THE EFFECT OF A GROUP-MEDIATED COGNITIVE-BEHAVIORAL INTERVENTION ON DIETARY CHOICES OF A PHASE IV CARDIAC REHABILITATION PROGRAM

by

KATIJA A. OPITZ

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN PHYSICAL EDUCATION CLINICAL EXERCISE PHYSIOLOGY/CARDIAC REHABILITATION

MINNESOTA STATE UNIVERSITY, MANKATO MANKATO, MINNESOTA

MAY, 2009
This thesis paper has been examined and approved.

Examining Committee:

__________________________
Dr. Kenneth Ecker, Chairperson

__________________________
Dr. Susan Fredstrom

__________________________
Dr. Cindra Kamphoff
ACKNOWLEDGEMENTS

I would like to thank my Heavenly Father for giving me the strength and determination to pursue my dreams. His guidance has not only helped me complete my thesis, but has encouraged me to aspire to be a better person each and everyday.

Dr. Kenneth Ecker, I express a most heartfelt thank you for your continued guidance, encouragement, and extensive knowledge throughout this enlightening experience. Your dedication, support, and confidence in my abilities have made my educational experience one to cherish.

To Dr. Susan Fredstrom and Dr. Cindra Kamphoff, your insight, feedback, and support gave me the motivation I needed to complete this thesis process. I thank you and appreciate all you have done for me.

To my family, without you, so many things would never be possible, and for that, I thank you a million times over. I consider myself blessed to have a family who has always believed in me, yet challenges me to be a better person each and everyday. The person I was, am, and will be, is a result of your loving support and guidance; always to be cherished, never to be forgotten.
ABSTRACT

THE EFFECT OF A GROUP-MEDIATED COGNITIVE-BEHAVIORAL INTERVENTION ON DIETARY CHOICES OF A PHASE IV CARDIAC REHABILITATION PROGRAM
OPITZ, K. A., M.A. in Clinical Exercise Physiology/Cardiac Rehabilitation
Minnesota State University, Mankato, Minnesota, 2009

The purpose of this study was to determine whether significant dietary and behavioral differences existed between treatment and control groups of a phase IV cardiac rehabilitation program. Over a 3-month period, each group completed a MEDFICTS (MF) questionnaire, 3-day dietary recall, and MedGem (MG) testing. The treatment group also participated in 12 weekly cognitive-behavioral intervention sessions. The treatment group had significantly higher fat and saturated fat percent of total kilocalories, and cholesterol intake at baseline in comparison to the control group. There were no significant differences between groups for post-study data (p > .05). For the treatment group, significant correlations existed between MF values and weight, and both fat and saturated fat with daily attendance. A significant correlation was also found between MG and predicted REE of both groups combined (p > .05). Therefore, weekly cognitive-behavioral intervention sessions positively influenced nutritional choices and dietary behaviors of cardiac rehabilitation participants.
# TABLE OF CONTENTS

**LIST OF TABLES** ........................................................................................................ iv

**LIST OF FIGURES** ..................................................................................................... v

**Chapter**

I. **INTRODUCTION** .................................................................................................. 1

A. Statement of the Problem .................................................................................. 3

B. Hypotheses ......................................................................................................... 3

C. Significance of the Study .................................................................................. 4

D. Delimitations ...................................................................................................... 5

E. Limitations ......................................................................................................... 6

F. Definitions ......................................................................................................... 6

II. **REVIEW OF LITERATURE** ................................................................................ 10

A. Cardiovascular Disease .................................................................................. 11

B. Cardiac Rehabilitation Programs .................................................................. 13

1. Program Adherence ...................................................................................... 15

2. Nutritional Focus .......................................................................................... 18

C. Behavioral Intervention Sessions .................................................................. 20

1. Quality of Life Changes .............................................................................. 20

2. Social Support ............................................................................................... 25

D. Dietary Intervention with Cardiac Patients .................................................. 28

1. Nutritional Barriers ........................................................................................ 29
LIST OF TABLES

1. MEDFICTS Dietary Categories ................................................................. 58
2. Group-Mediated Cognitive-Behavioral Intervention
   Session Attendance ..................................................................................... 63
3. Mean Physical and Dietary Characteristics for the
   Treatment and Control Groups Baseline ................................................. 65
4. Mean Physical and Dietary Characteristics for the
   Treatment and Control Groups – Post Study ........................................... 66
5. Amount of Change for the Treatment and Control
   Groups ........................................................................................................... 67
LIST OF FIGURES

Figure

1. Post-Data Correlation for the Treatment Group – MEDFICTS vs Weight ................................................................. 68
2. Post-Data Correlation for the Treatment Group – Daily Group Attendance vs Total Fat .......................... 69
3. Post-Data Correlation for the Treatment Group – Daily Group Attendance vs Saturated Fat ............... 70
4. Post-Data Correlation for the Treatment and Control Groups Combined – MedGem Resting Energy Expenditure vs Predicted Resting Energy Expenditure ................................................................. 71
Cardiovascular disease (CVD) is the leading cause of death among Americans (Jonalagadda, 2005). Though genetics plays a small role in the development of this disease, cardiovascular (CV) risk factors such as a sedentary lifestyle, poor nutrition and tobacco use are estimated to be the cause of 70-90% of overall deaths (Aldana, Greenlaw, Diehl, Salberg, Merrill, & Ohmine, 2005). Primary CV risk factors include obesity, hypertension, physical inactivity, cigarette smoking, impaired fasting glucose, and hypercholesterolemia (American College of Sports Medicine, ACSM, 2006). Maintaining a healthy lifestyle (i.e. diet and exercise) has been proven effective in controlling the development of CV risk factors and preventing CVD (Holmes, Sanderson, Maisiak, Brown, & Bittner, 2005).

Integral to the comprehensive care of patients, cardiac rehabilitation (CR) programs are designed to positively affect a patient’s physical, psychological, and social functioning. Specific components within CR programs, such as fostering healthy behaviors, cardiovascular risk reductions, and improving functional capacity and quality
of life in patients with heart disease, have maintained primary focus, effectively leading to a reduction in both morbidity and mortality (American Association of Cardiovascular and Pulmonary Rehabilitation, 2003).

Though CR programs have been proven effective in helping individuals with CVD develop and maintain a healthy lifestyle, the majority of focus is placed on physical activity (Plous, Chesne, & McDowell, 1995). As a result, CR programs may lack a strong nutritional component that many patients within a phase III and phase IV program could benefit from. Diet plays a large role in maintaining a healthy life, but many individuals lack dietary knowledge and are unaware of how to make appropriate dietary choices. Previous research, such as a study conducted by Timlin, Shores, & Reicks (2002), concluded that though nutritional education was important, it has never been at the forefront of many CR programs, leading to the question of how effective dietary education would be on CR patients. As a result, research on dietary interventions has increased over the past decade, proving its effectiveness.

Ignorance of appropriate dietary choices and an overall lack of nutritional knowledge have contributed to many common barriers patients find themselves fighting against
when trying to lead a healthy lifestyle (Lennie, Moser, Heo, Chung, & Zambroski, 2006). The opportunity to become educated on nutrition through a variety of resources, such as a dietitian, has proven to be not only effective, but a vital component in each patient's overall health (Jonalagadda, 2005). Dietary interventions have brought about a newfound knowledge of nutrition, improving overall eating behaviors and dietary choices (Timlin et al., 2002). Due to the success rate of nutritional education programs, dietitians and other resources, dietary interventions are now being implemented into CR programs (Cavallaro, Dwyer, Houser, Shores, Cañez, & Hong, 2004).

**Statement of the problem**

The purpose of this research study was to determine whether a 3-month group-mediated cognitive-behavioral intervention influenced nutritional choices and overall eating behaviors of cardiac rehabilitation participants.

**Hypotheses**

The investigator assumed the null position on the following hypotheses:

1. There will be no significant difference found between participant’s baseline and post-study results with respect to MEDFICTS food frequency (MF) scores and dietary
recall assessments in the treatment group versus the control group.

2. There will be no significant difference found between participant’s baseline and post-study results with respect to resting energy expenditure (REE) values in the treatment group versus the control group.

3. In the comparison between participant’s post-study results with respect to MF scores and dietary recall assessments, there will be no significant relationship found within the treatment and control groups.

4. In the comparison between participant’s post-study results with respect to REE values, there will be no significant relationship found within the treatment and control groups.

Significance of the study

Cardiac rehabilitation programs have become a key contributor in the treatment of CVD, playing an important and effective role by providing education, exercise training, and counseling to patients with heart disease (Holmes et al., 2005). Though essential in improving overall quality of life (Rejeski, Foy, Brawley, Brubaker, Focht, Norris, & Smith, 2002), many CR programs place little focus on the nutritional aspect of health. The
opportunity to gain knowledge about nutrition is vital as many patients are unsure of how to plan a proper diet and may face a variety of challenges when trying to maintain a healthy lifestyle.

An important component of disease management, nutritional therapy, is considered effective in the prevention and treatment of chronic diseases (Jonnalagadda, 2005). Dietary changes play an important role in reducing the risk of coronary heart disease and nutrition education is regarded as an important component of cardiac rehabilitation programs (Paxton & Ball, 1999). Though research on behavioral changes with respect to nutrition is limited, educating patients on proper nutrition and encouraging each individual to make positive behavioral changes has proven to positively impact overall quality of life (Bergmann & Boeing, 2002).

**Delimitations**

1. The sample consisted of males and females with documented CVD who participated in the Minnesota State University, Mankato/ Immanuel St. Joseph Hospital phase IV CR program.

2. The investigation consisted of three measurements which were administered at baseline and post-study to all
participants.

3. The dietary program (Food Processor) was the analysis tool used to measure intake of participant nutrients based on dietary recall information. All foods eaten by participants were approximated as closely as possible to the actual intake.

4. The selection process for both the control and treatment groups was non-random due to time constraints of various participants.

Limitations

The following limitations were recognized in this study:

1. Subjects may not have revealed accurate information on the self-reported measurement tools utilized in the study.

2. As a result of prior commitments, a minimal number of subjects within both groups were not available to attend the Heart Plus Fitness (HPF) exercise program and/or Group-Mediated Cognitive-Behavioral (GMCB) sessions on one to two occasions.

Definition of terms

Cardiac Rehabilitation: Coordinated, multifaceted interventions designed to optimize a cardiac patient’s
physical, psychological, and social functioning, in addition to stabilizing, slowing, or even reversing the progression of the underlying atherosclerotic processes, thereby reducing morbidity and mortality (AACVPR, 2007).

**Cardiovascular Disease (CVD):** A general term that includes many different diseases of the heart and circulatory system (Rosenbloom, 2000).

**Cognitive-Behavioral Therapy:** Therapy to help change how an individual feels by helping change how the individual thinks and reacts in response to internal or external stimuli (Health & Resource Center, 2007).

