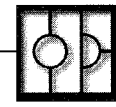

Research Article

The Coronary Health Improvement Projects Impact on Lowering Eating, Sleep, Stress, and Depressive Disorders

Ray M. Merrill, Stephen G. Aldana, Roger L. Greenlaw, and Hans A. Diehl

ABSTRACT

Background: *The Coronary Health Improvement Project (CHIP) is designed to lower cardiovascular risk factors among a group of generally healthy individuals through health education.* ***Purpose:*** *This study will evaluate the efficacy of the CHIP intervention at improving eating, sleep, stress, and depressive disorders.* ***Methods:*** *A health education randomized experimental study was used, with 348 participants, ages 24 to 81 years, from metropolitan Rockford, Illinois.* ***Results:*** *Higher Beck Depression Inventory (BDI) scores at baseline were significantly associated with being overweight, being physically inactive, eating little or no breakfast, eating fast, sleeping less than six hours per night, restless sleep, insomnia, very few vacations, feeling under pressure, being easily emotionally upset, feeling muscular tension, and feeling fearful or depressed. Each of these items showed a significantly greater improvement through six weeks and six months among those in the intervention group compared with the control group. BDI scores through six weeks and six months of follow-up were also significantly lower among those in the intervention group compared with the control group.* ***Discussion:*** *Selected eating and sleep practices were associated with depression. Eating little or no breakfast has been associated with health-compromising behaviors that may increase stress and depression. The health education intervention designed to reduce cardiovascular risk improved eating and sleep practices and reduced stress and depression.* ***Translation to Health Education Practice:*** *Lifestyle change programs such as CHIP aimed at improving physical health behaviors can likewise have a profound influence on mental health.*

BACKGROUND

Health education intervention programs are currently available to improve cognitive understanding of the importance of adopting certain dietary and physical activity behaviors and lifestyle choices. The aims of such programs are to improve health. The Coronary Health Improvement Project (CHIP) is a health education intervention that teaches people the importance of making better choices in nutrition, physical activity, and tobacco in order to prevent, arrest, and even reverse coronary heart disease.[1-2] Since 1988, over 40,000 individuals in faith-based communities, worksites, hospitals, and municipalities have participated in the CHIP.[3] Today there are over 150 CHIP alumni groups representing diverse settings.[3] This intervention is designed to improve people's knowledge of risk factors associated with chronic conditions such as diabetes, hypertension, cardiovascular disease, and cancer, with the goal of improving health behaviors. A randomized experimental study, along with other studies, have identified the efficacy of the CHIP intervention at improving health knowledge, diet and physical activity, and reducing several cardiovascular risks, including obesity and physical inactivity.[4-8]

Weight loss has been shown to improve mood state, psychosocial functioning, mental well-being, as well as decrease anxiety and depression.[9-13] Physical activity has also been associated with improved mood and lower levels of anxiety and depression.[14-18]

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It may also be a reasonable alternative to antidepressant medication in some patients suffering from milder forms of depression.[19] Further, adequate B complex of vitamins in one's diet may lower the risk of depression.[20,21] Excessive alcohol and caffeinated drinks may actually worsen depression because alcohol is a depressant and caffeine may prevent deep, restful sleep.[22-24]

PURPOSE

The CHIP focuses on improving risk factors associated with coronary heart disease. However, as the CHIP influences body weight, physical activity, and sleep and eating practices, stress and depressive disorders will also be influenced. Participation in the CHIP program may also provide a social support system that promotes better mental health. This study will evaluate the efficacy of the CHIP at directly and indirectly, through changes in physical health, improve stress and depressive disorders.

