PERIODIC FEEDBACK

TO REDUCE CHOLESTEROL LEVELS

BY

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(ABSTRACT)

The effectiveness of biweekly feedback regarding blood total cholesterol (TCH) to assist dietary adherence and lower blood TCH levels was assessed in a mixed population of healthy and cardiac diseased subjects (S) engaging in an unsupervised mall walking program. Based upon screening with a portable lipid analyzer (and with their physician's permission) 36 S's (x age=63, 83% females) with TCH levels between 200-300 mg/dl were randomized to control (CG) or experimental groups (EG). The CG received instruction regarding the National Cholesterol Education Program's Step 1 low-fat, low-cholesterol diet at 0, 2, 4, 6 weeks and completed 3-day food records at 0, 4, 8 weeks. In addition to this instruction, the EG received graphic feedback regarding their TCH at 0, 2, 4, and 6 weeks. Both groups had a goal of a 10% reduction in TCH. By 8 weeks, the CG increased TCH by 2.2 mg/dl (1%) from 240.2 $\pm$ 24.8 to 242.4 $\pm$ 40.0 mg/dl while the EG decreased TCH by 11.8 mg/dl (5%) from 239.9 $\pm$ 22.6 to 228.1 $\pm$ 26.8 mg/dl. Repeated measures ANOVA showed a trend toward a lowering of TCH in the EG

(time*group) [F(1,34)=3.39, p=.07]. A one way repeated measures ANOVA for TCH within the EG between 0 and 8 weeks was significant [F(4,64)=3.14, p=.02]. Goal attainment was statistically greater in the experimental group [z=2.12; p=.017]. Food record two way ANOVAs revealed no significant differences between groups over time on dietary intake of fats or dietary cholesterol. Using one way ANOVAs the experimental group demonstrated a significant pattern of initial decreases from food record 1 to food record 2 which was maintained at food record 3. A recently reported study conducted in a structured cardiovascular exercise program (Burkett, Southard, Herbert, & Walberg, 1990) showed statistical significance over a 16 week trial period using this feedback technique. The results of the present study suggest that the findings of Burkett, et al. may be generalizable to populations participating in an unsupervised mall walking program.

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Chapter I

Since 1950 there has been a 32% decline in deaths attributed to Coronary Heart Disease (CHD) which can primarily be attributed to better medical and emergency care (Higgens & Luepker, 1988). However, there has also been a decrease in risk factors including a lowering of blood pressure, a decrease in smoking behaviors, and a decrease in serum cholesterol levels. Despite this decline, CHD remains the leading cause of death in the United States. It is estimated that a half million people will suffer a heart attack each year and that, of these, over one half will die (Leaf, 1989). In addition about 170,000 people under-go coronary artery bypass surgery each year (McCuney, 1987). High blood cholesterol is one of the three most significant contributors to the development of CHD. It is also a prevalent disorder with approximately 79 million adult Americans above the optimal level of 200 mg/dl (Marwick, 1986).

High levels of blood total cholesterol (TCH) have been correlated with the incidence of atherosclerosis in a number of studies (ie., Goldbourt, Holtzman, & Nuefeld, 1985; Kannel & Gordon, 1970; Plant, Pierce, Rushworth, Goldstein, & Gregory, 1988; Stamler, Wentworth, & Neaton, 1986). Atherosclerosis results in ischemic heart disease, angina,

and myocardial infarction. Heart disease costs billions of dollars in health care, work-time lost, and insurance premiums.

Several reports have agreed that a 1% reduction in TCH levels is associated with a 2% reduction in risk of CHD (Castelli et al., 1989; Keys, Anderson, & Grande, 1965a; National Institutes of Health Consensus Conference, 1985). Due to these and other similar studies, the National Cholesterol Education Program (1988) has recommended that adults have TCH levels checked once every five years. Those found to have levels below 200 mg/dl should be given general dietary and risk reduction materials. Those above 200 mg/dl and especially above 240 mg/dl should receive dietary intervention and guidance with the possibility of drug therapy for individuals who do not respond to dietary management. These guidelines are expected to affect over one half of the adult United States population, approximately 79 million Americans, by lowering TCH levels and the development of CHD.

In addition to the large numbers of people at risk, there has also been a lack of awareness regarding the importance of cholesterol and knowledge of what the critical levels are. As of 1988 only an estimated 6% of the population people knew their TCH level (Centers for Disease Control, 1988). A pressing issue is how to effectively

increase awareness and educate the population. Concurrently, there is the difficulty of initiating and maintaining behavior modifications in life-style to lower serum cholesterol. Increases in activity levels, decreases in body weight, and alterations of dietary habits are the modifications usually implemented to lower cholesterol. Dietary modification is the first line of action with drug intervention suggested if 3-6 months of dietary modification leads to insufficient TCH changes (National Cholesterol Education Program, 1988).

Traditional medical/clinical interventions to lower blood cholesterol have often proven ineffective for lowering TCH levels. Typically this method includes a visit to the family physician where one receives information regarding a low-fat, low-cholesterol diet. However, adherence to the new diet is often quite poor (Superko, 1989; Wrisley & Rubenfire, 1988). Researchers have been investigating behavioral modification techniques to facilitate compliance. Several studies have demonstrated an ability to significantly lower blood cholesterol levels within an eight week period using a variety of behavioral modification techniques to facilitate dietary compliance including, education, familial involvement, positive or negative feedback of food intake behaviors from food records, and goal setting (Jeffery, 1988). Few studies have examined the

ramifications of a single intervention, probably because researchers felt they needed as much study power as possible.

Statement of the Problem

Due to the inability of patients to effectively implement dietary alterations with out follow-up or behavior modification (Crouch et al., 1986; Wrisley, & Rubenfire, 1988) various feedback and shaping procedures are being explored. Recent advances in technology have now made it feasible to monitor serum TCH on a frequent basis, using portable blood analyzers, which are acceptably accurate and inexpensive. One system, the Reflotron uses 30 microliters of blood from a fingerprick and automatically gives results in three minutes. Cost is only approximately $1.50 per test (Boehringer Manheim, 1986). This could be a useful tool allowing a doctor or any individual to check progress in the attempts to lower blood cholesterol.

One study (Burkett, Southard, Herbert, & Walberg, 1990) demonstrates a promising resolution to the difficulty of providing accurate, immediate feedback of blood cholesterol levels on a frequent basis. A Reflotron Portable Blood Analyzer was used to give monthly feedback of total blood cholesterol levels over a four month period to 28 cardiac rehabilitation patients. Twenty-six males and 2 females who had been participating in the supervised and structured

exercise program for an average of 4 years were participants. Statistically significant reductions were seen in the experimental group when compared to the control group ($p \leq .05$). A mean reduction of 23.7 mg/dl was found in the experimental group whereas the control group experienced a drop of only 5.7 mg/dl in blood cholesterol levels. In this setting, feedback of total cholesterol levels was found to be a strong motivator for participants to lower cholesterol levels. The Reflotron required a minimum of care giver training, and necessitated relatively small costs in terms of time and money for the individual. The present study was conducted to determine if these results can be generalized to a larger population participating in an unstructured, unsupervised exercise program.

Research Hypothesis

In this investigation the following hypotheses will be investigated:

1) Individuals receiving TCH feedback biweekly will have a greater reduction in TCH from baseline to week eight as compared to those receiving only pre- and post-measurements but no feedback of TCH levels over the eight week period.

2) Individuals receiving TCH feedback biweekly will have a greater success rate in attainment of the 10% TCH reduction goal as compared to those receiving only pre- and

post-measurements but no feedback of TCH levels over the eight week period.

Significance of the Study

This study has been designed to examine the effectiveness of receiving total cholesterol measures as a form of feedback to monitor progress of lipid lowering interventions. Typically, dietary modification is the primary intervention to lower blood cholesterol levels and drug therapy is recommended for use only after dietary modifications have failed. Several studies have shown the ineffectiveness of patients being given the dietary information and being left to implement this information of their own accord. Wrisley et al. (1988) evaluated the usual dietary intervention strategies for a group of cardiac patients and found that none of the participants had significantly lowered cholesterol. Crouch et al. (1986) found that by using phone calls, mailings, or face to face interviews, patients could implement statistically significant decreases in blood cholesterol, whereas those who received no follow up could not. Other, more extensive, studies have also shown decreases in TCH by using an assortment of techniques including self monitoring, self management skills training, setting of short term goals, etc. However a majority of these interventions require counseling training, lots of time and energy on the part of

the health care provider as well as considerable time and money on the part of the hypercholesterolemic.

By using a portable blood analyzer, individuals can conveniently have their blood cholesterol level checked at their primary care giver's office, local clinic, or mall. The procedure requires only five minutes to take blood and analyze cholesterol content. Although training is required, it is minimal, and could be an important adjunct to enhance compliance and supplement dietary counseling. This is also a method which the individual could use at will and costs very little in time or finances. Should this method of feedback aid individuals to monitor themselves and alter eating behaviors it would be an excellent method to recommend to large populations for screening and follow up after meeting with their physicians.

Definitions and Symbols

For the purpose of this study the following definitions are applicable:

Coronary Heart Disease (CHD)- damage or occlusion of one or several arteries supplying blood to the heart resulting in ischemia or myocardial infarction.

Blood Total Cholesterol (TCH)- sum of all cholesterol components carried by lipoproteins in the blood stream.

Cardiovascular Risk Factor- any behavior or condition which may put an individual at an increased likelihood for developing CHD.

HDL- high density lipoprotein component of total cholesterol in the blood, may serve to take cholesterol deposits out of the arteries where atherosclerotic build-up occurs.

LDL- low density lipoprotein component of blood total cholesterol, primary carrier of cholesterol in the blood often depositing cholesterol in the arteries.

mg/dl- milligrams per deciliter is the standard unit of measurement of cholesterol for North America.

Feedback- that information received in the form of a total cholesterol measure from a portable blood analyzer.

Delimitations

1. Participants of a walking club at a local shopping mall were the participants of this study.

2. Only TCH measures were analyzed and compared across groups.

3. The study was eight weeks long.

4. Food records were required and kept by all participants over 3-day periods at times 0, 4, and 8 weeks.

Limitations

1. Subjects may have received and utilized information on diet and cholesterol outside of the study.
2. HDL and LDL values may have changed without changes in total cholesterol.
3. Uncontrollable variables may have affected participants' abilities to maintain a low-fat low-cholesterol diet ie., death in the family, staying with other family during a crisis, etc.

Assumptions

For the purposes of this study the following assumptions were applied:

1. All blood analyses were valid and reliable.
2. Subjects maintained their level of exercise throughout the study period.
3. All self report data was entered correctly and honestly by participants.
4. All statistical assumptions were correct.

Summary

High total blood cholesterol levels have been closely associated with incidence of CHD (i.e. Goldbourt et al., 1985; Stamler et al., 1986) and has been identified as one of the primary risk factors for developing CHD. As much as 50% of the American population may have high cholesterol levels. CHD causes over a half million deaths each year and

costs the American people over 60 billion dollars per year in direct and indirect costs (National Institutes of Health Consensus Conference, 1985).

Recent developments in technology have made what used to be a time consuming and expensive process of cholesterol measurement much more convenient and cost effective. Rather than a physician's visit, venipuncture, and two weeks for the results, individuals can now have a fingerstick in a clinic or mall and have the results within five minutes. The ability to test and give the results of a cholesterol test at a convenient location may help reduce the incidence of high cholesterol if it can increase public awareness and work as a significant motivator for individuals to implement and maintain dietary changes to keep cholesterol levels low.

This study was designed to investigate the effects of frequent feedback of cholesterol levels using the Reflotron. Both groups were given the standard cholesterol lowering information through dietary interventions and met on a biweekly basis to equate attention levels. The experimental group also received a TCH measure that was visually depicted on a graph to show progression of lowering. Both groups were also asked to keep 3-day food records at week 0, 4, and 8 to evaluate any alterations in eating behavior over the intervention time.

Chapter II

LITERATURE REVIEW

Cardiovascular disease accounts for over 500,000 deaths per year. This is the single greatest cause of death in the United States and most industrialized countries. Many factors contribute to this disease process. High blood pressure, smoking, and high blood cholesterol levels are the three primary contributors and also the most modifiable. The following sections examine studies revealing the significance of high blood cholesterol levels, consensus on levels of cholesterol requiring treatment, dietary intervention as a method of treatment for high blood cholesterol, and types of behavior modification used to empower patients to lower their cholesterol levels.

Importance of Cholesterol Levels

A variety of epidemiological data exist supporting the hypothesis that high blood cholesterol levels significantly contribute to cardiovascular diseases, particularly coronary heart disease (CHD). Additionally many prospective studies have been done on large cohorts demonstrating the contribution of hyperlipidemia to CHD. Three primary evaluations of blood cholesterol have been utilized to determine levels of risk for CHD. These components in the total serum or plasma cholesterol (TCH) include: low density lipoproteins (LDL), high density lipoproteins (HDL), and

triglycerides.

Goldbourt, Holtzman, and Neufeld (1985) examined a cohort of 10,059 men for a fifteen year mortality. HDL and TCH were evaluated for their predictive effects on CHD mortality. Their results showed a highly predictive relationship between HDL and incidence for CHD. Total blood cholesterol was also found to be a reliable predictor with a direct relationship of total level to increased mortality. Their results did demonstrate a threshold level for total cholesterol beginning at 220 mg/dl with significant increases above 240 mg/dl.

A continuous and strong correlation to total level of blood cholesterol was found by Stamler, Wentworth, and Neaton (1986) in their trials of the Multiple Risk Factor Intervention Trial (MRFIT). This cohort consisted of 356,222 men aged 35-57 who were evaluated prospectively for a 6 year risk of fatal myocardial infarction. In this study it was shown that independent of diastolic blood pressure, cigarette use, or age there was a continuously increasing risk of CHD as TCH exceeded 180 mg/dl. A four times greater risk of mortality was found in individuals with cholesterol levels exceeding 264 mg/dl than those with a level of 167 mg/dl or below.