**Heart Healthy Diet (Step 1):** Recommended for all healthy people to prevent CHD and is recommended to precede pharmacotherapy of LDL cholesterol (Taylor et al., 2003).

**Step 1:** 7-10% of energy from saturated fat and < 300mg cholesterol

**Intervention:** the act of interfering with a condition to modify it or with a process to change its course.

**MEDFICTS Food Frequency Questionnaire:** A method of dietary measurement that adheres to AHA guidelines and assesses an individual’s cholesterol and total fat intake. Consisting of eight food categories, weightings are based on weekly consumption and serving size (Taylor et al., 2003).
**MedGem:** An FDA approved hand-held device that quickly and accurately measures an individual's resting energy expenditure.

**Phase IV Cardiac Rehabilitation Program:** Program designed to maintain the goals and principles established in a phase II CR program. Participant’s are more independent and adhere to this program which includes a recovery plan, education, lifestyle modifications, and gradual integration of exercise maintenance.

**Resting Energy Expenditure (REE) or Resting Metabolic Rate (RMR):** minimum number of calories your body needs to support its basic physiological functions, including breathing, circulating blood and all of the numerous biochemical reactions required to keep you alive. Generally 60-75% of total daily caloric expenditure.

**Therapeutic Lifestyle Changes Diet (Step II):** Recommended to further reduce LDL cholesterol for patients who have already achieved their Heart Healthy dietary goals. Initially recommended for patients with high-risk cholesterol levels or known CHD (Taylor et al., 2003).

Step 2: < 7% of energy from saturated fat and < 200mg cholesterol
Three-Day Dietary Recall: A measurement tool used to assess food and nutrient intake. Individuals are instructed to record everything consumed over 2 weekdays and 1 weekend day.

Total Cholesterol: The sum of HDL, LDL, and VLDL. A level of greater than 200 mg/dl increases the risk for CVD (Rosenbloom, 2000).
CHAPTER TWO
REVIEW OF LITERATURE

The intent of this study was to determine whether group-mediated cognitive-behavioral interventions in comparison to a traditional cardiac rehabilitation (CR) program influenced nutritional choices amongst phase IV CR patients over a 3 month period. Using 3 day dietary recalls, resting energy expenditure, and the MEDFICTS food frequency questionnaire, the study specifically investigated the correlation between both behavioral interventions and a traditional phase IV CR program.

On average, nationally, only 11-20% of cardiac rehabilitation patients enroll in a program after experiencing a cardiac event (Yates, Barlow-Whitton, & Agrawal, 2003). A cause of concern, many CR patients are unaware of the benefits, which include improved quality of life, reduced morbidity and mortality, and improved functional capacity, that result from regular participation in a CR program (Yates et al., 2003). Research on the effects of behavioral intervention with CR patients, more specifically in relation to diet, though minimal, has slowly increased within the last decade (Bergmann & Boeing,
2002). An area many individuals have difficulty adhering to, proper nutritional habits are extremely important and having the resources to promote positive behavioral changes through dietary intervention has been a vital component of CR programs (Paxton & Ball, 1999). In this chapter, the review was organized into the following categories: cardiovascular disease, CR programs, behavioral intervention sessions, dietary interventions with cardiac patients, and nutritional resources.

**Cardiovascular Disease**

In the United States, CVD is the number one cause of death among men and women, with an estimated 80.7 million people having one or more forms (AHA, 2008). Accounting for an estimated one million deaths each year, CVD encompasses many different diseases of the heart and circulatory system, including hypertension, coronary heart disease (CHD), congestive heart failure, stroke, and congestive heart defects (Jonalagadda, 2005).

Coronary heart disease, a major form of CVD, is the single largest cause of death for men and women (Cavallaro et al., 2004). Caused by atherosclerosis, a buildup of plaque on the coronary artery walls that narrows and restricts blood flow, CHD is likely to produce angina pectoris and/or a myocardial infarction (MI). Even with a
33% decrease in deaths from the years 1994 to 2004 (AHA, 2008), CHD will continue to be a health concern until lifestyle changes are made.

Despite a reduction in deaths, CVD is still the leading cause of morbidity and mortality among older men and women, directly threatening the maintenance of physical activity and independence with aging (Rejeski et al., 2002). Cardiovascular risk factors are habits or characteristics which contribute to the increased likelihood of developing heart disease. Primary risk factors, capable of being controlled or altered through lifestyle changes include cigarette smoking, hypertension, obesity, diabetes, sedentary lifestyle, impaired fasting glucose, and hypercholesterolemia. Secondary risk factors, which people are unable to control or alter, include age, sex, genetics, and ethnicity (ACSM, 2006).

Essentially preventable, many risk factors associated with CVD are modifiable through positive lifestyle interventions. Behavioral changes that result in healthier lifestyle choices play a major role in reducing personal, societal and financial burdens that coincide with developing heart disease (Jonalagadda, 2005). Leading a healthy life leads to the prevention or recurrence of CVD,
but for individuals who have experienced a cardiac event, secondary prevention is essential in the treatment of CHD and proven effective in reducing cardiovascular risk factors (Holmes et al., 2005).

In summary, a nationwide health problem, the development of CVD is a result of unhealthy decisions made by Americans, many of which can be changed with patience, knowledge, and a commitment to leading a healthy life. As a result, CR programs were developed and found to be extremely beneficial in helping patients cope with their condition and improve their overall health.

**Cardiac Rehabilitation Programs**

The leading cause of morbidity and mortality among men and women in the United States, CVD is largely responsible for the development of many physical disabilities that result from a cardiac event (Rejeski et al., 2002). A developing process, the degree and pace of heart disease progression depends on an individual's overall health and lifestyle. As CHD frequently impairs physical functioning, cardiac patients are referred to a CR program as a means of taking a step by step approach to improving health and reaching their previous physical state.

Cardiac rehabilitation defined refers to coordinated, multifaceted interventions designed to optimize a cardiac
patient’s physical, psychological, and social functioning, in addition to stabilizing, slowing, or even reversing the progression of the underlying atherosclerotic processes, thereby reducing morbidity and mortality (AACVPR, 2005). The goal of CR is to restore the functional independence and improve the quality of life of individuals who have experienced a cardiac event by reducing disability, morbidity, and mortality, thus designing programs that ensure safe recovery and promote lifestyle modifications for individuals with CHD (Jonalagadda, 2005).

Consisting of four medically supervised phases, CR begins with phase one in which the patient is in the hospital, continues into the outpatient phase two, and than provides ongoing maintenance in the outpatient phase three and four (Paxton & Ball, 1999). Essential in the treatment of coronary heart disease (CHD), CR programs have been proven effective in reducing cardiovascular risk factors by providing exercise training, counseling, behavioral interventions and education that targets cardiovascular risk reduction (Holmes et al., 2005). Associated with a 14% reduction rate in mortality as found by the third WHO European collaborative trial (Paxton & Ball, 1999), the use of CR programs still remains low. With about one third of
those eligible participating, the women tend to be older than the men, yet their participation rate is lower, leading to the problem of CR program adherence (Timlin et al., 2002).

**Program Adherence**

Though CR programs focusing on CVD have been proven effective of physical health benefits across a wide range of outcomes, long-standing problems associated with poor adherence and minimal guidance of older adults and women has still been given little attention (Rejeski et al., 2002). With 50% of individuals dropping out of therapy within the first 6 months, noncompliance across a variety of health behaviors has become a common problem.

According to Yates et al. (2003), nationally, only 11-20% of cardiac patients, on average, enroll in a CR program after their cardiac event. The purpose of Yates et al. (2003) study was to examine: (a) differences in functional health outcomes, clinical risk factor outcomes, and lifestyle behaviors between patients who participated in cardiac rehabilitation (CR) and those who did not during the first year after their cardiac event; and (b) predictors of and reasons for CR participation and non-participation in a Midwestern, rural clinical population.
Adopting Green’s health education framework, participants selected were patients from a rural county in central Nebraska who received treatment for cardiac illnesses. The study included 154 patients who participated in a CR program and 68 who were nonparticipants. Functional health status was measured by the validated Medical Outcomes Study Short Form-36 (SF-36), cardiac risk factors were measured by the Foundation Heart Test for Men and Women, and behavioral risk factor modifications were measured by participants' responses to alterations of lifestyle habits resulting from what was learned in the CR program. All data analyses were performed with SPSS (v. 10). Yates et al. (2003) found that CR participants reported significantly higher levels of health and functioning in seven of the eight subscales measured by the SF-36 as compared to nonparticipants. Cardiac rehabilitation participants also had a significantly lower body mass index and were more likely to engage in self-care behaviors such as exercise and dietary changes. This study supported the effectiveness of CR programs in making possible a significantly better quality of life, in lowering cardiovascular risks, and in achieving success with behavioral changes.

While the problem of adherence to CR has been
Extensively studied, only one third of patients are maintaining attendance after 6 months. Daly, Sindone, Thompson, & Hancock (2002) reviewed studies conducted over the last 15 years, summarizing research that investigated barriers to participation and adherence to CR programs, and offering suggestions to improve participation and adherence rates to CR. Consistent factors associated with nonparticipation in CR programs included lack of referral by physicians, poor perceptions of CR program benefits, and psychosocial issues, such as poor self esteem and lack of social support. Previous studies also revealed poor program uptake, poor adherence, and significantly higher drop-out rates for women.

In agreement with previous research, Daly et al. (2002) found that psychological variables of perceived benefits of exercise and CR programs, and perceived barriers to both exercise and CR programs were predictors of adherence. With positive perceptions, individuals who consistently participated in a CR exercise program used strategies to ensure their participation in the program. The results of this review strongly suggest that patients with known risk factors for nonadherence (e.g., women, and those with low social support) should be targeted soon.
after experiencing a cardiac event and educated about the benefits of CR.

Beckie (2006) focused on behavior change interventions for women in CR as fewer women than men are referred to, begin, or complete a CR program, despite numerous evidence supporting the physical and psychosocial benefits of CR. With logistical, motivational, and economic barriers to healthy changes in behavior, women are placed at greater risk for CHD. To improve female participation in CR programs, a 12-week theory-driven behavioral intervention was designed exclusively for women with CHD. The Transtheoretical model (TTM) composed of five stages (precontemplation, contemplation, preparation, action, and maintenance), guided the development of the intervention. The conclusion of this study found that individualized, theory driven, behavioral change interventions within a group setting increased CR program adherence and overall behaviors of women.

**Nutritional Focus**

As adherence to a healthy diet decreases each year a patient is out of rehabilitation, Plous et al., (1995) assessed cardiac patients’ knowledge and attitudes towards nutrition. With minimal focus given to nutrition in CR
programs, the lack of nutritional knowledge with patients has become a concern. In a survey administered to physicians, 78% of the respondents reported that their training in nutrition had not prepared them well to handle the patient problems, and only 10% reported using the services of a registered dietitian. With a minor role of nutrition in medical training, physicians were reluctant to initiate dietary counseling. Participants of this study \((n = 606)\) were chosen from various cardiology practices in New England, Southern California, and the Midwest. Anonymous, self-administered questionnaires focusing on medical history, knowledge questions, desire to follow a heart-healthy diet, nutrition quiz were used. Standard procedures concerning dietary advice and nutrition counseling was given and all statistical analyses were performed with BMDP PC90 statistics package.

