1-1-2010

Health Impact of Brief Interventions by a Registered Dietitian during Exercise Sessions in a Phase 2 Cardiac Rehabilitation Setting

Terrie Holewinski

Health Impact of Brief Interventions by a Registered Dietitian during Exercise Sessions in a Phase 2 Cardiac Rehabilitation Setting

by

Terrie Holewinski, RD

Thesis

Submitted to the School of Health Sciences

Eastern Michigan University

in partial fulfillment of the requirements

for the degree of

MASTER OF SCIENCE

Thesis Committee:

George Liepa, PhD, Chair

Kathy Rhodes, PhD, RD

April 16, 2010

Ypsilanti, Michigan

DEDICATION

A special thank-you to my husband, Rich, who quietly supported me through my journey of completing my education and goals.

To my children, Brittany and Ben, for their unconditional love and support.

ACKNOWLEDGEMENTS

There are many people who have assisted and supported me in the completion of this research project. My first acknowledgement is to Kathy Rhodes, who encouraged me to further my education and who was instrumental in the formation of my thesis.

Thank you to Dr. Melvin Reubinfire and Thomas Draper at the University of Michigan Health System Preventive Cardiology Clinic (PCC) at Domino's Farms for embracing this research project and the acknowledgement of the many benefits a dietitian can provide to their cardiac rehabilitation program.

To the exercise physiologists at PCC for their support and acceptance of me when I was in their rehabilitation classes and giving me the freedom to interact with their patients.

And finally to Dr. Liepa, for his patience, guidance, and flexibility in helping me in the completion of this project. I could not have written this document without his knowledge and support.

ABSTRACT

Weight management is integral to cardiovascular risk reduction. However, minimal weight loss is achieved during participation in many cardiac rehabilitation (CR) programs. The objective of the present study was to establish if brief interventions by a registered dietitian (RD) during cardiac rehabilitation sessions improved the health status of patients with cardiovascular disease. An RD provided individualized nutrition counseling, answered nutrition questions, and reviewed weekly progress in a CR program for a four-month period. At baseline and upon completion of 19 CR sessions, nutrition knowledge was assessed using a 38-question test, and body weight was measured. Upon completing CR, patients rated the degree at which they were making healthier food choices and how much they liked having an RD assessable during CR. After four months, the exercise physiologists (EPs) rated the value of having an RD in CR. Outcomes were collected on every patient who completed CR during this period, and values were compared to outcomes of patients who completed CR during the same timeframe one year earlier. Both groups received instruction regarding the traditional CR exercise program and four 45-minute weekly group nutrition education sessions. Forty-nine patients (36 males) completed CR with the RD present. Mean nutrition knowledge test scores improved from 59 ±1 4% to 72 ± 14%, ($p = < .001$). After completing CR, patients reported making healthier food choices 8.1 ± 1.2 out of 10 on a Likert scale. Additionally, patients related the helpfulness of having an RD available to answer their nutrition questions 8.7 ± 4.8 out of 10. The group of patients who had an RD present during CR had a mean weight loss of 1.48 ± 7.1 lbs (range -18.8 to 16.4 lbs) when compared to the group who did not have access to an RD. Ten patients were referred for individual nutrition counseling with an outpatient RD. Exercise physiologists rated the value of having an RD as part of the health care team a 9.8 out of 10. There was a trend towards greater weight loss in the group of patients who had access to an RD in CR.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Introduction

Introduction

Approximately seventy-one million Americans have cardiovascular disease (CVD) during their lifetime, of whom 27 million are estimated to be 65 years of age and older (1). Cardiovascular disease claims the lives of over 40% of the nearly 2.4 million Americans who die each year and is ranked as America's number one killer of older men and women. Established coronary heart disease (CHD) is a major form of CVD and is a risk factor for the occurrence of subsequent coronary events and death (1,2). Secondary prevention is essential in the treatment of CHD and has been proven to be effective in reducing the incidence of associated cardiovascular risk factors (3).

Cardiac rehabilitation (CR) was designed in the 1960s and initially focused on increasing aerobic capacity and exercise tolerance in the aftermath of prolonged hospitalization or de-conditioning after a myocardial infarction (4). The primary types of patient diagnosis that are found in a typical outpatient CR center include CHD, coronary artery bypass grafting (open heart surgery), percutaneous transluminal coronary angioplasty (stent placement), and valvular heart surgery (valve replacement).

In 1994, the American Heart Association (AHA) stated that CR programs should include both a multifaceted and multidisciplinary approach to facilitate cardiovascular risk reduction. Programs that consist solely of exercise training are not recognized today as true CR programs (5,6). The AHA and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) recognize that all cardiac rehabilitation/secondary prevention programs should contain specific core components that aim to optimize cardiovascular risk reduction, foster healthy behaviors, and

reinforce compliance with these behaviors with consistent reduction of disability while promoting an active lifestyle (5,7).

Obesity is becoming a global epidemic and is now considered to be an independent risk factor for CVD. Presently, 70-88% of patients diagnosed with CVD are overweight (8). According to the AHA, obese people are at greater risk of developing one or more serious medical conditions, such as hypertension, hyperlipidemia, diabetes, heart disease, and stroke. Consequently, the AHA has reclassified obesity as a major CVD risk factor (9). The National Heart, Lung and Blood Institute also identified obesity as a major health problem and stated it must be evaluated and treated in CR centers (4). Overweight and obesity are assessed by measurement of body mass index (BMI) (10,11).

Overweight patients who participate in CR programs around the country have been shown to be unsuccessful in losing weight (9). Cardiac rehabilitation programs are typically initiated 1 to 3 months after a patient experiences a coronary event and are provided in three phases to help ensure a patient's safe recovery and instill permanent lifestyle modifications. Nutrition education and counseling have become key components of CR (5), and medical nutrition therapy have been shown to improve CHD risk factors (12). Immediately after a patient is diagnosed with CHD or has successfully completed CVD surgery is an opportune time for a registered dietitian (RD) to discuss weight loss and lifestyle changes with patients and with people who are closely involved in the patient's life (8).

Objective of the Study

The objective of this study was to establish whether brief intervention by a RD during CR exercise sessions will improve the health status of patients who have been diagnosed with CVD.

Chapter 2

Literature Review

The success of CR/secondary prevention programs is dependent on the clinical attributes of the participants. Audelin et al. (13) examined the changes in the profile of individuals who entered CR from 1996 to 2006. They found that the age of the individual increased from 60.6 to 63.4 years, and the proportion of patients 75 years or older increased by 59%. The proportion of women, initially 25%, did not change. Entry weight increased from 84.7 to 88.5 kg. Overtime, the weight of patients with a diagnosis of obesity, diabetes, or hypertension increased 35%, 52% and 48%, respectively. Patients with elevated blood pressure levels did not show changes in their blood pressure. Total cholesterol, triglycerides and low-density lipoprotein cholesterol (LDL-C) decreased by 20%, 35% and 27%, respectively, whereas high-density lipoprotein cholesterol (HDL-C) increased by 12%. The use of all evidenced-based cardiovascular drugs increased significantly, particularly due to the use of statins (from 25% to 77%). It was concluded that CR patients are now older, more frequently present with features of metabolic syndrome, and are relatively less fit. However, they have also shown an increase in statin drug use over the past 10 years and this has contributed to a marked improvement in serum lipid management (13).

Coronary heart disease (CHD) is a major cause of morbidity and mortality and is related to adverse health events worldwide (14). Elevated LDL-C and reduced HDL-C concentrations are well recognized as CHD risk factors, with recent evidence supporting the benefits of intensive LDL-C reduction of CHD risk (15). According to the Third Report of the National Cholesterol Education Program Adult Treatment Panel (NCEP ATP III) (49), high risk individuals (those with preexisting CHD or CHD risk factors) require aggressive lipid lowering treatment to achieve the stringent LDL-

C goals. Statins have assumed the central role in this arena because of their superior ability to reduce LDL-C by inhibiting the rate of cholesterol biosynthesis and reduced CHD events (15).

Results of the United Kingdom Heart Protection Study (HPS) suggest those individuals with CHD or who are at high risk and have concentrations of LDL-C >100mg/dl could benefit from drug therapy. However, implementing lipid management guidelines has proven to be a difficult task. The Lipid Treatment Assessment Project (L-TAP) was a study of approximately 5,000 patients in the United States, including 1,400 individuals with CHD who were treated with lipid-lowering therapy for ≥3 months. In this study it was found that most of the patients did not achieve NCEP ATP III goals. In patients with CHD, only 18% achieved LDL-C concentrations ≤100 mg/dl. This study suggested that the patients were under-treated with statins, and in the future, statins need to be administrated at a higher dosage initially to be more effective (16,17).

