
Waianae Diet Program: Long-Term Follow-up

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Abstract

A long-term follow-up was conducted on 82 participants from prior programs based on *ad libitum* feeding of a traditional Hawaiian diet. Follow-up period ranged from 12 months to 90 months and averaged 33.67 months. An average weight loss of 15.1 pounds was maintained over 7.5 years of follow-up ($p < 0.0005$) even when stratified over two year intervals, suggesting that this type of program may be an effective long-term weight loss intervention.

Introduction

Obesity is a serious health problem in America; the national prevalence is approximately 31% in men and 34% in women¹ and it has been rising over the past 30 years.² It is associated with higher risks of a number of chronic diseases, such as cardiovascular disease, cancer, hypertension, and diet-induced diabetes. Obesity is of special concern among Native Hawaiians, as this ethnic population has one of the highest prevalences of obesity at approximately 64%.³ Furthermore, Native Hawaiians have among the highest age adjusted mortality rates in the Nation from disease associated with obesity, such as cardiovascular disease, diabetes, and stroke.⁴

Over the years, numerous approaches to the problem of obesity have been attempted using calorie restriction, exercise, meal substitution, surgical correction, medication, self-imposed fasting, and behavior modification. Unfortunately, while all of these approaches have demonstrated initial success, practically none of these interventions have shown any long-term efficacy in retained weight loss.⁵

Recently traditional diets, such as a traditional Mediterranean diet⁶ and traditional Asian diet,⁷ have been discussed as a viable approach to health risk factors and obesity intervention. The *ad libitum* use of a traditional Native Hawaiian diet coupled with a whole person approach, including lifestyle changes unique to the ancient culture and perspective has been previously evaluated in the Waianae Diet Program for its short term efficacy.⁸ However, the long term effectiveness of this approach has not been evaluated.

This article presents an analysis of a long term follow-up of individuals who have participated in an obesity and cardiovascular risk reduction program employing *ad libitum* feeding of a traditional Hawaiian diet known as the Waianae Diet Program.

Methods

The Original Intervention/Study

The original intervention evaluated was a 21 day dietary and lifestyle change program. A number of these programs were conducted over a 9 year period since the first intervention. Groups of approximately 20-25 men and women aged 24-64 years were fed an *ad libitum*, whole meal diet of traditional foods available in Hawaii before Western contact, such as taro, poi, sweet potato, yams, breadfruit, and greens (fern shoots and leaves of taro), fruit, seaweed, fish, and chicken. These staples were prepared in a manner that approximated ancient styles of cooking. To approximate the diet of the ancient Hawaiians, which was estimated to contain <10% fat, the amounts of fish and chicken were limited to a total of 142-198 g/d. As a part of the intervention, a whole-person oriented education component perspective was also provided in this program. In the evenings, during the dinner portion of the program, everyone met for cultural or health education sessions. Details of the intervention are described in previous publications.^{8,9}

After-program Follow-up

After each twenty-one day program, the participants organized follow-up for themselves usually in the form of weekly pot-lucks or monthly gatherings for support and the sharing of meals. This fellowship, most often, was undertaken enthusiastically shortly after the program, however, interest dwindled within a few months of each program. Thus, organized follow-up was not consistent. Nevertheless, participants in general, continued to apply the principles of the diet and lifestyle to the extent that they could on their own without much professional support.

Long-term Follow-up Study

Eight years after the first program was conducted, a formal survey was undertaken in order to track the long-term results and efficacy of the program. In order to ensure that the follow-up period was of sufficient length, only those participants who had completed their respective programs one-year or more prior to this survey were included in the pool of eligible participants. An attempt was made to contact each participant in each of the 8 programs who were closely monitored and who completed one year or more prior to the

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follow-up or longer. All participants in these programs with a known phone number or address were called and letters sent in an attempt to schedule them for a physical measurement of their weight.

Each participant who came in for follow-up was weighed on a balance scale similar to that which had been used in all prior programs. In addition, each participant was interviewed as to their knowledge, attitudes and behavior, and a health assessment was conducted. Encouragement and additional health and nutrition education were provided at this interview. The date of each interview was recorded so that the duration since the original diet could be calculated.

Statistical Analysis

The statistical significance of the results of the program was analyzed using a paired, two-tailed test, and a 95% confidence interval for the difference between the means was calculated.

