Diet as Primordial Prevention in Seventh-Day Adventists

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Epidemiologic studies of Seventh-Day Adventists have clearly shown that dietary habits are associated with risk of coronary heart disease (CHD) and other chronic diseases. However, a few surprising results emerge. Meat consumption is clearly hazardous for Adventist men by raising CHD mortality. However, no such effect was seen in women. Possible reasons are discussed. Our data, and that of others, strongly support the role of a fatty food, specifically nuts, as protective for CHD. The possible implications of this result for fat intake as a risk factor for CHD are discussed. In particular, it may be that consumption of modest quantities of certain fats is beneficial, rather than hazardous. The lower risk of CHD in Adventists probably has a complicated explanation and certainly cannot be entirely explained by their nonsmoking status or a superior serum lipid profile. Adventists are unique in that the majority of this group have adopted a dietary habit that is either vegetarian or tending in this direction. The power of incorporating health into a system of religious belief is discussed. Possibly others can also implement such a model to their advantage.

Key Words: religion; diet; coronary heart disease, Seventh-Day Adventist; risk factors.

INTRODUCTION

Seventh-Day Adventists have had their health experience studied now for at least 45 years. There are about 230 reports in the medical literature relating to Adventists from Norway, the Netherlands, and Denmark, as well as the well-known studies from Loma Linda University in California.

The reasons for the interest in this group become clear with the knowledge that Adventists do not smoke cigarettes, drink little (and usually no) alcohol, and have distinctive dietary habits. About 30% of our California study group ate no meat products (including fish and poultry); another 20% eat meat less than once per week, the rest eat meat almost as often as other Californians, and only 2–3% of Adventists qualify as vegans (those who eat no foods of animal origin).

The results of these studies are well known suggesting a lower risk of fatal ischemic heart disease for Adventists compared to other Californians [1]. Studies within this relatively low-risk group confirm that traditional risk factors for coronary heart disease (CHD) operate as usual [2], and also that a number of foods are correlated with risk of CHD in an interesting way. These foods are not obviously confounded with other known risk factors, such as past smoking habits, hypertension, or physical inactivity [3].

In this paper, we will not repeat these conclusions, but rather discuss some lesser known results and note some implications of the Adventist study results for the epidemiology of ischemic heart disease. It is often the somewhat unexpected finding that leads to progress in science and there are several of these in this data. These include apparent differences in the effects of certain foods on CHD risk according to gender, observations suggesting that consumption of an individual food may have effect on risk of CHD, and the absence of an association between total fat intake and CHD. Finally, what is it about Adventists that results in their lower risk as a group and how have they maintained their unusual dietary habits for over a century?

One outstanding feature of this population is their nutritional habits. If there is evidence that diet can improve biochemical and physiologic risk factors, then diet surely qualifies as a means of primordial prevention. If the food choices that we make (including the quantities that we eat) can importantly impact health, this has important implications for prevention at personal, community, and national levels.

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(a) Effect Modification by Gender

A striking feature of the two California cohort studies of Adventists is the apparent effect of meat consumption to increase risk of fatal CHD in men, but much less so, if at all, in women [3,4]. In the analysis from the most recent cohort [3], the relative risk for fatal CHD in male high beef consumers compared to subjects never using beef was 2.31 (P < 0.025), compared to 0.76 (NS) in women. This effect is found, even when adjusted for hypertension, diabetes, exercise habits, obesity, age, and intake of several foods. This is especially noteworthy since diet also independently affects several of these variables (e.g., diabetes and obesity). Blood lipids were not measured, and this difference in effect by gender may be partially mediated in this way. For instance, it appears that the biological effects of changes in LDL cholesterol are less marked in women than men [5]. In addition, the effects of diet on LDL cholesterol appear qualitatively similar in men and women [6–8], but this is not so clear for HDL cholesterol.

Several studies have suggested that HDL cholesterol levels in women are particularly sensitive to the type of fatty acid that predominates in the diet. Specifically, a change from either a saturated/or monounsaturated to a polyunsaturated fatty acid or low-fat diet is accompanied by a rather marked fall in HDL cholesterol, more so in women than men [6,7,9]. Hence when comparing vegetarian to nonvegetarian Adventists, the vegetarian diet has a greater proportion of polyunsaturated fat and also a modestly lower total fat. This would be expected to lower LDL cholesterol, slightly diminishing risk in women, but to also lower HDL cholesterol to a proportionately greater extent. The balance of CHD risk in vegetarian women, even considering potentially beneficial effects of vegetarianism on platelet function, factor VII levels, and LDL oxidative status [10] may still not clearly be in their favor given the effects on HDL cholesterol. In men, the decrease in HDL may be less and the drop in LDL cholesterol more biologically important. However, more evidence is needed.