METHODS

Subject Recruitment and Design

There were 403 individuals assessed for eligibility by the SwedishAmerican Center for Complementary Medicine (SACCM) in the greater Rockford, Ill, metropolitan area. Recruitment involved targeted advertising and marketing through the Centers of Excellence, CHIP alumni groups, corporate client sites, and the SwedishAmerican Medical Group. After excluding 26 individuals because of major health problems that would prevent them from exercising, 377 individuals completed baseline data collection. There were 29 individuals further excluded because of lack of interest in participating in the follow-up phase of the study. Thus, 348 participants were randomly assigned to either the health intervention class or the control group. Control participants were scheduled to take the health intervention group six months later. The study coordinator conducted the participant sign-up process, randomization, and group assignments.

The percent who participated with a partner or significant other was 42, in which the unit of randomization was the *pair*. No significant differences were observed at baseline in age, sex, race, marital status, annual family income, or education between those who participated as pairs versus individuals. By six weeks, nine people in the intervention group and three people in the control dropped out of the study. By six months, these numbers increased to 21 and 9, respectively. Analyses are based on the intent to treat method, with their initial scores carried forward. All participants provided informed consent. The class cost $290, but all the money was returned to those who completed the intervention. Attendance ranged from 80% to 100% at each of the sessions. Program sign-up, randomization via a random number generator, and group assignments were made by the study coordinator. The study was approved by the Institutional Review Board of the SwedishAmerican Health System on August 29, 2002.

CHIP Intervention

In March 2003, intervention participants met for four weeks, four times a week, for two hours per session where they attended lectures, food demonstrations, and question and answer sessions. The lectures were conducted by Dr. Hans Diehl, the founder of the CHIP intervention. In Week 1, the four classes cover the limitations of high-tech medical approaches in dealing with lifestyle related diseases; atherosclerosis, the culprit in many diseases; a review of the risk factors for coronary heart disease; and basic guidelines for healthy, sustained weight loss. In Week 2, the four classes cover smoking and the role of fiber in preventing and reversing lifestyle diseases; reversing hypertension and lifestyle factors that can arrest or reverse diabetes; effective cholesterol control; and the role of excessive fat intake in lifestyle diseases. In Week 3, the four classes cover the benefits of regular exercise in preventing and arresting disease; causes and prevention of osteoporosis; clinical studies that demonstrate how lifestyle choices are related to health; and positive dietary guidelines for preventing and reversing disease. In Week 4, the four classes cover dietary factors in the development and prevention of common cancers, the importance of adaptability in achieving and maintaining optimal health, building self-esteem, and the development, preservation and role of self-worth in a healthy person.

Theory-based intervention planning was used to develop the curriculum, class design, alumni association, and each of the take-home assignments.[25-27] Learning theory (behaviorism) was incorporated into the intervention to promote changes in physical and dietary behaviors. The CHIP alumni program was designed to help participants maintain positive behavior changes.

Along with the class lectures, participants received a health promotion textbook and workbook that followed the discussion topics. Assignments and learning objectives were included in the workbook to assist participants in understanding and integrating the concepts and information into their own lives. The workbook allowed participants to test their knowledge through several review questions. Completing workbook assignments required approximately 30 minutes outside of class. Dietitians and medical professionals spoke to the group weekly, introducing them to current nutritional and medical information related to the prevention of chronic disease. Further, participants had access to scheduled shopping tours and cooking demonstrations given by a dietitian. Program staff presided at each of the educational sessions to answer questions.

Participants were encouraged to adopt a more plant food-based diet, which emphasized eating "as-grown," unrefined foods high in complex carbohydrates and fiber, and low in fat, animal protein, sugar, and salt. Eating more whole grains, legumes, vegetables, and fresh fruits was encouraged. Reducing dietary fat to less than 20% of energy, and lowering intake of animal protein, sugar, and salt was also encouraged. Walking or exercising at least 30 minutes per day was a goal that all participants were encouraged to make and keep.

After the class, participants were encouraged to join the Rockford CHIP Alumni Organization for an annual cost of $25 per individual or $35 per couple. Alumni were also encouraged to attend special lectures

on healthy living and were provided ways to maintain healthy behaviors. A monthly newsletter containing information about health-promoting community events such as healthy dinners, walking groups, and support-group meetings was sent to all enrolled in the alumni organization.