The White Hall study by Rose and Shipley (1986) further strengthened the argument for a continuous and graded effect

of blood cholesterol level for mortality of CHD. This was a 10 year mortality study of 17,718 40-64 year old men. In fact, these researchers could not establish a minimum or optimal level for blood cholesterol because even in their lowest stratum of examination CHD death was still prevalent.

The 1987 report of the 30 year follow up on the Framingham study (Stokes, Kannel, Wolf, Cupples, & D'Agostino, 1987) showed that TCH was second only to blood pressure in its contribution to cardiovascular diseases. This study was one of the first to include women in its cohort of 5070, and further demonstrated that TCH was a significant contributor for middle aged men and women as well as older women. Until this report, professionals hesitated as to the value of reducing women's cholesterol levels. A re-examination of Framingham data (Castelli, Wilson, Levy, & Anderson, 1989) demonstrated a significant risk related to TCH levels in men and women, adding that not only were the relative risks the same for middle aged and elderly women but that since CHD was more prevalent in the elderly the absolute risk of CHD due to cholesterol contributions was higher in older women and men. The effects of cholesterol and the relative versus absolute risks among men and women in these two age groups is detailed by Gordon and Rifkind (1989). Based on this public health perspective, decreasing blood cholesterol from 285 to

200 mg/dl, would prevent CHD manifestations in elderly women at four times the rate of middle aged women. Elderly men would decrease manifestation rates twice the amount in middle aged men.

Finally, Benfante and Reed (1990) demonstrated from their cohort of 1480 men that high cholesterol is a risk for elderly men over 65 years of age. The incidence of CHD increased progressively from the lowest to highest quartile of serum cholesterol levels. Their major conclusions were that total cholesterol remained an independent predictor for CHD even for men over 65 years of age and that risk levels were undiminished when compared to middle aged men.

Through these studies researchers have come closer to elucidating the effects of cholesterol on the population as a whole. It has become apparent that high TCH is a risk factor for CHD in adult men and women of all ages. The following step in public health and clinical treatment has been to determine the levels of total cholesterol which will require treatment.

Consensus Levels for High Blood Cholesterol

Recently, expert panels have reached a consensus on what levels constitute high risk for development of CHD. This has occurred in the wake of much debate over the clinical issues of who to treat (sex, age, etc.), and at what TCH level. Physicians have been reluctant to treat

hypercholesterolemia aggressively and have only started drug therapy at a median cholesterol level of 300-319 mg/dl (Superko, 1988). The lay population has also been bombarded by innumerable media assaults on what increases or decreases cholesterol, the ability of an individual to lower their cholesterol level, and even whether cholesterol level is important or not (Cowley, 1989; Moore, 1989).

However the National Institutes of Health Consensus Conference (1985) selected levels considered safe and at risk in 1984. For those aged 20-29 years of age, 200-219 mg/dl is moderately increasing risk, >220 mg/dl is at high risk. For ages 30-39, 220-239 mg/dl is moderate risk with high risk above 240 mg/dl. Individuals aver 40 years of age are considered at moderate risk at 240-259 mg/dl and high risk over 260 mg/dl.

Since then the National Cholesterol Education Program (NCEP) (1988) has modified these recommendations to reflect newer information and for a more simplified approach. They have also extended diagnostic and treatment criteria to examine LDL and HDL levels. The initial treatment classification based on total cholesterol for all ages is as follows: less than 200 mg/dl is desirable; 200-239 mg/dl is moderately increased risk; and greater than 240 mg/dl is high risk for CHD development. Criterion for hyperlipidemia based on LDL levels has also been established due to the

strong correlations for LDL to predict heart disease. The LDL component also carries 60-70% of the total cholesterol in the blood. LDL values of 160 and 130 usually correlate with total cholesterol levels of 240 and 200 respectively. However, to make a more precise diagnosis utilizing a lipoprotein analysis, LDL values have been used to define hyperlipidemia. If LDL values are less than 130 mg/dl this is desirable, 130-159 defines moderate risk, and 160 mg/dl defines high risk for development of CHD. HDL has also been examined for predictive value in the development of CHD (Castelli et al., 1986). The NCEP has listed an HDL value of less then 35 mg/dl as another criterion for determination of treatment.

The NCEP (1988) has also suggested treatment for hyperlipidemia based on certain criteria. If total cholesterol is less than 200 adults should be tested again in another 5 years. If total cholesterol is found to be 200-239 mg/dl and the individual does not already have diagnosed disease or two other risk factors for CHD development (ie, smoking, male sex, high blood pressure) information regarding necessary dietary intervention is to be given and a recheck in 5 years. If total cholesterol is over 240 mg/dl or 200-239 mg/dl with 2 other risk factors, it is recommended for the individual to have a complete lipoprotein analysis done. If LDL levels are found below

130 mg/dl a recheck in 5 years is the next step. However, if LDL levels are 130-159 dietary intervention is recommended with follow-up in one year. LDL levels of 130-159 mg/dl with 2 or more other risk factors or LDL levels over 160 mg/dl require intensive treatment including dietary intervention usually accompanied with drug therapy.

Dietary intervention is the first line of attack for hyperlipidemia due to its cost effectiveness and lack of side effects as is found with drug intervention. Aerobic activity can be an important adjunct in the treatment of hyperlipidemia aiding in the decrease of body fatness and increasing HDL levels (for reviews see Dubbert, Rappaport, & Martin, 1987; McCunney, 1987; Vu Tran, Weltman, Glass, & Mood, 1983).

Effects of Dietary Intervention

Several epidemiological studies exist demonstrating the effects of diet on serum cholesterol and cardiovascular disease. The Seven Countries study by Keys (1970) compared diet across seven different countries and compares incidence of CHD manifestation. The Western Electric study has also been acclaimed to be one of the strongest studies done linking dietary factors to development of CHD (Nestel, 1987). Among others, these studies have revealed a strong association between the fat (in particular saturated fatty acids) and dietary intake of cholesterol as strong

correlates of high serum cholesterol levels.

Other prospective studies have further examined the relationship between saturated and unsaturated fatty acids. Both the Ireland-Boston Diet-Heart Study (Kushi et al., 1985) and the Leiden Intervention Trial (Arntzeniun et al., 1985) clearly demonstrate a relationship between the increased intake of saturated fats and CHD mortality. The Ireland-Boston Diet-Heart Study used measurement indexes of saturated fat and dietary cholesterol to find the significant dietary effects of CHD mortality. The Leiden Intervention Trial found that a diet containing a ratio of unsaturated fats to saturated fats of two helped curtail the manifestation of CHD. Furthermore, varying intakes of dietary cholesterol have been evaluated in combination with a low saturated fat diet and aerobic exercise demonstrating significant increases of blood cholesterol with increases in dietary cholesterol (Johnson, & Greenland, 1990).

It has been estimated using a mathematical formula (Keys, Anderson, & Grande, 1965a) that every 1% increase in total calories consumed as saturated fat resulted in a 2.7 mg/dl increase in serum cholesterol. This would mean that an increase of 10% in saturated fat intake would raise blood cholesterol 27 mg/dl. Additionally, an increase in dietary cholesterol from 250 mg-500 mg per day would raise blood cholesterol 10 mg/dl (Keys, Anderson, & Grande, 1965b).

Extensive work is being done to evaluate the effects of polyunsaturated and monounsaturated fatty acids. A variety of effects have been seen due to altered ingestion of these fats. Two primary conclusions have been reached. First, by replacing saturated fat consumption with either polyunsaturated or monounsaturated fats one will decrease serum total cholesterol. Secondly, monounsaturated fats will not lower the HDL component of total cholesterol as much as polyunsaturated fats will. (Grundy 1986, Grundy, 1987, Grundy, 1989).

Concomitantly, work is being done to evaluate the effects of the omega 3 and 6 fish oils on cholesterol. Both of these oils have shown a positive result when used to lower total cholesterol levels (Herold & Kinsella, 1986; Philipson, 1985). Research is just beginning on these oils however and they require much more evaluation of positive and negative effects (Nestel, 1987; Simopoulus, 1986). Another area which is currently being researched is coffee consumption. Coffee has been thought to raise the LDL level of TCH (Williams, Wood, Vranizan, Albers, Garay, & Taylor, 1985). Studies to evaluate differing dietary habits among coffee drinkers and non-drinkers are being conducted. It appears that coffee may have an independent effect on TCH (Solvoll, Selmer, Loken, Foss, & Trygg, 1989). In addition, the brewing of coffee may independently affect TCH levels

(Bonna, Arnesen, Thelle, & Forde, 1988; Stensvold, Tverdal, & Foss, 1989). Alcohol has been another beverage under investigation. It appears that moderate consumption of alcohol increases the HDL-3 component of HDL. This is the more dense fraction which in not thought to be protective against CHD development (Hartung et al., 1983; Haskell et al., 1984).

Until further definitive answers can be reached, modest recommendations have been made for the general public and for those diagnosed as hyperlipidemic. The Nutrition Committee and Council on Atherosclerosis recommended in 1985 that the general population should adopt a "Phase 1" diet consisting of 30% of total calories coming from fat with equal distributions of polyunsaturated, monounsaturated, and saturated fatty acids. Dietary consumption of cholesterol should be less than 300 mg per day. When treating hyperlipidemia, should this diet fail to attain the desired results a "Phase 2" diet would be recommended. This phase reduces total fat intake to 25% of calories with equal parts of the three fatty acids and restricts dietary cholesterol to 200-250 mg. "Phase 3" of the lipid lowering diet consists of 20% calories from fat, equal parts of fatty acids, and 100-150 mg of dietary cholesterol per day.

Since that time the National Cholesterol Education Program (1988) has altered these recommendations slightly.

Their basic "Step 1" diet consists of 30% total calories coming from fat with less than 10% of total calories coming from saturated fat, up to 10% from polyunsaturated, and 10-15% from monounsaturated fat. Dietary cholesterol is to remain below 300 mg/day. Further restrictions for the "Step 2" diet are to keep dietary cholesterol below 200 mg/day and further reduce saturated fat intake to less than 7% of total calories.

These recommendations sound simple enough but there is alot of necessary education before the general population understands and can determine how much fat and cholesterol they consume. Even when people are educated and understand the necessary changes to be made in their diet, it will often require a dietician or other health professional to ensure that proper nutritional requirements are being met, especially on the more restricted diets. Given sufficient dietary knowledge, additional factors limiting behavior change include poor self management skills, insufficient feedback regarding progress, and lack of social support.

Behavior Modification Strategies

For many years therapists have been working with behavior modification techniques to alter behaviors putting individuals at risk for cardiovascular disease (Elder Hovell, Lasater, Wells, & Carleton, 1985). Concepts which have been explored most frequently have been the effects of

positive and negative reinforcement; barrier reductions; substitute behavior; feedback and shaping. Through implementation of these ideas researchers have altered dietary habits, medication adherence, and exercise to alter plasma lipids and the risk for cardiovascular disease (Carmody, Fey, Pierce, Connor, & Matarazzo, 1982). Critical factors influencing the adoption of change include use of family involvement; group support; behavioral shaping; setting small goals; social policy formation; and length of follow up.

Dietary programs which have been attempted to lower TCH usually consist of a strong educational aspect, incremental goal setting, involvement of the family, and monitoring of progress as best as possible. This latter component has usually been done with food recalls or food records (Jeffery, 1988). Both of these methods although helpful and inexpensive are not very accurate. Until recently however it has been very costly and time consuming to measure lipid levels because the only method available was complete lipoprotein analysis, with the sample drawn via venipuncture. Currently there are several methods available that only require blood from a single finger stick and can give feedback in a matter of minutes.

Several large community wide studies have been conducted to alter a variety of cardiovascular risk factors.

Among these are the Multiple Risk Factor Intervention Trial, the Stanford Three Community Study, and the Baylor College Study (in Singleton, Neale, Scott, & Hess, 1988). The Pawtucket, R. I. Study (Lefebvre et al., 1986) will serve as an example of how these large scale interventions work in the community. These researchers divided the year into two month segments and devoted each section to a cardiovascular risk factor. Media was recruited for public service announcements, and for coverage of events. To address cholesterol issues, several sites were located around the town at differing times for screening procedures, dietary counseling and referrals. At follow up 1439 had participated and 600 of the 1040 hyperlipidemics had lowered their cholesterol an average of 29.1 mg/dl. This study is a brief sample of how other large community interventions have worked. An atmosphere of consciousness was created with group support and involvement. Barrier reduction occurred by constructing sites for information, screening, dietary counseling etc.

Smaller scaled projects have also taken on the intense multifaceted behavior modification at work sites. Bruno, Arnold, Jacobson, Winick, and Wydner (1983) utilized 145 people over an eight week intervention period to try to lower cholesterol levels. Intervention concepts were food behavior change strategies, education, physical activity

plans, and self management skills. Specific actions consisted of self monitoring, contingency contracting, stimulus control, cognitive restructuring, self reinforcement, and nutrition counseling for one hour each week. The treatment group lowered their cholesterol by an average of 24 mg/dl (8.8%). However, it is impossible to discern which behavior modification technique was most critical.

Lovibond, Birrell, and Langeluddecke (1986) utilized three groups over eight week periods. This project was initially designed to alter weight, blood pressure and aerobic fitness although serum lipids were also measured. The three interventions differed primarily on the intensity of behavior shaping and feedback each group received. A variation in the amount of: a) information one received concerning weekly blood pressure, fitness, weight, and risk of CHD, b) self monitoring of eating habits and c) training to make realistic short term goals. At the end of eight weeks, although changes were seen in other variables such as fitness, all groups had significantly decreased cholesterol levels (decreased by 34 mg/dl). It is possible that the least intensive intervention offered enough behavior modification to inspire alterations in lipid levels.