Current cholesterol lowering therapies include use of statins, bile acid sequestraints, niacin, plant stanols, and combination therapy:

Statins: Statins are by far the most powerful, consistent, and best tolerated agents for lowering LDL-C. They have been shown to lower LDL-C up to 52-55% when used at the highest dose of 80 mg/day. Possible side effects of statin use may include myalgia (muscle weakness) and significant elevations of hepatic enzymes, which could result in having to stop the use of the statin or reduce the dose (16).

Bile acid sequestrants: These are gut-acting, non-absorbable agents that have been used for the past 30 years. They are only moderately effective in lowering the LDL-C levels (15-25%). The major barrier to their use is the amount required, palatability, and gastrointestinal side-effects (gas, bloating, and constipation) (16,18).

Niacin: Niacin is the oldest lipid-lowering drug, dating back to the 1950s. It has demonstrated moderate LDL-C reducing ability (10-20%). Niacin has proven to be a powerful agent for increasing HDL-C from 10-15% to as much as 20-30% depending on the dosage. In addition, niacin is also effective in lowering triglycerides. The major drawback of this agent is patient compliance and initial side effects, which include flushing and skin irritation, mainly of the neck and face. The side effects can often be overcome in most patients by gradually increasing the dosage and instructing patients to take niacin with food and a low dose of aspirin. For patients requiring additional LDL-C reduction to meet suggested goals, a combination of niacin and a statin is a good option and may even be more effective in arresting or reversing atherosclerosis than the use of statins alone (16,19).

Plant Stanols: Plant stanols are ester derivatives of plant sterols that can decrease LDL-C by about 10%. These compounds are generally given as dietary supplements such as stanol-containing margarines, juices, breads, and chews. Plant stanols are more popular in Europe than in the United States and are generally well tolerated (16,20).

Combination therapy: Combination statin therapy with any of the above lipid-lowering agents can assist patients in attaining LDL-C goals. If maximum dose of a statin fails to reduce LDL-C to target concentrations, a bile acid sequestraint may also be added to the drug regimen. This combination can yield an additional 10-12% decrease in LDL-C concentrations (16,21). A study conducted by Kashyap (21) and colleagues showed a 47% LDL-C reduction, accompanied by a 30% increase in HDL-C concentrations and a 42% decrease in triglyceride concentrations when patients were prescribed niacin and a statin that was titrated from a dose of 500 mg niacin/10 mg lovastatin to 2000 mg niacin /40 mg lovastatin.

Type 2 diabetes mellitus is becoming more prevalent in the United States and has been shown to increase the risk of cardiovascular disease (22). A patient's poor understanding of diabetes is believed to impede appropriate self-management of the disorder, thus accelerating cardiovascular complications. A study conducted by Sanchez et al. (23) investigated the relationship between patients' Diabetes-Related Knowledge (DRK) and measurements of risk factor control and cardiac outcomes. Clinical outcomes data were obtained 6 months after enrollment. Years of education and DRK assessment scores were found to be moderately correlated ($r = 0.496$, $p < 0.0001$). Glycosylated hemoglobin A1C, LDL-C and body mass index showed no correlation with DRK assessment scores, even after multivariable adjustment for differences in age, race, insulin requirement, duration of diabetes, and years of education. Rate of myocardial infarction was not significantly different between groups of patients stratified by DRK assessment scores (high vs. low scoring groups). The study concluded that new strategies must be developed to translate understanding of the disease into better risk modification among patients who have diabetes.

A study conducted by Martin and colleagues (24) evaluated the effectiveness of a multidisciplinary team that provide both education and medication management in a group setting for cardiac risk reduction in patients with diabetes. Forty-one patients attended four 1.5-hour diabetes self-management education classes that were provided by a multidisciplinary team. The team consisted of a pharmacist, nurse educator, dietitian, physical therapist, and a social worker. Four 1-hour group medication adjustment sessions were also provided by the pharmacist. The patients showed improvements in all parameters after the intervention. Significant reduction in glycosylated hemoglobin A1C (-1.5 %± 1.0%) ($p < .01$) and diastolic blood pressure (-5 mg Hg)($p < .01$) occurred.

Hypertension is a common disease that affects approximately 1 billion people worldwide (25). Hypertension is defined as a systolic pressure above 140 mmHg and /or a diastolic pressure above 90 mmHg (26). The Seventh Report of the Joint National Committee (JNC-7) on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure defined a new entity, "pre-hypertension," in order to reflect the growing evidence that systolic blood pressure (SBP) values between 120-139 mmHg and diastolic blood pressure (DBP) values between 80-89 mmHg are associated with increased cardiovascular risk (26,27). It is estimated that an additional 30% of the adult population fall into this category (26,28). Coronary artery disease is the most common form of target-organ damage and most common cause of mortality associated with hypertension (26). There have been several studies that have examined the relationship between hypertension and coronary events, and some studies have included "pre-hypertension" range. Sipahi and colleagues (26) were the first research group that showed the impact of pre-hypertension on coronary events. They conducted the CAMELOT (Comparison of Amlodipine Versus Enalapril to Limit Occurrences of Thrombosis) trial. This study demonstrated a continuous relationship between SBP and the progression of coronary atherosclerosis over a broad range of blood pressures extending from 100 mm/Hg to the hypertensive range. They concluded that in a patient population with well controlled BP and coronary artery disease, a higher SBP level was associated with an increased progression of coronary atherosclerosis. This study suggested that for patients with coronary artery disease, the optimal BP goal may be lower than < 140/90 mm Hg level.

It is known that the risk of cardiovascular disease increases in the presence of endothelial dysfunction. Both hyperlipidemia and hypertension are significant risk factors of CAD, and when these two conditions are present, the risk of CAD more than doubles (29,30). There is growing evidence suggesting that hyperlipidemia causes impairment in vasorelaxation in both animals and humans (29,31). Brett et al. (32) found a positive correlation between the increase in diastolic

blood pressure during exercise and the serum concentration of total cholesterol, but they did not find this correlation with an increase in systolic blood pressure. Kubozono (29) examined the relationship between serum cholesterol and blood pressure during exercise in patients with CAD and found that patients with CAD had an increase in diastolic blood pressure during exercise that was significantly higher in patients with hypercholesterolemia. During normal exercise, systemic vascular resistance decreases as exercise becomes more intense in order to allow more blood to flow to the exercising muscles. In normal subjects it is known that diastolic blood pressure, which is a parameter determined by cardiac output and peripheral vascular resistance, does not significantly change during exercise in spite of a large increase in systolic blood pressure. Kubozono (29) proposed that impaired vasodilator capacity in patients with hypercholesterolemia may have resulted in a higher vascular resistance, causing high diastolic blood pressure during exercise. This suggested that patients with hyperlipidemia were at a higher risk of developing hypertensive complications.

Weight management should be an essential component in CR programs since most patients with CHD are overweight. However, only minimal weight loss occurs with participation in a traditional CR program (8). Ades et al. (33) reported that body weight should be reduced initially by at least 10% from baseline at a rate of 1 to 2 pounds per week over a period of 6 months in CR patients. Successful short-term weight loss, however, is not always achievable since targeted weight reduction interventions are not available as a core component of traditional CR programs (8,34,35).

It has been proposed that the reason for minimal weight loss noted among patients participating in CR is that there is typically only a modest increase in exercise-related caloric expenditure, and this is often combined with inadequate caloric reduction. The exercise-related caloric expenditure that is usually prescribed during CR is only 720-800 kcal per week and is, therefore, unlikely to lead to significant weight loss over a 2-3-month period (37,38). As CR patients change their diet by

lowering saturated fat and sodium consumption, or increasing fiber, there is generally no purposeful decrease in total caloric intake (39).

Savage and Ades (40) acknowledge that there has been an increased focus of CR protocols on coronary risk factors (CRF) and weight reduction, and his team has suggested a new approach to managing obesity in CR. In their study, patients were instructed on how to count calories and keep dietary food records. Each week after CR, a one-hour-long education session was conducted by a nurse or dietitian coordinator. During these sessions, patients were specifically trained in behavioral weight loss techniques. Various topics covered during weekly meetings included goal setting, stimulus control, assertiveness training, "heart healthy" nutrition, stress management, emotional eating, and relapse prevention. Over a 3-month period, the combination of behavior modification, weight loss counseling, and standard CR exercise resulted in a mean weight loss of 5 kilograms (11 pounds), a 4-centimeter (1.57 inch) reduction in waist circumference and improvement in serum lipid concentrations. Savage and Ades (40) have suggested that the proven effectiveness of weight loss behavior interventions should be considered along with exercise in all CR programs. Exercise interventions must be assessed relative to calories expended per session per week. Furthermore, physical activity outside of structured CR programs should be encouraged, and compliance should be assessed.

