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Change in quality of life and immune markers after a stay at a raw vegan institute: a pilot study

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Abstract

Objective—The purpose of this study was to explore changes in quality of life (QOL), anxiety, stress, and immune markers after a stay at a raw vegan institute.

Design—Prospective observational study.

Setting—English-speaking attendees at Hippocrates Health Institute (Florida, US), a raw vegan institute, were recruited on arrival and typically stayed 1–3 weeks.

Main outcome measures—Participants completed questionnaires assessing overall QOL (SF-36), dietary QOL (QOL Related to Dietary Change), perceived stress (Perceived Stress Scale), anxiety, and depression (Hospital Anxiety and Depression Scale) upon arrival and 12 weeks later. C-reactive protein (CRP), lymphocytes, T cells, CD4 cells, CD8 cells, B cells, and NK cells were measured at baseline and 12 weeks in participants living in North America.

Results—Of 107 attendees eligible for the questionnaire study and 82 for the blood marker substudy, 51 and 38 participants, respectively, provided complete follow-up data. Overall QOL improved 11.5% ($p=0.001$), driven mostly by the mental component. Anxiety decreased 18.6% ($p=0.009$) and perceived stress decreased 16.4% ($p<0.001$). Participants' ratings of the food's taste were unchanged, but their ratings of how well they were taking care of themselves improved. CRP, lymphocytes, T cells, and B cells did not change significantly, but CD4, CD8, and NK cells decreased slightly.

Conclusions—A stay at a raw vegan institute was associated with improved mental and emotional QOL. Studies are needed to determine the feasibility of conducting a clinical trial of the raw vegan diet among healthy people, and subsequently among patients with specific diseases.

INTRODUCTION

Raw vegan diets have received an increasing amount of attention in the press recently.(1) Various books and websites assert that raw vegan food has healing properties. Raw vegan diets consist of food that is plant-based, contains no animal products, and is uncooked or heated to temperatures no higher than about 118°F.

Little research has focused on the effects of eating only raw vegan food. However, studies indicate that following a vegetarian or vegan diet is associated with increased longevity(2), and decreased risk of cancer(3) and heart disease(4), and some evidence suggests that eating

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vegan food *raw* is more beneficial than eating it cooked.(5) Cooking both removes some nutrients and denatures important enzymes, such as myrosinase in cruciferous vegetables and alliinase in garlic, that convert certain nutrients to their anti-cancer forms. Cooking food also creates mutagenic and proinflammatory compounds.(6,7) In two intervention trials, patients with fibromyalgia and rheumatoid arthritis reported that while following a raw vegan diet they experienced alleviation of symptoms.(8,9)

There is also little information about the effect of consuming a raw vegan diet on the immune system. A study from 1930 showed that the white blood cell count increased after people ate food that had been cooked, but not after they ate the same food raw.(10) More recently, a clinical trial found that among subjects assigned to a raw vegan diet for one week, white blood cell counts decreased slightly, although the control group's white blood cell counts also decreased.(11) Another recent study found that vegans (not raw vegans) had lower leukocyte and lymphocyte counts than omnivores, but natural killer cell activity was similar in both groups.(12) C-reactive protein levels have also been found to be lower among healthy people following a raw vegan diet than among those following a standard American diet.(13)

Given the limited amount of research on the raw vegan diet, a prospective observational study of people who might begin following the diet was needed to explore its effects. The purpose of this study was to assess the effect of a stay at a raw vegan institute on overall quality of life (QOL), dietary QOL, and inflammatory and immune markers. We hypothesized that overall QOL would improve, but dietary QOL would diminish.

METHODS

Hippocrates Health Institute (HHI), in West Palm Beach, Florida, is a raw vegan institute where attendees usually stay 1–3 weeks, following and learning about a program that includes a strict vegan diet, nearly all of which is raw, wheatgrass juice and vegetable juice daily, exercise classes, stress reduction activities, psychotherapy, spa treatments, and other complementary therapies. Attendees' health ranges from very healthy to very ill. They are guests of HHI, not patients, and since this is not a medical facility, attendees almost always pay out of pocket for their stay.

Recruitment took place between August and October 2004. Attendees were approached for participation within a day of arrival. Eligible attendees were ≥ 18 years of age, able to speak and read English, well enough to participate, without dementia significant enough to be detected during the course of the interview, and intending to stay at least 7 days. To participate in the blood marker substudy, attendees had to expect to be in North America at the 12-week follow-up, and had to complete the questionnaire. Written informed consent was obtained from those who agreed to participate. The study was approved by the Institutional Review Board at Columbia University. Participants were asked to complete a baseline questionnaire and, if eligible, to have their blood drawn within a day of their arrival and about 12 weeks later.