Despite this, the only Adventist HDL data we have on both sexes, from Norway and the Netherlands, show the usual sex differences in HDL cholesterol (i.e., a higher level in females) [11–13] (Table 1). This must be interpreted with the knowledge that there is less vegetarianism among Adventists in these countries, but does not support the above explanation for the different effects of meat by gender. Second, as we discuss below, the Adventists of our study as a group did not have low fat intake.

The average age of the women in our cohort was 53 years, and virtually all CHD events were postmenopausal. It also seems probable that for a substantial postmenopausal period, the potentially hazardous effects of meat consumption in women are reduced by the continuing and previous effects of estrogen on the vascular endothelium [14] and the oxidation of LDL cholesterol [15,16]. These are the final common pathways of action of several risk factors, and however the effects of meat consumption are mediated, its relative effects are much reduced in Adventist women or alternatively much enhanced in men.

(b) Possible Effects of an Individual Food on CHD Risk

Our observations that the 25% of our cohort who consumed nuts 5 or more times per week had dramatically lower risk of CHD [3] (Table 2) is a consistent finding in virtually all important exposure subgroups, and is now reported also from the Iowa Women’s Study [17] and the Nurses’ Health Study [18]. These findings initially provoked some disbelief [19], but after the publication of evidence of the lipid lowering effects of nuts, and considering further their nutrient composition, the results are less surprising [20]. Yet the observed effect on disease risk is greater than can be easily accounted for by the expected lipid lowering effect, given that even the frequent consumers on average took only 2–3 oz each day, which would be expected to lower serum lipids, in comparison to more typical fats in the U.S. diet.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>HDL Cholesterol Levels (mg/dl) among Adventist Men and Women</th>
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<tbody>
<tr>
<td></td>
<td>Males</td>
</tr>
<tr>
<td>Norway</td>
<td>49.9</td>
</tr>
<tr>
<td>Netherlands</td>
<td>49.9</td>
</tr>
<tr>
<td>Age 50–55 years</td>
<td>37.5</td>
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<tr>
<td>Age 30–35 years</td>
<td>40.0</td>
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<table>
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<tr>
<th>TABLE 2</th>
<th>Nut Consumption and Relative Risk (95% Confidence Interval) of CHD*</th>
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<tbody>
<tr>
<td>Nuts</td>
<td>Definite nonfatal myocardial infarctionb</td>
</tr>
<tr>
<td>&lt;1/week</td>
<td>1.00**</td>
</tr>
<tr>
<td>1–4 week</td>
<td>0.78 (0.51–1.18)</td>
</tr>
<tr>
<td>&gt;5/week</td>
<td>0.49 (0.28–0.85)</td>
</tr>
<tr>
<td>a Adjusted for hypertension, past cigarette smoking, diabetes, exercise habits, and consumption of bread, beef, cheese, fish, coffee, legumes, and fruit.</td>
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<tr>
<td>b International diagnostic criteria [51].</td>
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<tr>
<td>* P &lt; 0.005.</td>
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<td>** P &lt; 0.001.</td>
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by only about 10%. Thus, it is difficult to account for the 50% reduction in CHD risk, suggesting that additional factors may be at work here.

Recently it has become more well known that foods, particularly vegetable foods, contain a myriad of complex and probably biologically active chemicals aside from the standard nutrients, vitamins, and minerals [21]. Although the dietary research in relation to CHD risk over the past 40 years has largely focused on dietary fat, it is important not to ignore the possibility that other phytochemicals may also affect risk of CHD. Recently there has been a good deal of publicity relating to antioxidant vitamins and risk of CHD. However, the observational studies mainly used indices that may well have been surrogates for other dietary substances aside from the antioxidant vitamins. Perhaps it is more telling that intervention trials of supplementary antioxidants are not so far very encouraging. Hence, mechanisms underlying the association of high vegetable consumption with decreased risk of CHD are not well understood.