The role of nutritional intake and the contributions of an RD in the outpatient CR setting are specified in practice guidelines (40). Medical nutrition therapy (MNT) is an integral component of a comprehensive management and treatment program that focuses on decreasing coronary artery disease (CAD) risk factors (25, 41, 42, 43). One of the first published studies that dealt with the analysis of nutrition services in CR was conducted by Cavallaro and colleagues (2). They randomly surveyed 250 United States outpatient clinics nationwide to describe the type and amount of

nutrition services offered in CR programs. It was determined that more nutrition services were offered in CR programs that had an RD working in the program than in those CR programs that did not. The clinical expertise of an RD was recognized as an important component in a CR setting. Overall, RD's were the preferred source for one-on-one counseling and nutrition information. However, many CR clinics reported that other healthcare professionals were performing nutrition services because of inadequate funding. Although nutrition education and RD support are highly regarded in CR programs, research has shown that for RD's to be successful in these settings and to be utilized in a greater capacity, the RD must strive to be seen as a full and active member of the CR team. It is recognized that other healthcare professionals can learn nutrition-related skills, but presently RD's are the only identifiable group with standardized education, clinical training, and national credentials.

Lemon and colleagues (43) have shown positive outcomes in adults receiving nutrition intervention from an RD for patients with type 2 Diabetes. Patients reported improvements in their diet/lifestyle and felt very knowledgeable and motivated after consultation with an RD.

Clearly, diet and lifestyle modifications can play key roles in both the prevention and treatment of CVD. With the surge of unregulated nutrition messages it is understandable that the American public is confused and often makes poor decisions with respect to diet choices. In 2006, the American Heart Association (AHA) published the diet and lifestyle recommendations for cardiovascular disease risk reduction in an attempt to put balance and perspective on healthy behaviors. The recommendations include:

- Balance calorie intake and physical activity to achieve or maintain a healthy body weight.
- Consume a diet rich in vegetables and fruit.
- Choose whole-grain, high-fiber foods.
- Consume fish, especially oily fish, at least twice a week.

- Limit intake of saturated fat to < 7% of energy, *trans*-fat to < 1% of energy, and cholesterol to < 300 mg per day by:
    - Choosing lean meat and vegetable alternatives
    - Selecting fat-free (skim), 1%-fat and low fat dairy products
    - Minimizing intake of partially hydrogenated fats
- Minimize your intake of beverages and foods with added sugars.
- Choose and prepare foods with little or no salt.
- If you consume alcohol, do so in moderation.
- When you eat food that is prepared outside of the home, follow the AHA Diet and Lifestyle Recommendations (44)

The aim of these recommendations is to decrease CVD risk through improvements in diet and lifestyle. They were formulated to support the AHA goals for CVD prevention by getting patients to aim for healthful body weight, recommended concentrations of LDL-C, HDL-C, triglycerides, normal blood pressure, and normal glucose concentration. Goals also focused on having patients be more physically active and avoid the use of and exposure to tobacco products. The 2006 diet and lifestyle recommendations are not presented as a "diet" plan but as something that can be thought of as a lifestyle prescription to promote cardiovascular health (43).

Chapter 3

Research Design and Methodology

Patients

Ninety-two patients who entered the outpatient CR program at the University of Michigan Health System Preventive Cardiology Clinic at Domino's Farms (Ann Arbor, Michigan) were involved in the present study. All patients attended the CR orientation and were treated in one of two ways. The control group (Group A) consisted of 43 patients (33 males and 10 females), who participated in Year 1 of the study and did not have an RD present during their CR. The experimental group (Group B) consisted of 49 patients who participated in Year 2 of the study and who had an RD present during their CR. This group included 36 males and 13 females. All patients who participated in this study had clinical confirmation of having had a coronary event during the previous 3 months or were at high risk for experiencing a coronary event in the future.

The present study was approved by the University of Michigan Medical School Institutional Review Board (IRBMED) and by the Eastern Michigan University IRB. All patients were provided informed consent prior to participation in this study.

Experimental Design

The present study was conducted over a two-year period. Prior to starting the CR program, all patients attended a two-hour orientation which was directed by an exercise physiologist (EP). The EP reviewed the program with all patients and provided them with an initial Health History Questionnaire (HHQ) that they completed during orientation. Comprehensive physical examinations and serum analysis were also completed at this time. Both groups of patients completed 18 prescribed CR sessions, over a period of six to nine weeks.

After initial testing and training was completed, Group A patients who entered CR between October 2003 and January 2004 followed the traditional CR protocol. Group B patients entered CR between October 2004 and January 2005. The Group B patients had a research RD present during their CR sessions. Treatments provided to patients in Groups A and B are shown in Table 1.

Table 1 A comparison of treatments/questionnaires/tests provided to control (Group A) and experimental (Group B) cardiac rehabilitation patients who participated in a 6-9 week cardiac rehabilitation program over a 2 year period.

	Group A	Group B
1. Comprehensive physical exam and pre- and post-serum analysis	**X**	**X**
2. 6-9 week aerobic and resistance training	**X**	**X**
3. Weekly class instruction; nutrition, exercise, and stress management	**X**	**X**
4. Opportunity for one-on-one nutrition education sessions with a dietitian	**X**	**X**
5. Access to dietitian during CR exercise Sessions		**X**
6. 3-day food analysis at the start of CR		**X**
7. Pre- and post-CR Nutrition Knowledge Test		**X**
8. CR Graduation Questionnaire		**X**
9. Exercise physiologists evaluation of RD		**X**

The exercise component of the CR session consisted of both aerobic and resistance training. The CR team provided weekly class instruction that focused on improving the patients' nutritional intake and exercise patterns while decreasing their stress levels. The initial nutrition training focused on the improvement of the following six dietary behaviors that have been associated with healthy eating: (a) reading labels, (b) eating healthy when dining out (restaurants/cafeterias/takeout), (c) consuming desired food portion sizes, (d) choosing healthy fats in appropriate amounts, (e) increasing soluble fiber intake by consuming fruits, vegetables, legumes, lentils, oats and oat bran,

and (f) lowering dietary sodium intake. If staff members decided that additional counseling was needed, patients were provided with a referral for a one-on-one nutrition or stress management counseling session.

Anthropometric Measurements / Vital Signs

Anthropometric measurements were obtained from all patients throughout the study. Each patient's height and body weight were measured while he/she were wearing clothing and shoes. Height was measured using a stadiometer and was rounded off to the nearest 1/8 inch. Weights were measured using a calibrated Scaletronix 845010 digital scale and were recorded to the nearest pound. Subsequent body weight measurements were made at the start of each CR session. A person's BMI is normally calculated to determine levels of body fat. Overweight is defined as a BMI of 25.0 to 29.9 kg/m^2, whereas obesity (class 1) is 30.0-34.5 kg/m^2, obesity (class 2) is 35-35.9 kg/m^2, and extreme obesity is defined as a BMI of 40 or greater kg/m^2 (10, 11). Measurement of body mass index was calculated using the following formula:

$$BMI=kg/m^2 \quad (11)$$

At each CR session, the patient's pre- and post-blood pressure measurements were also obtained, using a Critikon Vital Answers dura cuff 2791.

Biochemical Measurements

Fasting serum blood samples were collected and analyzed by the Preventive Cardiology Out-Patient Pathology Laboratory (University of Michigan Health Systems; Ann Arbor, Michigan). Blood samples were drawn by a trained phlebotomist after an overnight fast of at least 10-12 hours and were tested within 10-15 minutes after collection. Plasma cholesterol and triglyceride concentrations were measured using enzymatic colorimetic methods (46,47). HDL cholesterol was

separated from LDL and very-low density lipoprotein cholesterol by precipitation and was then measured using enzymatic colorimetric methods (46,47). In samples where triglycerides were less than 400 mg/dl (4.5 mmol/L), LDL cholesterol was calculated using the Friedewald equation (48). If triglycerides were over 400 mg/dl, the sample was sent to the University of Michigan Health System Laboratory for further testing.

RD Encounter Form:

This form was created by the researcher to document interactions between the researcher and the CR patient when they were actively engaged in their CR session. This tool was useful to the RD to monitor weekly interactions with individual patients' and recording their nutrition concerns and questions, lifestyle changes and challenges, and weekly progress (Appendix A).

Patient Nutrition Knowledge:

Upon initiation and completion of the CR program, patients were asked to complete a Nutrition Knowledge Test (NKT) to determine improvement of each patient's nutrition knowledge. This form was developed by facility staff members to assess patient knowledge in various other programs at the PC Clinic (Appendix B).

3-Day Food Record:

At the start of their CR program, all patients' nutrition intakes were assessed using their 3-day food record. Patients were asked to provide a detailed description of the type and quantity of food they consumed over a 3-day period. The completed food records were reviewed with the patient, collected, and analyzed using the Nutritionist Pro™ First Databank software (2006). Individual dietary feedback regarding healthy nutritional habits patterned after the National Cholesterol

Education Program Adult Treatment Panel III (NCEP ATP III) criteria was provided by the RD when patients came to their CR exercising sessions (Appendix C).

Nutrition and Cardiac Rehabilitation Questionnaire:

Prior to this study, an RD was not available to patients during CR. A short questionnaire was developed, using a 10-point Likert scale, and given to patients upon completion of their CR program. The questions were designed to determine if the CR patients (a) valued having access to an RD while participating in CR and (b) were confident in making healthier food choices (Appendix D).