Results

Of the 173 participants in the 8 groups eligible for this follow-up study, we were able to contact and make appointments for 82 individuals for follow-up and weigh-in at the Waiānae Coast Comprehensive Health Center. The follow-up period ranged from 12 months to 90 months with an average follow-up time of 33.67 months. As the time of follow-up became greater, a smaller percentage of the participants could be contacted. The attrition rate was due to a number of factors. The most difficult factor was out-migration from the community and inability to locate a current phone number or address. Another factor included the fact that follow-ups were done during working hours and many of the participants were unable to come in for a follow-up due to their employment commitment which contributed further to the attrition rate. Six of the participants of the original programs who would have otherwise been eligible for this survey were deceased.

The original weight loss over the initial three week program in these participants who completed the survey was an average of 13.9 pounds. The overall mean weight loss over all periods of follow-up of the 82 individuals surveyed was 15.1 pounds or 6.85 kg. The greatest amount of weight loss was 174 pounds, 78.9 kg, and the

second greatest amount was 117 pounds, 53.1 kg. The greatest amount of weight gained was 31 pounds, 14.1 kg. Of the 82 individuals, fifty-five (67%) individuals weighed less than they did when they started and 27 remained the same or weighed more. Among these 55 individuals, 43 (52.4%) weighed 10 or more pounds less than when they started; 24 (29.3%) weighed 20 or more pounds less; 15 (18.3%) weighed 30 or more pounds less.

Retained weight loss stratified over time was also examined in figure 1. One would expect the weight loss to diminish with time, especially in light of the studies that indicate that most diet programs see their participants gain their weight lost back in only a few years.^{10,11} Remarkably, however, the retained reduction of weight remained fairly constant over time, when participants are stratified into periods of follow-up at two-year intervals.

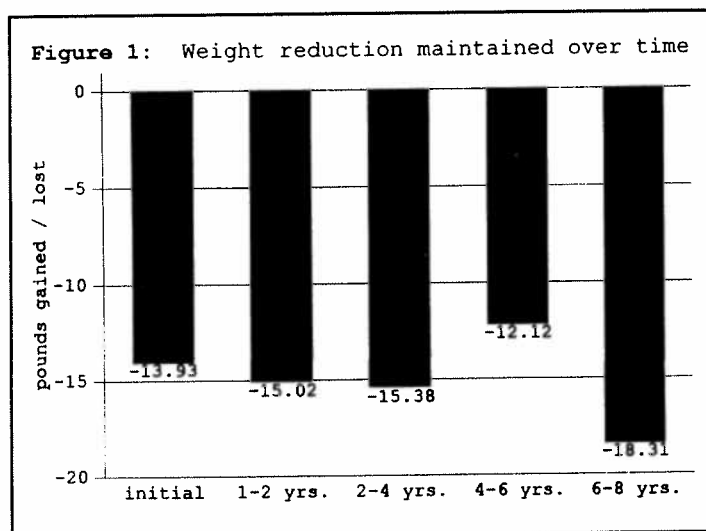
Of the 82 individuals surveyed, 36 of them were surveyed one to two years after their participation in the program and they weighed a mean 15.02 lb or 6.81 kg ($p < 0.0133$) less than they did when they started. There were 28 participants who were in the two to four year follow-up period and they weighed a mean of 15.38 lb or 6.98 kg ($p < 0.0098$) less than that of when they had started. There were 10 participants surveyed in the four to six year time period and their mean weight was 12.12 lb, 5.49 kg ($p < 0.1960$) less than their beginning weight. The remaining 8 individuals were surveyed six to eight years from time of completion of the WDP. They weighed a mean of 18.31 lb or 8.31 kg ($p < 0.0789$) less than what they did at the start of the intervention.

Discussion

The use of an *ad libitum*, low fat, traditional Hawaiian diet has been shown to induce short-term weight loss in obese adults. This phenomenon may be due, primarily, to its high bulk, high carbohydrate, low fat content. Epidemiological studies have positively correlated obesity with high amounts of dietary fat. One reason may be that the high bulk of the diet increases satiety and its low energy density causes a reduction in caloric intake despite an increase in the total amount of food consumed. Other studies of *ad libitum* diets have shown that subjects spontaneously consume less calories on high carbohydrate diets.^{12,13,14} In addition, a low fat diet has a positive correlation with leanness¹⁵ and weight loss^{16,17} independent of caloric intake. This suggests that there are other factors aside from caloric intake that contribute to obesity.