Measures

Data was gathered and recorded by a registered nurse at baseline, six weeks, and six months. Demographic data was collected only at baseline. Exercise was self-reported using the categories: (1) none; (2) mild (2-3 days/week); (3) moderate (3-5 days/week); and (5) vigorous (4-6 days/week), which closely related to total steps measured by a seven-day self-recorded pedometer log maintained by each participant during one-week periods at baseline, six weeks, and six months. The Walk4Life Model 2000 Life Stepper pedometer (Plainfield, Ill) was used, worn on a belt at the right hip directly above the right kneecap each day for seven days. Immediately prior to going to bed, the pedometer counts for the day were recorded and the number reset. Tobacco smoking, alcohol drinking, and coffee/tea drinking were self-reported, with the latter two variables reflecting their typical number of drinks per week. Weight and height were measured using standard medical scales recently calibrated by the Biometrics Department of the SwedishAmerican Health System. Body Mass Index (BMI) was determined as weight (kg)/height (m^2). In addition, participants indicated whether they had ever been told by a physician that they were overweight.

The shorter Beck Depression Inventory (BDI-SF) was used for assessing depressive symptoms, which has been shown to have a high degree of internal consistency and correlation with the original BDI.[28-30] The reliability and validity of the BDI-SF in older adults has been established previously.[31] Categories of depression for the BDI-SF have been established as 0-4 (not depressed), 5-7 (mildly depressed), 8-15 (moderately depressed), and 16-39 (severely depressed).

Questions about rest and stress were taken from a lifestyle evaluation used by the Lifestyle Medicine Institute, Loma Linda, Calif. Participants were also asked to indicate yes or no to the following items: (1) evening is the biggest meal; (2) eats little or no breakfast; (3) eats between meals; (4) eats fast; (5) obtains less than six hours of sleep per night; (6) sleeps restlessly; (7) experiences insomnia; (8) goes on very few vacations; (9) feels under pressure; (10) easily emotionally upset; (11) feels muscular tension; and (12) feels fearful or depressed.

Statistical Techniques

Cross-tabulations were used to perform bivariate analyses between selected variables, with statistical significance based on the chi-square test for independence. The Mantel-Haenszel Chi-square test was used to evaluate differences in trends for levels of selected variables across ordinal categories of BDI. Differences in means between independent groups adjusted for selected variables were evaluated using the *F* test, which involved type III sums of squares. The Cochran-Mantel-Haenszel statistic was used to evaluate the association between dichotomous variables, adjusting for selected variables. Relative risks were derived to assess the risk of selected variables related to mental health according to intervention status. Finally, multiple regression was used to evaluate the association between BDI and selected independent variables. Analyses were performed using SAS version 9.1 (SAS Institute Inc., Cary, NC, USA, 2003). Statistical significance was based on the 0.05 level.

RESULTS

There were no significant differences between participants in the intervention and control groups with respect to age, gender, marital status, race, income, education, and employment at baseline. Distributions of these selected variables are presented in Table 1. Participants tended to be in their 40s or 50s (M = 50.4, SD = 11.1), female, married, White, have an annual income of at least $60,000, and have had at least some college education.

Beck Depression Inventory scores were not significantly different between intervention and control groups at baseline. Mean BDI was 4.4 (SD = 4.6). Approximately 64% were not depressed, 16% were mildly depressed, 17% were moderately depressed, and 3% were severely depressed, according to the BDI. Beck Depression Inventory scores were significantly higher in younger ages, females, never married or divorced, those with lower income, and high school graduates or those with some college education (Table 1).