An additional experimental study (Ostwald, 1989) followed 167 people in three groups over a 12 week

intervention period. The basic intervention group received an education seminar, cholesterol test with written evaluation, an introduction (by sampling) low-fat low-cholesterol foods, and a monthly news letter. The moderate intervention group further received a more extensive interpretation of the cholesterol screening, a physical examination, a maximal treadmill test, and access to exercise facilities. In addition to those previously mentioned, the following interventions were used for the most intensive intervention group a) a personal explanation of lab tests of cholesterol, b) a personalized exercise prescription, and c) attendance of three aerobics classes weekly. Significant drops of total cholesterol were seen only in the intensive intervention group of 15 mg/dl or 8%. Improvements were seen in the basic and moderate intervention groups in the total cholesterol to HDL cholesterol ratio. This may be explained because the intensive intervention group was initially more physically active than the other two groups. There was no significant difference in reported change of dietary or exercise habits among either group ie., the amount of improvement seen due to the different interventions. Thus the differences in behavior modification techniques and intensities are difficult to interpret. It could have been that education and a newly created consciousness as well as an improved

group support could have made the difference for all groups or the basic intervention group could have been more competitive and tried harder. There could be a variety of potential explanations, although it was apparent that all groups modified behaviors to a physiologically significant degree.

Individual elements of intervention have been evaluated in a few studies. The effectiveness of face to face interviews, or phone calls and mailings, as opposed to no follow up after the initial interview session were compared for a group of 83 hypercholesterolemics (Crouch et al., 1986). There were five contacts made over a 4 month period in the face to face and phone/mail groups with a one year follow up for all three groups. At follow up, those who received a face to face interview had decreased their cholesterol by 6.2% or 15 mg/dl; the phone/mail groups had decreased total cholesterol levels by 4.6% or 13 mg/dl as compared to a statistically nonsignificant increase in cholesterol for the control group. These results clearly demonstrated the ineffectiveness of traditional clinical/medical intervention for lowering blood cholesterol levels. Follow up was needed to motivate behavior change.

Singleton et al. (1988) used volunteered contract signing as their primary intervention over their six month clinical assessment. Of 118 hyperlipidemics 51 volunteered

to sign behavioral contracts agreeing to self-monitor food intake and attend educational sessions. The other individuals were encouraged to attend sessions and monitor food intake. Only the self-selected group who were motivated to sign contracts were found to be motivated to alter dietary habits enough to decrease blood cholesterol. Decreases of 34 mg/dl or 13.5% were seen in this group. Decreases were not dependant on the number of educational sessions attended although those who monitored food intake for at least 14 days were seen to have the greatest decreases in blood cholesterol. The only difference in the signing versus not signing groups was that those who signed had a higher average cholesterol level and may have had a higher perception of threat.

Finally, Burkett, Southard, Herbert and Walberg (1990) utilized the Reflotron portable blood analyzer to give immediate feedback on total cholesterol levels for a group of 28 cardiac patients. Both groups received an educational packet of materials to help reduce TCH through dietary means. Total cholesterol measures were given on a monthly basis for 4 months and visually graphed for the intervention group.

At the end of 4 months the experimental group showed a statistically significant reduction of 24 mg/dl (9%) while the control group showed a statistically nonsignificant

reduction of 6 mg/dl (2%). Clearly this form of immediate feedback was an effective method to motivate these individuals to utilize their knowledge for dietary intervention and it was achieved at a low cost in terms of time and money.

Most recently, Gould, Winett, Neubauer, and Walberg (1990) showed over 6 weeks significant reductions in TCH of 14.7% and 9.2% for their intensive and non-intensive intervention groups respectively. The groups both received personalized recommendations for altering eating behaviors to lower TCH, macronutrient feedback from recently recorded food diaries, goals for nutrition changes and cholesterol reduction. In addition, the intensive group received three sessions per week with a researcher to have TCH measures taken, to show food records of the previous day, and to receive specific step by step dietary change instructions. It was reported that these procedures took approximately 30-40 minutes for each individual each week (N=8). These results compare favorably to Burkett et al. (1990) and others demonstrating the effectiveness of frequent feedback in conjunction with dietary education.

As a singular intervention, feedback of the physiological parameter to be controlled has proven quite effective in other areas of research. Biofeedback of blood pressure and heart rates has proven an effective

intervention for decreasing cardiovascular reactivity (for review see Surwit, 1985). Visual depiction of feedback for heart rates has also been shown to significantly decrease cardiovascular reactivity when subjects were placed under a mental stressor (Sharpley, 1989).

All of the above mentioned studies used some form of behavior modification including feedback, education, support, and follow up either individually or in a multifocused effort. It is difficult to identify which factor or factors were the most critical or successful in helping an individual to reduce his or her cholesterol levels although feedback on performance probably plays a critical role. However, the primary goal would be to find a reliable, inexpensive method that takes a minimum of training and experience to produce the desired motivation for a majority of hypercholesterolemics. By taking advantage of the latest technology, immediate feedback of cholesterol levels might be an excellent choice for self monitoring and behavioral modification technique.

Chapter III

JOURNAL MANUSCRIPT

PERIODIC FEEDBACK TO REDUCE CHOLESTEROL LEVELS

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ABSTRACT

The effectiveness of biweekly feedback regarding blood total cholesterol (TCH) to assist dietary adherence and lower blood TCH levels was assessed in a mixed population of healthy and cardiac diseased subjects (S) engaging in an unsupervised mall walking program. Based upon screening with a portable lipid analyzer (and with their physician's permission) 36 S's (x age=63, 83% females) with TCH levels between 200-300 mg/dl were randomized to control (CG) or experimental groups (EG). The CG received instruction regarding the National Cholesterol Education Program's Step 1 low-fat, low-cholesterol diet at 0, 2, 4, 6 weeks and completed 3-day food records at 0, 4, 8 weeks. In addition to this instruction, the EG received graphic feedback regarding their TCH at 0, 2, 4, and 6 weeks. Both groups had a goal of a 10% reduction in TCH. By 8 weeks, the CG increased TCH by 2.2 mg/dl (1%) from 240.2 $\pm$ 24.8 to 242.4 $\pm$ 40.0 mg/dl while the EG decreased TCH by 11.8 mg/dl (5%) from 239.9 $\pm$ 22.6 to 228.1 $\pm$ 26.8 mg/dl. Repeated measures ANOVA showed a trend toward a lowering of TCH in the EG (time*group) [$F(1,34)=3.39$, $p=.07$]. A one way repeated measures ANOVA for TCH within the EG between 0 and 8 weeks was significant [$F(4,64)=3.14$, $p=.02$]. Goal attainment was statistically greater in the experimental group [$z=2.12$; $p=.017$]. Food record two way ANOVAs revealed no significant

differences between groups over time on dietary intake of fats or dietary cholesterol. Using one way ANOVAs the experimental group demonstrated a significant pattern of initial decreases from food record 1 to food record 2 which was maintained at food record 3. A recently reported study conducted in a structured cardiovascular exercise program (Burkett, Southard, Herbert, & Walberg, 1990) showed statistical significance over a 16 week trial period using this feedback technique. The results of the present study suggest that the findings of Burkett, et al. may be generalizable to populations participating in an unsupervised mall walking program.

INTRODUCTION

Awareness of the issues concerning high blood total cholesterol (TCH) has recently increased among the lay and professional populations (National Cholesterol Education Program, 1988). High cholesterol levels in the blood are a primary risk factor for developing coronary heart disease (CHD). Critical levels of blood total cholesterol (TCH) have been established to help determine the level of risk associated with development of CHD. Levels less than 200 mg/dl are desirable. Moderately increased risk is associated with levels between 200 and 239 mg/dl. High risk is greater than 239 mg/dl. NCEP recommends checking TCH levels every five years and more often if one has hypercholesterolemia. Dietary intervention is the first method used to lower TCH levels.

It is often difficult to implement the dietary changes necessary to lower TCH. Habits, feelings, and values of the individual and the family exert an effect which is usually resistive to change. Routine dietary counseling is often ineffective in altering lipid levels (Wrisley, & Rubenfire, 1988). Therapists have utilized several behavior modification techniques including positive and negative reinforcement, barrier reduction, shaping and feedback to alter behavior (Carmody, Fey, Pierce, Connor, & Matarazzo, 1982). Dietary programs usually consist of a strong

educational component, incremental goal setting, family involvement, and monitoring progress (Jeffrey, 1988).

Certain factors have been evaluated as most critical for implementation of behavior change (Elder, Hovell, Lassater, Wells, & Carleton, 1985). These include demonstrating that effects of the intervention are apparent to the individual and that the intervention is inexpensive in terms of time and money so that participation is maximized. Until recently it has been difficult to monitor progress and show the effectiveness of interventions for lowering TCH. This was due to the costs (time and money) of venipuncture procedures used for lipoprotein analysis. The development of portable lipid analyzers has eliminated some of the financial and time costs previously associated with lipid analyses. For example, the Reflotron (Boehringer Manheim Diagnostics, 1986) utilizes only 30 microliters of blood from a finger prick and analyzes it in 3 minutes.

Using a portable lipid analyzer as a source for feedback and monitoring has been shown effective for participants in a supervised, multidisciplinary cardiac intervention and maintenance program (Burkett, Southard, Herbert, & Walberg, 1990). The current study was completed to evaluate the effectiveness of frequent TCH feedback in an elderly population participating in an unsupervised walking program at a shopping mall.

METHODS

Approximately 60 individuals expressed initial interest in the study. All had a history of hypercholesterolemia and at least one of CHD. Many reported having been instructed to walk at the mall by their physicians. After study requirements were explained and single representatives of married couples volunteered, 41 individuals desired to participate. Only 36 were included in the final analysis because 2 began taking lipid lowering medications, 2 failed to complete week 8 measures, and 1 withdrew due to a fear of contracting AIDS. Criteria for entry were: a) TCH between 200-300 mg/dl b) not currently taking lipid lowering medications c) participation in the walking club for at least 2 months d) not currently on any rapid weight loss diet. Personal interviews were given to: discuss the goal of the study; study protocol; sign consent, information, and physician's consent forms; and sign up for a dietary food records class.

Groups were stratified into categories by baseline TCH as determined by the average of two baseline TCH measurements using the Reflotron and randomized into control and experimental groups. TCH measures were taken just prior to participation in the cholesterol reduction class and initial weights were also taken at this time. Double blood

sampling occurred at weeks 0 and 8 to check the reproducibility of the Reflotron. Weight measures were also taken at week 0 and week 8 to ensure no significant changes took place. All TCH measurements were taken with the Reflotron between 7:00 and 10:00 a.m., the usual walking hours at the mall. Sessions lasted between 5 and 10 minutes. Feedback for the experimental group consisted of taking a TCH measure and graphing the results to visually demonstrate proximity to the desired goal.

Both groups attended a food records class and a cholesterol lowering class. The food records class emphasized accurate measurement of dry and liquid foods, describing serving sizes, preparation, and accuracy in recording. The cholesterol lowering class was based on the Step 1 dietary recommendations of the NCEP (ie. keeping fat less than 30% of total calories, and dietary cholesterol less than 300 mg/day). To aid in the attaining of this goal, cooking and shopping techniques, and reading food labels were covered. After everyone had received the same information, both groups continued to meet with the researcher on a biweekly, individual basis to receive handouts of cholesterol lowering hints and to ask questions. In addition to this information, the experimental group received feedback on TCH levels taken at 2, 4, and 6 weeks. Both groups had the goal of a 10% reduction in TCH at the

end of the intervention. All missed appointments were rescheduled for 2 to 4 days following the missed appointment.

Food records were kept for three consecutive days prior to baseline TCH measurements, just after the week 4 session, and prior to the week 8 session. Diets were analyzed on the Nutritionist 3 program (N-Squared Computing, 1988) for the following 7 dietary components and 2 ratios: total kilocalories (TKCAL), total fat (TFAT), percent of calories from fat (%FAT), saturated fat (SFAT), polyunsaturated fat (PFAT), monounsaturated fat (MFAT), polyunsaturated to saturated fat ratio (P/S), monounsaturated to saturated fat ratio (M/S), and dietary cholesterol (D-CH).

The specific hypotheses were that TCH would decrease in the experimental group more than in the control group. Successful achievement of the 10% TCH reduction was expected to be greater in the experimental group. Food record data were expected to verify the dietary alterations needed to lower TCH. Reductions in dietary fat and cholesterol were expected to be greater in the experimental group.

Statistics used were two and one way ANOVAs for TCH and the dietary parameters. Independent t-tests were used to evaluate any initial differences in TCH or dietary components as well as any changes in weight between groups from week 0 to week 8. Chi square determined any

differences in demographic variables. These analyses were run using Statistics Analysis System (SAS) Institute (SAS, 1982). Number Cruncher Statistics System (NCSS; 1987) evaluated reproducibility of the Reflotron using one way ANOVAs and successful goal attainment for groups using a 2 sampled proportion test. A clinical perspective was also utilized to evaluate whether subjects altered risk categories as defined by the National Cholesterol Education Program (1988).

RESULTS

There were no statistically significant, initial differences between groups as determined using the Likelihood Ratio Chi Square (LRCS) in sex LRCS(1)= .56; p=.45, age LRCS(3)=.74; p=.86, marital status LRCS(3)=1.82; p=.61, education LRCS(3)=.94; p=.81, frequency of exercise LRCS(3)=.22; p=.97, smoking habits LRCS(1)=.002; p=.96, or fiber supplementation LRCS(1)=1.46; p=.22. No significant changes in weight occurred over the 8 week intervention t(33)=.74; p=.46.

Insert Table 1

TCH analysis showed a trend toward significance using the two way ANOVA [F(1,34)=3.39; p=.07] for group by time

interaction. No main group effect [$F(1,34)=.64$] or time effect [$F(1,34)=1.64$; $p=.21$] was seen. This analysis alone may not have elucidated the entire response of the groups. Figure 1 presents the means and 95% confidence intervals for TCH measurements. As can be seen, there is a seemingly large difference between means of the two groups for TCH at week 8. In addition, there was a large standard deviation in the control group at week 8 (40 mg/dl control vs 27 mg/dl experimental). Given that the control group received more information and attention than one would receive with clinical visits and more than the NCEP guidelines recommend, it is not unexpected that some individuals in the control group would have responded to the intervention. This response could have resulted in altered eating behaviors and a lowering of TCH. Further analyses of within group changes aid the understanding of intervention effects.