Overall QOL was measured with the Medical Outcomes Study SF-36 (version 2), a well-validated and reliable measure of both the physical and mental components of QOL and functional status.(14) Dietary QOL was measured with the Quality of Life Related to Dietary Change Questionnaire(15), which asks respondents to rate the taste, convenience, cost, and self-care (belief that one is taking good care of oneself) aspects of their diet. The taste and self-care components have been shown to have good internal reliability (0.74 and 0.87, respectively).(16)

Subjects also provided data on their anxiety and depression, as measured by the Hospital Anxiety and Depression Scale(17); stress, as measured by the Perceived Stress Scale(18); and general well-being and pain, which were each measured with visual analog scales scored from

0 to 100. Adherence to the raw vegan diet was assessed with the question, “Whether or not you have been trying to follow a raw food diet, about what percent of your diet, by weight, is raw and vegan (no dairy, eggs or meat)?” Participants whose responses were $\geq 80\%$ were considered adherent to a raw vegan diet.

Fasting venous blood was drawn on the morning after arriving at HHI and shipped overnight at ambient temperature to Columbia University for processing. The blood for high sensitivity C-reactive protein (hsCRP) was drawn in 4-mL serum separator tubes, centrifuged within 30 hours at 2700rpm for 10 minutes, and then stored at -80°C .⁽¹⁹⁾ The baseline and follow-up hsCRP levels were measured simultaneously, in duplicate, using a standardized enzyme-linked immunosorbent assay (Life Diagnostics, Inc., West Chester, PA; sensitivity 0.1 mg/L). The immune markers measured were absolute counts for lymphocytes, T cells, CD4 cells, CD8 cells, B cells, and NK cells. Blood was drawn in 3-mL EDTA tubes, kept at ambient temperature, and processed within 30 hours. Lymphocyte phenotypes were determined by four-color flow Multitest™ cytometry: CD3/CD16+CD56/CD45/CD19, CD3/CD8/CD45/CD4; and Fastimmune™ cytometry: CD56/CD69/CD45 (Becton-Dickinson, San Jose, CA). Absolute counts were obtained using TruCOUNT™ control tubes (BD). Samples were prepared by the whole-blood, lyse/no-wash technique and analyzed on a FACSCalibur® flow cytometer (BD) with CellQuest software. The cytometer was calibrated on each day of analysis with CaliBRITE® beads (BD), using FACSComp software (BD).

Statistical analysis was done using SAS™ software (version 8.2, SAS Institute). Descriptive statistics, chi-square, and paired *t*-tests were conducted to analyze baseline characteristics and differences between those who completed the study and those who dropped out. All scores were transformed to range from 0–100. Paired *t*-tests and chi-square were used to assess changes from baseline to follow-up of the primary and secondary outcome measures and *t*-tests were used to compare results for those who were, and were not, adherent to the diet. These results were based on data from participants who had completed the study.

RESULTS

Of 107 attendees eligible for the questionnaire part of the study, 84 agreed to participate, and 51 completed the 12-week follow-up questionnaire (Figure 1). The median age of the initial cohort was 53 years, the majority were female, Caucasian, employed, and of upper socioeconomic status (Table 1). Although most participants were Protestant, Jewish, or Catholic, the largest religious group was “other.” For this category, participants most commonly wrote that they were part of no religion (11%), “spiritual” (6%), Christian (6%), or a combination of religions (5%). Most participants used complementary or alternative therapies (CAM) in the past year and a few were already following a raw vegan diet. Cancer was the most common disease diagnosis, and 18% had severe comorbidity. Participants often cited multiple motivations for going to HHI. The most common reasons were to feel better, to try to heal a physical or emotional illness, to learn how to eat better, and to ‘detoxify’ or ‘cleanse’ their bodies. A comparison of those who completed the study with those who dropped out showed no significant differences in these baseline characteristics, although substantially more people who completed the study were employed.

Quality of Life

As shown in Table 2, overall QOL improved significantly from baseline to the 12-week follow-up (+11.5%); most of the improvement was accounted for by mental QOL (+14.5%). Scores in all 8 subcategories in the SF-36 improved during the study; statistically significant improvements were observed in: role limitation due to physical problems (role physical, +11.9%), general health (+12.4%), vitality (+21.1%), social functioning (+14.6%), role limitation due to emotional problems (role emotional, +12.1%), and mental health (+16.1%).