Plous et al. (1995) found that even though participants viewed diet as an important factor in the prevention and treatment of CHD, 30.5% had difficulty understanding the dietary information administered during the study. The results of this study revealed that though cardiac patients view diet as important, their knowledge of nutrition was limited. Thus, dietary counseling should
receive higher priority, in both medical training and in patient care, dietitians should be consulted on a more routine basis, and physicians should not assume that patients who receive dietary information understand the materials they are given.

Behavioral Intervention Sessions

Quality of Life Changes

Proposing that through the use of cognitive-behavioral therapy, the outcomes of physical activity programs for older adults, particularly those that involve cognition/perception will enhance, Rejeski et al. (2002) compared a standard CR program versus a group-mediated cognitive-behavioral intervention (GMCB) on changes in performance related and self-reported measures of physical function of older adults after 3 months of exercise therapy. The moderating variables considered to be potential for this study included both gender and baseline values. Participants for this investigation were recruited from the Triad region of North Carolina within a 50-mile radius of Wake Forest University. Participants consisted of 76 men and 71 women with the mean age of 64.7 years, who have had either documented evidence of or were at high risk for CVD. All participants completed a 6 minute walk, a
self-reported physical function questionnaire, and a symptom-limited maximal graded exercise test. All data obtained from these tests were analyzed by SPSS 10.07. Rejeski et al. (2002) found that men in the GMCB group experienced larger short term improvements in both the distance covered for the 6-minute walk and MET capacity. Participants in the GMCB group also had the most improvements in performing daily physical tasks over the 3 months. Women in both groups improved their 6-minute walk and MET capacity. Both GMCB and CR groups experienced significant improvements in performance related and self-reported physical functioning; supporting the position that exercise therapy is a valuable intervention for improving the physical function of older adult men and women.

Aldana et al. (2005) researched the clinical impact of lifestyle change education on chronic disease risk factors. Changes in nutrition, physical activity behavior, health knowledge, and several chronic disease risk factors were assessed at baseline and 6 weeks. With the intent to reduce the incidence of chronic disease and improve overall health by providing a lifestyle change program, all intervention sessions were led by the Coronary Heart Improvement Project (CHIP). Men and women between the ages of 43-81 were
recruited within the greater Illinois area and highly encouraged to attend the sessions with a spouse or partner. Over a 4-week period, the intervention group attended educational courses focused on learning the importance of making healthy lifestyle choices. Measurement tools utilized included a multiple-choice health knowledge test, the block 98 full-length dietary questionnaire, and a 7-day self-recorded pedometer log.

Aldana et al. (2005) found that along with positive changes in test scores, overall knowledge of health and clinical improvements were greatest for the intervention group. The control group experienced small, but significant improvements in knowledge and clinical outcomes. As a result, lifestyle modification programs are effective nutritional and physical activity interventions, with the potential to dramatically reduce the risks associated with common chronic diseases.

Bergmann & Boeing (2002) found that even though positive diet and lifestyle changes are highly recommended, there is limited evidence for the effectiveness of behavioral changes in adults. This study was conducted with the purpose of investigating the reason for and the direction of dietary changes, while also focusing on
factors associated with the self-report of a change in diet.

Part of the European Prospective Investigation into Cancer and Nutrition (EPIC)-Potsdam study, 4028 men and 7401 women between the ages of 35-64 years, from Potsdam, Germany participated. A description of the TTM coincided with a food frequency questionnaire completed at baseline. A participant follow-up within the first two years indicated consistent dietary changes.

Bergmann & Boeing (2002) found that behavior changes included dietary changes related to health and weight problems. The most reported reason for dietary changes in both men and women were weight problems and prevention/treatment of metabolic diseases. Women, obese participants, and those with one or more nutrition related diseases were more likely to report a change. The results from this study proved that with an individual’s readiness to change, positive dietary changes are linked with a general change in behavior.

Hamilton, Kives, Micevski, & Grace (2003) hypothesized that health-behavior change necessary for improving health in the CR population would necessitate a future, goal-oriented perspective. The purpose of this study consisted
of two components: (1) measure the strength of Zimbardo’s 5 time orientation (past negative, past positive, present fatalistic, present hedonistic, future) in an older CR population with individuals who underwent a recent life threatening event, and (b) compare the relationship between time perspective and health promoting behaviors in a CR population whose goal directed modifications could significantly improve clinical outcomes and quality of life.

Participants of this study were men \((n = 56)\) and women \((n = 18)\) from the University Health Network in Toronto, Canada who were between the ages of 33-80 years and experienced a previous cardiac event. Completion of the Health Promotion Lifestyle Profile II and the Zimbardo Time Perspective Inventory, which measured an individual’s beliefs, preferences, and values regarding temporary experiences were required.

In their research, Hamilton et al. (2003) found that age significantly and positively related to greater self-reported nutrition, but negatively related to future orientation. A positive association with respect to future outlooks was notably related to greater health responsibility, health-promoting behavior, spiritual
growth, and nutrition. The results of this study concluded that instead of emphasizing prevention of a future disease, the integration of self-actualization, spiritual growth, and interpersonal relations in a CR patient’s daily life would effectively promote healthy behaviors.

**Social Support**

An important factor in successful health behavior changes is social support. A wide range of support, such as emotional and informational, may be provided by friends, family, and coworkers, directly influencing health behaviors and health outcomes. Individuals surrounded by a network of social support are less likely to engage in high risk behaviors compared to people who are more isolated (Sorenson, Stoddard, & Macario, 1998).

Sorenson et al. (1998) utilized the TTM as the basis for examining the relationship between reported social support and readiness to increase fruit and vegetable consumption. Social support and readiness were compared with worker characteristics, including education, ethnicity, smoking status, and income. The investigators used the five stages of the TTM to assess each individual in regards to behavior changes. Referred to as the Treatwell 5-a-day study, participants (n = 1588) were
adults from 22 community health center (CHC) work sites located in Eastern Massachusetts.

Located in ethnically and racially diverse communities, all CHCs provided services to low income families. The 22 worksites were randomly assigned to three treatment groups: minimal intervention, work site intervention, and work site plus family intervention. A fruit and vegetable intake screener, readiness for dietary change questionnaire, coworker support for healthy eating survey and a household support for healthy eating survey were administered. The survey response rate was 87%.

Sorenson et al. (1998) found that workers who did not live alone had significantly higher household support, especially for Hispanic and African American individuals. Household support was also higher for nonsmokers, men, and individuals living with adults as compared to children. Coworker support was significantly associated with positive behavior changes. The results conclude that nutrition intervention programs are more effective in promoting health behavior changes by teaching individuals to provide social support to coworkers and family members and teaching skills on how to reduce dietary barriers.
Hildingh, Fridlund, & Larsen (2003) compared individuals who participated in peer support groups (intervention) after a cardiac event with individuals who declined to participate (control). The variables considered for this study were self-rated health, life situation, social support, clinical data, rehospitalization, and mortality. The Heart School, a program developed by The Swedish National Association for Heart and Lung Patients creates multiple opportunities for CR patients to participate in activities aimed at influencing a person’s overall lifestyle. This study focused on how effective peer support groups and activities offered by The Heart School influenced an individual’s quality of life.

Participants (n = 184) aged 35-85, lived in southern Sweden and were recently discharged from the hospital. Clinical data, along with a valid and reliable three part questionnaire (Life Satisfaction questionnaire, Social Network and Social Support Scale, and the Zung self-rating depression scale) were mailed to each participant 2-weeks, 3-months, and 12-weeks after discharge.

Hildingh et al. (2003) found that despite a higher degree of social support and physical symptoms reported by
the intervention group, no other differences were found between both groups. Within the intervention group, an increase in physical activity and decrease in smoking were found. As a support strategy that has positively impacted an individual’s physical and psychological health, personality traits, and life situation, peer support groups should be implemented in CR programs.

Dietary Intervention with Cardiac Patients

Lifestyle interventions play a major role in reducing the personal, societal, and financial burden of the disease according to Jonalagadda (2005). More specifically, nutrition interventions have become an integral component of risk-reduction strategies in CR programs. Within primary and secondary prevention, observed dietary interventions were more cost effective and beneficial for CR patients. By integrating nutrition services in CR programs and providing targeted nutrition interventions that matched individual needs, patient outcomes were positively impacted.

A form of nutrition intervention, Medical Nutrition Therapy (MNT) has been recognized by the AACVPR as a cornerstone of therapy for the prevention and treatment of chronic diseases and is an essential element of national standards of care guidelines for many chronic diseases.

Jonalagadda (2005) found that nutrition interventions
within CR programs that included resources such as an RD, offered significantly more nutrition services, one-on-one nutrition counseling and cooking demonstrations compared with programs without an RD. The results of this brief study also concluded that the five step nutrition care process (assessment, establishment of goals and determination of a nutrition plan, implementation of intervention, documentation and communication, and evaluation and reassessment) should continue to stay an integral part of the patient care process.

**Nutritional Barriers**

Optimizing and promoting nutritional intake of patients who have had a cardiac event is not only an important goal, but also an essential component of comprehensive management. However, multiple factors, such as psychological and social, affect food intake and prevent achievement of this goal (Lennie et al., 2006). Barriers to leading a healthy life are commonly experienced and therefore problematic as these factors are either ignored or not recognized by individuals. Having the resources and willpower to overcome these barriers and adhere to healthier choices is beneficial in multiple ways.

Lennie et al. (2006) focused on the comparison between
patients with heart failure and healthy elders regarding their perceptions on how appetite and hunger, emotional and social, and illness factors affected the amount of food consumed in the previous week. Participants included 67 patients recruited from three Midwestern Heart Failure clinics and 68 healthy elders from two Midwestern senior citizen centers. All participants were asked to fill out the Food, Eating Experiences, and Diet (FEED) questionnaire, a valid tool used to measure factors that influence food intake. Participants rated their degree of hunger and appetite over a week period and used the Likert scale to rate the degree to which each factor (appetite/hunger, emotional/social, and illness) influenced their food intake.

Lennie et al. (2006) found that the degree of appetite was higher among the healthy elders and the degree of hunger for both groups was similar. Most factors that affected food intake in the heart failure patients to a greater extent, especially diet restrictions and the illness in itself. Appetite and hunger were the biggest factors for all participants in affecting food intake, with a decreased sense of taste and smell affecting the healthy elders the most. The results of this study determined that
a variety of factors affect food intake in older adults, especially adults who have had some form of a cardiac event.