Exercise Physiologists Evaluation of RD Support

At the completion of this study, the researcher provided each CR EP with a questionnaire asking him/her to evaluate the RD researcher's effectiveness as member of the CR program (Appendix E).

Chapter 4

Patient Demographics

A comparison of background characteristics of the men and women who participated in the present study is shown in Table 2**.**

Table 2: Baseline characteristics of cardiac rehabilitation patients who did not have the RD support (Group A) and patients who did have RD support (Group B)

Demographics				
	Group A (n=43)		**Group B (n=49)**	
	Mean±SD	**Range**	**Mean±SD**	**Range**
Age (years)	64.1±10.6	31.9-78.3	60.9±11.4	35.7-87.4
BMI (kg/m^2)	29.2± 5.3	22.6-46.5	30.3± 6.9	18.5-52.1
	N	**%**	**n**	**%**
Gender				
Males	33	76.7	36	73.5
Females	10	23.2	13	26.5
Ethnicity				
African American	5	11.6	3	6.1
Asian	0	0	3	6.1
Caucasian	38	88.3	42	85.7
Other	0	0	1	2.0
Marital Status				
Single	2	4.6	4	8.1
Married	34	79.0	39	79.5
Divorced	1	2.3	4	8.1
Widowed	6	13.9	2	4.0
Education				
8th grade of less	0	0	2	2.0
12th grade	10	23.2	15	30.6
4 or more years of college	33	76.7	32	65.3
Occupational status				
Active	21	48.8	25	51.0
Retired	22	51.1	24	48.9
Diagnosis				
Coronary Artery Disease	42	97.6	45	91.8
Hypertension	33	76.7	42	85.7
Diabetes	14	32.5	15	30.6
Medication				
Lipid lowering	36	83.7	45	91.8
Anti-diabetic	12	27.9	13	36.5

[a]SD=standard deviation [b]To convert mg/dl cholesterol to mmol/L, multiply mg/dL by 0.02587 [c]To convert mg/dL triglycerides to mmol, multiply mg/dL by 0.001129.

No significant differences in characteristics were observed between Group A and B patients at the beginning of this study. The majority of patients in both groups were male (76% of Group A and 73% of Group B). Group A patients had a mean age of 64.1±10.6 years, whereas those in Group B had a mean age of 60.9 ±11.4 years. Drug therapy that focused on lipid lowering medications was received by 84% of Group A and 92% of Group B patients. Incidence of type 2 diabetes occurred in 12 patients in Group A and 13 patients in Group B.

Serum Biomarkers

Data presented in Table 3 show that serum lipid concentrations (total cholesterol, triglycerides, HDL-C and LDL-C) for Groups A and B improved slightly, but there was no significant difference between Groups A and B at the end of CR.

Table 3 Pre- and post-cardiac rehabilitation patient of serum lipids, glucose, and hemoglobin A1C concentrations, as well as body weight and blood pressure.

	Control n = 43					**Intervention** n = 49				
	Pre CR		Post CR		P value	Pre CR		Post CR		P value
	Mean±SD	**Range**	**Mean±SD**	**Range**		**Mean±SD**	**Range**	**Mean±SD**	**Range**	
Total Cholesterol mg/dL	163.9 ± 9.4	84 – 262	162.9 ± 35.3	93 - 230	.591	151 ± 39.9	70 - 255	142.2 ±35.0	80 - 225	.224
Triglycerides	148.9 ± 97.6	41 – 594	141.2 ± 81.9	47 – 505	.241	130 ± 93.5	36 - 614	118.7 ±72.4	37 - 433	.280
HDL-C mg/dL	48.0 ± 11.5	31 – 78	49.4 ± 13.7	29 – 96	.506	44.8 ± 13.9	20 - 81	47.7±15.6	19 - 93	.260
LDL-C	91.2 ± 30.6	36 – 178	85.2 ± 27.1	33 – 139	.160	74.3 ± 30.0	20 - 155	71.7±28.5	18 -151	.218
Glucose	109.2 ± 28.0	65 – 202	98.9 ± 24.6	61 – 163	.001	104.6±18.8	80 - 171	115.4±29.4	77 - 99	.029
HgbA1c	7.6 ± 1.7	5.8 - 11.0	7.0 ±. 75	6.4-8.7	.000	7.2 ± 2.0	5.2-13.0	6.9 ± 1.0	5.4- 8.6	.000
Weight	191.7 ± 5.7	135.4- 333.4	190.2 ± 5.3	140.1-320.0	.179	196.9± 6.1	114.9-324.7	194.4 ± 6.0	112.0-332.2	.009
BMI(kg/m^2)	29.2 ± 5.3	22.6 - 46.5	29.0 ± 4.8	22.6-44.6	.183	30.6 ± 6.9	18.6-52.2	29.9 ± 6.9	18.1-52.3	.009
Rest SBP	125 ± 20.7	92 -172	111.0 ± 17.9	86 – 156	.000	122.0± 19.9	90 -174	114.9 ± 17.4	80 -160	.005
Rest DBP	73.9 ± 9.9	54 -100	63.5 ± 9.1	44 – 84	.000	70.0 ± 9.6	50 - 90	65.0 ± 7.8	48 - 86	.000

Anthropometric Measurements

Group B patients had a significant ($p \leq .001$) mean weight loss of 2.5±6.4 pounds (range -10.6 to 19.5 pounds). In comparison, Group A patients had an insignificant mean weight loss ($p \leq 0.1$)of 1.48±7.1 pounds (range -18.8-16.4), (Figure 1).

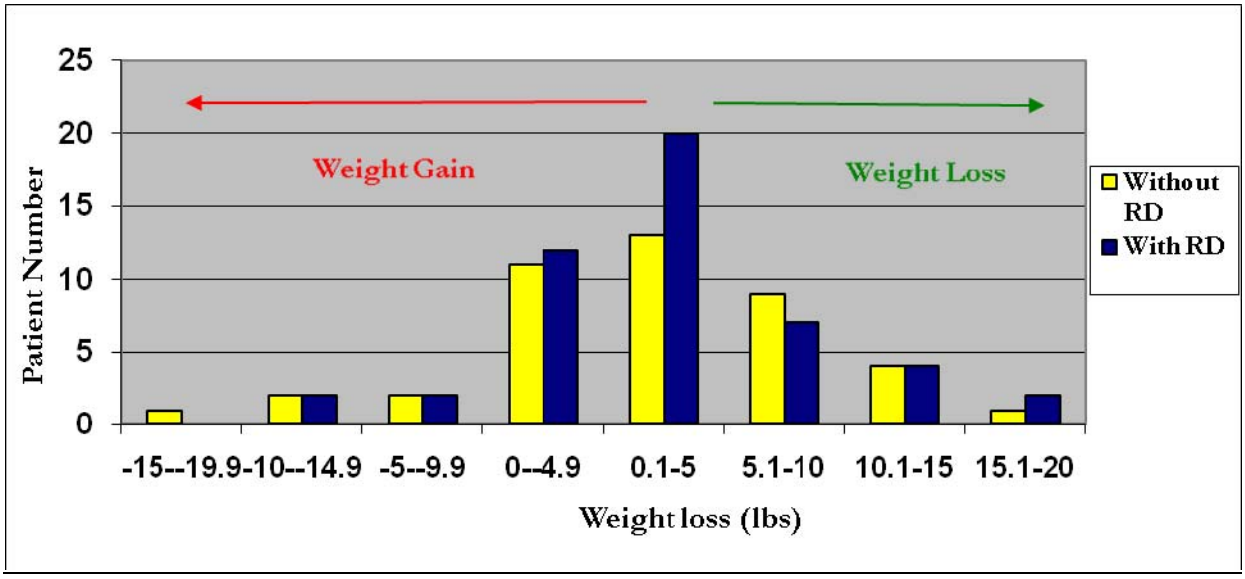

Figure 1 Weight loss experienced by cardiac rehabilitation patients at completion of rehabilitation with and without an RD present

The BMI of Group B patients improved significantly ($p \leq 0.009$), whereas Group A patients did not show a significant change ($p \leq 0.018$). Group A patients showed an 8.8% decrease in resting SBP and an 8.5% decrease in resting DBP. Group B patients also showed significant improvement in their blood pressure (resting SBP decreased 9.4% and resting DBP decreased 9.2%).

Patient Nutrition Knowledge

As illustrated in Figure 2, Group B patients showed a noticeable improvement in nutrition knowledge (10% score increase) by the end of the study.