Non-significant improvements occurred in the physical component summary score (+2.5%), and the subcategories, physical functioning (+1.7%) and bodily pain (+8.8%). The improvement in the bodily pain score was consistent with, though greater than, the non-significant improvement in the pain score on the visual analog scale (+1.1%; Table 3).

Those whose diet was $\geq 80\%$ raw vegan at the end of the study, but not at the beginning ($n=9$), were compared with those who were not following this diet at the end of the study ($n=37$) to better understand whether the changes in overall QOL were associated with adoption of and adherence to the diet. Although the differences between these groups did not reach statistical significance for any of the QOL comparisons, the group that began to follow the raw vegan diet by the end of the study scored better in every SF-36 category.

At the 12-week follow-up of those who were and were not following the raw diet, the dietary aspect of QOL improved significantly for self-care (+27.1%), and non-significantly for taste (+5.9%). Convenience and cost of food remained about the same. The group who had begun the raw vegan diet during the study had greater improvement in each dietary QOL category than the group not following the diet, although the differences were significant for cost and self-care only.

Mean baseline scores for anxiety and depression were less than the minimum considered abnormally symptomatic (abnormal ≥ 33.3), however, the mean anxiety score had decreased significantly (-18.6%) and the mean depression score non-significantly (-8.8%) at 12 weeks (Table 3). Perceived stress also decreased significantly (-16.4%). Overall well-being improved (+6.0%), but the improvement was not statistically significant. Scores for anxiety, depression, stress, and overall well-being improved more in the group who had begun to following the raw vegan diet during the study than in the group not adhering to it, however, none of these differences reached statistical significance.

In analyses of the entire cohort, assuming no change from baseline for those without follow-up data, the results for physical and mental QOL, dietary QOL, anxiety, depression, pain, and overall well-being were similar.

Of the 33 participants who did not complete the follow-up questionnaire, 3 reported in telephone conversations with one of the authors (LBL) that they believed their stay at HHI harmed them. Two were women in their 80s who had never tried a raw vegan diet before; they said that for weeks after their 1 week stay at HHI, they felt unwell even though they had reverted back to their usual eating habits. The third person, a man with advanced liver cancer, said he had lost too much weight on the diet and was very fatigued.

Inflammatory and Immune Markers

Of the 82 people eligible for the blood marker substudy, 66 agreed to participate, and 40 provided follow-up blood specimens. One follow-up blood was excluded because the participant did not return the follow-up questionnaire and another because it was delayed in shipping. A comparison of those with and without follow-up blood markers showed no statistically significant differences in the baseline characteristics listed in Table 1. High-sensitivity CRP did not change significantly over the 12 weeks in the cohort (Table 4). All immune markers measured (lymphocytes, T cells, CD4 cells, CD8 cells, B cells, and NK cells) decreased from baseline to follow-up, with small, but statistically significant decreases in CD4 cells, CD8 cells, and NK cells. There were no significant differences when comparing the change in immune markers of those with a comorbidity score of zero ($n=23$) and those with a score > 0 ($n=15$). Of note, the CRP levels decreased over the 12 weeks (-0.21) in the former group while it increased ($+0.53$) in the latter group, but this difference was also not statistically significant.

DISCUSSION

Participants in this study were similar to others who use CAM in that the majority were female, educated, and of higher socioeconomic status, and many had a history of cancer.(20) At 12 weeks after their baseline measurements, subjects who had stayed at the raw vegan institute reported improved QOL, specifically mental QOL, anxiety, and stress. Staying there was also associated with the belief that participants were taking better care of themselves, particularly those who were newly adhering to the diet at 12 weeks. CRP did not change significantly over the 12 weeks, but some subgroups of lymphocytes did decrease slightly.

A strength of our study is that it addresses the health effects of an increasingly popular diet, the raw vegan diet, about which little is known. In addition, the study was longitudinal and included many subjects who were new to the diet. A limitation is that the subjects were a self-selected group of people, unrepresentative of the general population, and the sample size was small, particularly for those adhering to the diet and for those whose blood was analyzed. There were a number of participants who did not provide follow-up data, however, their baseline characteristics were similar to those with complete follow-up data, and analyses that assumed no change from baseline for the dropouts showed similar results. Although not formally assessed, subjects frequently stated that they were too busy to complete the survey and blood tests. Finally, our method of assessment of adherence to the raw vegan diet has not been validated; our findings should therefore be considered an estimate of adherence.