Patient adherence to dietary recommendations for CHD and compliance with medical treatments has been a long-standing problem, requiring more focus on a patient’s mental representation of illness as mediators of health-related behavior. In 1996, Janas & Bisogni investigated how cardiac patients mentally represented their dietary treatments, focusing on two areas, personal dietary guidelines and beliefs about deviating from dietary guidelines that were conceptualized as “diet representations”. Placed in the core or supplemental group, all participants (n = 28) had a previous cardiac event and were willing to be a part of this study for at least 3 months. Data about diet representations was collected via open-ended ethnographic interviews. Interviews for the core group were weekly for up to 6 months while interviews for the supplemental group was based on availability, ranging from between two and eight.

The importance of personal dietary guidelines in terms of either symptoms or perceived physiologic processes
were expressed by most participants as found by Janas & Bisogni (1996). Therefore, perceptions of diet and the process by which these perceptions shape dietary behavior are essential to overall health. Results from this study showed that symptom representations influence cardiac patients’ beliefs about the importance of specific dietary guidelines.

**Dietary Behavior Changes**

Though interventions have been conducted to help individuals meet dietary goals, adherence to positive dietary changes has been a common struggle. Keenan, AbuSabha, Sigman-Grant, Achterberg, & Ruffing (1999) examined patterns of behavior change in individuals who had made progress in decreasing dietary fat. The purpose of this study was to identify and categorize perceived factors that led to sustained dietary changes to either decrease fat or increase fiber.

Information was collected from 155 from Ohio residents, between the ages of 30 and 55. All subjects reported modifications in their diets to decrease fat for at least 5 years and had been consuming a “healthy” diet for at least 6 months. All participants completed an interview that consisted of a five-step protocol used to
assess diet and health behavior change and two food frequency questionnaires assessing prior and current food consumption patterns.

From the interviews, Keenan et al. (1999) identified 134 factors, planned or unplanned, that played a facilitating role in the adoption of multiple fat reduction strategies. Length of time to decrease dietary fat by changing dietary patterns ranged from 5 to 34 years as reported by the subjects. The results of this study concluded that adherence to dietary change is complex and individuals will cycle through the change process time and time again, due to both relapse and the adoption of new change.

Frame, Green, Herr, & Taylor (2003) monitored eating behavior changes in response to a CR program. The purpose of this study was to track the stages of change (precontemplation, contemplation, preparation, action, maintenance) within a CR population over a 2-year period for two nutrition behaviors: reduction of dietary fat intake and an increased intake of fruits and vegetables. Focusing on readiness and motivation to change a behavior, all nutritional behaviors were compared between the control group and intervention group. From the Department of
Pulmonary and CR at Moses H. Cone Memorial Hospital in Greensboro, North Carolina, all participants (n = 118) were overweight and had a previous cardiac event. Questionnaires relative to both stage of change with consuming five or more fruits and vegetables per day and reducing dietary fat intake were used. Administered at baseline, 3 months, and 2 years after completion of CR, the questionnaire analyzed each patient’s progress. The intervention group also attended weekly group nutrition education sessions for 12 weeks.

Most subjects took the initiative to reduce fat intake and increase fruit and vegetable intake with 87.3% and 22.9% respectively, reaching the maintenance stage at the 2 year mark as found by Frame et al. (2003). The results from this study concluded with food behaviors, CR patients will always be in different stages. Emphasis on health benefits and barriers to change were more suitable for modifying fruit and vegetable intake behaviors, whereas nutrition education was most beneficial for fat reduction behaviors.

**Nutritional Resources**

*Dietitian Education and Nutrition Programs*

With the intent to describe variations in nutrition services offered by the presence of a registered dietitian (RD, Cavallaro et al. (2004) conducted a study consisting
of a nationally representative sample of out-patient CR programs. A fundamental component of the comprehensive management and treatment of CHD risk factors is through Medical Nutrition Therapy; therefore the purpose of this study was to describe how the type and amount of nutrition services offered by the presence of an RD varied between nationwide out-patient CR programs.

A random sample of 250 out-patient CR centers nationwide, chosen from the 1998/1999 CR Directory of the AACVPR were selected to participate in this study. The instrument used was a questionnaire that focused on monitoring, staffing, the role of the RD, nutrition services offered, perceived importance of nutrition in the CR setting, approximate number of patients seen per year, and the location and setting of the program. Of the 250 CR centers chosen, 190 surveys were returned for a response rate of 76%. Respondents included RDs (10%) exercise physiologist (26%), nurses (62%), and “other positions” (2%).

Cavallaro et al. (2004) found that 75% of the centers had an RD working in their program and certified programs were more likely to have an RD on staff. A total of eight possible outpatient nutrition services were reported as
being offered, with programs having an RD present providing more services and a greater variety of nutrition services on average. Programs with RDs were more likely to offer one-on-one counseling and the collective census of all respondents regarded nutrition as an essential component of CR. The results from this study concluded that the presence and expertise of an RD was needed in CR programs. More nutrition services and a greater variety of services were offered in CR programs with an RD, positively influencing an individual’s behavior and overall health.

Paxton & Ball (1999) found nutrition education to be a valuable component of CR programs, bringing about positive dietary changes that reduce CHD risk factors. The National Heart Foundation (NHF) developed minimal requirements for outpatient CR programs and recommended objectives for nutrition education within these programs. Therefore, the intent of this study was to investigate current activities in nutrition education in outpatient CR programs and compare the results to NHF recommendations.

A questionnaire consisting of questions related to background information, general CR program structure, and nutrition components was mailed to all coordinators of whom worked in either a hospital based CR program ($n = 56$) or a
community health centre-based program \((n = 18)\) in the state of Victoria, Australia. The survey response rate was 100%. This study found that all CR programs included nutrition education with 97% providing a dietitian as the nutrition educator. For each program, 78% offered one to two sessions with 68% providing hour long sessions. All programs provided information on dietary fat reduction, while recipe modification, behavior changes, and food labeling were not provided as often. The majority of programs reported using a combination of educational techniques in nutrition education. Nutrition education is very effective in providing information within an outpatient CR program and can benefit overall health. As many programs focus on knowledge-based objectives, it was recommended that more focus be placed on behavior change skills.

In a review of literature by Timlin et al. (2002), the effectiveness of nutrition education delivered by a dietitian within an outpatient CR program was evaluated. With data assessing the efficacy of nutrition education within CR programs being limited, the purpose of this study was to determine if nutrition education outcomes could be documented in terms of positive dietary changes. Subjects were assigned to either the treatment group \((n = 54)\) or the
control group (n = 50) according to participation in CR programs in two community hospitals located in Minnesota.

Men and women, ages 35 to 85 years, were recruited for this study upon physician referral to an outpatient CR program. All participants had some form of CVD, were enrolled in a 6-week CR program, and 80% of the men involved were classified as overweight. All participants completed an eating behavior questionnaire called the Diet Habit Survey, a Cardiac Diet Self-Efficacy Instrument, and a health related quality of life measure known as the Health Status Questionnaire at baseline, 6-weeks, and 3-months after discharge. The control group was provided with nonindividualized nutrition education from CR therapists, whereas the treatment group attended two group nutrition education classes and one individual diet counseling session led by the same dietitian.

Significant improvement on both the Diet habit Survey and Health Status Questionnaire scores improved in both groups from CR entry to discharge, indicating positive dietary changes. In regards to the Cardiac Diet Self-Efficacy instrument, the treatment group improved their self-efficacy for cardiac diet behaviors to a greater extent than the control group. A good predictor of health
behavior, the combination of self-efficacy and nutrition education in the outpatient CR setting has helped many participants manage lipids and reduce weight, further preventing future cardiac events. Timlin et al. (2002) concluded that nutrition education within an outpatient CR program can improve dietary choices at restaurants and boost self-confidence in the ability to adhere to a lipid-lowering diet.

Holmes et al. (2005) designed a study with two purposes: (a) to examine the effectiveness of registered (RD) dietitian education and counseling on diet-related patient outcomes compared with general education provided by the cardiac rehabilitation staff and (b) evaluate the effectiveness of the Meats, Eggs, Dairy, Fried foods, In bake goods, Convenience foods, Table fats, Snacks (MEDFICTS) score as an outcome measure in CR. The use of the MEDFICTS questionnaire was to further assess dietary fat intake among patients with CHD as recommended by the National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III) guidelines along with appropriate pharmacologic therapy.

Participants (n = 426) had some form of CHD and had completed CR between January 1996 and February 2004. With a
mean age of 62 ± 11 years, the group formations were based on the education sources of either a RD or general education from CR staff. The general education class included individualized treatment plans and general information on heart healthy eating through pamphlets, videos, and discussion. Education led by an RD focused solely on heart healthy eating and label reading. The Baseline characteristic, were compared between groups while diet-related and behavioral variables (anthropometric measurements, lipid profiles, MEDFICTS scores) were compared within in groups. Both pre/post results were compared between both groups and the MEDFICTS score determined which diet category, step 1 or step 2, each participant fell within.

Holmes et al. (2005) found that participants who had the greatest degree of dietary score improvements were in the RD education group and initially had baseline MEDFICTS scores indicating the poorest dietary habits. Though both groups were successful in cholesterol improvements and anthropometric measurements, the RD education group experienced greater overall benefits. The only significant improvement for the education group was noted MEDFICTS scores. The results of this study indicated that regardless
of the education method, improvements in dietary habits were achieved by the MEDFICTS questionnaire. Education and counseling facilitated by an RD showed the greatest amount of diet-related outcome improvements when compared with participants in the general education group. The MEDFICTS questionnaire is also a responsive and valid measure in CR that tracks diet quality changes of which improves diet-related clinical outcomes.

**Assessment Methods**

Essential to determining an individual’s current health status, many measurement tools that assess a variety of health components, such as physical activity and nutrition, are extremely useful. Commonly used tools include the MEDFICTS food frequency questionnaire, 3-day dietary recall and the MedGem (MG) device that measures resting energy expenditure (REE), all of which have been validated and provide information essential to developing a proper diet.

As many dietary assessment tools are time consuming, expensive, and difficult to analyze, Taylor et al. (2003) compared the accuracy of the MEDFICTS questionnaire to the standardized Block Food Frequency Questionnaire (FFQ). The purpose of this study was to determine whether the MEDFICTS
would be a clinically useful screening tool for physicians to counsel patients about diet and coronary risk reduction by assessing dietary fat intake.

Participants \((n = 164)\) were active duty U.S. Army personnel stationed at the National Capital Area of the Walter Reed Health Care System. All participants had no known coronary artery disease (CAD) and were between the ages of 39-45 years. All subjects completed both the MEDFICTS and FFQ surveys at their initial interview and both surveys were independently scored. The correlation between each tools’ assessment of fat intake, the test characteristics of the MF, and the agreement in the AHA step categorization of dietary quality with each tool was assessed using the FFQ as the gold standard. All data was analyzed using SPSS windows v10.05.