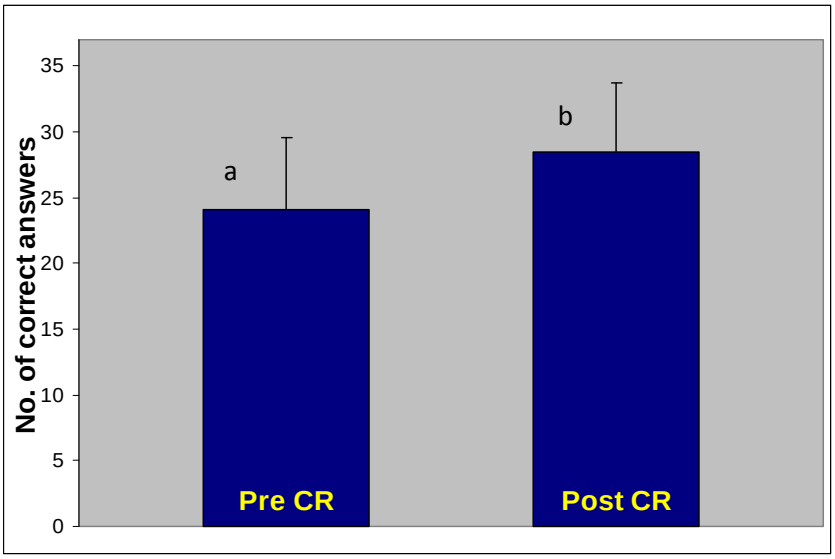

Figure 2 Nutrition Knowledge Test results of cardiac rehabilitation patients pre- and post-rehabilitation

Dietary Intake at the Start of CR

Dietary intake of Group B patients was assessed at baseline using data from the 3-day food diaries. The average daily caloric energy intake was 1826 calories. The macronutrient energy intake breakdown was as follows: 49.5 % carbohydrates, 17 % protein, 31.5% fat, and 4.1 % saturated fat. The data from the 3-day food records suggested that an adequate amount of fiber, sodium, and Vitamin C were consumed. Patients exceeded the Recommended Daily Intake (RDI) of total fat, saturated fat, and dietary cholesterol and consumed inadequate amounts of calcium. The summary of nutrient intake is shown in Table 4.

Table 4 3-Day Food Record nutrient intake of cardiac rehabilitation (n=29)

Nutrient	Mean±SD	Range
Total calories	1827 ± 538	686 – 2614
Carbohydrate (%)	50.1 ± 13.2	9.7 - 73.5
Protein (%)	18.4 ± 5.1	12.2 - 30.0
Fat (%)	31.0 ± 12.3	8.9 - 61.0
Saturated Fat (%)	8.8 ± 4.2	2.3 - 19.0
Alcohol	1.4 ± 2.9	0.0 - 13.3
Cholesterol (mg)	206 ± 161	30 – 809
Fiber (gm)	24.8 ± 11.2	7.1 - 53.9
Sodium (mg)	2594 ± 1082	595 – 4816
Calcium (mg)	796.1±355.9	83.7-1653.3

mg = milligrams
g = grams
* = exceeds recommendations
** = below recommendations

CR Patient Survey

Upon completing CR, Group B patients gave very positive ratings when asked if having an RD available was helpful (8.7±1.48 out of 10). Patients also indicated that they were making healthier food choices after interacting with the RD (8.1±1.29 out of 10).

Exercise Physiologist Survey

Upon completion of the study, EPs rated the overall value of having an RD present as part of the CR team very favorably (9.8 out of 10), (Figure 3).

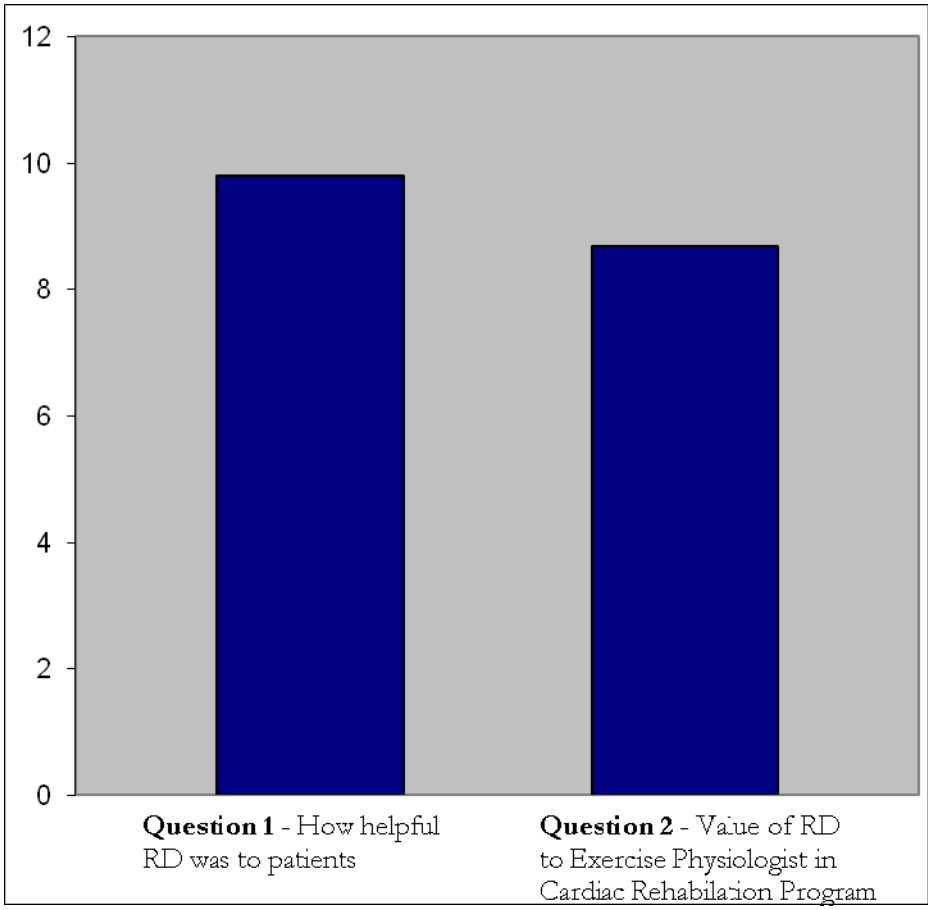

Figure 3 Attitude of cardiac rehabilitation patients regarding the benefit of mini-nutrition counseling provided by an RD and value of RD in rehabilitation as viewed by EP's

Chapter 5

Discussion

In 1994, the AHA declared that cardiac rehabilitation should not be limited to an exercise training program but should also include multifaceted strategies aimed at reducing modifiable risk factors for CVD (6,49). In addition to exercise training, a comprehensive secondary prevention program for cardiac patients requires aggressive reduction of risk factors through nutritional counseling, weight management, and adherence to prescribed drug therapy (3,5,9,30,31).

Lipid Management

In response to evidence that cholesterol medications decrease morbidity and mortality, the National Cholesterol Education Program (NCEP) released its third Adult Treatment Report in 2001. This report recommended a low-density lipoprotein concentration lower than 100 mg/dl for all patients with coronary artery disease (49). The work from the Scandinavian Simvastatin Survival Study Group demonstrated a 22% to 42% reduction in risk of fatal CHD with the use of statin drug therapy. This supports the NCEP ATP III recommendations that patients with CHD and other forms of arteriosclerosis should be treated in order to achieve an LDL level of 100 mg/dl (31,32, 33). These findings were consistent with results from Group A and B patients whose LDL was below 100 mg/dl prior to starting CR.

In the current study, no improvement was noted in serum lipid biomarkers when RD support was provided to Group B patients. It is suggested that the clinicians who were treating these patients were proactive in identifying patients at high risk for CHD and, therefore aggressively treated them to target lipid levels. In addition to current first-line statin therapy, other treatment options are also available, including combination therapies with bile acid sequestrants, niacin, and plant stanols.

Weight Management

In the present study, while only modest weight loss was achieved in Group B patients, the loss was statistically significant. In the vast majority of studies which have assessed changes in body weight as a result of CR interventions, minimal to modest reductions in weight (1-5%) were reported. Lavie and Milani (54) studied the clinical and metabolic profiles of 588 CAD patients (40% obese) who participated in a 12-week CR program and who showed an average weight loss of 5%. Bader et al. (4,36) examined the clinical and metabolic outcomes for 449 consecutive cardiac rehabilitation patients who were stratified according to the NHLBI weight classifications: normal (BMI 18-24.9 kg/m2), overweight (BMI 25-29.9 kg/m2), class I/II obese (BMI 30-39.9 kg/m2), and class III morbidly obese (BMI > or = 40 kg/m2). After 10 weeks, all groups had a significant exercise capacity, and on average obese patients in each category lost weight (Class I/II lost 4 lbs and Class III lost 12 lbs).