Diet's effect on QOL is most frequently considered in studies of gastrointestinal diseases. We included it in our study because we wanted to capture the effects of diet on well-being among people with a broad spectrum of diseases and without a specific disease diagnosis. In addition, complementary therapies (CAM) are commonly used to improve QOL.(21) We observed little change in participants' physical QOL, but significant improvement in their mental QOL. These changes may be due to the change in diet, perceived improvement in self-care, the stay at HHI, or other lifestyle changes. A study of prostate cancer patients showed that CAM users experienced less psychological distress, over time, than non-users.(22) Improved QOL may also have occurred because the participants in our study had a very high internal locus of control at baseline (results not shown). If they felt they were doing something to control their health by going to HHI, those who were ill might have more confidence that they would be cured (5), and therefore, experience less stress. In some respects, a stay at HHI is more like a vacation than a health care intervention. So some of the improvement in QOL may reflect the self-renewal that vacations are intended to provide. However, that improvement was reported 2 months after subjects departed from HHI. Finally, although the raw vegan diet is a focus of the program, there are a number of other elements to the HHI program, such as exercise and supplements, which could account for these changes.

Contrary to our expectations, dietary QOL did not diminish, though the raw vegan diet is very restrictive and different from the standard American diet. Even those subjects who reported that they were adhering to the diet did not rate their diet's taste, cost, and convenience on follow-up lower than at baseline. These results may reflect the selection factors for choosing to stay at HHI. However, a vegan diet that included cooked food also had high acceptability in a study of overweight, post-menopausal women.(23) Future studies with longer follow-up are needed to assess duration of both adherence to and satisfaction with the raw vegan diet.

Mean hsCRP rose slightly. This finding contradicts those of a cross-sectional study comparing adherents of the raw vegan diet with omnivores.(13) However, it is consistent with a study of the diet in rheumatoid arthritis patients, in which CRP increased non-significantly over the 2–3 month intervention, while participants' symptoms improved.(24) It may be that among subjects who initiate a raw vegan diet, CRP increases in the short term, but decreases in the

long term. The effect of the diet on CRP also may depend on baseline health status. The subjects of the above-mentioned cross-sectional study were without chronic disease, unlike the participants in the rheumatoid arthritis study. In our study, mean CRP levels decreased slightly among those with a comorbidity score of zero, while it increased slightly among those with higher comorbidity scores.

The decrease in the different types of lymphocytes was consistent with results from one raw vegan study(11) and one vegan study(12), each of which showed a decrease in white blood cell count. Although there was a decrease in the absolute number of natural killer cells, which are thought to fight diseases such as cancer(25), their activity may not have changed, as was found in a study of vegans.(12) Psychosocial interventions have also been found not to increase the number of natural killer cells.(26,27) It remains to be determined whether the change in number of certain subgroups of lymphocytes is clinically meaningful.

This exploratory study indicates that a stay at a raw vegan institute is associated with improvement in mental and emotional quality of life 12 weeks later, and has minimal adverse effects for most people. Since this was not a randomized intervention study, it is impossible to be sure if this positive outcome is a result of the raw vegan diet, a different aspect of a stay at HHI, or some other factor. Nevertheless, these results may be reassuring for clinicians whose patients follow this extreme diet. Of note, a cross-sectional study deemed the raw vegan diet unsafe based on the prevalence of underweight and amenorrheic adherents.(12) Thus, particular attention to these outcomes is warranted in future studies and in clinical practice. The negative experiences reported by the 2 elderly women and the man with advanced cancer also suggest that extra caution is needed when studying vulnerable populations.

Results of this study should help guide future studies of this diet by providing information about the short-term safety and acceptability of the diet and showing that it may also be beneficial. Although, for the most part, we did not find the raw vegan diet to be associated with significant changes in selected immune or inflammatory markers, other studies have shown it to be associated with elevated and lower CRP levels, possibly related to baseline health status or other unknown factors.(13,24) Aside from this study, little information is available regarding the raw vegan diet's effect on adherence, quality of life, and other immune markers. Information from this study may help to inform power calculations for interventional studies that evaluate the diet, first in a population of healthy people and subsequently in those with disease. Such studies would help clarify the diet's effects on quality of life and the immune system as well as the course of specific diseases.

