6	17	15.3	64	22.0	27	5.3	54	23.5
Diabetes	M	8	5.2	0	0.0	1	4.5	1	2.0	7	7.0	2	2.7	6	7.7
	F	35	13.8	2	9.1	7	17.5	9	14.5	26	13.6	14	13.7	21	13.8
	Total	43	10.6	2	4.1	8	12.9	10	9.0	33	11.3	16	9.0	27	11.7
Hypertension	M	29	19.0	1	3.7	4	18.2	5	10.2	24	24.0	13	17.3	16	20.5
	F	80	31.5	8	36.4	14	35.0	22	35.5	58	30.4	32	31.4	48	31.6
	Total	109	26.8	9	18.4	18	29.0	27	24.3	82	28.2	45	25.4	64	27.8

vember 1999. At each site, interviewers collected demographic and socioeconomic information; took and recorded weight, height, hip, and waist measurements and drew fasting blood samples.

Measurements

Anthropometric measurements were taken with participants barefoot and wearing light clothing. Weight was measured on an electronic scale to the nearest 0.1 kg, and height with a stadiometer to the nearest 0.1 cm. Waist and hip circumferences were measured using a flexible measuring tape to the nearest 0.1 cm. Body mass index (BMI) was calculated as weight measured in kilograms, divided by height in meters squared. Participants were considered overweight if their BMIs were between 25 and 29, and obese if their BMIs were 30 or greater. Waist-to-hip ratio (WHR) was calculated as waist divided by hip circumference.

Blood pressure was measured on the seated participant's right arm with an appropriately sized cuff. Three systolic and diastolic measures were recorded to the nearest 2 mm Hg on the first (systolic BP) and the fifth (diastolic BP) phase Korotkoff sounds, using a standard mercury sphygmomanometer. Subjects with systolic blood pressures of greater than or equal to 140 mm Hg, diastolic blood pressures of greater than or equal to 90 mm Hg, self-reported use of anti-hypertensive medication, or a self-reported physician's diagnosis, were classified as hypertensive.

Blood Collection

Twelve-hour fasting venous blood samples, for full blood count (FBC), glucose, glycated hemoglobin, and lipids (total cholesterol, high density lipoprotein [HDL] and low density lipoprotein [LDL] cholesterol, and triglycerides), were drawn from the antecubital region of the forearm. While participants were seated, 5.0 mL of blood was drawn by plastic syringe, and placed in sample tubes containing lithium heparin, EDTA, and sodium fluoride. Blood glucose and total cholesterol levels were analyzed on a biochromatic analyzer (Abbott Spectrum); FBCs on the cell Dyn 1700; and glycated hemoglobin on the Abbott Imx, using relevant reagents. Subjects were classified as diabetic according to the World Health Organization (WHO) criteria of a fasting venous plasma glucose level of 7.8 mmol/L (140 mg/dL) or higher, or a self-reported physician's diagnosis of diabetes.

Table 5. Odds ratios between vegetarians and obesity, diabetes, and hypertension

Risk Variable	Outcome Variable	Odds Ratio, 95% C.I.		
Non-SRV	BMI ≥25 kg/m²	1.16	(0.75, 1.80)	ns
SRV ≤5 yrs	BMI ≥25 kg/m²	1.43	(0.67, 3.0)	ns
Non-SRV	BMI ≥30 kg/m²	1.53	(0.85, 2.75)	ns
Non-SRV	Diabetes	1.27	0.77, 2.10)	ns
Non-SRV	Hypertension	1.19	0.72, 1.97)	ns
Non-vegetarian	BMI ≥25 kg/m²	1.38	(0.93, 2.05)	ns
Non-vegetarian	BMI ≥30 kg/m²	1.70	(1.02, 2.83)	$P<.05$
Non-vegetarian	Diabetes	1.34	(0.70, 2.57)	ns
Non-vegetarian	Hypertension	1.13	(0.72, 1.76)	ns

Data Analysis

Data were checked, recorded and entered into a computerized database for statistical analyses that were performed using the Statistical Packages for the Social Sciences (SPSS). Only the data for 407 individuals ($N=407$) between the ages of 25 and 74 will be included in this analysis in order to make it directly comparable with the representative "national" population sample studied in the International Comparative Study of Hypertension In Blacks (ICSHIB). The means of independent variables were compared using the *t* test. The Mantel-Haenszel chi-square statistic was used to determine associations between categorical vari-

ables, and to determine estimates of risk. *P* values were two-tailed, and the *P* value<.05 was considered significant for all tests.