Approximately 50% of participants had been previously told by a physician that they were overweight; 10% drank alcohol daily and 34% drank alcohol weekly; 60% drank coffee/tea daily and 21% drank coffee/tea weekly; 3% were current smokers; and 39% did not exercise, 33% exercised 2-3 days per week, 22% exercised 3-5 days per week, and 6% exercised 4-6 days per week. Mean vitamin B6 was 1.9 (SD = 0.8) and the percent who took supplementary B6 was 43. Distributions of these variables did not significantly differ between intervention and control groups at baseline, with the exception of overweight, which was higher in the intervention group (61% vs. 39%, $P < 0.0001$).

In a multiple regression model, BDI was regressed on group (intervention vs. control), age, gender, marital status, race, annual income, education, employed, overweight, exercise, smoking, alcohol drinking, coffee/tea drinking, and vitamin B6 and supplemental B6. Backward elimination of insignificant variables resulted in a model containing age, marital status, education, overweight, and exercise. Higher BDI was associated with younger age, divorced or never married, having been told by a physician that they were overweight, and physical inactivity. For example, the percentage who had been previously told by a physician that they were overweight was 41 for those not depressed, 59 for those mildly depressed, 67 for those moderately depressed, and 83 for those severely depressed ($P = 0.0001$). Further, the percentage who exercised at least 2-3 times per week for at least 20 minutes each time was 66 for those not depressed, 57 for those mildly depressed, 53 for those moderately depressed, and 17 for those severely depressed ($P = 0.0006$).

Mean change in BDI from baseline to six weeks was significantly greater for those in the intervention group compared with the control group (M = -2.4 vs. -0.7, $P < 0.0001$), after adjusting for baseline BDI. A similar result was observed through six months (i.e., M = -2.2 vs. -0.8, $P < 0.0001$). Body mass index at baseline was added to both models, but failed to reach statistical significance and thus was dropped from the models. At six weeks, the risk of BDI of at least 5 for participants in the intervention group was 0.42 (95% CI 0.30-0.60; $P < 0.0001$) times that of the control group (or 58% lower), after adjusting for baseline BDI. At six weeks, the risk of BDI of at least 5 for participants in the intervention group was 0.66 (95% CI 0.47-0.91; $P = 0.0106$) times that of the control group (or 34% lower), after adjusting for baseline BDI. Interaction terms were also assessed in both models, with the group by baseline BDI significant (Figure 1); that is, the intervention group showed greater decrease in BDI across all the baseline categories of BDI, but at a greater level for those with less than severe depression at baseline.

In addition to observing that higher levels of BDI were significantly associated with being younger, never married or divorced, overweight, or physical inactivity, higher BDI scores were significantly associated with eating little or no breakfast, eating fast, sleeping less than six hours per night, restless sleep, insomnia, very few vacations, feeling under pressure, being easily emotionally upset, feeling muscular tension, and feeling fearful or depressed at baseline (Table 2). The risks of these variables are presented for participants in the intervention group compared with the control group at six weeks and also at six months (Table 3). The risks of these items at six weeks and six months were significantly lower for those in the intervention group compared with the control group, with the exception of "insomnia," "very few vacations," and "feels muscular tension."

Finally, a new variable was created that is the sum of the number of these 14 outcomes variables that participants experienced.

Table 1. Beck Depression Inventory according to Selected Demographic Variables for Participants in the Coronary Health Improvement Project, Rockford, Ill

			Beck Depression Inventory	
Variable	No.	%	Mean (SD)	P Value
Age				
24-39	57	16	6.3	0.0020
40-49	106	31	4.5	
50-59	112	32	3.7	
60-81	73	21	3.4	
Gender				
Male	98	28	3.3	0.0169
Female	250	72	4.7	
Marital Status				
Never married	32	9	6.8	< 0.0001
Married	265	77	3.7	
Divorced	32	9	7.8	
Widowed	17	5	2.3	
Race				
White	327	95	4.2	0.0886
Black	14	4	6.8	
Other	5	1	1.8	
Annual Income				
0–20,000	26	8	5.2	0.0428
20,001–40,000	62	18	5.2	
40,001–60,000	78	23	4.9	
60,000+	174	51	3.6	
Education				
<High school	11	3	2.2	0.0051
High school	83	24	4.7	
Some college	97	28	5.6	
College degree	77	22	3.3	
Post-college degree	77	22	3.6	
Currently Employed				
Yes	280	20	4.2	0.8604
No	68	80	4.3	