In clinical medicine, we are well acquainted with the potent pharmacologic effects of tiny amounts of certain chemicals. Yet many of these substances, or their parent substances, were originally phytochemicals. Thus, the possibility should at least be considered that an individual food, with its unique chemical mix, could contain potent bioactive substances that have preventive potential for CHD. These could affect blood lipids, the vascular endothelium, or arrhythmic thresholds, for instance. We have no evidence that this is true for nuts, but our findings at least prompt one to consider the possibility of such a situation as a general premise.

(c) Dietary Fat and CHD

It is well established that saturated fats raise serum cholesterol, and unsaturated fats less powerfully lower serum cholesterol [22]. These facts, along with the knowledge that most fats eaten by Americans are saturated, have guided public health policies for several decades. One consequence is that in the eyes of the public and most professionals, all fats in the diet have been given a bad reputation. Despite the balance in the latest American Heart Association statement [23], between a modest reduction in total fat, but an emphasis on reducing saturated fats, the message that has become ingrained in the consciousness of the public and many professionals often goes no further than a conviction of the harmful effects of all fats. If there is any evidence that certain fats may in fact be beneficial by reducing risk of CHD, then these attitudes are inappropriate.

Although there are as yet no foods unequivocally established as protective for CHD, it is of interest, and concern, that the few foods that do seem to show such associations consistently are mainly fatty foods, albeit foods high in omega-3 polyunsaturates (fish) [24] and high in monounsaturates (nuts), and in the case of walnuts, omega-3 acids. A number of cohort studies [25–28] have suggested that higher consumption of unsaturated fats may be actually beneficial, reducing risk of this disease. This is true also in the data for Adventists where the only significant association between CHD risk and dietary fats is a protective association with polyunsaturated fat intake (P < 0.05) in men, but not women [29]. No effect was seen for total fat consumption. Indeed California Adventists as a group do not have particularly low fat consumption at 38.7% of calories (estimated from food frequency questionnaires and validated fat and calorie indices of the Adventist Health Study).

In view of this, recommendations may more appropriately focus on the probable harm from overconsumption of animal fats and even point out the relative freedom to use vegetable fats within a framework of modest reduction in total fat. Our evidence that nut consumption may be beneficial was initially rejected by some, simply because nuts were fatty foods. We do not believe that this is an appropriate rationale for skepticism. There is some concern that fat consumption in particular increases the risk of obesity, an increasing problem in most economically developed countries. However, although it is prudent to limit total fat consumption, there is some evidence here also that it may be important to distinguish different types of fatty acids [30–32] from total fat intake and some doubt that fat is especially hazardous above other sources of calories [33].

(d) Why Do Adventists Have Lower Risk of CHD Than Other Nonsmokers?

Traditional risk factor differences do not clearly explain why Adventists have lower risk than other nonsmokers. Total serum cholesterol levels in Adventists are lower by 5–10% than those of non-Adventists [11–13,34]. Although this may translate to a 10–25% lower incidence of CHD, such a calculation neglects to consider that HDL cholesterol levels are also lower than those of non-Adventists by 8–10% (see Table 1). This in theory should counterbalance the changes in total cholesterol. The reason for the lower HDL levels may be lower fat intake, though as mentioned any lowering of fat intake by California Adventists is very modest indeed. In this context the virtual absence of alcohol consumption may be more important, as alcohol consumption is well known to raise HDL cholesterol levels [35,36]. However, any such effect to lower HDL may be partially compensated by higher levels of physical activity [34,37] among Adventists. Whether the somewhat lower HDL cholesterol levels actually incrementally raise risk in this low-risk population is unknown.
Consequently the often held opinion that the lower risk of Adventists is due to better serum cholesterol levels is not yet clearly supported by evidence. Triglyceride tolerance [38,39] in this population has not been studied but may be less atherogenic than others given the lower levels of obesity in the vegetarians and higher polyunsaturated fat content of the diets.

Blood pressure levels are lower in the vegetarians [40], as is the prevalence of hypertension [41], but overall blood pressure levels in Adventists are not clearly different from those of non-Adventists [34,42], perhaps due to the influence of the nonvegetarian Adventists. Factor VII levels appear to be influenced by diet [43,44], and although we know of no data that specifically addresses this in Adventists, it is likely that their levels are modestly lower as is the case in other vegetarians [43].