Short term analysis

While the average weight loss of some other weight reduction programs is greater than in this study, those results cannot be compared directly to the results of this program as treatment usually spanned several months longer than this three week program. Therefore, comparisons were made using the rate of weight loss, calculated from the results of original research by dividing the total average weight loss by the duration of treatment. Over the 21 d treatment period, the mean weight loss for all subjects was 2.1 kg/week. Other studies using the low fat approach had substantially lower rates of weight loss than ours.^{18,19,20,21,22,23} Studies using the behavior modification approach also had relatively modest rates of weight loss in comparison.^{24,25,26} One study using the "very low calorie diet" (VLCD) approach had results that were the most similar to our findings,²⁷ but another showed rates similar to those



found using behavior modification alone.²⁸ Our rate even exceeded the rate of weight loss in a study using the combination of VLCD and behavior modification.²⁹

Long term analysis

The success of any obesity treatment program must be measured in terms of weight loss maintenance because obesity is a chronic condition. Atkinson asserts that "life-long follow-up by health professionals... is needed. Maintenance of weight loss or improvement in complications for 6 months is a minimum standard; lesser periods have little meaning." In fact, "full success," defined by Atkinson, "is a 5-year period of weight maintenance [for patients with chronic obesity]."³⁰

Again, due to the relatively short period of the initial program, 21 days, data taken from original research had to be reanalyzed for comparison purposes. Percent weight regain was chosen as a good guideline for comparison as well as a measure of weight cycling. Studies have found that fluctuations in body weight may result in increased long term health risks.^{31,32}

After 8 years of follow-up, on the average, none of the weight lost while on the Waianae Diet Program was regained. While individual weight loss or weight regain varied widely from each individual, the overall average weight loss remained at about 15 pounds. A significant constancy in the amount of weight loss retained through the first four years of follow-up and then at the six to eight year follow-up interval demonstrates that this approach appears to limit the dangers of weight cycling due to the relatively slow rate of weight regain. Continuity of weight loss was maintained over the four to six year interval of follow-up as well, though the level of significance was somewhat marginal.

Few studies have been conducted that demonstrate the success of weight loss programs after two or more years.³³ One behavior modification program conducted by Lavery, et al. yielded similar results to ours, though the amount of weight loss maintained was noticeably less than our results. Participants demonstrated a net weight loss of 5.8 kg at time of a 2 year follow-up.³⁴ Percentage weight regain of three other weight loss programs was significantly higher than ours: Kramer, et al., showed a weight regain two years after a behavior modification program of 62% in group A and 65% in group B.³⁵ The study by Wadden, et al., long term evaluation of VLCD, behavior therapy, and their combination yielded weight regains of 84%, 75%, and 73%, respectively, in a three year follow up.³⁶ In a successive study with a 5 year follow-up, Wadden et al., demonstrated similar results. Only 11.1% of subjects following a VLCD maintained a weight loss of 5 kg or more and 10 kg or more. 13.3% of subjects on behavior therapy maintained a weight loss of 5 kg or more, whereas 0% could maintain a weight loss of 10 kg or more. Combination therapy allowed 27.3% and 9.1% of subjects to maintain a weight loss of 5 kg more and 10 kg or more.³⁷ Hovell, et al., presented subjects who lost a mean of 83.9% of their excess weight, only to regain an average of 59% to 82% of their initial excess weight by 30 months of follow-up.³⁸

Other studies examining the efficacy of an *ad libitum*, low fat, high carbohydrate diet have confirmed its greater effectiveness in promoting sustained weight loss, though their follow-up period was not as extensive: In one such weight maintenance program by Toubro and Astrupin which an *ad libitum* diet or a fixed energy

regimen was administered, 65% of those subjects following the *ad libitum* diet maintained a weight loss greater than 5 kg after one year of follow-up. Comparatively, only 40% of those subjects on a fixed energy intake were able to maintain a weight loss greater than 5 kg at time of follow-up. The *ad libitum* group also maintained 13.2 kg of the initial weight loss of 13.5 kg, whereas the fixed energy intake group maintained 9.7 kg of the initial 13.8 kg weight loss.³⁹ This clinical study and a successive review by Astrup, et al., concluded that, "after a major weight loss, an *ad libitum*, low fat, [high carbohydrate] diet program, appears to be superior to calorie counting in maintaining weight loss 2 years later [from initial treatment]."⁴⁰ Fitzwater, et al., also showed additional average weight loss at two years follow-up: 53% of subjects maintained their weight loss or continued to lose weight; 24% regained some weight, but below that of their pretreatment weight, whereas 23% incurred full weight rebound.⁴¹