Insert Figure 1

One way ANOVAs were utilized to examine within group changes over time. The control group showed no significant changes [$F(1,18)=.69$; $p=.69$]. However, the experimental group showed significant changes from week 0 to week 8 [$F(4,64)=3.14$; $p=.02$]. Further contrast analyses showed significant decreases from week 0-2 [$F(1,16)=19.49$; $p\leq.001$]

and 0-6 [$F(1,16)=4.80$; $p=.04$]. No significant change was seen between weeks 6 and 8 [$F(1,16)=.06$; $p=.81$].

Goal attainment was significantly greater in the experimental group. The two sampled proportion test (NCSS non-parametrics test) found that the 41% (7/17) success rate of the experimental group was statistically greater than the 10% (2/19) success rate in the control group [$z=2.12$; $p=.017$].

Due to the current emphasis on risk categories for CHD development, it was thought important to evaluate results in this manner. The experimental group had 6 people decrease risk categories (4 from moderate to low and 2 from high to moderate), while only 4 individuals in the control group made similar reductions (from moderate to low); see Table 1 for distributions.

Three individuals failed to return at least one of the diet records. These individuals' data were left out of all repeated measures analyses. Using the two way ANOVA the analysis of dietary components (Table 2) showed significant main effects of time for: TFAT, %FAT, PFAT, MFAT, P/S, M/S, and D-CH. In addition there was a significant main group effect for %FAT $p=.04$. There were no significant group by time interactions.

Insert Table 2

Upon further examination, the one way ANOVAs showed significant changes over time for the experimental group and not for the control group in six of the seven dietary components. These components were TKCAL ($p=.04$), TFAT ($p=.02$), D-CH ($p=.04$), %FAT ($p\leq.001$), PFAT ($p=.03$), and MFAT ($p=.00$). The seventh factor, SFAT, approached significance at $p=.06$. A pattern of response was also established for these factors demonstrating initial significant decreases from FR1 to FR2 which was maintained at FR3 (Table 3). For examination of absolute values and change from pre- to post-intervention see Figure 2 for TFAT, SFAT, PFAT, MFAT; for percents of total calories from fats for %FAT, %SFAT, %PFAT, and %MFAT see Figure 3; and Figure 4 for D-CH and TKCAL.

Insert Figures 2,3, and 4

In addition, there were large percents of change from week 0 to week 8 in both groups although the experimental group consistently decreased more than the control group. TKCAL decreased 7.5% in the control group (1701 to 1574 kcal/day) and 11.8% in the experimental group (1706 to 1505

kcal/day). Decreases in TFAT were 11.6% (58.96 to 52.10 grams/day) for the control group and 22.8% (68.66 to 53.03 grams/day) for the experimental group. Percent of calories from fat decreased 6.1% (29.4% to 27.6%) in the control group and 11.6% (35.0 to 30.9%) in the experimental group. The control group also decreased SFAT 6.6% (16.2 to 15.3 grams/day); PFAT 14.6% (9.13 to 7.8 grams/day); MFAT 23.3% (14.6 to 11.2 grams/day); and D-CH 18.0% (208.9 to 171.2 mg/day). The experimental group saw decreases for SFAT of 19.0% (18.2 to 14.73 grams/day); PFAT 20.7% (12.2 to 7.23 grams/day); MFAT 32.5% (17.7 to 12.0 grams/day); and D-CH 204.7 to 155.9 mg/day).

There was only one initial difference of significance in dietary parameters. %FAT was significantly different initially [$t(23.8)= -2.53$; $p=.01$] with means for the control group of 29.4% and the experimental group of 35%. Thus, the control group did have a lesser capability to decrease %FAT and the significance of the change in %FAT attributed to the intervention must be interpreted with caution. As previously seen, the control group decreased 6% to a %FAT of 27 and the experimental group 11.6% to a %FAT of 30. It was possible however for individuals to decrease fat intakes below the recommended 30% even if initial values are below 30%. Six individuals in the control group decreased from an average of 27.6% to 17.5% and 4 in the experimental group

decreased from 28.8% to 24.3%. However, due to the statistically significant initial difference, statistical significance of change in %FAT due to the intervention must be interpreted with caution.

The coefficient of variation for determining the reliability for the Reflotron including both technicians and pre/post measures was 3.9%. This is acceptable as it is below the 5% critical level for reliability (United States Department of Health and Human Services, 1989).

DISCUSSION

In examination of TCH changes between groups the two way analysis of variance showed no significant differences between groups or across time but did demonstrate a trend toward significance with the group by time interaction. Figure 1 shows the 12 mg/dl difference in the mean TCH measure between groups at week 8 and the overlap of 95% confidence intervals for measurements. This factor with the large standard deviation in the control group's week 8 measures may have interfered with the ability to show significance of group by time interaction. Within group analyses were completed to further evaluate intervention effects on the groups. Results from the within group analyses support a significant difference for the effectiveness of the intervention on TCH. The experimental

group did demonstrate a significant drop in TCH ($p=.02$) using the repeated measures one way ANOVA while the control group demonstrated no significant changes.

Several reasons may exist to explain this finding. It is possible that some individuals in the control group may have responded simply from the knowledge that they were in a "cholesterol lowering study." Participation in the study and meeting with the researcher biweekly, may also have created an increased awareness in these individuals prompting them to alter dietary habits. This group did receive more education and contact than is recommended by NCEP guidelines and probably more than they would have from their physician. In addition, there was some contamination between groups. These individuals walked in a highly social environment, the same environment where the investigative sessions were held. By observation, it was known that some individuals in the experimental group were "best friends" with those in the control group. It is unclear if the effects of the intervention would have been more demonstrable if those not receiving feedback had not had an opportunity to speak with those who were receiving feedback.

The experimental group did have significantly greater success attaining their goal of a 10% reduction in TCH. This finding could have great importance when counseling individuals to lower TCH. When individuals are attempting

to lower their TCH, frequent feedback and visualization of progress toward a goal could be a very helpful motivator for behavior change.

Typically, TCH interventions are conducted in a clinical situation where use of NCEP guidelines has been encouraged. Therefore, it is important to note the clinical impact of the current intervention. Four individuals in the control group did lower their risk for CHD (NCEP criteria) from moderate to low risk ie., 200-239 mg/dl to $\leq$ 200 mg/dl. with an average decrement of 28.5 mg/dl. In the experimental group, 4 individuals lowered their risk categories from high to moderate and 2 from moderate to low, with an average decrement of 37.25 mg/dl.

The results from the dietary analyses are intriguing and support a difference in the effectiveness of the intervention between the groups. Although two way analyses demonstrate no main group or group by time interaction, there are several factors which show significant main time effects. These include: TFAT, %FAT, PFAT, MFAT, P/S, AND D-CH. However, within group repeated measures analyses demonstrate significant reductions only for the experimental group in the following parameters: TKCAL, TFAT, %FAT, PFAT, MFAT, M/S, AND D-CH. It is possible that a few people in the control group decreased dietary factors contributing to significant differences in main time effects and to

interfere with significance of group by time interaction. Apparently, not enough of the individuals in the control group decreased intakes to show significant within group changes.

The results suggest that frequent feedback of TCH may help individuals alter their dietary habits to affect their TCH levels. Feedback may be a strong motivator for TCH lowering by allowing visualization of progress. With new portable TCH analyzers it could become more efficacious to give populations frequent feedback to help behavior changes and TCH lowering.

There are some potential difficulties with this method. In this study the coefficient of variation for reliability of Reflotron measurements taken by both technicians was 3.9%, acceptable but not outstanding (United States Department of Health and Human Services, 1989). Much of this error is associated with technician error, not machine error (Naughton, Luepker, & Strickland, 1990). This error variable would need to be very small and maintained across time for all technicians giving this type of feedback. Inaccurate feedback could be much more damaging to behavior change than it would be helpful. Misleading information regarding TCH could lead to misguided dietary changes or cause the participant to feel a lack of control, and possibly give up on behavior changes entirely. Considerable

intrasubject variability has been reported depending upon time of day or day of the week measurements are taken (Gould, 1990). Subjects have been found to vary as much as 20 mg/dl over two days with no apparent explicable reason. This deviation could be due to emotional arousal, constitutional factors, or unknown biological reasons (Dimsdale & Herd, 1982). Both technician and participant would need education to interpret these results and any potential significance.

Further research needs to examine the capabilities of TCH frequent feedback. Frequent feedback was successful in helping individuals in an unsupervised, unstructured exercise program attain their TCH lowering goals. This technique could have important use in clinical situations. Additional populations should be examined to determine the ability for broader generalization using this technique. Any future use or research must ensure reliability of technician and instrumentation below 5% and preferably below 2%. Feedback of TCH may be a valuable tool to increase awareness and help decrease TCH and CHD prevalence.

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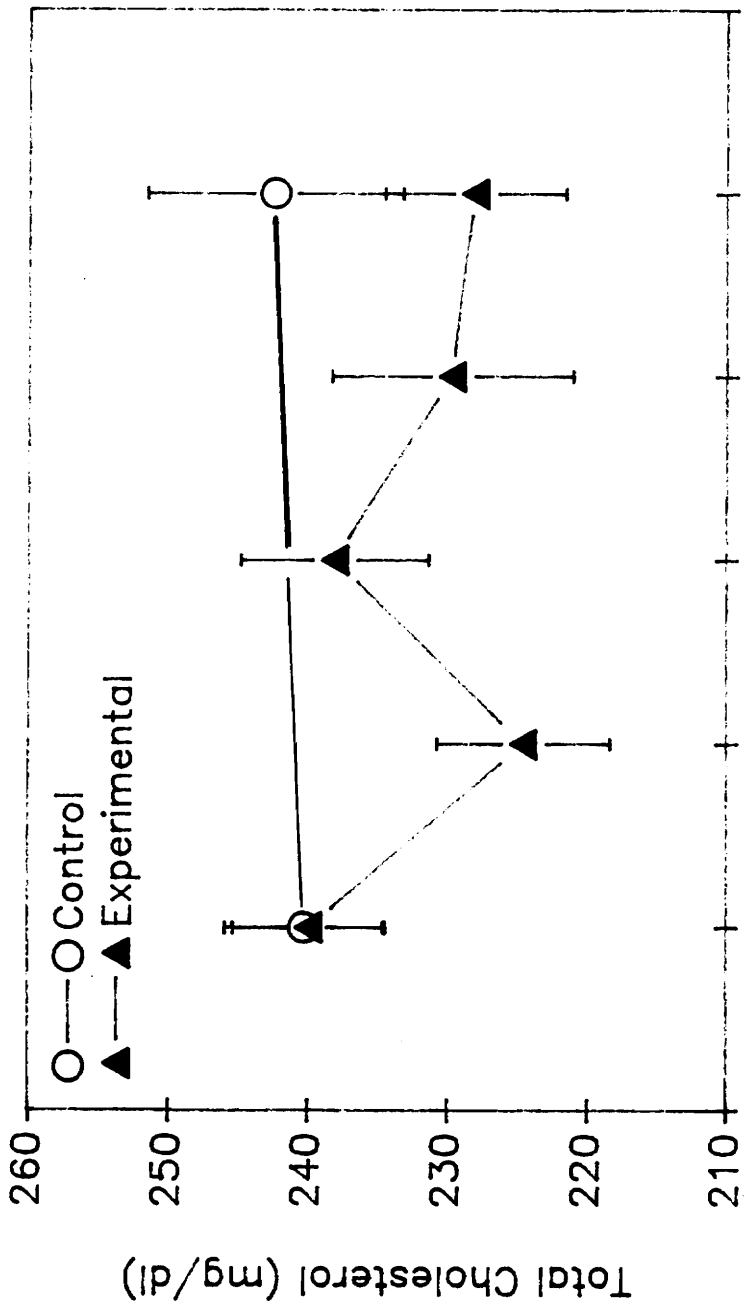

Figure 1. Means and standard errors for total cholesterol measurements

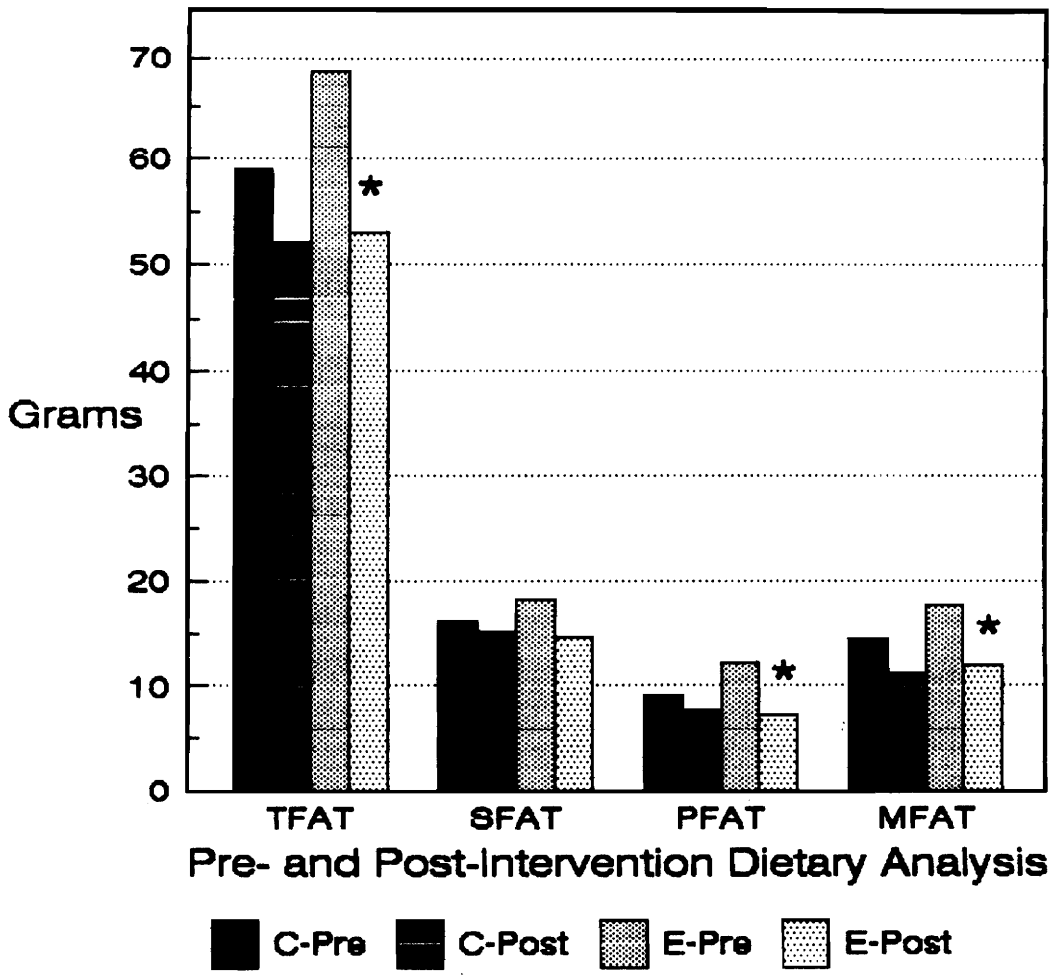

Figure 2. Absolute amounts of Consumed Fats.
Total Fat (TFAT), Saturated Fat (SFAT), Polyunsaturated Fat (PFAT), Monounsaturated Fat (MFAT) consumed by the control (C) and experimental (E) groups pre- and post-intervention.
* P<.05 vs E-Pre