Taylor et al. (2003) found that the majority of participants consumed a diet high in fat, placing them in the Step 1 dietary category, meaning that 7-10% of energy came from saturated fat and less than 300 milligrams (mg) of cholesterol was consumed. The intake for total and saturated fat between both the MEDFICTS and FFQ was significantly correlated. The results of this study concluded that though the MEDFICTS was most suitable in
identifying high fat diets, it is not as accurate identifying the three AHA dietary classifications.

Andersson, Gustafsson, Fjellstrom, Sidenvall, & Nydahl (2001) determined whether a qualitative method, in relation to traditional dietary assessment methods, was adequate to establish both sufficient energy intake and content in separate meals in a population of elderly women. Despite the assumption that a sufficient intake of energy will lead to satisfactory nutritional intake, elderly women were still found to be at risk for malnutrition, raising the question of what is the best method to record dietary intake and prevent eating deficiencies from occurring.

Participants (n = 135) included elderly women who lived at home, ages 63-88 years, from three communities in mid-eastern Sweden. The quantitative methods used included a 3-day estimated food diary where all foods consumed over three consecutive days were recorded, and repeated 24-hour recalls. The qualitative method used was the Food-Based Classification of Eating (FBCE) episodes model, which describes and analyzes separate meals. Andersson et al. (2001) found that the FBCE was useful in evaluating diets among a group of elderly women; however with low total energy intake, this method was insufficient on an
individual level as it did not consider amounts of food consumed. The 24-hour recall and food diary were more accurate because they were individualized, however validity was an issue as food intake was underestimated. The results of this study concluded that a qualitative method, such as the FBCE, must be supplemented with a dietary assessment method giving the energy intake to ensure that it is sufficient.

Lof & Forsum (2004) compared the validity of dietary recalls and physical activity recalls and also investigated factors that may have influenced this validity. The focus of the investigators was to show how the validity of dietary recalls and the identification of subjects constantly underreporting their energy intake (EI) could be assessed based on procedures for physical activity recalls.

All 37 participants were middle income women from Linkoping, Sweden and between the ages of 21-41, with a mean age of 29 years. The methods of assessment used were three 24-hour dietary recalls, two physical activity recalls, indirect calorimetry to estimate total energy expenditure (TEE), and the doubly labeled water method which estimates TEE of free living human subjects. Lof & Forsum (2004) had found that 18 women underreported their
TEE by 76% and 24 women were constantly underreporting their EI as lower than TEE on all three dietary recall days. In regards to the PA recalls, 13 women underreported and 20 women constantly underreported. The results of the study concluded that EI obtained with dietary recalls were biased with respect to BMI and attitudes toward body weight and diet. As energy intake obtained with PA recalls was not biased in respect to estimating TEE, it was determined that characteristics of particular subjects contributed to underestimations of EI rather than the dietary method itself.

As humans age, energy requirements tend to decrease as a result of decreased REE that has been associated with a loss of fat-free mass, and due to a reduction in the intensity of physical activity, time spent being physically active, or both. The accurate estimation of a person’s energy expenditure of physical activity is important and useful when estimating an individuals total daily energy needs (Kruskall, Campbell, & Evans, 2004). Thus, measurement of energy expenditure is the most accurate method for determining energy requirements and is commonly done using indirect calorimetry (Reeves, Capra, Bauer, Davies, & Battistutta, 2005).
Reeves et al. (2005) compared measurements of REE from traditional indirect calorimetry to measurements of REE from the MG in patients with cancer and in healthy subjects. The investigators also compared measured REE from both devices to REE values estimated using prediction equations.

Participants for this study included cancer patients ($n = 18$) and healthy subjects ($n = 17$) between the ages of 37-86 years. Both men and women were recruited from Brisbane, Australia, and the cancer patients were from the Private oncology radiation centre located in the city. Cancer patients consisted of 12 males and seven females and the healthy subjects consisted of 10 males and seven females. Assessment methods included the traditional indirect calorimetry and MG calorimetric device and were conducted in random order after a 12-hour fast and 30-minute rest. Resting Energy Expenditure was measured and the data collection protocol was the same for both groups. The predicted REE equation used was the Harris-Benedict equation.

Reeves et al. (2005) found that for the cancer patients, the mean measured REE from the traditional calorimetry as compared to the MG significantly differed
statistically and clinically. Whereas the mean measured REE between both devices for the healthy subjects did not differ statistically, they differed clinically. Individually, there were clinically significant differences of REE by the MG as compared to the traditional method. No differences between mean measured REE and predicted REE were found. The results of this study concluded that the MG is acceptable for measuring REE in the healthy subjects at the group level, but is not as clinically accurate for individual healthy subjects or for cancer patients. The Harris-Benedict equation predicted REE within acceptable limits at the group level, but not at the individual level.

Developed to estimate physical activity in an older population, the Yale Physical Activity Survey (YPAS) through previous research has been found to be adequately valid, but its accuracy still remains in question. Therefore, Kruskall et al. (2004) compared energy expenditure of physical activity (EPAA) estimated from the YPAS with that obtained from direct measurements of metabolic energy intake and REE in a group of older men and women.

Participants (n = 28) consisted of 11 men and 17 women between the ages of 55-78 years. All participants were
volunteers and agreed to be part of this 14-week controlled diet study in which 10 weeks were in an outpatient setting and 4-weeks were in an inpatient setting at the General Clinical Research Center, Noll Physiological Research Center, The Pennsylvania State University, University Park. Metabolizable energy intake (MEI) was measured at week 14 from the gross energy contents of food, urine, and feces, and REE was determined using indirect calorimetry over three trials. The last method of assessment included the YPAS which was administered three times throughout the 14 weeks.

Kruskall et al. (2004) found that the EEPA derived from indirect calorimetry was not different from that estimated by the YPAS for men alone and men and women combined. The YPAS estimate was greater than the measured mean value for women. Limited difference was found between the EEPA estimated from indirect calorimetry and energy expenditure estimated from the YPAS. Results from this study concluded that YPAS reasonably predicts the EEPA in older groups of people, with the caution that it might over predict EEPA of older women. With limited studies comparing EEPA values from indirect calorimetry and values estimated from the YPAS and unless accompanied by a more accurate
method of indirect calorimetry, the YPAS should be used with caution when estimating energy expenditure in older adults.

**Summary**

In the literature review, all areas discussed have provided more in depth information necessary to support the investigation. Factors discussed were CVD, CR programs, behavioral intervention sessions, dietary interventions with cardiac patients, and nutritional resources. This chapter expressed the importance of patients gaining dietary knowledge and learning how to apply it to their own life. Therefore, it is essential for CR programs to offer resources that focus not only on nutrition, but also provide behavioral interventions in which patients feel supported and motivated to adhere to a CR program.

Research discussed within this chapter has proven the success of CR programs within the United States, more specifically within the physical aspect of health. The increased significance of cardiac events, lack of dietary knowledge, and poor eating behaviors expressed by many patients’ further conveys the lack of nutritional focus by CR programs. By providing nutritional education to CR patients and implementing this resource into CR programs,
eating behaviors, adherence to a CR program, overall physical health and satisfaction has improved.

As physical, psychological, and dietary issues were not at the forefront of many individuals’ minds, behavioral interventions were not considered a necessity within CR programs. With problems of compliance and adherence to CR programs being noticed, hospitals all around the United States began offering behavioral intervention sessions to all of their patients. The support system, abundance of information, and continuous feedback provided to each patient has been proven successful in leading to positive quality of life changes. This study takes another step in research as it will compare the differences between a traditional phase IV CR program and a group-mediated cognitive-behavioral intervention group.
CHAPTER THREE
METHODOLOGY

The intent of this investigation was to determine whether there were significant nutritional differences between a group-mediated cognitive-behavioral group (treatment) and a traditional cardiac rehabilitation group (control) among phase IV CR participants. Conducted over a 3 month period, this study specifically investigated the following factors for each participant: 3-day dietary recall, resting energy expenditure (REE), and the MEDFICTS (MF) food frequency questionnaire. The intent of this chapter is to convey the following information: selection of participants, instrumentation and procedures, and treatment of data.

Selection of Participants

All participants from the Heart Plus Fitness Program, a phase IV CR program that is a collaboration of Minnesota State University, Mankato (MSU)/Immanuel St. Joseph Hospital-Mayo Health System (ISJ-MHS) were invited to participate in the study. A total of 22 participants, 15 men and 7 women were recruited for this investigation. Participants, aged 45 to 85 years, were either at risk for
CVD or had documented evidence of CVD. All participants were placed within the treatment or control group and volunteered to be a part of the study upon a physicians request and/or for personal benefit.

Placement within the Group-Mediated Cognitive-Behavioral (treatment) or traditional CR (control) group was by non-random selection due to time constraints of various participants. Consisting of 11 subjects (7 men, 4 women) and 11 subjects (8 men, 3 women) respectively, the control group and treatment group participants continued with their daily aerobic and strength training exercise routines, the difference being that the treatment group participated in weekly cognitive-behavioral intervention sessions in addition to their daily routine.

Informed of what the study would entail, all subjects completed the following requirements: read and signed a consent form, medical history form to obtain physician approval, dietary assessment forms, and physical testing. Participants were assured that all information and data collected would be kept confidential and maintained by the investigators for the duration of the study.

Prior to this investigation, the application for the Conduct of Research involving Human Participants was
completed and submitted for review to both the Institutional Review Board (IRB) administrator at MSU on November 30, 2007 and to the IRB at ISJ Hospital in Mankato, Minnesota on February 13, 2008. The application was approved by the MSU review board in early January and by the ISJ review board in mid-February.

**Instrumentation and Procedures**

All participants were members of the Heart Plus Fitness Program (HPFP) and were either at risk for had documented evidence of CVD. The purpose and length (3 months) of the study was explained to each member of HPFP and individuals who agreed to participate were placed within the treatment or control group. All participants who volunteered were required to complete an informed consent form and medical history form prior to the study. At both baseline and post-study, the 3-day dietary recall, MF food frequency questionnaire, and MedGem (MG) test were provided by the researcher along with thorough instructions.

**Traditional Phase IV Cardiac Rehabilitation**

Specifically designed to assist individuals in maintaining their physical and dietary goals, each individual participated in supervised physical activity at MSU, three to five days a week. Participants focus on their
daily routine that consists of a warm-up, aerobic exercise, strength training, and a cool-down.

**Group-Mediated Cognitive-Behavioral Intervention**

Participants in the GMCB group gathered once a week to engage in instruction and behavior change sessions that were both designed and led by the researchers. Based on the social cognitive theory developed by Albert Bandura, strong emphasis was placed on exercise behavior and how it is influenced by both cognition (i.e., beliefs or attitudes) and external stimuli (i.e., experiences or social pressure). The purpose of these sessions was to help the participants’ learn how to use self-regulatory tools to maintain physical activity and overall health.

Previously investigated and tested by Rejeski et al. (2002), the 12 sessions were carefully developed by the researchers leading this study and approximately 30-45 minutes in duration. Including active-learning principles to promote individual learning, the main goal of the cognitive-behavioral sessions was to prepare the participants to continue physical activity and promote functional independence after the CR program.