Mean numbers were 5.7 (SD = 2.8) at baseline, 3.8 (SD = 2.6) at six weeks, and 4.1 (SD = 2.7) at six months. Mean changes in the numbers were significantly greater for those in the intervention compared with the control group (M = -2.9 vs. -0.8 at six weeks, $P < 0.0001$; M = -2.4 vs. -0.8 at six months, $P < 0.0001$), after adjusting for the baseline number of outcome experiences.

DISCUSSION

Higher BDI scores at baseline were significantly associated with being overweight; being physically inactive, eating little or no breakfast, eating fast, sleeping less than six hours per night, restless sleep, insomnia, going on very few vacations, feeling under pressure, being easily emotionally upset, feeling muscular tension, and feeling fearful

or depressed. Each of these items showed a significantly greater improvement through six weeks and six months among those in the intervention group compared with the control group. Beck Depression Inventory scores through six weeks and six months of follow-up were also significantly lower among those in the intervention group compared with the control group.

The majority of participants were obese at baseline, with a 9% and 12% greater reduction in obesity in the intervention group through six weeks and six months, respectively. As presented in the outset of this paper, weight loss can improve mental health. This may be in part because of better self-image, but also better physical health. Weight loss among overweight individuals can decrease blood pressure and hypertension, reduce abnormally high levels of blood glucose and diabetes, lower blood concentrations of cholesterol and triglycerides, improve sleep, decrease osteoarthritis, and increase self-esteem.[32]

At baseline 39% were not physically active, with a 67% and 68% greater reduction in physical inactivity in the intervention group through six weeks and six months, respectively. The improvement in mental health associated with physical activity may be because exercise increases endorphin and monoamine levels, which, in turn, decrease clinical depression and depressive symptoms.[33,34] Three other hypotheses may apply: (1) the distraction hypothesis, which states that diversion from unfavorable stimuli results in improved mood during and after exercise;[35] (2) the self-efficacy hypothesis, which states that because of the challenging nature of physical activity, consistent involvement might lead to improved mood and self confidence;[36] and (3) the social interaction hypothesis, which states that social relationships that often accompany physical activity, as well as mutual support among individuals involved in physical activity, may have a positive effect on mental health.[37]

Alcohol drinking or coffee/tea consumption was not associated with BDI at baseline. Although alcohol is a mood altering depressant drug,[23] and nearly 40% of heavy drinkers display symptoms that resemble depressive illness,[38] few of the people in the current study could be considered heavy drinkers. The average number of drinks per week was 2.0 (Median = 0). Ninety-nine percent of the population consumed 14 or fewer drinks per week and only two individuals reported drinking more. As for caffeine, excessive consumption can prevent deep, restful sleep, which is necessary for well-being, and in turn, may raise anxiety levels.[23] The mean number of drinks of coffee/tea per week was 10 (median = 7). Most of the participants in the study consumed slightly above one cup of coffee/tea per day; 76% drank two or fewer cups of coffee/tea per day. Mean BDIs for those who drank more than two cups of coffee/tea per day and for those who drank less than two cups of coffee/tea per day were not significantly different (4.5 vs. 3.6; $P = 0.0831$).