Savage et al. (8) examined the effects of a structured behavioral weight loss program that incorporated behavior modification principles which were designed to have an impact on the body weights and lipid profiles of 82 patients, 27 of whom received intervention and 55 of whom composed the CR control group. The results showed that the intervention group experienced reductions in body weight, BMI, and total cholesterol, when compared with the control group. There was an average weight reduction of 4.3% in the intervention group, as compared to a 1.7% weight reduction in the control group. These findings were similar to the findings of Bader et al. (4), who also did not reach the initial target weight loss of 10% as recommended by the NHLBI guidelines (36). More importantly, these studies demonstrated that CR programs have not been successful in terms of weight loss. Thus, the current findings of this study are in accordance with previous studies in the CR literature.

In the present 6 month study, many patients entering CR were unwilling or unready to commit to making significant changes in their eating style. It is possible that additional changes in eating or cooking habits or the thought of trying to lose weight was too overwhelming for some patients. However, other patients embraced the need to make improvements in their diet or quit smoking and committed themselves to making the necessary lifestyle changes to improve their health.

The Role of a Dietitian in CR and In Helping Patients Increase Their Nutrition Knowledge and Confidence

Nutrition services offered by RD's can include providing nutrition pamphlets, one-on-one nutrition counseling, group nutrition classes, guest lectures on nutrition, and cooking demonstrations. Cavallaro and colleagues (2) found there was a greater variety of a nutrition services offered in cardiac rehabilitation programs when there was an RD who was involved in CR sessions. In CR sessions that did not have an RD present, EP's and registered nurses provided limited nutrition services.

Improved dietary choices when dining out and patient's self-confidence in adhering to a serum lipid-lowering diet after nutrition education was provided were noted in a study by Timlin et al. (41). Patients indicated that they were most confident in knowing which foods to purchase and eat and that they were better able to decrease dietary fat, cholesterol, and egg yolks eaten per week and were able to remain on a healthy diet by themselves after receiving nutrition education classes. This concurs with results from a study completed by Delahanty et al. (42), which suggested that MNT provided by RDs is a reasonable investment of resources because it results in significantly higher patient satisfaction levels when it comes to understanding lifestyle and eating habits and knowledge related to cholesterol's role in CHD, and their ability to manage cholesterol levels as well as eating habits when compared to MNT provided by physicians and other healthcare professionals.

At the completion of this study, the EP's were surveyed to provide feedback of the experience they had with an RD present in the CR sessions. They indicated it was beneficial for the CR patients to have access to an RD while they attended CR sessions. The EP's expressed the importance of patients receiving nutrition information from an RD which enabled the EP's to focus on training and monitoring patients on cardiovascular exercise equipment and strength training.

Dietary Intake at the Start of CR

As patients entered CR in the present study, the majority reported consumption of a diet that had a nutrient composition which corresponded to a typical American diet with levels of fat consumption at more than 30% of total calories (33). Patient food records also indicated they were consuming an average of 206 mg of dietary cholesterol/day. Saturated fat intake was also higher than recommended, while calcium intake was lower than recommended.

Delahanty and colleagues (42) reported in their study that patients assigned to an RD for consultation as well as medical nutrition therapy (MNT) achieved and sustained an 8% decrease in total dietary fat intake (from 32 % to 24%) and a 4% decrease in saturated fat intake (from 11% to 7%), which was statistically significant at both 3 and 6 months following MNT. Unfortunately, similar follow-up data in the present study were unavailable due to the lack of patient participation.

Conclusions

The typical American is exposed daily to information from a variety of sources regarding new findings related to CVD. Some press releases have made claims of a "wonder" or "miracle" food; others have reported about the dangers of particular foods. It is understandable that the American public is confused and therefore prone to making misinformed decisions regarding their food selections. Individuals need help sifting through the current popular fad diets or lifestyle recommendations that are running rampant in the lay press. There are no easy answers on how to

help patients improve their diet and lifestyle in regard to the prevention of CVD. Registered Dietitians are ideally trained to implement change in dietary intake. They can help clarify and identify the best approaches in regard to diet modification, by gradually introducing diet modifications.

The findings of this pilot study demonstrated a positive association between CR patients' health related outcomes and the presence of an RD in a Phase 2 CR program. Short weekly interactions between patients and an RD showed improvements in patients' dietary food choices and increased self-confidence in the ability to adhere to lifestyle changes that can have a positive impact on their health status such as body weight, blood glucose, and blood pressure.

References

1. AHA Statistical Update, Heart Disease and Stroke Statistics-2006 Update A report from the American Heart Association statistics committee and stroke statistics subcommittee. *Circulation.* 2006 February;1-47.

2. Cavallaro V, Dwyer J, Houser RF, Shores K, Canez I, Hong A, Altman K, Helman E, Murphy J. Influence of dietitian on outpatient cardiac rehabilitation nutrition services. *J Am Diet Assoc.* 2004 April;104(4):611-4.

3. Smith SC Jr, Blair SN, Bonow RO, Brass LM, Cerqueira MD, Dracup K, Fuster V, Gotto A, Grundy SM, Miller NH, Jacobs A, Jones D, Krauss RM, Mosca L, Ockene I, Pasternak RC, Person T, Pfeffer MA, Starke RD, Taubert KA. AHA/ACC Guidelines for preventing heart attack and death in patients with atherosclerotic cardiovascular disease: 2001 update. A statement for health care professionals from the American Heart Association and the American College of Cardiology. *Circulation.* 2001;104:1577-1579.

4. Bader DS, Maguire TE, Spahn CM, O'Malley CJ, Balady GJ. Clinical profile and outcomes of obese patients in cardiac rehabilitation stratified according to National Heart, Lung and Blood Institute criteria. *J Cardiopulmon Rehabil.* 2001; 21(4):210-7.

5. Balady GJ, Ades PA, Comoss P, Limacher M. Pina HL, Southard D, Williams MA, Bazzarre T. Core components of cardiac rehabilitation /secondary prevention programs: a statement for healthcare professionals from the American Heart Association and the American Association of Cardiovascular and Pulmonary Rehabilitation. *Circulation.* 2000;102:1069-1073.

6. Balady GJ, Fletcher BJ, Froelicher EF. Cardiac rehabilitation programs: a statement for healthcare professionals from the American Heart Association. *Circulation.* 1994;90:1602-1610.

7. Wenger NK, Froelicher ES, Smith LK, Ades PA, Berra K, Blumenthal JA, Certo CM, Dattilo AM, Davis D, DeBusk RF, Drozda JP, Fletcher BJ, Franklin BA, Gaston H, Greenland P, McBride PE, McGregor CG, Oldridge NB, Piscatella JC, Rodger FJ. Clinical practice guidelines quick reference guide for clinicians. *Cardiac Rehabilitation.* 1995 Oct;(17):1-23.

8. Savage P, Lee M, Harvey-Berino J, Brochu M, Ades P. Weight reduction in the cardiac rehabilitation setting. *J Cardiopulmon Rehabil.* 2002; 22(3):154-160.

9. Savage P, Brochu M, Poehlman E, Ades P. Reduction in obesity and coronary risk factors after high caloric exercise training in overweight coronary patients. *Am Heart J.* 2003; (146)317-323.

10. Poirier P, Giles T, Bray G, Hong Y, Stern J, Pi-Sunyer F, Eckel R. AHA Scientific statement: obesity and cardiovascular disease: pathophysiology, evaluation and effect of weight loss. An update of the 1997 American Heart Association scientific statement on obesity and heart disease from the obesity committee of the council on nutrition, physical activity and metabolism. *Circulation*. 2006;113:898-918.

11. American Heart Association Obesity and Overweight. Available at http://www.americanheart.org. Accessed on June 5, 2006.

12. Yu-Poth S, Zhao G, Etherton T, Naglak M, Jonnalagadda S, Kris-Etherton PM. Effects of the National Cholesterol Education Program's step I and step II dietary intervention programs on cardiovascular disease risk factors: a meta-analysis. *Am J Clin Nutr*. April 1999;69:632-646.

13. Audelin MC, Savage PD, Ades PA. Changing clinical profile of patients entering cardiac rehabilitation/secondary prevention programs: 1996-2006. *J Cardiopulm Rehabil Prev*. 2008 28(5):299-306.

14. Medical lipid-regulating therapy: current evidence, ongoing trials and future developments. *Drugs* 2004;6(11):1181-96.

15. Stein EA. The power of statins: aggressive lipid lowering. *Clin Cardiol* 2003; (4Suppl3): 11125-31.

16. Stein E. Managing dyslipidemia in the high-risk patient. *Am J Cardiol* 2002;89(suppl):50C-57C.

17. Pearson TA, Laurora, I Chu H, Kafonek S. The Lipid Treatment Assessment Project (L-TAP). A multicenter survey to evaluate the percentages of dyslipidemic patients receiving lipid-lowering therapy and achieving low-density lipoprotein goals. *Arch Internal Med* 2000;160:459-467.

18. Knopp RH. Drug treatment of lipid disorders. *N Engl J Med* 1999;341:498-511.

19. Brown BG, Zhao XQ, Chait A, Fisher LD, Cheung MC. Morse JS, Dowdy AA, Marino EK, Bolson EL, Alaupovic P. Simvastatin and niacin, antioxidant vitamins, or the combination for the prevention of coronary disease. *N Engl J Med* 2001;345:1583-1593.