Topics of the intervention sessions included:

- **Week 1: Stepping into “The New You”**
Week 2: Group Identity and Expectations

Week 3: Goal Setting

Week 4: Problem Solving and Overcoming Barriers to be Active

Week 5: Nutrition

Week 6: Nutrition

Week 7: Roadblocks to Achieving Goals

Week 8: Stress Management

Week 9: “I Know Better, but…”

Week 10: Motivation to be Physically Active

Week 11: Maintenance of Physical Activity

Week 12: Presentation of Motivation Plan and Discussion of Evidence of Change

Three-Day Dietary Recall

Assessing a patients dietary habits and providing recommendations that are consistent with a heart healthful dietary pattern are extremely beneficial for cardiac patients (Holmes et al., 2005). Dietary assessment tools have been used in research, hospital, and clinical settings as a means of determining an individual’s current nutritional status and providing information on how to modify diets. One of the most frequently used assessment procedures, the dietary recall is inexpensive, easy to
administer, reliable, and valid form of nutritional assessment (Rosenbloom, 2000). Dietary recalls are needed to quantify total food intake and have been proven accurate on an individualized basis (Andersson et al., 2001).

A three-day dietary recall that included two weekdays and one weekend day was administered to all subjects. With investigator assistance, each participant was encouraged to record all food and beverages consumed with total honesty and accuracy.

All food records collected were analyzed by the investigator prior to analysis by the Food Processor, a computerized tool that allows for the input of dietary recall components. To provide a complete nutritional analysis, all foods were entered into the Food Processor by the researcher for each subject as accurately as possible.

**MEDFICTS Food Frequency Questionnaire**

Specifically designed to evaluate patient adherence to the National Cholesterol Education Program (NCEP) Heart Healthy and Therapeutic Lifestyle Change diets adopted by the American Heart Association (AHA), the MEDFICTS Food Frequency Questionnaire (MF) is a self-reported diet questionnaire that quantifies diet quality and identifies adherence to a diet in accordance with restrictions for
saturated fat and cholesterol recommendations. Validated by the AHA, the MF is an easily scored and reliable food frequency questionnaire that is commonly used as an outcome measure in CR programs (Holmes et al., 2005).

With strong focus on food quantity and quality, the MF scores range from zero to 216 points placing each individual within one of three diet categories: Heart Healthy, Therapeutic Lifestyle Change (TLC), or needs to make dietary changes. The main objective of these dietary steps is to decrease the risk of CHD by reducing total fat intake to 30% or less of total calories, and progressively reducing saturated fat and cholesterol intake. The three step approach to diet therapy according to NCEP is described in table 1.
Table 1

MEDFICTS Dietary Categories.

<table>
<thead>
<tr>
<th>Needs to Make Dietary Changes</th>
<th>Heart Healthy Diet</th>
<th>TLC Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 70 points</td>
<td>Between 40-70 points</td>
<td>Less than 40 points</td>
</tr>
<tr>
<td>High fat Diet</td>
<td>Diet contains less dietary fat</td>
<td>Low-fat diet</td>
</tr>
<tr>
<td></td>
<td>Less than 300 mg/dL cholesterol</td>
<td>Less than 200 mg/dL cholesterol</td>
</tr>
<tr>
<td></td>
<td>7-10% of energy from saturated fat</td>
<td>Less than 7% of energy from saturated fat</td>
</tr>
<tr>
<td></td>
<td>Recommended for all healthy persons for the prevention of CHD</td>
<td>Commonly recommended for patients with either high-risk cholesterol level (&gt; 240 mg/dL) or with known CHD</td>
</tr>
</tbody>
</table>

Required to quantify food intake (weekly consumption and daily serving sizes) within each of the eight food categories, each participant was placed within a diet category once all questionnaires were collected and scored. All participants were informed of their baseline results and dietary category with which they fell within. As a means of encouragement to make dietary changes, the investigator provided participants with nutritional education and tips that would preferably result in improved MF post-study scores.
**MedGem Calorimetric Device**

A Food and Drug Administration (FDA) approved hand-held device, the MedGem (MG) quickly and accurately measures resting energy expenditure (REE), defined as the number of calories the body burns on a daily basis while at rest to maintain essential functions such as heart rate, brain activity, and breathing. An important factor in how efficiently calories will be burned off, REE can represent up to 75% of the total energy expenditure for an individual who leads a sedentary lifestyle.

With advancing age, energy requirements of adult humans tend to decrease due to a reduction in REE that is associated with a loss of fat-free mass and a reduction in the intensity of physical activity. Knowledge of REE may improve compliance with diet and exercise components of CR programs. Accurate REE measurements are critical to nutritional assessments for successful weight management, improved medical outcomes, improved diabetic control, and overall health and wellness (Kruskall et al., 2004).

The MG has been clinically validated by the FDA, is easy to administer, and provides accurate results in 10 minutes or less. This device works by measuring the difference between the amounts of oxygen inhaled and exhaled with each breath.
Prior to testing, each participant’s height, weight, and age were collected. Once in a rested state, a nose clip was administered to prevent air from escaping through the nostrils to ensure all breathing was done through the mouth. The REE obtained from the device was compared to the predicted REE calculated from the following Harris-Benedict Equation (Reeves et al., 2005):

Men: \( \text{REE} = 66.473 + (5.003 \times \text{ht}) + (13.752 \times \text{wt}) - (6.755 \times \text{A}) \)

Women: \( \text{REE} = 655.096 + (1.850 \times \text{ht}) + (9.563 \times \text{wt}) - (4.676 \times \text{A}) \)

* \( \text{ht} = \) height in centimeters, \( \text{wt} = \) weight in kilograms, \( \text{A} = \) age in years

All participants were informed of baseline results for their own knowledge and as a means of encouragement to make dietary and physical activity changes that would result in improved REE post-study values.

**Treatment of Data**

Data from the instruments involved in the investigation were compiled and analyzed for comparison. Descriptive analysis was used to calculate the means and standard deviations of all the variables studied.
Independent t-tests were performed to determine whether significant nutritional differences were found between the traditional phase IV group (control) and the GMCB group (treatment). Pearson-Product correlations were performed to determine whether significant relationships were found between participants within the treatment and control groups. One-Way ANOVA analyses were performed to further determine the strength of the linear (regression) relationships between variables. All statistical analyses performed were used to compare the test results of all baseline and post-study data obtained. Data was analyzed by the Statistical Analysis Sciences (SAS, version 6) computer program and a .05 level of significance was used.
CHAPTER FOUR
RESULTS AND DISCUSSION

Results

This intent of this study was to determine whether group-mediated cognitive-behavioral (GMCB) interventions versus a traditional phase IV cardiac rehabilitation program effected nutritional choices and overall eating behaviors of cardiac rehabilitation (CR) participants after a three month period. In addition, this investigation was done to determine whether there were significant dietary differences between and significant relationships within the treatment group and control group. The following variables were investigated to determine whether potential relationships existed: weight, MEDFICTS (MF) value, MedGem (MG) resting energy expenditure (REE), predicted resting energy expenditure, total kilocalories, total fat, saturated fat, cholesterol, and attendance.

Subjects

All 22 participants who took part in this investigation attended the Heart Plus Fitness Program (HPFP), an MSU/ISJ-MHS phase III/IV CR program, at least 3 days a week, displaying good compliance to the program. The
descriptive statistics for the participants are presented in Tables 3 and 4. The mean ages for the treatment and control groups were 68 and 61 years respectively. The mean height for the treatment and control groups were 172 and 173 centimeters respectively. The mean baseline/post-study weight for the treatment and control groups were 98/96 and 91/91 kilograms respectively.

The 11 participants who were placed within the treatment group also displayed good attendance records for the GMCB intervention sessions. Of the 12 sessions administered, eight sessions had attendance above the 75th percentile rank. Table 2 illustrates the percentage of daily attendance for the GMCB intervention sessions over the 3 month period.

<table>
<thead>
<tr>
<th>Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Mediated Cognitive-Behavioral Intervention Session Attendance.</td>
</tr>
<tr>
<td>Sessions</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>Daily Total (n)</td>
</tr>
<tr>
<td>Daily Percentage (%)</td>
</tr>
</tbody>
</table>

n = number (total number in group is 11), % = percent

**Dietary Assessments**

As determined by this investigation, there were statistical differences found between the treatment and control group’s baseline data. There were no statistical
differences found between the treatment and control group’s post-study data. When compared to the control group, the treatment group displayed higher baseline values, yet had the most significant changes (decreases) in the post-study data. These results are portrayed in Tables 3 through 5.

This investigation determined that there were significant correlations between the dietary variables of MF scores and weight, fat/saturated fat and daily attendance, and MG REE and predicted REE for the treatment and control groups. These results are portrayed in figures 1 through 4.

Table 3 illustrates baseline data of the average physical and dietary characteristics for the treatment and control groups. As shown, the treatment group consumed a significantly higher amount of fat and saturated fat percent of total kilocalories and cholesterol.
Table 3

Mean Physical and Dietary Characteristics for the Treatment and Control Groups – Baseline.

<table>
<thead>
<tr>
<th></th>
<th>Treatment Group (n = 11)</th>
<th>Control Group (n = 11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>68(8.14)</td>
<td>61(8.12)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>98(14.8)</td>
<td>91(11.97)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>172(9.70)</td>
<td>174(6.64)</td>
</tr>
<tr>
<td>MEDFICTS</td>
<td>44(22.83)</td>
<td>46(22.40)</td>
</tr>
<tr>
<td>MedGem REE (cal)</td>
<td>1819(636.58)</td>
<td>1902(410.17)</td>
</tr>
<tr>
<td>Predicted REE (cal)</td>
<td>1775(317.92)</td>
<td>1722(246.87)</td>
</tr>
<tr>
<td>Total Kilocalories</td>
<td>1554(355.68)</td>
<td>1588(364.78)</td>
</tr>
<tr>
<td>Total Fat (g)</td>
<td>69(24.21)</td>
<td>59(21.97)</td>
</tr>
<tr>
<td>Total Fat (%)</td>
<td>* 39(7.42)</td>
<td>* 33(7.09)</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>21(8.31)</td>
<td>16(7.11)</td>
</tr>
<tr>
<td>Saturated Fat (%)</td>
<td>* 12(3.69)</td>
<td>* 9(2.97)</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>* 346(129.38)</td>
<td>* 223(109.78)</td>
</tr>
</tbody>
</table>

* Significantly different between groups according to a p > .05

Table 4 illustrates post-study data of the average physical and dietary characteristics for the treatment and control groups. When comparing all post-study physical and dietary variables between the treatment and control groups, no statistical differences were found.