RESULTS

Table 1 describes characteristics of the study population. One hundred fifty-three (37.6%) participants were male, and 245 (62.4%) were female. There were two and a half times as many hypertensives as there were diabetics; almost 71% of participants were either self-reported vegetarians or were vegetarian by definition; and more than half were overweight.

Table 2 indicates that vegetarianism, however defined, was lower in females than in males and was significantly so, for SRVs of more than 5 years (*P*<.01). Further, both diabetes and hypertension were significantly more prevalent among women compared to men.

The descriptive and mean values, and associated standard deviations of the 6 anthropometric variables are displayed in Table 3. The mean BMIs for all self-reported vegetarians (SRVs) regardless of gender (26.0), and for vegetarians by definition (VBD) (25.8), were similar to the BMI for non-SRVs (26.6), and non-VBD (26.9). However, SRVs of more than 5 years were leaner (BMI 25.0), compared to those of less than 5 years (BMI 26.8), and to non-SRVs (26.6). Therefore, our findings indicate that long-term adherence (5 years or more) to a vegetarian diet had an effect on BMI that approached statistical significance compared to both non-vegetarian diets, and adherence to a vegetarian diet for less than five years (*P*=.066 and .095, respectively). It should also be noted that male self-reported vegetarians of longer than 5 years were leaner than female self-reported vegetarians of the same duration. Similarly, in all groups defined by vegetarian status, waist circumferences were approximately 2 cm less in men compared to women.

Table 4 illustrates that the prevalence rates of overweight (BMI>25 kg/m^2) and obesity (BMI>30 kg/m^2) were significantly lower (*P*<.05) only among those participants who had been long-term vegetarians (SRVs for more than 5 years).

In another analysis (Table 5), the odds ratio evaluating the association between non-vegetarian status and obesity (BMI>30 kg/m^2) was significant at 1.70 (95% CI: 1.02–2.83). Thus, persons who were non-vegetarians had a 70% increased risk of being obese.

DISCUSSION

The study indicates that while the body mass index (BMI) for vegetarians as a group did not differ dramatically from their non-vegetarian cohort, those reporting adherence to a vegetarian diet for >5 years were significantly leaner. Male vegetarians appeared to be uniformly leaner than female vegetarians. However, these differences are significant only at the 5% level. Consequently, they must be interpreted with caution, as there numerous pairs of means were tested. The data also demonstrated an association between self-reported vegetarians (SRVs) of more than 5 years and leanness. These vegetarians had the lowest BMI, obesity prevalence, and waist and waist/hip ratios. Self-reported vegetarians of less than 5 years did not differ significantly from non-vegetarians.

Similarly, diabetes and hypertension prevalence rates showed a constant trend toward lower values in all self-reported vegetarians and vegetarians by definition; however, again, the differences were greatest for those consuming a vegetarian diet for more than 5 years. It seems clear, therefore, that while a vegetarian diet is consistently related to a lower BMI, waist circumference, and waist/hip ratio, and with their complications, ie, diabetes and hypertension, that the benefits are initially modest and accrue over time. Melby et al[21] also reported evidence of the benefits of long-term adherence (at least 5 years or more) to a vegetarian diet.

"The study indicates that while the body mass index (BMI) for vegetarians as a group did not differ dramatically from their non-vegetarian cohort, those reporting adherence to a vegetarian diet for >5 years were significantly leaner."

These results are also consistent with those of previous studies among Seventh-Day Adventists, conducted by researchers from Loma Linda University elsewhere, which concluded that a vegetarian diet is associated with a lower mean body mass index, and a lower risk for both diabetes mellitus and hypertension.[22–26]

CONCLUSION

This study confirms the high prevalence rates of diabetes and hypertension in Barbados, as has been found elsewhere in the Caribbean region. The study also posits benefits derived from adhering to a vegetarian diet, especially for a longer duration, ie, after 5 years. This finding has implications for health planners, health promotion, and community health education leaders involved in preventing and controlling these chronic diseases. We also recommend further analyses of additional data from this study that could illuminate the relative contribution of other lifestyle components, such as physical activity, dietary composition, and participation in social and religious activities (after controlling for the confounding

effects of this participation). Research has suggested that participation in church and social activities has protective benefits and may reduce mortality.[18] Further research will assist in determining risk factors whose reduction may contribute to lessening the prevalence rates of obesity, diabetes, and hypertension.