20. Lichtenstein AH, Deckelbaum RJ. The American Heart Association Nutrition Committee. Stanol/sterol ester-containing foods and blood cholesterol levels. A statement for healthcare professionals from the Nutrition Committee of the Council on Nutrition, Physical Activity, and Metabolism of the American Heart Association. *Circulation* 2001;103:1177-1179.

21. Kashyap ML, Evans R, Simmons PD, Kohler RM, McGovern ME. New combination niacin/statin formulation shows pronounced effects on major lipoproteins and is well tolerated. *J Am Coll Cardiol* 2000;35:326A. Abstract 906-4.

22. Nesto RW. Beyond low-density lipoprotein: addressing the atherogenic lipid triad in type 2 diabetes mellitus and the metabolic syndrome. *Am J Cardiovasc. Drugs* 2005;5(6):379-87.

23. Sanchez C, Newby L, McGuire D, Hasselblad V, Feinglos M, Ohman E. Diabetes-related knowledge, atherosclerotic risk factor control, and outcomes in acute coronary syndromes. *Am J Cardiol* 2005;95:1290-1294.

24. Martin O, Wu W, Taveira T, Eaton C, Sharma S. Multidisciplinary group behavioral and pharmacologic intervention for cardiac risk reduction in diabetes: a pilot study. *The Diabetes Educator* 2007;(33)118:118-127.

25. World Health Report 2002. Reducing Risk, Promoting Healthy Life. Geneva, Switzerland: World Healthy Organization, 2002. Available at: http://www.who.int/whr/2002. Accessed on June 12, 2006.

26. Sipahi I, Tuzcu E, Schoenhagen P, Wolski K, Nicholls S, Balog C, Crowe T, Nissen S. Effects of normal, pre-hypertensive, and hypertensive blood pressure levels on progression of coronary atherosclerosis. *J Am Coll Cardiol* 2006;48:833-838.

27. Chobanian AV, Bakris GL, Black HR. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC-7 report. *JAMA* 2003;289:2560-72.

28. Wang Y, Wang QI. The prevalence of pre-hypertension and hypertension among U.S. adults according to the new joint national committee guidelines: new challenges of the old problem. *Arch Intern Med* 2004;164:2126-34.

29. Kubozono T, Koike A, Nagayma O, Tajima A, Aizawa T, Fu L, Itoh H. High diastolic blood pressure during exercise is associated with hypercholesterolemia in patients with coronary artery disease. *Int Heart J* 2005;46:80-87.

30. Pericone F, Ceravolo R, Pujia A. Prognostic significance of endothelial dysfunction in hypertensive patients. *Circulation* 2001:104:191-6.

31. Creager MA, Cooke JP, Mendelsohn ME. Impaired vasodilatation of forearm resistance vessels in hypercholesterolemic humans. *J Clin Invest* 1990;86:228-34.

32. Brett SE, Ritter JM, Chowinczyk PJ. Diastolic blood pressure changes during exercise positively correlate with serum cholesterol and insulin resistance. *Circulation* 2000.101:611-5.

33. Ades PA, Balady GJ. Berra K. Transforming exercise-based cardiac rehabilitation programs into secondary prevention centers: a national imperative. *J Cardiopulmon Rehabil.* 2001;21:263-272.

34. Harvey-Berino J. Weight loss in the clinical setting; applications for cardiac rehabilitation. *Coronary Artery Dis.* 1998;9(12):795-798.

35. Shubair M, Kodis J, McKelvie R, Arthur H, Sharma A. Metabolic profile and exercise capacity outcomes, their relationship to overweight and obesity in a Canadian cardiac rehabilitation setting. *J Cardiopulmon Rehabil. 2004*;24:405-413.

36. Executive summary of the clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. *Arch Intern Med.* 1998;158:1855-1867.

37. Savage PD, Brochu M, Scott P Ades PA. Low caloric expenditure in cardiac rehabilitation. *Am Heart J* 2000;140:527-33.

38. Schairer JR, Kostelnik T, Proffitt SM, Faitel KI, Windeler S, Riciman LB. Caloric expenditure during cardiac rehabilitation. *J Cardiopulmon Rehabil.* 1998;18:290-294.

39. Brochu M, Poehlman ET, Savage P, Ross S, Ades PA. Coronary risk profiles in men with coronary artery disease: effects of body composition, fat distribution, age and fitness. *Coronary Artery Dis.* 2000;11:137-144.

40. Savage P, Ades P. The obesity epidemic in the United States: role of cardiac rehabilitation. *Coronary Artery Dis.* 2006;17(3): 227-231.

41. Timlin M, Shores K, Rickes M. Behavior change outcomes in an outpatient cardiac rehabilitation program. *J Am Diet Assoc.* 2002;(102):664-671.

42. Delahanty L, Sonnenberg L, Hayden D, Nathan D. Clinical and cost outcomes of medical nutritional therapy for hypercholesterolemia; a controlled trial. *J Am Diet Assoc.* 2001; (101):1012-1023.

43. Lemon C, Lacey K, Lohse B, Hubacher D, Klawitter B, Palta M. Outcomes monitoring of health, behavior, and quality of life after nutrition intervention in adults with type 2 diabetes. *J Am Diet Assoc.* 2004;(104):1805-1815.

44. Lichtenstein AH, Appel LJ, Brands M, Carnethon M, Daniels S, Franch HA, Franklin B, Kris-Etherton P, Harris WS, Howard B, Karanja N, Lefevre M, Rudel L, Sacks F, Van Horn L, Winston M, Wylie-Rosett J. Diet and lifestyle recommendations revision 2006: A scientific statement from the American Heart Association Nutrition Committee. *Circulation* 2006;114:82-96.

45. Lichtenstein AH. Diet, heart disease, and the role of the registered dietitian. *J Am Diet Assoc.* 2007;(107):205-208.

46. Boahorik PS, Rifkind BM, Kwiterovich Jr. PO. Lipids and dyslipoproteinemia. Henry JB. Clinical diagnosis and management by laboratory methods. (19th ed)) Philadelphia: WB Saunders 1996:208-236.

47. Deacon AC, Dawson PJ. Enzymic assay of total cholesterol involving chemical or enzymic hydrolysis: a comparison of methods. *Clin Chem.* 1979;25:276-284

48. Friedwald WT, Levy RI Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clin Chem*. 1972;18:499-502.

49. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA*. 2001;285:2486-2497.

50. Leon A, Franklin B, Balady G, Stewart K, Williams M. AHA Scientific Statement: Cardiac rehabilitation and secondary prevention of coronary heart disease. An American Heart Association scientific statement from the council on clinical cardiology (subcommittee on exercise, cardiac rehabilitation, and prevention) and the council on nutrition, physical activity and metabolism (subcommittee on physical activity) in collaboration with the American Association of Cardiovascular and Pulmonary Rehabilitation. *Circulation*. 2005;111:369-376.

51. Scandinavian Simvastatin Survival Study Group. Randomized trial of cholesterol lowering in 4444 patients with coronary heart disease. *Lancet*, 1994;344:1383-1389.

52. Long-term intervention with pravastatin in ischaemic disease (LIPID) study group. prevention of cardiovascular events and death with provastation in patients with coronary heart disease and a brad range of initial cholesterol levels. *N Engl J Med*. 2001;339:1349-1357.

53. Post coronary artery bypass graft trial investigators. The effect of aggressive lowering of low-density lipoprotein cholesterol levels and low-dose anticoagulation on obstructive changes in saphenous vein coronary artery bypass grafts. *N Engl J of Med*. 1997;336:153-162.

54. Lavie CJ, Milani RV. Effects of cardiac rehabilitation, exercise training, and weight reduction on exercise capacity, coronary risk factors, behavioral characteristics, and quality of life in obese coronary patients. *Am J Cardiol*. 1997;79:397-401.

Appendix A – RD Encounter Form

Name _____

Week:

Weight:

Week:

Weight:

Week:

Weight:

Week:

Weight:

Week:

Weight:

Consults:

Appendix B- Nutrition Knowledge Test

Nutrition and the Health of Your Heart
Test Your Nutrition Knowledge!

Please circle the letter corresponding to the best answer.