The current study showed that selected eating and sleep practices were associated with depression. Eating little or no breakfast has been associated with health-compromising behaviors that may increase stress and depression.[39] Further, research has shown that consuming 50% or more of daily food after 6:00 pm is associated with difficulty falling and/or staying asleep, stress, depres-

Figure 1. Change in the Beck Depression Inventory (BDI) between Baseline and Six Weeks or Six Months according to Intervention Status and Baseline BDI

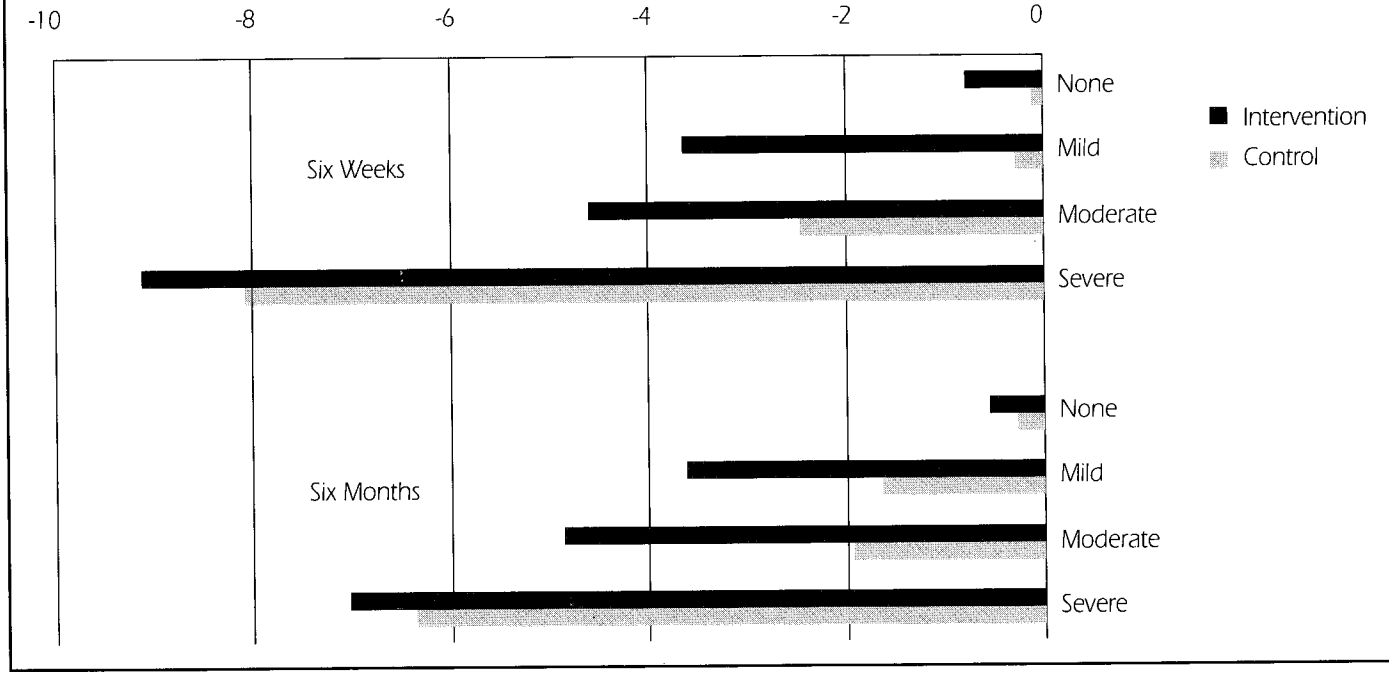

Table 2. Percentage with Selected Eating, Sleeping, and Stress Characteristics according to the Beck Depression Inventory

	Beck Depression Inventory				
Characteristics	Not Depressed (n = 222)	Mildly Depressed (n = 56)	Moderately Depressed (n = 58)	Severely Depressed (n = 12)	MH(trend) chi-square P Value
Evening is biggest meal	73%	75%	78%	83%	0.3578
Eats little or no breakfast	34%	36%	52%	75%	0.0008
Eats between meals	71%	66%	81%	83%	0.1380
Eats fast	45%	43%	57%	75%	0.0310
Less than 6 hrs sleep/night	28%	34%	41%	58%	0.0081
Sleeps restlessly	27%	45%	69%	83%	< 0.0001
Insomnia	6%	7%	21%	42%	< 0.0001
Very few vacations	32%	39%	67%	67%	< 0.0001
Feels under pressure	25%	52%	71%	83%	< 0.0001
Easily emotionally upset	12%	39%	67%	67%	< 0.0001
Feels muscular tension	29%	48%	50%	83%	< 0.0001
Feels fearful or depressed	5%	25%	55%	92%	< 0.0001