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REFERENCES

1. Cooper RS, Rotimi CN, Kaufman JS, et al. Prevalence of NIDDM among populations of the African Diaspora. *Diabetes Care.* 1997; 20(3):343–348.
2. Holder Y, Lewis M. Epidemiological overview of morbidity and mortality. *Health Conditions in the Caribbean.* Pan American Health Organization, Scientific Publication; 1997;561.
3. King H, Rewers M. Diabetes in adults is now a Third-World Problem. World Health Organization Ad Hoc Diabetes, Reporting Group. *Ethn Dis.* 1993;3(suppl):S67–S74.
4. James R, Young TK, Mustard CA, Blanchard J. The health of Canadians with diabetes. *Health Rep.* 1997;9(3):47–51.
5. Brunt MJ, Milbauer MJ, Ebner SA, et al. Health status and practices of urban Caribbean Latinos with diabetes. *Ethn Dis.* 1998; 8(2):158–166.
6. Modeste NN, Abbey DE, Hopp JW. Hypertension in a Caribbean population. *Int Q Community Health Educ.* 1985–86;5:203–211.
7. Foster F, Rotimi C, Fraser H, et al. Hypertension, diabetes, and obesity in Barbados: findings from a recent population-based survey. *Ethn Dis.* 1993;3:404–412.
8. Freeman V, Fraser H, Forrester T, et al. A comparative study of hypertension prevalence, awareness, treatment, and control rates in St Lucia, Jamaica, and Barbados. *J Hypertens.* 1996;14:495–501.
9. Beer-Borst S, Morabia A, Hercberg S, et al. Obesity and other health determinants across Europe: The EURALIM Project. *J Epidemiol Community Health.* 2000;54:424–430.
10. Melby CL, Goldflies DG, Hyner GC, Lyle RM. The relationship between vegetarian and non-vegetarian diets and blood pressure in Black and White adults. *Am J Public Health.* 1989;79:1283–1288.
11. Fraser GE. Diet as a primordial prevention in Seventh-day Adventists. *Prev Med.* 1999;29: S18–S23.
12. Famodu AA, Osilesi O, Makinde YO, Osonuga OA. Blood pressure and blood lipid levels among vegetarian, semi-vegetarian, and non-vegetarian Native Africans. *Clin Biochem.* 1998;31(7):545–549.
13. Fraser GE, Lindsted KD, Beeson WL. Effect of risk factor value on lifetime risk at first coronary event. *Am J Epidemiol.* 1995;142: 746–758.
14. White EG. *Counsels on Diet and Foods.* Hagerstown, Md: Review and Herald Publishing Association; 1976.
15. White EG. *The Ministry of Healing.* Boise, Idaho: Pacific Press Publishing Association; 1942.
16. Snowdon DA, Phillips RI. Does a vegetarian diet reduce the occurrence of diabetes? *Am J Public Health.* 1985;75(5):507–512.
17. Key TJ, Davey GK, Appleby PN. Health benefits of a vegetarian diet. *Proc Nutr Soc.* 1999;58:271–275.
18. Snowdon DA. Animal product consumption and mortality because of all causes combined, coronary heart disease, stroke, diabetes, and cancer in Seventh-day Adventists. *Am J Clin Nutr.* 1988;48:739–748.
19. Scholfield DJ, Behall KM, Bhathena SJ, Kelsay J, Reiser S, Revett KR. A study on Asian Indian and American vegetarians: indications of a racial predisposition to glucose intolerance. *Am J Clin Nutr.* 1987;46:955–961.
20. Fraser GE. Determinants of ischemic heart disease in Seventh-day Adventists: a review. *Am J Clin Nutr.* 1988;48:833–836.
21. Melby CL, Goldflies DG, Toohey ML. Blood pressure differences in older Black and White long-term vegetarians and non-vegetarians. *J Am Coll Nutr.* 1993;12(3):262–269.
22. Key TJ, Fraser GE, Thorogood M, et al. Mortality in vegetarians and non-vegetarians: detailed findings from a collaborative analysis of 5 prospective studies. *Am J Clin Nutr.* 1999;70(suppl):516s–524s.
23. Singh PN, Lindsted KD, Fraser GE. Body weight and mortality among adults who never smoked. *Am J Epidemiol.* 1999;150(11): 1152–1164.
24. Key TJ, Davey GK, Appleby PN. Health benefits of a vegetarian diet. *Proc Nutr Soc.* 1999;58:271–275.
25. Appleby PN, Thorogood M, Mann JI, Key TJ. Low body mass index in non-meat eaters: the possible roles of animal fat, fibre and alcohol. *Int J Obes Relat Metab Disord.* 1998; 22(5):454–460.
26. Omar MA, Seedat MA, Motala AA, Dyer RB, Becker P. The prevalence of diabetes mellitus and impaired glucose tolerance in a group of urban South African Blacks. *S Afr Med J.* 1993;83:641–643.

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