1. To protect against heart disease, it is recommended that you eat fish:
   a. Every day
   b. Rarely
   c. A few times each month
   d. At least twice per week

2. For a heat-healthy diet, you should consume at least:
   a. 5-10 grams of fiber every day
   b. 10-20 grams of fiber every day
   c. 15-25 grams of fiber every day
   d. 25-30 grams of fiber every day

3. When the label of a food indicates the item is "low fat", one serving must contain:
   a. Less than 30% of the calories from fat
   b. Less than 10% of the calories form fat
   c. 5 or less grams of fat per serving
   d. 3 or less grams of fat per serving

4. Even small amounts of weight loss have been shown to:
   a. Decrease HDL
   b. Decrease triglycerides
   c. Increase blood pressure
   d. Increase LDL

5. Tom is going to a steakhouse restaurant for dinner. Which cut of beef is lowest in saturated fat?
   a. Sirloin
   b. Porterhouse
   c. T-bone
   d. Ribs

6. Which types of foods are rich in Vitamin E, an important antioxidant?
   a. Fruits and vegetables
   b. Whole grains and nuts
   c. Dairy
   d. Meat

7. Which of the following labels claims to be the most useful in choosing foods?
   a. Reduced fat
   b. Light

c. Low fat
d. Natural

8. Which of the following items on an ingredient list indicates that a food may contain trans fatty acids?
   a. High fructose corn syrup
   b. Partially hydrogenated vegetable oil
   c. Corn oil
   d. Citric acid

9. For adults who responsibly consume alcohol, the heart healthy recommendations for daily alcohol consumption is not to exceed:
   a. More than two glasses of red wine everyday
   b. More than one drink per day for men and two drinks per day for women
   c. More than two drinks per day for men and one drink per day for women
   d. More than two drinks per day for men and women

10. The most effective way to lower your serum cholesterol level is to decrease your intake of:
   a. Cholesterol
   b. Sodium
   c. Sugars
   d. Saturated fat

11. Which grain is most helpful in lowering cholesterol when consumed regularly?
   a. Oats
   b. Rye
   c. Rice
   d. Wheat

12. Which food is high in sodium?
   a. 8 oz milk
   b. 1 oz processed American cheese
   c. 3 oz chicken breast
   d. 1 cup oatmeal

13. Janet is told by her doctor that she should lose weight to protect herself against heart disease. The best way for Janet to lose weight is:
   a. To skip lunch and to park her car at the back of the parking lot at work so she has to walk.
   b. To learn to make healthier food choices and to begin exercising most days each week.
   c. To maintain her current food intake habits but begin exercising for at least one hour each day.
   d. To learn to make healthier food choices and maintain her current level of activity.

14. Which cheese has the lowest amount of saturated fat and cholesterol?
   a. Processed American
   b. Part-skim mozzarella
   c. Swiss

d. Cheddar

15. Which source of protein is lowest in cholesterol?
a. Baked pork loin
b. Baked skinless turkey breast
c. Broiled beef sirloin
d. Black beans

16. Cholesterol is generally found in:
a. Fruits and vegetables
b. Oats and wheat bran
c. Meat and dairy
d. Coconut and palm oil

17. Folate has been shown to decrease harmful homocysteine levels in the blood. The recommended intake of folate is 400 micrograms per day. Which is a good source of folate?
a. ½ cup boiled spinach
b. 3 oz beef loin
c. 1 oz. natural cheese
d. 1 oz. cashews

18. Which of the following snack foods is likely to contain trans fatty acids?
a. Natural peanut butter
b. Orange sherbet
c. Tomato salsa
d. Wheat snack crackers

19. Mary has high triglycerides. Which of the following may help Mary lower her triglycerides?
a. Drinking two glasses of red wine each day
b. Eating less pastries, ice cream, soda pop and fruit juice
c. Choosing fat free cookies
d. Eating fewer eggs

20. Which of the following terms on a label is most useful for choosing a food for a cholesterol-lowering diet?
a. Made from turkey
b. No cholesterol
c. Dietetic
d. Low saturated fat

21. Which of the following is a risk factor for heart disease?
a. Having blood pressure 120/80
b. Having a parent who had a heart attack at age 54
c. Having an HDL of 60 mg/dl
d. Having and LDL of 98 mg/dl

22. The recommended intake of dietary sodium for the general population is:
    a. Less than 15,000 mg per day
    b. Less than 5,000 mg per day.
    c. Less than 2,400 mg per day.
    d. Less than 1,200 mg per day.

23. Which of the following fast food choices has the least amount of fat?
    a. Regular hamburger
    b. A fried fish sandwich
    c. A fried chicken sandwich
    d. A regular cheese burger

24. Which of the following sandwiches has the most saturated fat?
    a. Peanut butter and jelly
    b. Turkey bologna and natural cheese
    c. Tuna fish salad
    d. Turkey breast and processed cheese

25. Which of the following accurately describes a serving of alcohol?
    a. 5 ounces of wine or 12 ounces of beer or 1 ½ ounces of 80 proof liquor
    b. 7 ounces of wine or 14 ounces of beer or 2 ounces of 80 proof liquor
    c. 5 ounces of wine or 12 ounces of beer or 1 ½ ounces of 100 proof liquor
    d. 7 ounces of wine or 14 ounces of beer or 2 ounces of 100 proof liquor.

26. Peter had salad with spinach, sprouts, avocado, olives, tomatoes, walnuts, radishes, and Italian dressing. How many sources of added fats did he have?
    a. 2
    b. 3
    c. 4
    d. 5

27. Which of the following seafood items has the most omega 3 fatty acids?
    a. Orange Roughy
    b. Salmon
    c. Shrimp
    d. Ocean perch

28. Which has the most cholesterol-lowering fiber?
    a. 1 slice whole wheat brad
    b. 1 corn tortilla
    c. 1 cup kidney beans
    d. 1 banana

29. Betty is going to an Italian restaurant for dinner. Which main course is lowest in saturated fat?
    a. Pasta with white alfredo sauce
    b. Lasagna

c. Cheese ravioli
d. Pasta with red clam sauce

30. High blood pressure is a risk factor for heart disease. There are many ways to lower blood pressure through nutrition, including:
a. Increase fat intake
b. Increase sodium intake
c. Decrease dairy intake
d. Eat 8-10 servings of fruits and vegetables each day

31. Palm and coconut oils are high in:
a. Saturated fat
b. Polyunsaturated fat
c. Cholesterol
d. Monounsaturated fat

32. Which of the following has the most calories?
a. 1 gram of carbohydrates
b. 1 gram of protein
c. 1 gram of fat
d. 1 gram of fiber

33. Which of the following is lowest in saturated fat and trans fat?
a. Oleo
b. Stick margarine
c. Soft margarine
d. Shortening

34. Which meat is lowest in fat?
a. Ground hamburger
b. Porterhouse steak
c. Round steak
d. Corned beef

35. Which has the most fiber in an average serving?
a. Marinated flank steak
b. Vegetarian chili
c. Turkey meatloaf
d. Corned beef

36. Janet's blood test has indicated that she has high LDL-cholesterol and low HDL-cholesterol. Which of the following is the best oil for Janet to use in cooking?
a. Canola oil
b. Sunflower oil
c. Soybean oil
d. Liquid margarine

37. Combination of mildly elevated factors can result in Metabolic Syndrome which indicates increased risk for heart disease. Which is <u>not</u> a symptom of Metabolic Syndrome?
    a. Waist circumference of 43 inches
    b. Triglycerides at 155 mg/dl
    c. HDL cholesterol at 55 mg/dl
    d. Fasting blood glucose of 115

38. You may want to schedule an appointment with a University of Michigan Cardiovascular Center Nutritionist if:
    a. You still have questions about which foods are the best choices for a heart healthy diet.
    b. You knew many of the answers on the test but are having trouble incorporating changes into your lifestyle
    c. You aren't enjoying your heart healthy diet.
    d. All of the above.

Appendix C – 3-Day Food Record

Name_____

Date_____

Time	Amount	Food	Feelings/Emotions

Appendix D – Nutrition and Cardiac Rehab Graduation Questionnaire

Name_____

Date_____

Nutrition and Cardiac Rehab

Graduation Questionnaire

1. How strongly do you agree with the following statement:

After completing cardiac rehab, I am making healthier food choices.

1	2	3	4	5	6	7	8	9	10
Low				Moderate					High

Comments:

2. How helpful was it having a dietitian available to answer your nutrition questions while you were in cardiac rehab?

1	2	3	4	5	6	7	8	9	10
Not Helpful				Moderately Helpful					Highly Helpful

Comments:

Appendix E – Exercise Physiologists Evaluation of Dietitian in the Cardiac Rehabilitation Clinic

Evaluation of the Dietitian in the Cardiac Rehab Clinic

Please take a few minutes to fill out the following questions to evaluate the benefits and effectiveness of having a dietitian in the cardiac rehab clinic.

1. What were the benefits for the rehab patients of having a dietitian in the rehab clinic for the past 5 months?

   1._____

   2._____

   3._____

2. What were the benefits for the exercise physiologists of having a dietitian in the rehab clinic for the past 5 months?

   1._____

   2._____

   3._____

3. What other things can be incorporated in the rehab setting to improve patient education with nutrition? (ie. mini-teaches, demonstrations, nutrition handouts).

   1._____

   2._____

   3._____

4. Please rate the over all value of having a dietitian in rehab clinic 2 days a week:

1	2	3	4	5	6	7	8	9	10
Not Helpful				Moderately Helpful					Highly Helpful