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Figure 1.

Flow chart for participant recruitment and follow-up in both the questionnaire and blood marker components of the study. Attendees could participate in the questionnaire component only, but to take part in the blood marker component, they had to complete the questionnaire.

Table 1

Baseline characteristics

	Initial cohort (N=84)	Completed study (N=51)	Dropped out (N=33)	<i>p</i> -value [*]
Median age (range; yrs.)	53 (23–86)	51 (23–86)	54 (25–84)	0.67
Male (%)	27	25	30	0.63
Married (%)	40	49	45	0.75
Caucasian (%)	87	88	85	0.65
Employed (%)	56	63	45	0.12
Income > \$75K (%) ^{**}	60	63	64	0.78
≥ College degree (%)	48	49	45	0.75
Religion				0.57
Protestant (%)	24	24	24	
Catholic (%)	19	20	18	
Jewish (%)	16	12	21	
“Other” (%)	39	43	33	
Used CAM in past yr. (%)	81	84	76	0.33
Following raw vegan diet (%)	13	16	9	0.38
Length of stay (%) [†]				0.41
1 week	37	37	38	
2 weeks	16	14	19	
3 weeks	45	49	38	
>3 weeks	2	0	6	
Comorbidity score (%) ^{††}				0.75
0	56	59	52	
1	11	8	15	
2–3	16	16	15	
≥4	18	18	18	
Most common diseases (%)				
Cancer	24	26	21	0.65
Depression (self-described)	16	14	18	0.58
Diabetes mellitus	12	10	15	0.46
Thyroid disease	12	8	18	0.15
Cardiovascular disease	10	8	12	0.51
No medical problems (%) [‡]	17	18	15	0.74

NS, non-significant

^{*} Comparing those who completed the study and those who dropped out.^{**} Five values missing from ‘Completed study’ group; two values missing from ‘Dropped out’ group.[†] One missing value from ‘Completed study’ group.^{††} A score ≥4 is considered severe comorbidity.[‡] One missing value from ‘Dropped out’ group.

Table 2

Change in quality of life.

Scale: 0–100	Baseline	12-week follow-up	p-value
Overall quality of life *	65.4	72.9	0.001
% who said health is somewhat or much better than one year ago	26%	51%	0.03
Mental component summary score	40.8	46.7	<0.001
Physical component summary score	48.9	50.1	0.26
Physical functioning	77.2	78.5	0.54
Role physical	68.8	77.0	0.04
Bodily pain	66.0	71.8	0.18
General health	65.3	73.4	0.001
Vitality	48.7	59.0	0.001
Social functioning	65.9	75.5	0.03
Role emotional	67.2	75.3	0.02
Mental health	62.7	72.8	<0.001
Dietary quality of life **			
Taste	73.0	77.3	0.14
Convenience	62.1	61.1	0.85
Cost	55.3	55.3	1.00
Self-care	55.3	70.3	<0.001

* SF-36. All values represent means scores, unless otherwise specified.

** Quality of life related to dietary change questionnaire.

Table 3

Change in mean scores of other self-reported outcomes.

Scale: 0–100	Baseline	12-week follow-up	<i>p</i> -value
Anxiety [*]	27.1	22.0	0.009
Depression [*]	22.7	20.7	0.28
Perceived stress ^{**}	41.6	34.8	<0.001
Pain [†]	84.0	84.9	0.76
Overall well-being [†]	71.9	76.2	0.08

^{*} Hospital Anxiety and Depression Scale. Scores > 33.3 are considered abnormal.

^{**} Perceived Stress Scale

[†] Visual analog scales (0–100)

Table 4Change in blood marker values (mean $\pm$ sd).

Blood marker	Baseline	12-weeks	<i>p</i> -value
hsCRP	2.59 $\pm$ 2.92	2.67 $\pm$ 2.95	0.82
Lymphocytes *	2295 $\pm$ 741	2129 $\pm$ 860	0.07
T cells *	1770 $\pm$ 644	1641 $\pm$ 681	0.07
CD4 cells *	1190 $\pm$ 476	1070 $\pm$ 449	0.04
CD8 cells *	505 $\pm$ 260	462 $\pm$ 260	0.04
B cells *	263 $\pm$ 163	253 $\pm$ 156	0.60
NK cells *	286 $\pm$ 149	241 $\pm$ 95	0.04

* Values represent absolute count in cells/uL.