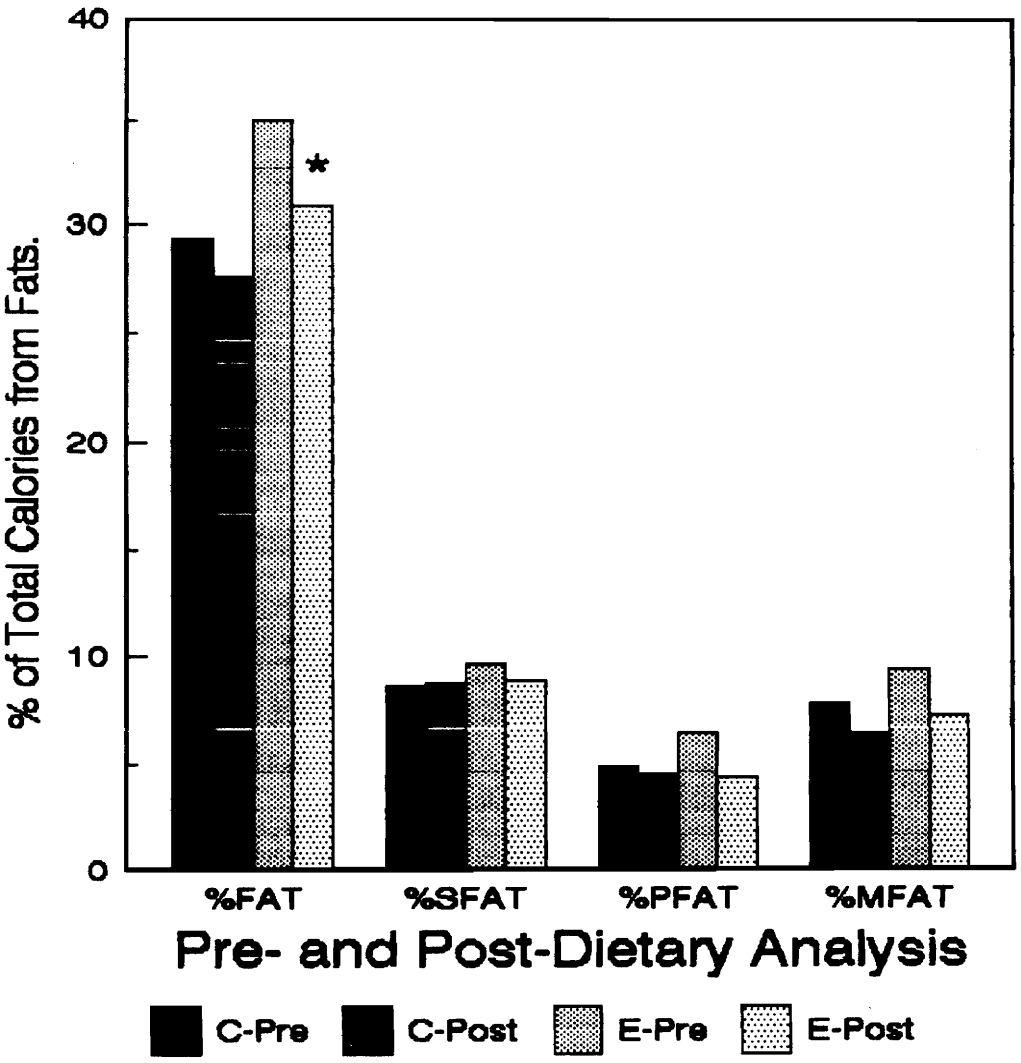

Figure 3. Percent of Total Calories from Fats.

Total percentage of calories from fat (%FAT), Saturated Fat (%SFAT), Polyunsaturated Fat (%PFAT), and Monounsaturated Fat (%MFAT).

* P<.01 vs E-Pre

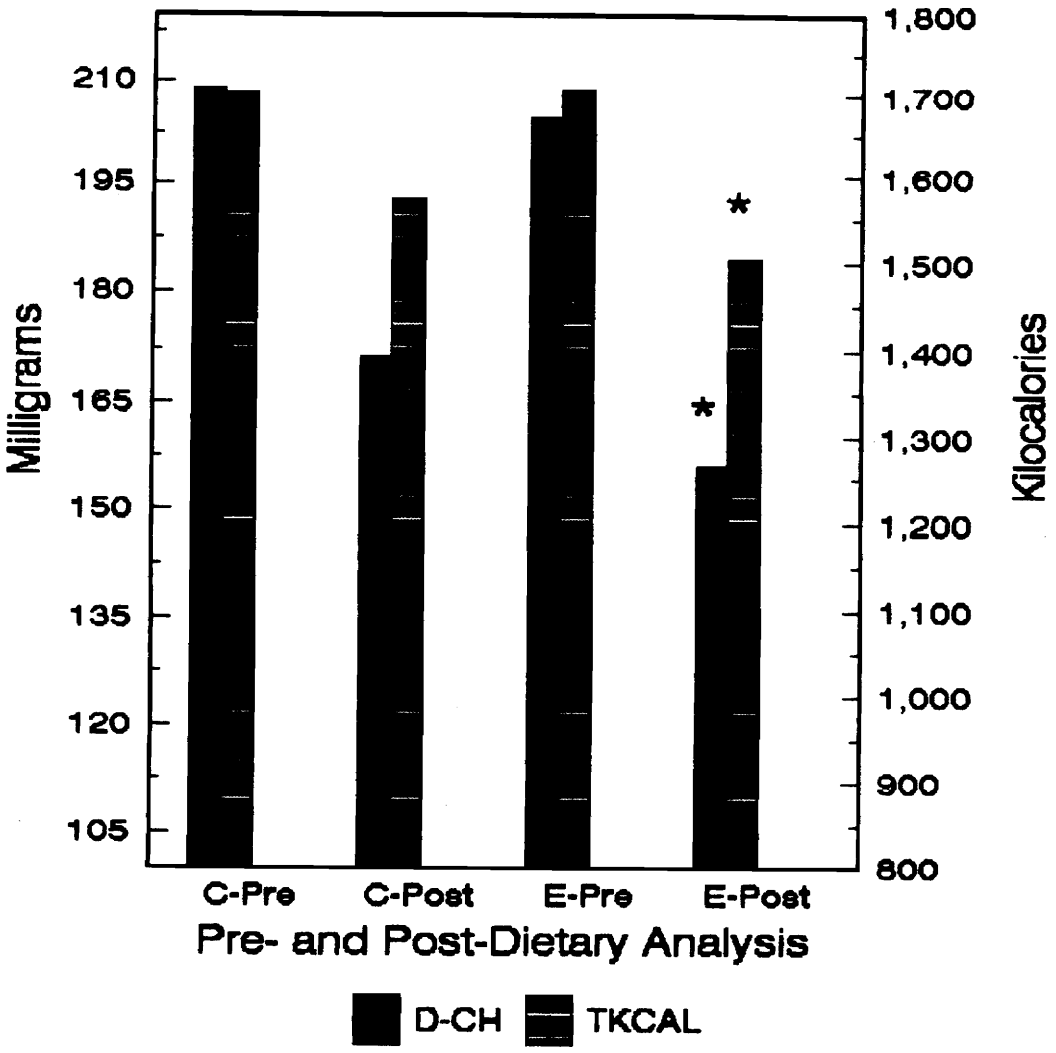

Figure 4. Reductions in Dietary Cholesterol (D-CH) and Total Kilocalories (TKCAL).
*** P<.05 vs E-Pre**

Table 1
Frequency of subjects in demographic categories

Sex	Male	Female
C	4	15
E	2	15

Age	46-49	50-59	60-69	70-80
C	2	3	12	2
E	2	3	8	3

EDCTN	ELEM	HS	COLL	PSTCOLL
C	1	4	8	5
E	1	6	7	3

FRQEX	1-2/WK	3-4/WK	5-6/WK	7+/WK
C	4	7	7	1
E	4	7	5	1

FIBER	yes	no
C	1	17
E	3	13

SMOKE	yes	no
C	1	17
E	1	16

TCH	≤200		201-239		≥240	
	WK0	WK8	WK0	WK8	WK0	WK8
C	1	4	10	5	8	10
E	0	2	9	10	8	5

Note. categories for education (EDCTN) are some elementary schooling (ELEM), some high school (HS), some college (COLL), or post college (PSTCOLL) work; categories for frequency of exercise (FRQEX) are times per week (X-Y/WK); categories for fiber supplementation (FIBER) are currently taking (yes) or not currently taking (no); categories for smoking status are currently smoking (yes) or not smoking (no); categories for blood total cholesterol (TCH) are those used by NCEP for low, moderate, and high risk for CHD development.

TABLE 2
Two way analysis of variance for food record variables

VARIABLE	df	GROUP	df	TIME	df	GP*TM
TKCAL	1,31	.05	2,62	2.34	2,62	2.34
TFAT	1,31	1.20	2,62	4.79**	2,62	1.46
%FAT	1,31	4.41*	2,62	3.14*	2,62	.70
SFAT	1,31	.46	2,62	1.11	2,62	1.69
PFAT	1,31	.44	2,62	5.05**	2,62	1.85
MFAT	1,31	.87	2,62	7.54***	2,62	2.21
P/S	1,31	.88	2,62	3.12*	2,62	.16
M/S	1,31	.65	2,62	5.66**	2,62	.12
D-CH	1,31	.24	2,62	4.47**	2,62	.44

Note. For analyses of main effects (GROUP); effects overtime (TIME); group*time interaction (GP*TM) F values are significant at *p<.05; **p<.01; ***p<.001

TABLE 3
One way analysis of variance for food record variables

VARIABLE	GROUP	df	TIME	df	WK0-4	WK4-8	WK0-8
TKCAL	C	2,34	.32	1,17	.01	.34	.43
	E	2,28	3.46*	1,14	6.40*	1.18	2.23
TFAT	C	2,34	.56	1,17	1.00	.01	.51
	E	2,28	5.61*	1,14	9.88**	.04	4.77*
%FAT	C	2,34	.34	1,17	.35	.04	.43
	E	2,28	6.85**	1,14	13.03**	.01	7.02*
SFAT	C	2,34	.05	1,17	.05	.03	.09
	E	2,28	3.25	1,14	4.74	.17	3.10
PFAT	C	2,34	.68	1,17	.29	.42	1.29
	E	2,28	4.74*	1,14	5.37*	.24	5.18*
MFAT	C	2,34	1.83	1,17	.95	1.01	3.21
	E	2,28	5.87**	1,14	13.61**	.08	5.54*
P/S	C	2,34	1.05	1,17	.57	.50	2.01
	E	2,28	2.34	1,14	.33	2.51	4.50*
M/S	C	2,34	3.20*	1,17	.83	2.29	9.50**
	E	2,28	2.62	1,14	2.34	.40	6.36*
D-CH	C	2,34	1.89	1,17	7.28**	1.93	.11
	E	2,28	3.63*	1,14	6.84*	.69	2.68

Note. For analyses of time (TIME) and contrasts between weeks (WK) 0-8 F values are significant at *p<.05; **p<.01; ***p<.001

Chapter IV

DISCUSSION

Results

This study was completed on 32 women and 4 men (average age 63 years), all reported a history of hypercholesterolemia and at least one of CHD. Five individuals were not included in the final analysis because 2 began taking lipid lowering medications, 2 did not complete week measures, and 1 with-drew due to a fear of contracting AIDS. During the intervention, both groups received a dietary records class and a cholesterol lowering class. The food records class gave explicit instructions regarding the maintenance of the 3-day food records that were required at 0, 4, and 8 weeks. The cholesterol lowering class covered information concerning shopping, cooking techniques, reading food labels, and low-fat foods to enable individuals to lower their intake of fat to 30% of total calories and dietary cholesterol to less than 300 mg/day. After baseline measurements were taken, subjects were randomly assigned to either experimental or control groups.

The 19 people in the control group met with the researcher on a biweekly basis to receive handouts and to have the opportunity to ask questions. In addition, the 17 experimental subjects met biweekly for handouts and

questions but also received TCH measurement using the Reflotron. The result of this measurement was graphed to show a visual depiction of progress. Both groups had a goal of a 10% reduction in TCH. Anyone missing an appointment was rescheduled and seen within the following 4 days.

The Reflotron uses 30 microliters of blood taken from a fingerprick. Within 5 minutes the entire procedure is complete. This machine is convenient and has been reported to compare favorably to other more established methods of cholesterol measurement (James et al., 1988; Kinlay, 1988; Phillips et al., 1988). Measurements were taken from 7:00 - 10:00 a.m. which were the normal hours for walking at the mall. Reliability for this study was determined by taking double fingerstick samples at weeks 0 and 8. The coefficient of variation determined using one way ANOVAs was 3.9% including both technicians' and pre/post measurements. This is below the critical level of 5% set by the NCEP. Ideally, it should have been below 2% to ensure the most accurate and reliable feedback of TCH measures.