However, there seems to be room for other explanatory risk factors in Adventists that may include (a) effects of foods on oxidation of LDL cholesterol; (b) a high intake of folate that should reduce homocysteine levels [45]; (c) other as yet unknown effects of plant-based diets on health; (d) a number of possible benefits of religiosity [46]; and (e) other beneficial psychosocial influences such as increased social support.

(e) Probable Beneficial Effects of Vegetarianism on Hypertension and Noncardiovascular Diseases in Adventists

Comparisons of the health experience of Adventist vegetarians and nonvegetarians suggest that the advantages of vegetarianism are not confined to coronary heart disease [41]. The vegetarians have lower body mass indices, such that on average 5 foot 10 in. males are 14 lb lighter and 5 foot 4 in. females 12 lb lighter than their nonvegetarian counterparts. The prevalence of diabetes is almost twice as great (P < 0.0001) in the nonvegetarians [41] and other data show the vegetarian Adventists to have lower mortality ascribed to diabetes [47]. Similarly the nonvegetarians have a prevalence of hypertension that is 2.20 times (P < 0.0001) that of the vegetarians.

The incidence of colon and prostate cancers (adjusted for age and sex) are 88% (P = 0.03) and 54% (P = 0.03) greater, respectively, in the nonvegetarian Adventists who also experience a higher incidence for most other cancers, but with numbers too small to produce conclusive results.

(f) The Long Adherence to a Nontraditional Dietary Pattern

What can others learn from the success of Adventists in promoting a vegetarian dietary habit for over 120 years? Why is it that Adventists have apparently been able to adopt such a pattern with relative ease, whereas the general population still has a considerable distance to go, despite the long existence of authoritative recommendations?

Adventists have not been extensively studied from this perspective but others have speculated on the possible beneficial effects of religion to change social norms and promote adherence to healthy behaviors. Vaux [48], for example, described a concept he called “purity in life,” which may often be present in the Judeo-Christian belief system. If the body and its health come to be considered sacred, then maintenance of health inevitably becomes a “core belief.” This will powerfully influence motivations and actions. While there are few religions that formally incorporate health into their belief structure, Adventists do so, and it is a natural fit for at least Christianity, Judaism, and Islam. Vaux also described a second concept he calls “peace in existence.” He postulates that “beliefs that elicit contentment and purposiveness in the life, directly affect health attitudes and behaviors.” It is possible that a sense of wellbeing and purpose elicits a desire to “guard one's health,” and may lead to “a desire for more life, rising with new enthusiasm each day.”

Finally, the knowledge and social support obtained by belonging to a group that subscribes to similar nontraditional values and health behaviors is a powerful aid. For many Adventists, the majority of their friends are church members, a situation well suited to social learning as propounded by Bandura [49].

These ideas raise the question of whether other religious groups and social organizations could benefit in similar ways to the Adventists, by incorporating health as a core belief and providing learning opportunities and social support for their members. As scientific evidence of the health benefits of a plant-based diet accumulates, scientists and the media should more effectively promote this way of eating, helping to counteract the powerful economic forces that discourage vegetarianism.

CONCLUSIONS

Our findings emphasize the importance of evaluating the epidemiology of disease in a number of disparate groups within the same broad cultural setting, where this is possible. The effects of an exposure cannot be properly evaluated in a population that rarely manifests this exposure. The effect of nut consumption on risk of CHD is difficult to evaluate in most American populations because less than 5% of the population consume nuts 4–5 times weekly [50], yet this is true of 25% of Adventists.

It is also important to have sufficient contrast in values of a particular exposure within the study population. Hence, a population with a broad range of dietary habits, such as our population, should in theory have
increased statistical power. However, on the downside, a population that is overall too low in risk of CHD will have decreased statistical power due to a low number of observed events.

Finally, despite 40 years of intensive research in the realm of diet, lipids, and CHD risk much has yet to be learned. We know a great deal about the effects of diet on lipids in men. Much less is known regarding effects of diet on lipids, including HDL, in women, and their effects on disease risk. The possibility that lowering fat intake markedly, or increasing polyunsaturated fat intake, may be less beneficial for women should be acknowledged.

A greater distinction should be made between different types of fat. Public health policies will need continual review as new knowledge becomes available to ensure that recommended dietary changes will most effectively result in primordial prevention.

REFERENCES


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