Table 3. Risk of Selected Characteristics among Participants in the Intervention Compared with the Control Group at Six Weeks and Six Months

		Six weeks		Six months	
Characteristics	% with characteristic at baseline	Relative Risk	95% CI	Relative Risk	95% CI
Obese (BMI ≥ 30)	52	0.91	0.85, 0.96	0.88	0.79, 0.98
Physically inactive	39	0.33	0.19, 0.58	0.32	0.20, 0.53
Evening is biggest meal	75	0.46	0.38, 0.57	0.66	0.55, 0.78
Eats little or no breakfast	38	0.14	0.07, 0.27	0.47	0.33, 0.68
Eats between meals	72	0.43	0.34, 0.56	0.67	0.55, 0.83
Eats fast	48	0.62	0.48, 0.80	0.74	0.59, 0.94
Less than 6 hrs sleep/night	32	0.64	0.47, 0.88	0.69	0.52, 0.93
Sleeps restlessly	39	0.57	0.41, 0.79	0.74	0.55, 0.98
Insomnia	10	0.49	0.23, 1.02	0.62	0.31, 1.25
Very few vacations	40	0.86	0.69, 1.07	0.98	0.75, 1.29
Feels under pressure	39	0.77	0.56, 1.04	0.65	0.48, 0.90
Easily emotionally upset	27	0.49	0.31, 0.76	0.57	0.36, 0.90
Feels muscular tension	37	0.88	0.63, 1.22	0.82	0.58, 1.17
Feels fearful or depressed	19	0.46	0.29, 0.74	0.54	0.35, 0.85

Each model adjusted for the baseline level of the variable.

sion, and poor attempts to lose weight.[40,41] Alternatively, stress and/or depression may compromise healthy eating practices.[42] One study showed that eating disorders were associated with negative mood and that negative mood was related to poor sleep quality.[43] Short sleep duration has been shown to increase the risk of emotional stress.[44] Hence, eating and sleep disorders appear to produce negative mood, stress, and depression, which may, in turn, further promote eating and sleeping problems.

Limitations of this study include self-selection and self-reported responses. Participants in both the intervention and control groups were interested in making health behavior changes. The participants were primarily White, married, and had an annual income of at least $60,000. Hence, the results do not reflect minority populations. The majority was obese and 39% were not physically active. Therefore, generalization of results may be limited. In addition, self-reported responses may be biased. However, weight and height, which were used to compute BMI, were acquired objectively from a trained nurse and individuals were encouraged to complete the anonymous questionnaires as accurately and honestly as possible.

TRANSLATION TO HEALTH EDUCATION PRACTICE

The educationally-centered CHIP program highlights the importance of making better lifestyle choices in hopes of preventing, arresting, and reversing health problems in 40 hours of classroom time and in alumni activities. Although the program focuses on improving risk factors associated with coronary heart disease, it confirms the relationship between physical and mental health. Participants in the CHIP intervention not only experienced a significantly greater decrease in weight and increase in physical activity, but also demonstrated a greater improvement in eating and sleep behaviors and other stress conditions associated with depression. As a result, a significant decrease in depression was observed for those in the intervention group. Some of the decrease in depression may have also occurred because of participation in the intervention itself, where social interactions fostered mutual support and self-efficacy. Hence, lifestyle change programs such as CHIP aimed at improving physical health behaviors can likewise have a profound influence on mental health.

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