Results of TCH analysis showed a trend toward significance using a two way repeated measures ANOVA (group*time) [$F(1,34)=3.39$; $p=.07$]. Because a TCH reduction in some subjects of the control group was not unexpected, the large standard deviation (40 mg/dl) in the control group week 8 measures was believed to be an important factor of

the analyses. This variability at week 8 was believed to have interfered with ability to show significance and could have been caused by a few responders in the control group. To better understand how the groups responded to the different levels of intervention, within group repeated measures analyses were used. When comparing groups independently, the control group showed no significant changes of TCH [$F(1,18)=.16$; $p=.69$] which corresponds with the increase of 2 mg/dl over the eight weeks. The experimental group however, showed a significant decrease of 12 mg/dl [$F(4,64)=3.14$; $p=.02$]. Further contrast analyses demonstrated significant decreases from week 0 to week 2 [$F(1,16)=19.49$; $p\leq.001$] and week 0 to week 6 [$F(1,16)=4.80$; $p=.04$]. There was no significant difference between weeks 6 and 8 [$F(1,16)=.06$; $p=.81$].

These analyses correspond well with the 7 examined dietary components and 2 ratios. These components were: total kilocalories (TKCAL), total fat (TFAT), saturated fat (SFAT), polyunsaturated fat (PFAT), monounsaturated fat (MFAT), percent of total calories from fat (%FAT), dietary cholesterol (D-CH), polyunsaturated to saturated fat ratios (P/S), and monounsaturated to saturated fat ratios (M/S). Food record (FR) 1 was taken prior to baseline TCH measurements; FR2 was taken just after week 4 TCH measurements; and FR3 was taken on the days just prior to

returning for week 8 measures. There were 3 individuals who failed to return at least one of the food records. Their data was omitted from repeated measures analyses.

Analyses for TKCAL showed no main group effect (p=.82); main time effects (p=.10); or group by time interaction (p=.27). However, the experimental group did show a significant decrease over time (p=.04) using a within group analysis and also demonstrated significant decreases from FR1 to FR2 which was maintained at FR3 (p=.02 and p=.04 respectively). The control group showed a -7.5% of change (1701 to 1574 kcal/day) while the experimental group showed -11.8% change (1706 to 1505 kcal/day).

TFAT demonstrated significant decreases over time using the two way analysis, but no main effect or time by group interaction. Therefore both groups apparently decreased fat consumption to some degree. Yet, within group analysis revealed significant drops only in the experimental group (p=.02) with the greatest decrease occurring between FR1 and FR2 (p=.00) which was maintained at FR3 (p=.04). A change of 11.6% (58.96 to 52.10 grams/day) was seen in the experimental group but the control group experienced a -22.8% change (68.66 to 53.03 grams/day).

Significant decreases were seen for %FAT in the main group effects (p=.04) and time effects (p=.05). However, the two way ANOVA did not demonstrate any time by group

interactions. Within group analyses did show a significant decline only for the experimental group ($p \leq .001$). Decreases between FR1 and FR2 were significant ($p \leq .001$) and maintained at FR3 ($p=.01$). Initial differences were observed for %FAT $p=.01$ with means for the control group of 29.4% and the experimental group of 35%. Thus, the control group did not need to eliminate as much fat from their diet to reach the 30% goal as did the experimental group. The control group experienced -6.1% change from initial values (29 to 27%) while the experimental group had a -11.6% change from baseline (35 to 30%). It is quite possible to decrease %FAT well below the recommended 30% even if initial intakes begin below 30%. Six in the control group decreased from an average of 27.6% to 17.5% and 4 in the experimental group decreased from 28.8% to 24.3%.

SFAT showed no main group effects, time effects, or interaction when analyzed with the two way ANOVAs. Over time the experimental group showed a tendency toward significance ($p=.06$) with initial decreases ($p=.04$) which were maintained at FR3 ($p=.06$). However the control group showed a -6.6% change (16.2 to 15.13 grams/day) while the experimental group showed a -19.0% change (18.2 to 14.73 grams/day).

Significant differences over time were also seen with PFAT ($p=.01$) but not with main effects or group by time

interaction. Again, both groups must have decreased PFAT consumption although it appears that the experimental group may have dropped more. In examination of the one way ANOVAs the control group showed no significant changes while the experimental group decreased over time ($p=.03$). There was an initial drop from FR1 to FR2 ($p=.03$) which was held at FR3 ($p=.03$). There was a -14.6% change for the control group (9.13 to 7.8 grams/day) and the experimental group a 20.7% change (12.2 to 7.23 grams/day).

These same results were demonstrated with MFAT. Two way analysis showed significance over time ($p\leq.001$). Within group examination showed no significant changes for the control group, but significance over time ($p\leq.001$) with initial decrements at FR1-FR2 ($p\leq.001$) which was maintained at FR3 ($p=.03$) for the experimental group. The control group showed a -23.3% change (14.6 to 11.2 grams/day) while the control group showed a -32.5% change (17.76 to 12.0 grams/day).

P/S and M/S both showed significant decreases over time ($p\leq.001$ and $p=.05$ respectively) with no main effects or interaction. The experimental group did not show the previously established trend of decline and maintenance.

D-CH analyses also demonstrated interesting results. There was a significant time effect for both groups ($p=.01$) with no main or interaction effects. Both the experimental

and control groups demonstrated a significant decrease from FR1 to FR2 (p=.02 and p=.01 respectively). However, only the experimental group maintained this change showing a significant decrease over time (p=.04). The control group showed a -18.0% change (208.93 to 171.23 mg/day) while the experimental group showed a -23.9% change (204.76 to 155.9 mg/day).

In sum, there were significant changes over time using the two way analyses for TFAT, %FAT, PFAT, MFAT, P/S, M/S, and D-CH. In addition there was a significant main effect difference for %FAT. The experimental group demonstrated significant changes over time with a pattern of initial decreases from FR1-FR2 which was maintained at FR3 for TKCAL, TFAT, PFAT, MFAT, and D-CH. SFAT approached significance within these parameters at p=.06. One explanation for the significant decreases over time but lack of group by time effects could be that a few individuals responded to the control group dietary instructions to the point that a group by time interaction did not occur even though the within group analyses showed significant differences in response to the interventions.

Several reasons may exist for this finding which might also explain the group by time interaction at significance of p=.07 for the analysis of TCH. Differences in demographical influences such as education level, age, or

changes in weight can not account for differences among groups because there were no differences among any of these variables (see Appendix C). Exercise was to be maintained throughout the study as well. One possible explanation could be that some individuals in the control group responded simply from participating in the study and meeting with the researcher on a biweekly basis. This may have created an increased awareness in these individuals causing them to alter dietary factors. Additionally there was some contamination between groups. These individuals walked in a highly social environment and some were intimate friends who had been assigned to separate groups. It is unclear if the effects of the intervention would have become more demonstrable if those not receiving feedback had not had the opportunity to speak with those who were receiving feedback.

It is important to note that from a clinical perspective 4 individuals in the control group lowered their TCH from moderate to low risk categories for development of CHD by NCEP standards with an average reduction of 28.5 mg/dl. In the experimental group 4 individuals lowered their risk from high to moderate and 2 from moderate to low with an average reduction of 37.25 mg/dl. The experimental group also showed significant attainment of TCH reduction goals. There was approximately a 40% success rate in the experimental group compared to the 10% success of the

control group. Utilization of this technique in a clinical setting could prove very significant, perhaps even more so if the goal of TCH reduction was decreasing risk categories or achieving a desired TCH reduction goal.

Research Implications

Many studies have begun to examine the effects of behavioral modification techniques to reduce cardiovascular risk factors. Cholesterol levels have been among these factors targeted for modification. Cholesterol is a primary risk factor for CHD which affects half of the adult population. CHD costs billions of dollars and causes over half of a million deaths each year (National Institutes of Health Consensus Conference, 1985). All hypercholesterolemics are at risk regardless of age or sex (Castelli et al. 1989) and relatively few people are aware of their cholesterol level (Morbidity and Mortality Weekly, 1988).

Behavior modification methods have often used very intensive intervention strategies. Communities have been involved in developing special screening sites with counseling and referral services available and recruiting the media for advertising and event coverage (Lefebvre et al., 1986). Lovibond (1986) used extensive feedback on a variety of health parameters for his intervention including:

a) feedback on cardiovascular disease risk factor profile b) training to establish realistic short and long term goals with detailed personalized feedback on how to reach these goals c) regular feedback on weight, blood pressure, fitness, and food record monitoring. Other interventions (Ostwald, 1989) have used a) physical exams, maximal stress testing, personalized exercise prescription and supervised exercise sessions b) free low-fat low-cholesterol lunches c) utilization of food purchasing and cooking information.

It would be desirable to develop and implement a behavior modification technique or feedback process which proved to be a significant motivator for people to alter eating behaviors and decrease TCH while remaining time and cost efficient. Crouch et al. (1986) found that by having five follow-up sessions either by phone and mailing contact or 15-20 minute face-to-face sessions, subjects were able to significantly decrease cholesterol levels at the end of one year. These follow-up sessions consisted of strong reinforcement of information regarding food quality and quantity, weight loss and exercise as well as some behavioral rehearsal. Burkett et al. (1990) also had success using a relatively simple intervention. Feedback of TCH was graphed and shown to subjects as progress reports. This method only required approximately 5 minutes and cost about $1.50 per test. The feedback sessions were administered at

the cardiac rehabilitation center where the subjects exercised three times per week.

Due to the recent advances in technology, Burkett et al. were able to capitalize on those aspects of behavior modification found to be most crucial to behavior changes and implement them in a cost effective manner. Among others, these elements include (Elder et al., 1985) a demonstration of the effects of the intervention. This aspect was difficult to accomplish prior to the portable analyzers. Usually individuals saw their physician, waited 2 weeks for lab results, were given dietary information and checked again in a year (Superko, 1989; Wrisley & Rubenfire, 1988). Secondly, the intervention should be timely and financially inexpensive. The Reflotron only costs about five minutes and $1.50 per test. A third element is to target the specific behavior for change, given that this behavior is in the control of the participant. The use of a portable lipid analyzer gives the most quick and reliable source of feedback demonstrating the physiological consequences due to eating behaviors.

The present research has further contributed to these findings. Results showed that portable lipid analyzers may be a valuable tool for feedback enabling individuals to visualize the ramifications of their eating behaviors. Often comments were made regarding TCH increases such as "It

must have been that Hardee's sausage and gravy biscuit I had yesterday" or "I didn't know shrimp scampi (with butter) would affect me so soon". The results showed that using the Reflotron did help the experimental group to lower their TCH by 12 mg/dl (5%). Success at achieving the desired reduction of 10% was significant for the experimental group In addition, within group analyses showed that only the experimental group reduced TCH and dietary parameters known to increase TCH to significant degrees. Group by time interactions probably did not show significance because some individuals in the control group may have responded due to the intervention. The control group did receive more education and contact than these individuals probably would have received at a physician's office and more than NCEP guidelines recommend. A response of this sort would not be unexpected.

The intervention took place in a convenient location and required a minimum of training or time involvement per person for the health provider. In using this method it could be possible to incorporate elements which have been identified with behavior compliance and maintenance (Carmody et al., 1982) ie., use of the family, group support, shaping procedures, follow-up, and development of social policies.

Implementation of this technique may create a greater awareness in the population of cholesterol levels and their

significance. The United States consumes 35-40% of its total calories from fats each day. By decreasing fat intakes to less than 30% of total calories with saturated fats less than 10% as recommended by the National Cholesterol Education Program (1988), most individuals would experience a significant decrease in TCH levels (Grundy, 1986). However, dietary changes are not easily implemented. This study suggested that the portable lipid analyzer and corresponding feedback of TCH may be successful in helping individuals alter eating behaviors. This was seen in the patterns of the experimental group decreasing fat and cholesterol from FR1 to FR2 and maintaining these changes through FR3.

There are some areas which would require some improvement prior to utilizing a portable analyzer in the population. Health providers should be specifically trained and practiced such that the coefficient of variation was well below the established 5% (U.S. Department of Health and Human Services, 1989). This error is usually associated with technician error (Naughton, Luepker, & Strickland, 1990). In addition, there may be alot of intrasubject variability which could be difficult to differentiate from technician error unless the technician has been shown to take reliable and consistent measures. Subjects have been shown to vary in measurements over different days within one

week as much as 10-25% (Hegsted & Nicholosi, 1987; Keys, 1988). This variability may be due to life stress, nutritional or unknown biological mechanisms (Dimsdale & Herd, 1982). Education regarding these findings must be explained to participants and technicians so that there is an understanding of any health implications.

If further research of this technique continues to prove frequent feedback a significant tool, it may lead to further decreases of TCH in the population at large. There has been an abundance of research correlating the incidence of CHD and high cholesterol levels (ie. Castelli, et al., 1986; Goldbourt et al., 1985; Stamler et al., 1986). The National Cholesterol Education Program (1988) has been developed to disseminate information to lay and professional populations regarding the importance of high TCH and the recommended steps for treatment. Should proper awareness and resources be developed among the American population, significant reductions of TCH and CHD are possible. Feedback using the a portable lipid analyzer may be a valuable tool to increase awareness and help individuals lower their TCH levels.

Recommendations for Future Research

1. A similar study over a longer time period should be conducted to evaluate if or when decreases plateaued or

returned to baseline so that a maximal percent of reduction using this technique could be determined.

2. A research design including an intensive feedback period similar to the present study but in addition containing a more intermittent follow-up/feedback period would be helpful to evaluate issues of maintenance.

3. A study examining the effects of risk category reduction for the TCH lowering goal could further demonstrate the value of using this technique in a clinical setting.

4. Examination of dietary goal setting at the time of TCH feedback could be important by demonstrating whether setting small weekly goals for fat or dietary cholesterol reduction is a valuable adjunct to TCH feedback in helping individuals reach TCH goals more rapidly.

5. A study using control and experimental groups so that no contact occurs between groups would help demonstrate purer effects of an intervention.

6. This feedback technique should be evaluated for its effects on other populations for instance younger and otherwise healthy hypercholesterolemics.