The steady maintenance of weight during the 90 month period was remarkable in that the mean weight reduction remained at 15 pounds. While these figures are very promising, they do need to be read with some caution. First it should be noted that as may be expected, as time elapsed, there were fewer participants who could be reached. Thus, the groups with a longer follow-up period had fewer participants: The 4-6 year follow-up group had only 10 participants who were measured in this survey, whereas the 6-8 year group had only 8 participants. This decrease in "n" had a commensurate effect on the significance of the survey results. There may also be some measure of selection bias as some of the individuals may have declined to participate if they had not retained much of their healthy lifestyle and weight control habits. Finally, the individual weight and amount of weight loss varied fairly broadly from individual to individual, especially in the later follow-up intervals. This wide variation had a consequential effect on the associated confidence indexes per time interval, as some participants loss a remarkable amount of weight, while a few gained in weight. Again, the corresponding p-values from the 4-6 year and 6-8 year marks are only moderately reliable as they are not significant. With these cautions in mind, a complete survey of the long-term weight loss of the *ad libitum* feeding of traditional Hawaiian diet reveals a remarkable consistency that suggests an effective long-term dietary intervention.

Assuming the results are real we can at least speculate about what is it about this program that yields these relatively good results. As with other *ad libitum* feeding diets, we experienced results that were superior to simple calorie restriction diets. It appears that an approach to weight loss that features *ad libitum* feeding of foods high in mass to energy ratio yet are low in mass to energy density is an easier approach to maintain than other diets. It may be that a whole person approach, which includes modifications based on traditional Hawaiian diet had a long-term impact on diet and lifestyle changes even without consistent follow-up or support. This has important implications in hard to reach populations such as those with lowered socio-economic status and in minority groups who may be alienated from white-middle class level health education.

Conclusion

In this long-term follow-up survey, the traditional Hawaiian diet administered *ad libitum* is a comparatively effective approach to the

Table 1.— Overall weight loss results

n	Mean Follow-up Duration	Group Mean Weight Gain/Loss	p-value
82	33.67	-15.11	0.0000265

Table 2.— Mean weight loss stratified over time.

Group	n	Variable	Mean	p-value	Lower 95% CLM	Upper 95% CLM
1-2 yrs	36	Follow-up (mo.)	13.78			
		Mean start weight	242.89			
		Mean end weight	227.88			
		Mean weight +/-	-15.02	0.01	-26.71	-3.32
2-4 yrs	28	Follow-up (mo.)	36.57			
		Mean start weight	257.40			
		Mean end weight	242.03			
		Mean weight +/-	-15.38	0.01	-26.73	-4.03
4-6 yrs	10	Follow-up (mo.)	60.60			
		Mean start weight	266.22			
		Mean end weight	254.10			
		Mean weight +/-	-12.12	0.196	-31.75	7.51
6-8 yrs	8	Follow-up (mo.)	79.38			
		Mean start weight	270.69			
		Mean end weight	252.38			
		Mean weight +/-	-18.31	0.0789	-39.38	2.76

treatment of obesity in terms of rate of weight loss and extended maintenance. Utilizing a whole person approach, including lifestyle behavioral modification, culture-sensitive education, and *ad libitum* feeding of traditional foods, participants on average were able to maintain a consistent weight loss over the course of eight years following the cessation of the initial program.

Some discretion should be exercised however, when interpreting these results. Over the course of follow-up, contact with many of the participants could not be established or maintained for various reasons. Ideally, the number of participants in successive follow-up years should be maintained so as to strengthen the significance of the results. Future studies should also add a control group and provide for closer long-term follow-up so that a larger percentage of the participants from the original interventions may be included in the long-term analysis. It is also suggested that the subjects should be reevaluated at least annually with blood analysis for serum lipids, glucose and other health risk factors to provide an even more detailed survey. Nevertheless, a positive overall performance from this three week, whole person, *ad libitum* program may be an effective long-term weight loss intervention and warrants further study.

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