Table 4
Mean Physical and Dietary Characteristics for the Treatment and Control Groups - Post Study.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Treatment Group (n = 11)</th>
<th>Control Group (n = 11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs.)</td>
<td>68 (8.19)</td>
<td>61 (8.12)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>96 (18.78)</td>
<td>91 (11.56)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>172 (9.70)</td>
<td>173 (6.64)</td>
</tr>
<tr>
<td>MEDFICTS</td>
<td>35 (21.76)</td>
<td>30 (22.15)</td>
</tr>
<tr>
<td>MedGem REE (cal)</td>
<td>1550 (392.33)</td>
<td>1649 (358.65)</td>
</tr>
<tr>
<td>Predicted REE (cal)</td>
<td>1747 (313.89)</td>
<td>1716 (240.39)</td>
</tr>
<tr>
<td>Total Kilocalories</td>
<td>1218 (341.04)</td>
<td>1291 (272.12)</td>
</tr>
<tr>
<td>Total Fat (g)</td>
<td>41 (15.93)</td>
<td>43 (10.75)</td>
</tr>
<tr>
<td>Total Fat (%)</td>
<td>31 (11.40)</td>
<td>30 (4.27)</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>12 (4.02)</td>
<td>12 (3.61)</td>
</tr>
<tr>
<td>Saturated Fat (%)</td>
<td>9 (3.01)</td>
<td>8 (1.94)</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>190 (82.58)</td>
<td>241 (123.02)</td>
</tr>
</tbody>
</table>

* Significantly different between groups according to a p > .05

cal = calories, cm. = centimeters, g = grams, n = number of subjects, kcal = kilocalories, kg. = kilograms, mg = milligrams, % = percent of total kilocalories, yrs. = years

The amount of change between baseline and post-study data for the treatment and control groups is displayed in Table 5. When in comparison, the treatment and control groups had significant positive changes (decreases) in all physical and dietary characteristics, except for cholesterol intake, in which the control group increased their consumption by 18mg.

Table 5
Amount of Change for the Treatment and Control Groups.
<table>
<thead>
<tr>
<th></th>
<th>Treatment Group (n = 11)</th>
<th>Control Group (n = 11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>MEDFICTS</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>MedGem REE (cal)</td>
<td>269</td>
<td>253</td>
</tr>
<tr>
<td>Predicted REE (cal)</td>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>Total Kilocalories</td>
<td>336</td>
<td>297</td>
</tr>
<tr>
<td>Total Fat (g)</td>
<td>28</td>
<td>16</td>
</tr>
<tr>
<td>Total Fat (%)</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Saturated Fat (%)</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>156</td>
<td>-18</td>
</tr>
</tbody>
</table>

cal = calories, cm. = centimeters, g = grams, n = number of subjects, kcal = kilocalories, kg. = kilograms, mg = milligrams, % = percent of total kilocalories, yrs. = years

To determine whether a significant relationship existed between dietary variables for the treatment and control groups, all post-data results were used.

For Figures 1 through 3, if the Pearson Pairwise correlation between variables is greater than or equal to .602 (r ≥ .602, degrees of freedom = 9) according to a .05 level of significance (p > .05), the correlation coefficient is considered significant.

For Figures 1 through 3, an f-ratio using One-Way ANOVA that is greater than or equal to 5.12 (f ≥ 5.12, degrees of freedom = 1, 9) according to a .05 level of significance (p > .05), further indicates the strength of the linear relationship between the variables observed.
As shown in Figure 1, the MEDFICTS food frequency questionnaire values were measured against weight (kg) in the treatment group to determine if a correlation existed. A significant positive correlation exists between both variables with a coefficient of .7814 (significant probability = .0045).

**Figure 1. Post-Data Correlation for the Treatment Group – MEDFICTS versus Weight**

* Significantly related according to a p > .05

** The observed f-ratio is 14.11

Figure 2 illustrates the correlation of daily group attendance against total fat (g) in the treatment group. With a correlation coefficient of -.6794 (significant probability = .0215), a significant negative correlation existed between both variables.

**Figure 2. Post-Data Correlation for the Treatment Group –**
Daily Group Attendance versus Total Fat

* Significantly related according to a p > .05

** The observed f-ratio is 7.72

As shown in Figure 3, the daily group attendance was measured against saturated fat (g) in the treatment group to determine if a correlation existed. A significant negative correlation existed between both variables with a coefficient of -.5435 (significant probability = .0840).

Figure 3. Post-Data Correlation for the Treatment Group -
Daily Group Attendance versus Saturated Fat

* Significantly related according to a p > .05

** The observed f-ratio is 3.77

Figure 4 illustrates the correlation between MedGem REE (cal) and predicted REE (cal) for the treatment and control groups combined. According to a .05 level of significance (p > .05), the correlation coefficient is considered significant if the Pearson Pairwise correlation between variables is greater than or equal to .423 (r ≥ .423, degrees of freedom = 20). With a correlation coefficient of .5232 (significant probability = .0125), a significant positive correlation existed between both variables.

For Figure 4, an f-ratio using One-Way ANOVA that is
greater than or equal to 4.35 (f ≥ 4.35, degrees of freedom = 1, 20) according to a .05 level of significance (p > .05), further indicates the strength of the linear relationship between the variables observed.

**Figure 4. Post-Data Correlation for the Treatment and Control Groups Combined – MedGem Resting Energy Expenditure versus Predicted Resting Energy Expenditure**

* Significantly related according to a p > .05

** The observed f-ratio is 7.54

**Discussion**

A modified version of a study completed by Dr. Jack Rejeski and colleagues of Wake Forest University in 2002, this investigation focused primarily on eating behaviors and nutritional choices of participants in a phase IV CR program. Numerous studies have researched the effectiveness
of cardiac rehabilitation programs, and though found to be beneficial in helping individuals maintain a healthy lifestyle, most programs focus on the aspect of physical activity and lack the nutritional components (Plous et al., 1995). The question arose of how effective nutritional education would be in a CR program, resulting in increased research of dietary interventions with CR patients (Timlin et al., 2002).

Gaining the knowledge of how to develop and maintain a proper diet can positively impact an individual’s overall health. Dietary changes have been found to play an important role in reducing the risk of coronary heart disease, thus nutrition education is regarded as an important component of CR programs (Paxton & Ball, 1999).

Nutritional therapy is an important component of disease management and considered effective in the prevention and treatment of chronic diseases (Jonalagadda, 2005). Previous studies have concluded that positive lifestyle modifications are highly recommended, but minimal research has been done on the effectiveness of behavioral changes in CR participants. Educating an individual on proper nutrition and encouraging positive behavioral changes makes an impact on their overall
life (Bergmann and Boeing, 2002).

**Group-Mediated Cognitive-Behavioral Interventions**

With the goal of optimizing each participant’s knowledge in various aspects of health, sessions focused on nutrition, physical activity, stress, and psychological aspects of health. Surprisingly, no matter the topic, conversation eventually led to questions and concerns in regards to nutrition. Plous et al. (1995) conducted a study which showed that cardiac patients viewed diet as an important component in the prevention and treatment of CHD, yet knowledge in this area was limited as 30.5% of individuals had difficulty understanding dietary information. One major concern, counseling within the nutritional field should be given higher priority to participants within a CR program as the knowledge gained through educational sessions can be applied to the physical, psychological, and nutritional aspects of life.

In a study conducted by Bergmann & Boeing (2002), both men and women stated weight problems and prevention/treatment of metabolic diseases as the main reason for dietary changes. Cardiac rehabilitation participants on average had a lower body mass index, yet programs that initiated dietary interventions boosted
participant morale and engagement of positive behaviors, such as dietary and exercise changes (Yates et al., 2003).

Proven within this investigation, participants in the treatment group were given the opportunity to learn more about themselves and gain confidence in their abilities to make positive behavioral changes. As found similar in a study led by Aldana et al. (2005), positive changes in test scores was a result of overall knowledge of health for the treatment group, whereas the control group experienced small, but significant changes. A benefit to offering educational classes focused on healthy living is the ability to reach out to individuals in who feel “stuck” or frustrated with their current routine and need help breaking through the barriers. Though both groups were successful in positively modifying their dietary habits, the treatment group displayed the most significant results. Through previous education, the media, and conversation with individuals in the health profession, participants in the control group were solely able to modify their dietary habits. These participants learned not only about their individual capabilities, but focused more attention on their eating behaviors, taking advantage of the knowledge gains in each session and effectively applying it to their
everyday lives.

Social support is also an integral factor in the success of healthy behavior changes. Whether for emotional or information reasons, a wide network of social support directly influences health behaviors and outcomes (Sorenson et al., 1998). The support, encouragement, and gain of confidence that each individual felt within the treatment group led to multiple changes of lifestyle. The participants' engaged themselves in conversation, thriving on the knowledge gained within each intervention session, proving that the integration of spiritual growth, interpersonal relationships, and self-actualization in a CR patients life promotes overall healthy behaviors (Hamilton et al., 2003). As a result, the benefits obtained by individuals exposed to education programs, dietitians, and other resources, led to permanent integrations of dietary interventions within CR programs (Cavallaro et al., 2004).

**MEDFICTS Food Frequency Questionnaire**

Due to the results obtained in this investigation, the null hypothesis that a significant difference would not be found between the participant’s baseline and post-study MF values in the treatment versus the control group was accepted. MEDFICTS values were not significantly different
between both groups.

The null hypothesis that there would be no significant relationship found within the treatment and control groups when comparing participant’s post-study results with respect to MF values was rejected. A significant positive relationship was found within the treatment group when comparing MF values to weight. Participants who lowered their MF scores displayed a decrease in weight.

Specifically designed to evaluate patient adherence to the National Cholesterol Education Program Step 1 and Step 2 diets adopted by the AHA, the MF was designed to help cardiac patients reduce CHD risk through diet-induced reductions of fat and cholesterol intake (Holmes et al., 2005). Holmes et al. (2005) findings were consistent with the findings of this study when determining the effectiveness of the MF questionnaire and methods of assisting individuals in decreasing their overall fat and cholesterol intake. The participants in the treatment group had poorer MF scores at baseline, yet had significant improvements in post-study scores.

Though improvements in dietary habits were achieved by both groups, the treatment group showed significant dietary changes in both fat and cholesterol intake. Most suitable
in identifying high fat diets, MF scores show greater improvements for individuals who were further educated on nutritional components (Taylor et al., 2003). With food behaviors varying for individuals, Frame et al. (2003) led a study in which participants analyzed their progress with respect to fat intake. With the treatment group participating in weekly group nutrition education sessions for 12 weeks, the majority of these individuals displayed a reduction in fat, as is similar to this investigation.

3-Day Dietary Recall

Due to the results obtained in this investigation, the null hypothesis that a significant difference would not be found between the participant’s baseline and post-study data of dietary intake in the treatment versus the control group was rejected. Significant differences in the baseline data were found between the groups with respect to fat percent of total kilocalories, saturated fat percent of total kilocalories, and cholesterol intake (p<.05). However, no significant differences in post-study data were found between groups for all dietary variables.