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Appendix A

METHODOLOGY

METHODOLOGY

Research Design

A pre-post test design was used with subjects stratified by baseline TCH and randomized to either an experimental group to receive biweekly TCH measurements and TCH reduction guidelines or to the control group to receive the guidelines alone.

Subject Recruitment

A mailing list of walkers and permission to recruit volunteers were obtained from the Director of Seniority at Montgomery Regional Hospital and the head of the walking club, Hearts in Motion, at New River Valley Mall. This list was composed of the total number of people in the community who had expressed interest in walking at the mall. An informational letter was sent to approximately 1000 individuals on this list with an enclosed self-addressed return postcard to express interest. Other individuals were recruited by setting up an information table at the mall during walking hours.

Approximately 60 individuals expressed initial interest. All of these had a history of hypercholesterolemia and some of CHD. Many reported being instructed to walk at the mall by their physicians. However, after the study commitments were explained and

single representatives of married couples volunteered, only 41 individuals desired to participate. Only 36 were included in the final analysis because two did not complete the week eight lipid measures, two began taking lipid lowering medications during the course of the study, and one dropped for fear of contracting AIDS.

Criteria for entering the study were:

1. total blood cholesterol levels $\geq$ 200 mg/dl based on an average of two readings by the Reflotron;
2. not taking any lipid lowering medications;
3. must have been maintaining their current level of exercise for at least 2 months prior to the start of the study; and
4. must not be on any rapid weight loss program or have lost over 5 pounds in the past month.

Procedures

Assessment. Upon receipt of the return postcard or contact at the mall, participants were called to set a time for a screening cholesterol measure to be taken. At this meeting, participants also signed consent forms approved by the Human Subjects Committee of Virginia Polytechnic Institute and State University (Appendix B), and had the opportunity to ask questions regarding study procedures. After questions were answered to the satisfaction of the participants, a

general information sheet was completed and individuals signed up for the food records class. After gaining written consent from the participants, their personal physicians were contacted with an informational letter about the study including patients' age and cholesterol level to ensure that this form of treatment did not conflict with another regimen preferred by the doctor.

The dietary food records class stressed the importance of honesty and detailed accuracy in recording of consumed foods. Demonstrations of volume measurements were made for solids and liquids. Educative materials produced by The Dairy and Food Nutrition Council (1989) were used to show serving portions of meats, fruits, vegetables, and condiments. There was no discussion of cholesterol lowering methods, and all questions were held until the cholesterol lowering class. The first food record was intended to be representative of food consumption based on knowledge and motivation of participants at that time, prior to any intervention.

After the food records class, subjects were assigned a return time for baseline weights and cholesterol measurements. Immediately following these measurements, participants were to attend the cholesterol reduction class. The primary goal of the cholesterol reduction class was to alter eating behaviors to follow the Step 1 guidelines of

NCEP (1988). These guidelines suggest food intake such that less than 30% of total calories came from fat, 10% or less from saturated fat, and dietary cholesterol intake is less than 300 mg/day. The instructional emphasis was placed on removing fat, in particular saturated fat, and dietary cholesterol from the diet. Specific techniques for reduction included: food shopping strategies, cooking methods, reading food labels, determining the percent of fat in a food item, false advertising and good versus poor food choices.

Intervention. After completing the class, subjects were randomized by baseline TCH and notified by telephone regarding which group they would be in and to establish appointment times. All participants were required to return every 14 days and both groups had a goal of 10% reduction at the end of eight weeks. The control group received handouts (Appendix C) containing recipes, good and poor food choice lists, and information on fast food restaurants. They were required to meet with the researcher to counter the effects of attention otherwise received by the experimental group alone. The experimental group received the same handouts and also had TCH measurements taken. These measures were subsequently graphed and shown to the participant to demonstrate proximity to the desired goal of a 10% reduction at the end of eight weeks.

Subjects' body weights were taken at baseline and at eight weeks. This information was collected to ensure that no significant changes in weight occurred over the intervention period.

Diet records were also required at three time intervals, pre-, mid- and post-intervention. Two week days and one weekend day were required. Everyone kept records on the same days unless confounded by other extraneous events eg. attending a wedding, in which case the days were otherwise arranged. These data were analyzed on the Nutritionist 3 (N-Squared Computing, 1988) software program for the following dietary components: total calories, total fat, dietary cholesterol, monounsaturated fat, polyunsaturated fat, saturated fat, and percent of total calories from fat. The results of these analyses were compared across time between and within groups. No feedback was given regarding any food record analyses.

Measurements were taken non-fasting between 7:00 and 10:00 a.m. on the designated mornings. These were the normal hours for walkers to be at the mall before the stores opened.

Instrumentation

All cholesterol measures were taken using the Reflotron (Boehringer Manheim, 1986) which is an electrochemical

reflectance photometer. The Reflotron was expected to be reliable and valid as demonstrated in a number of other studies (James, Tyler, & Henrickson, 1988; Kinley, 1988; Phillips, Wydnam, Shaw, & Sheila, 1988). Calibration was checked each morning before the day's measurements began. The heaters and photo lenses were also thoroughly cleaned each morning with rubbing alcohol.

As a general rule, samples were taken from the middle finger of the non-preferred hand. Exceptions to this occurred when subjects had a complete mastectomy on that side and when double fingersticks were taken. In the latter case the second stick was taken from the ring finger of the non-preferred hand. A Monoeject automatic pricking device was used to pierce the fingers and a 30 microliter lithium heparin coated glass capillary tube was used to collect each blood sample. Blood was then transferred to the Reflotron reagent tab. Sterilization was accomplished by: cleaning the finger with rubbing alcohol, using a new lancet for each fingerstick, and wearing surgical gloves during all measurement taking.

The reagent tabs consist of a separation pad, reagent pad and magnetic code. The magnetic strip contains information about the lot and test procedure being run. In this way lot variations of test tabs are corrected and calculations appear automatically. The separation pad

consists of a glass fiber filter which separates the erythrocytes from the whole blood. Plasma is left to sift to the bottom layer of the tab. Enzymes there will cleave the cholesterol ester into the cholesterol and fatty acid components. The cholesterol proceeds to other oxidative steps where it reacts with the indicator to form a blue dye. The intensity of color affects the amount of reflectance detected by the photometer. In this way the amount of cholesterol is determined.

Analyses

Two statistics systems were used for data analysis. Statistical Analysis System Institute Inc. was used for all analyses except for Reflotron reliability and success of goal attainment.

Two way repeated measures ANOVAs were used to analyze the main group effects, main effects of time and group by time interaction for TCH and the dietary components. Further one way ANOVAs were used to detect within group trends which the two way ANOVAs would not discern. One way ANOVAs were also used to determine the reliability of the Reflotron. Independent t-tests were used to establish any initial differences in the dietary parameters or TCH. Chi square was used to examine any differences in demographic variables.

A two sampled proportion test was used to evaluate the success rate in goal achievement of a 10% TCH reduction from week 0 between the groups. Examination of results from a clinical perspective used the National CHolesterol Education program's risk category definitions. Low risk was defined as <200 mg/dl; moderate risk from 200-239 mg/dl; and high risk ≥240 mg/dl.

Appendix B

INFORMED CONSENT

HUMAN PERFORMANCE LABORATORY

Division of Health, Physical Education and Recreation

Virginia Polytechnic Institute and State University

Informed Consent

I, _____, do hereby voluntarily agree and consent to participate in a testing program conducted by the personnel of the Human Performance Laboratory of the Division of Health, Physical Education and Recreation of Virginia Polytechnic Institute and State University.

Title of Study: Periodic Feedback to Reduce Cholesterol Levels

The purpose of this experiment:

To investigate whether an increase in feedback of cholesterol level will show a greater lowering of cholesterol throughout the 10-week study period.

I voluntarily agree to participate in this testing program. It is my understanding that my participation will include:

1. Showing promptly at assigned times to receive my cholesterol measure.

2. Attending the dietary monitoring and cholesterol lowering classes to be offered when baseline measures are taken.

3. To keep accurate, 3-day food records at the beginning, middle, and end of the study, and to turn them in promptly.

4. Maintaining present exercise levels, neither increasing nor decreasing exercise levels.

5. A subsample of participants in this study will be asked to have a venipuncture procedure performed at Montgomery Regional Hospital (MRH) at the beginning and end of the 10-week study. Venipuncture uses a needle

to take blood from a vein. In this case MRH will take the blood from the participant's arm. This analysis of blood lipid profile will be provided free of charge to this subsample only.

I understand that certain personal benefits may be expected from participation in this experiment. These include:

1. Learning how to change and adapt better eating habits to lower cholesterol.

2. Actually reducing risk of heart disease by lowering cholesterol.

3. Receiving free cholesterol measures.

I understand that participation in this experiment may produce certain discomforts and risks. These discomforts and risks include:

Although very minimal, a chance of infection through the standardized methods of finger prick or venipuncture procedures does exist because blood is being taken. The finger prick procedure uses a very small lancet in an automatic device so that only the smallest cut is made on the skin. This mark is invisible within seconds after taking the blood. There is also minimal chance of bruising with venipuncture (the drawing of blood with a needle through a vein in the arm) because the professional must use a needle to reach the vein.

Appropriate alternative procedures that might be advantageous to you include:

Your doctor's approval will be necessary for your participation in this study. This will be attained by sending letters through the mail. Only consent for participation will be discussed, no other information will be exchanged. Alternative treatment to lowering cholesterol should be discussed with your physician.

I understand that any data of personal nature will be held confidential and will be used for research purposes only. I also understand that these data may only be used when not identifiable with me.

I understand that I may abstain from participation in any part of the experiment or withdraw from the experiment should I feel that the activities are injurious to my health. The experimenter may also terminate my participation should he/she feel the activities might be injurious to my health.

I understand that it is my personal responsibility to advise the researchers of any preexisting medical problems that may affect my participation or of any medical problems that may arise in the course of this experiment and that no medical treatment or compensation is available if injury is suffered as a result of this research. A telephone is available which would be used to call the local hospital for emergency service.

I have read the above statements and have had the opportunity to ask questions. I understand that the researchers will at any time answer my inquires concerning the procedures used in this experiment.

Scientific inquiry is indispensable to the advancement of knowledge. Your participation in this experiment provides the investigator the opportunity to conduct meaningful scientific observations designed to make significant educational contributions.

If you would like to receive the results of this investigation, please indicate this choice by marking in the appropriate space provided below. A copy will then be distributed to you as soon as the results are made available by the investigator. Thank you for making this important contribution.

_____ I request a copy of the results of this study.

Date _____ Time _____
a.m./p.m.

Participant signature

_____

Witness

_____

HPL personnel

Project Director _____ HPER Human Subjects Chairman, Dr. Charles Baffi
Dr. Charles Waring, Chairman, Institutional Review Board for Research Involving Human Subjects. Phone 231-5283

Appendix C
SUBJECT HANDOUTS

VIRGINIA TECH

Division of Health, Physical Education and Recreation
(703) 961-6561

War Memorial Hall
Blacksburg, Virginia 24061-0326

August 21, 1989

Dear Mall Walking Participant:

Hello! My name is Katie Roseveare. I am conducting research in the Health and Physical Education Division of Virginia Tech. I am studying ways to help people lower their cholesterol levels. If you have an elevated cholesterol level (greater than 200 mg/dl), I would like to invite you to consider participating in a very special project that we anticipate offering for members of the Walking Club at the New River Valley Mall. This proposed study will examine the usefulness of checking cholesterol levels on a regular basis to assist individuals in maintaining a low fat, low cholesterol diet. Participation in the study will be entirely voluntary and there is no financial cost.

We anticipate that participants in the study will:

1. have their cholesterol measured on a routine basis (Tuesday or Thursday mornings) at the New River Valley Mall,
2. receive a class about how to record the foods that they eat,
3. receive a class about shopping and preparing low fat and low cholesterol foods,
4. receive feedback at the end of the study on the content of the foods that they have eaten.

If you have elevated cholesterol (or believe you might have), and would like more information about this study, please return the enclosed postcard to me by Wednesday, August 30th. Please provide your name, address, and phone number where you can be reached on the back of the card. In addition, if you know your cholesterol level, you may indicate it in the space labeled "LEVEL". I will contact you by phone to arrange a personal interview and explain the study further. Please note that at the time of the interview I will ask that your family physician be consulted before you begin to participate in the study.

Thank you for considering participation in this exciting project. I look forward to hearing from you! If you wish further information, a message can be left for me at 231-4254.

Sincerely,

Katie Roseveare

Katie Roseveare

Virginia Polytechnic Institute and State University

WANT HELP WITH THAT CHOLESTEROL LEVEL?

With the help of Laurie Clark, Gayle Griffin, and professors in the graduate department in exercise physiology at Tech, I am coming to you with an innovative technique to help you lower your cholesterol level. This project will recruit as many as 60 volunteers to participate in a 12 week study beginning the first week of September. Individuals will receive:

1) an instruction class learning specific ways and techniques to lower cholesterol levels and how to keep accurate food records.
2) free cholesterol measure at varying times throughout the 12 weeks.
3) frequent handouts with recipes, reminders, and tips to keep "cholesterol consciousness" high.
4) complete dietary analysis of what you ate before, during, and after the 12 weeks.
5) A random selection of group members will receive a complete cholesterol analysis (HDL, LDL, triglycerides) before and after the 12 week period.

What do you have to do? Have a cholesterol level greater than 220 and not be taking any cholesterol lowering drugs, show up at the mall to walk, and keep track of what you eat for three days at 6 week intervals (3 times). Don't worry, I'll remind you when it's time to keep track. And that's it!!

If you are interested, fill out and detach the bottom of this letter. If you have questions please call 552-2317. I hope to be contacting you soon!

I'll also be back at the mall on August 15 and 17, next Tuesday and Thursday. Bring your friends!