The hypothesis that there would be no significant relationship found within the treatment and control groups when comparing participant’s post-study results with
respect to dietary intake was rejected. A significant negative relationship was found within the treatment group when comparing daily group attendance to both total and saturated fat grams. Participants who consistently attended GMCB sessions displayed a reduction in fat/saturated fat intake.

In a previous study conducted by Lennie et al. (2006), multiple factors affect dietary choices, preventing individuals from achieving their goal of optimizing nutritional intake. Many individuals lack the education when it comes to planning a proper diet, running into endless barriers when attempting to maintain a healthy nutritional regimen. Having the resources, such as dietary recalls, will help cardiac patients overcome barriers and adhere to healthier choices. Found in accordance with this study, dietary recalls are a means of assessing daily food intake (deficiencies/overabundance) and provides more accurate information when reported on an individual basis (Thompson et al., 2008).

Providing a dietitian or additional educational programs as a resource had a positive effect on cardiac patients (Cavallaro et al., 2004). Nutritional services, such as interventions, provide a variety of information
through various techniques that CR programs can and should take advantage of. As shown consistent with this study, quantitative methods used to determine food intake are accurate on both an individual and group basis (Andersson et al., 2001). With the ability to monitor food intake, each individual was able to display greater self-control on the quantity and quality of foods consumed. As found in the study, though each group exhibited positive changes, the treatment group had the greatest improvements as the combination of self-efficacy and nutrition education aided in the ability to manage lipids, fat intake, and weight reduction, further preventing future cardiac events (Timlin et al., 2002).

**MedGem Resting Energy Expenditure**

Due to the results obtained in this investigation, the null hypothesis that a significant difference would not be found between the participant’s baseline and post-study MedGem REE in the treatment versus the control group was accepted. The treatment and control did not have significantly different MedGem and Predicted REE caloric values.

The null hypothesis that there would be no significant relationship found within the treatment and control groups
when comparing participant’s post-study results with respect to MedGem REE was rejected. A significant positive relationship was found when comparing MedGem REE and Predicted REE values within the treatment and control groups combined. Participants who were consistent with their MG testing and daily routine displayed similar predicted REE values, of which was determined from physical characteristics.

The assumption that a sufficient intake of energy will lead to satisfactory nutritional intake was proven correct in a previous study conducted by Andersson et al. (2001). The ability to function effectively on a daily basis is directly related to REE and knowledge of this component is essential. A reduction in REE is associated with a loss of muscle mass, reduction in physical activity, and weight loss, all of which are directly related to advancing age. An important factor in determining how efficiently calories will be burned off, an accurate estimation of energy expenditure of physical activity is useful when estimating an individual’s total daily energy needs (Kruskall et al., 2004).

As determined by this study, both groups experienced a reduction in caloric values for resting energy expenditure
due to positive dietary and exercise modifications. More specifically, resulting from a healthier diet and consistent physical activity, the treatment group experienced a greater weight loss, leading to a decrease in REE values as the body requires less energy to function. The most accurate and commonly used method for determining energy requirements is by indirect calorimetry (Reeves et al., 2005). Measurements are critical to nutritional assessments for modifying individuals overall health, thus knowledge of REE will improve compliance with diet and exercise components of CR programs (Kruskall et al., 2004).
CHAPTER FIVE
SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

The purpose of this investigation was to determine whether group-mediated cognitive-behavioral interventions in comparison to a traditional phase IV cardiac rehabilitation program influenced nutritional choices and eating behaviors over a 3 month period. In addition to comparing the treatment to the control group, this investigation was conducted to determine whether significant dietary differences existed between the treatment and control groups. The variables examined to determine whether significant differences existed included: weight, MEDFICTS (MF) value, MedGem (MG) resting energy expenditure (REE), predicted REE, total kilocalories, total fat, saturated fat, cholesterol, and attendance.

Twenty-two subjects, aged 45-85 years, who were either at risk for or had documented evidence of cardiovascular disease participated in this study. All individuals invited to participate in this study were from the Heart Plus Fitness (HPF) Program, a phase IV cardiac rehabilitation program that is a collaboration of Minnesota State University, Mankato/Immanuel St. Joseph Hospital-Mayo
Health System. Participants were placed within the either the treatment (11 subjects) or control (11 subjects) group and completed an informed consent form and medical history form prior to the start of this investigation.

While both groups continued with their daily aerobic and strength training exercise routines, the treatment group also participated in 12 weekly group-mediated cognitive-behavioral (GMCB) intervention sessions that focused on helping participants learn how to use self-regulatory tools to maintain physical activity and overall health. Both the treatment and control groups completed a 3-day dietary recall, MF food frequency questionnaire, and MG REE testing at both baseline and post-study. These assessment tools were used to determine whether the GMCB sessions made an impact on the treatment groups overall dietary choices as compared to the control group.

The 3-day dietary recall was used to assess daily food intake over the span of 2-weekdays and 1-weekend day. The MF questionnaire was used to assess the quality and quantity of food consumed on both a daily and weekly basis, with concentrated focus on cholesterol and saturated fat intake. The MG device was used to determine REE, or the amount of calories the body requires in order to function
effectively on a daily basis.

Eight of the 12 intervention sessions had attendance above the 75th percentile rank for the treatment group. Using a .05 level of significance, independent t-tests were performed for baseline and post-study data to determine whether significant dietary differences were found between the treatment and control groups. At baseline, the treatment group was found to have significantly higher dietary intake of cholesterol, fat and saturated fat percent of total kilocalories. No significant differences were found between both groups with respect to the post-study data. Overall, the treatment group exhibited greater significant dietary changes when compared to the control group.

Pearson-Product correlations were performed to determine whether significant relationships were found within the treatment and control groups post-study data. The treatment group was found to have significant relationships between the following variables: MF values and weight (positive), attendance and total fat (negative), and attendance and saturated fat (negative). The combination of MG and predicted REE values for both groups were found to have a significant positive relationship.
One-Way ANOVA analyses were performed to further indicate the strength of the functional (linear) relationships between dietary variables. The regression analysis between the following variables: MF values and weight, attendance and total fat, and MG and predicted REE were found to have a significant functional relationship between the variables observed. Data was displayed in both tables and figures in chapter four.

Conclusions

Based on the analysis of the data obtained, the following conclusions can be made from this investigation:

1. Dietary intake and behaviors were statistically different between the treatment and control groups with respect to baseline data. The treatment group had significantly higher intake cholesterol, fat and saturated fat percent of total kilocalories.

2. No significant differences were found between the treatment and control groups post-study data with respect to dietary intake and behaviors.

3. Significant relationships of dietary variables were found within the treatment group with respect to post-study data. The treatment group had a positive correlation between MF and weight, and negative correlations between
daily attendance and both total and saturated fat.

4. A significant relationship (positive correlation) was found between the combination of both the treatment and control groups MedGem REE and predicted REE.

5. Participation in group-mediated cognitive-behavioral intervention sessions resulted in positive value changes between baseline and post-study data for the treatment group.

6. Participation in group-mediated cognitive-behavioral intervention sessions positively affected nutritional choices and eating behaviors of individuals in the treatment group during the 3-month study.

**Recommendations**

The following recommendations for future research are made:

1. An investigation on a larger, more diverse sample size from a greater geographical area.

2. There is need for future studies to employ more randomization in the process of delegating individuals from the same population to the treatment or control group.

3. There is need for further studies to closely analyze the diet of participants following dietary interventions over a longer period of time.
4. There is need for further research similar to this study, comparing one group that receives dietary interventions to another group that will not, in order to determine whether differences exist.
# TABLE OF CONTENTS

| LIST OF TABLES | iv |
| LIST OF FIGURES | v |

Chapter

I. INTRODUCTION ................................................................. 1
   B. Statement of the Problem .............................................. 3
   B. Hypotheses ................................................................. 3
   E. Significance of the Study .............................................. 4
   D. Delimitations ............................................................... 5
   E. Limitations ................................................................. 6
   F. Definitions ................................................................. 6

II. REVIEW OF LITERATURE .................................................... 10
   B. Cardiovascular Disease ............................................... 11
   B. Cardiac Rehabilitation Programs .................................... 13
      1. Program Adherence .................................................... 15
      2. Nutritional Focus ..................................................... 18
   C. Behavioral Intervention Sessions ................................... 20
      2. Quality of Life Changes ............................................. 20
      2. Social Support ......................................................... 25
   F. Dietary Intervention with Cardiac Patients ....................... 28
      2. Nutritional Barriers .................................................. 29
      2. Dietary Behavior Changes ......................................... 32
II. METHODOLOGY 

B. Selection of Participants ........................................ 51
B. Instrumentation and Procedures ............................... 53

6. Traditional Phase IV Cardiac Rehabilitation .................. 53

7. Group-Mediated Cognitive-Behavioral Interventions ............. 54

8. 3-Day Dietary Recall .............................................. 55

9. MEDFICTS Food Frequency Questionnaire ....................... 66

10. MedGem Calorimetric Device .................................... 59

D. Treatment of Data .................................................. 60

IV. RESULTS AND DISCUSSION ..................................... 62

A. Results ..................................................................... 62

1. Subjects .................................................................. 62

2. Dietary Assessments ................................................ 63

B. Discussion ................................................................ 71

2. Group-Mediated Cognitive-Behavioral
Interventions .......................................................... 73
2. MEDFICTS Food Frequency Questionnaire ... 75
3. 3-Day Dietary Recall .............................................. 77

V. SUMMARY, CONCLUSION, AND RECOMMENDATIONS .......... 82
   A. Summary ................................................................. 82
   B. Conclusions ............................................................ 85
   C. Recommendations .................................................. 86

REFERENCES .................................................................................. 88

APPENDICES .................................................................................. 92
   A. Informed Consent Form .......................................... 92
   B. Medical History Questionnaire .............................. 97
   D. MEDFICTS Food Frequency Questionnaire .... 103
   D. 3-Day Dietary Recall Form .................................. 109
   E. MedGem Data Recording Chart ......................... 111
   F. Sample Intervention Session Worksheet ......... 113

LIST OF TABLES
Table

1. MEDFICTS Dietary Categories .......................................................... 58
2. Group-Mediated Cognitive-Behavioral Intervention
   Session Attendance ............................................................................ 63
3. Mean Physical and Dietary Characteristics for the
   Treatment and Control Groups Baseline ............................................. 65
4. Mean Physical and Dietary Characteristics for the
   Treatment and Control Groups – Post Study ................................. 66
5. Amount of Change for the Treatment and Control
   Groups .................................................................................................. 67

LIST OF FIGURES
Figure

5. Post-Data Correlation for the Treatment Group – MEDFICTS vs Weight ................................................................. 68

6. Post-Data Correlation for the Treatment Group – Daily Group Attendance vs Total Fat ........................................ 69

7. Post-Data Correlation for the Treatment Group – Daily Group Attendance vs Saturated Fat ............................. 70