Sincerely,

Katie Roseveare

Name: _____

Address: _____

Phone:(day) _____(evening)_____

Last reported cholesterol level_____

Physician's name:_____

Can you come to walk on Tuesday or Thursday mornings?
yes____ no ____

INFORMATION RELEASE FORM

As a potential participant in a research project on cholesterol lowering I,_____ hereby authorize my personal physician: Dr. _____ to transfer, receive, exchange, and/or release information concerning my medical status with Ms. Katie Roseveare and Dr. Douglas R. Southard (Project Directors). I also authorize Ms. Roseveare and Dr. Southard to exchange information related to my participation in the research study with the physician noted above. I understand that this release is subject to revocation by me at anytime, and unless an earlier date is specified, that it automatically expires 12 months after the date affixed below.

Signed:_____ Date: __/__/__

Witness:_____ Date: __/__/__

3-DAY DIET RECORD

To complete your 3-day diet record, please write down all the food and drink that you consume on each of the three days. You will need to include two (2) weekdays and one (1) weekend day such as, Thursday, Friday and Saturday of Sunday, Monday and Tuesday. Please indicate the **type** of food eaten as well as the **quantity**, **brandname**, and how the food was **prepared**. When you indicate the **type** of food, please include important **adjectives** such as skim milk or lowfat cottage cheese. When you indicate the **quantity** of food eaten include important units of volume such as 8 ounces of orange juice or 2 cups of green beans. Examples of **brandnames** may include Wendy's Single or Lite-n-Lively Yogurt. Also, please indicate how foods were **prepared** such as fried, baked, broiled.

Please include:

I. **TYPE:** skim milk, white bread

II. **QUANTITY:**

A. Number of items eaten, such as 1 orange, 5 cookies or 1 large order of fries.

B. Volume units such as one-half cup, 8 ounces, 2 cups. Use a measuring cup whenever possible to help you estimate the volume of foods eaten. A measuring cup will be provided for you if you do not have one.

C. Serving Size is sometimes difficult to estimate especially for meats, breads or pies and cakes. If serving size is not indicated on the food package, please try to use the diagrammed models to help you determine serving sizes or estimate ounces of servings.

III. **BRAND NAMES:** If you know the brand name of food eaten, please indicate them also. Examples of these may include Smuckers Grape Jelly, Philadelphia Cream Cheese, Mrs. Filbert's. Fast Food Chains should also be isted such as Wendy's, Hardee's or McDonald's.

IV. **PREPARATION:** Please indicate how food was prepared such as fried, baked, broiled, sauteed, etc. Also, indicate if the skin or peel was removed from meats, vegetables or fruits such as chicken without the skin, peeled apples or peeled potatoes.

An Example Entry May Look Like This:

Breakfast:	Thomas' English Muffins	1 whole
	with margarine	1 ounce
Lunch:	Chicken Breast	one-half baked
	French Fries	1 lg. order

NAME: ______________________

DATE: ______________________ I.D. #: ______________

TYPE	QUANTITY		BRAND NAME	PREPARED
	NUMBER	VOLUME		

SIMPLE WAYS TO MODIFY A RECIPE

To reduce cholesterol or saturated fats:

1. Select lean cuts of meat.
2. Serve moderate portion sizes.
3. Replace animal fats with appropriate substitutes.

Examples:

Instead of:	Use:
Butter, lard, bacon or bacon fat, and chicken fat	Polyunsaturated margarine or oil
Sour cream	Low-fat yogurt
Whole milk	Skim milk
Whole milk cheeses	Low-fat cheese
Whole eggs	Egg whites or egg substitue

NOTE: Many cheeses, although made with skim milk, have cream added to them. Check labels for fat content.

To reduce calories or fats:

1. Brown meats by broiling or cooking in non-stick pans with little or no oil.
2. Chill soups, stews, sauces and broths. Lift off congealed fat (saves 100 calories per tablespoon of fat removed).
3. Trim fat from meat. Also remove skin from poultry.
4. Use waterpacked canned products (canned fish, canned fruits).
5. In recipes for baked products, the sugar can often be reduced by ¼ to ⅓ without harming the final product. Cinnamon and vanilla also give the impression of sweetness.
6. Use fresh fruit whenever possible. If canned fruit must be used, select water-packed varieties, fruit in own juice or drain heavy syrup from canned fruits.
7. For sauces and dressings, use low-calorie bases (vinegar, mustard, tomato juice, fat-free bouillon) instead of high calorie ones (creams, fats, oils, mayonnaise).

To reduce sodium:

1. Make full use of herbs and spices instead of salt. You may not want to eliminate salt completely, but consider reducing the amount used.
2. Salt can be eliminated from any recipe except one containing yeast.
3. Avoid recipes that contain substantial amounts of baking powder or baking soda which may be high in sodium.
4. Use low sodium or unsalted ingredients during cooking (unsalted margarine, low sodium canned products, salt-free crackers and cereals, low sodium stocks).
5. Check processed foods for sodium content and replace with homemade varieties whenever possible or purchase low sodium products. Commercial mayonnaise and salad dressings, for example, may contain high levels of sodium.
6. Reduce consumption of luncheon meats, ham, bacon, frankfurters and sausage, smoked, pickled and salted foods. Instead, use *fresh* meats, poultry and fish and specially-processed low sodium luncheon meats.
7. Use fresh or frozen fish instead of canned or dried varieties.
8. Water in which salty products are cooked can be poured off and replaced with new water.
9. Do not automatically add salt to boiling water when cooking pasta, vegetables and cereals.

HOW TO CHOOSE FOODS LOW IN CHOLESTEROL AND SATURATED FAT

FOOD GROUP	RECOMMENDED	AVOID OR USE SPARINGLY
MEAT, POULTRY, FISH DRIED BEANS AND PEAS, NUTS, EGGS	Chicken, turkey, veal (except the breast), fish, shellfish (clams, crab, lobster, oysters, scallops), lean meats, egg whites, specially-processed low-fat luncheon meats. Dry beans and peas such as: kidney beans, lima beans, vegetarian-style baked beans, pinto beans, lentils, chick peas, split peas, navy beans. Soybean curd (tofu), peanut butter, cholesterol-free egg substitutes.	Duck, goose, heavily marbled meats, luncheon meats, bacon, sausage, ham, frankfurters, organ meats such as heart, kidney, sweetbread, and liver. Egg yolks (limit to three times per week—includes eggs used in cooking).
VEGETABLES AND FRUITS (canned, fresh, or frozen)	All varieties.	Avoid if: fried, served in cream, butter or cheese sauces.
BREAD AND CEREALS	Bread made with a minimum of saturated fat, such as: whole wheat, enriched white, French, Italian, oatmeal, rye, pumpernickel, English muffins, pita. Pasta, cereal, rice, melba toast, water crackers, matzos, pretzels, popcorn with polyunsaturated oil, water bagels.	Pastries, butter rolls, commercial biscuits, muffins, donuts, cakes, egg breads, cheese breads, commercial mixes containing dried eggs and whole milk. (Many of these products are made with saturated fat: lard, butter, suet, palm oil, coconut oil, hydrogenated vegetable oil, etc.)
MILK PRODUCTS	Ones which are low in saturated fat: skimmed milk and milk powder, low-fat products, buttermilk (from skim milk), low-fat yogurt, evaporated skim milk. Low-fat or skim milk cheese (without added cream): cottage cheese, farmer's, hoop, baker's, mozzarella, ricotta.	Whole milk and whole milk products include: ice cream, cheese made from whole milk or cream, butter. All creams (sour, half-and-half, whipped).
FATS AND OIL	Margarines, liquid oil shortenings, salad dressings and mayonnaise made from polyunsaturated oils, vegetable oils: corn, cottonseed, sesame, soybean, sunflower, safflower.	Butter, lard, salt pork, meat fat, coconut oil, completely hydrogenated margarines and shortenings. Use peanut oil and olive oil occasionally for flavor.
DESSERTS, BEVERAGES, SNACKS AND CONDIMENTS	Fresh fruit and fruit canned without sugar, cocoa or carob powder, water ice, sherbet, gelatin, fruit whip, angel food cake, cakes made with polyunsaturated oils. Vinegar, mustard, herbs, spices.	Coconut, cream products, fried food, snacks (potato chips, corn chips, etc.), chocolate pudding, ice cream, and most commercial cakes, pies, cookies and mixes.

NOTE: New, acceptable versions of standard products are appearing on the market. Be sure to read product labels on any item you are interested in purchasing.

Recipes to Try

Five Minute Soup

A quick cooking soup, this is best served immediately while the vegetables are fresh and colorful.

4 cups chicken broth
1/2 raw cucumber, scrubbed, unpeeled and sliced very thin
4 raw mushrooms, sliced
2 cups shredded raw green leaf vegetable (spinach, lettuce, cabbage)
1 tomato cubed
1/2 cup leftover meat, shredded

Heat the bouillon. Add the vegetables and meat. Bring to a boil and simmer five minutes. Adjust seasoning. Serve immediately. Yield: about 1 1/2 quarts. Approx. cals/serv: 1 cup = 45

Crispy Baked Chicken

Cornflake crumbs give this skinless chicken a crisp new coating.

1 frying chicken (2 1/2 - 3 lbs), cut into serving pieces
1 cup cornflake crumbs
1 cup skim milk
Seasoning if desired

Preheat oven to 400 F. Remove all skin from the chicken, rinse and dry the pieces thoroughly. Season. Dip each piece in milk and shake to remove excess. Roll in crumbs. Let stand briefly so coating will adhere. Place chicken in an oiled baking pan. Pieces should not touch. Bake 45 minutes or more. Crumbs will form a crisp "skin". Yield 4 servings. Approx cals/serv.: 270

Oven French Fries

French fries without frying - a surprise for those who thought this crispy treat was a forbidden food.

4 medium potatoes
1 Tablespoon oil

Preheat oven to 475 F. Peel potatoes and cut into long strips about 1/2 inch wide. Dry strips thoroughly on paper towels. Toss in bowl with oil as if making salad. When strips are thoroughly coated with the oil, spread them on a cookie sheet, single layer, and place in preheated oven for 35 minutes. Turn strips periodically to brown on all sides. If a crispier,

browner potato is desired, run under broiler for a minute or two. Sprinkle with salt before serving. Yield: 6 servings. Approx. cal/serv.: 80

Carrot and Pineapple Mold

1 3-ounce package orange or lemon gelatin
1 cup boiling water'1/2 cup mixed orange and pineapple juice
1 cup drained crushed pineapple
1 cup raw grated carrots'1/4 cup chopped almonds
1 tablespoon minced green pepper

Dissolve the gelatin in boiling water. Add fruit juice, and chill until slightly thickened. Fold in remaining ingredients, and pour into individual molds, or 1-quart mold. Yield: 6 servings. Approx. cal/serv.: 135

Mock Sour Cream

2 tablespoons skim milk
1 tablespoon lemon juice
1 cup low-fat cottage cheese
1/4 teaspoon salt

Place all ingredients in a blender and mix on medium-high speed until smooth and creamy. Use as a sour cream substitute. This sauce may be added to hot dishes at the last moment. Or serve it cold, with the addition of flavoring or herbs, as a dressing for salad or a sauce for a mousse. Yield: about 1 1/4 cups. Approx. cal/serv.: 1 cup = 160 1 tablespoon = 10

ADAPTING RECIPES

Original	Substitute
1 oz. chocolate	3 T. cocoa powder + 1 T. oil
1 c. butter or margarine	7/8 c. oil
1 whole egg	1 egg white + 1 T. oil
1 c. non-fat milk	7/8 c. water + 4 T. dry milk
1 c. low-fat milk	1 c. skim milk + 1 t. oil
1 c. heavy cream	1/3 c. oil + 2/3 c. skim milk
1 c. sour cream	2/3 c. buttermilk + 1/3 c. oil

flavor them. Stuffing cooked in poultry absorbs much fat.

Judicious use of herbs, spices, and wines in cooking meats will help compensate for the lack of fat in the meats. Learn to use a variety of them.

FISH

Poaching is the least aromatic method of cooking fish and produces a very mild flavored fish with the least amount of fat. Use a small amount of water, white wine, and some onions and herbs as the poaching liquid. Simmer but do not boil liquid as it will break the fish. Cook fish only until it just becomes flaky; longer cooking will cause fish to be tough and dry.

When broiling fish fillets, place them on a greased broiling pan. Broil only until tender and do not try to turn fish over.

Stuffed fish should be baked between 375-400 F. Brushing fish with melted corn oil margarine before baking will give it a crisp crust.

An easy way to cook flavorful fish is to wrap them in foil with a small amount of wine and seasonings. Bake at 375 F until tender usually 10-15 minutes.

GENERAL HINTS

Use water packed can products ie. canned fish and fruits.

In recipes for baked products, sugar can often be reduced by 1/4 to 1/3 without harming the final product. Cinnamon and vanilla also give the impression of sweetness.

Use fresh fruit whenever possible. If canned fruit must be used, select water packed varieties, fruit in own juice, or drain heavy syrup from canned fruits.

For sauces and dressings use fat-free bases (vinegar, mustard, tomato juice, fat-free bouillon) instead of high calorie ones (creams, fats, oils, mayonnaise).

COOKING HINTS AND TECHNIQUES

To Reduce Cholesterol or Saturated Fats

1. Select lean cuts of meat.
2. Serve moderate portion sizes.
3. Replace animal fats with appropriate substitutes.

Examples:

Instead of:	Use:
Butter, Lard, Bacon or Bacon Fat, Chicken Fat	Polyunsaturated margarine or oil
Sour Cream	Plain Low-Fat Yogurt
Whole Milk	Skim Milk (1/2% if not skim)
Whole Milk Cheese	Low-Fat Cheese*
Whole Eggs	Egg Whites or Egg Substitutes

*Many cheeses although made with skim milk, have added cream. Check labels for fat content, preferably < 2 g of fat/ounce. Good choices are: ricotta, cottage, mozzarella.

MEAT

Trimming all visible fat and skin from meats and poultry are the first steps to eliminating saturated fat from a recipe. This step is particularly important when roasting or broiling meat.

When roasting meat, use a rack under the meat so the meat does not sit in the drippings. Roasting between 325-350 F is recommended for flavor as well as eliminating most fats from the meat. (Higher temperatures seal fat in.) The drippings will contain fat so do not baste with them! Use wine, fruit juice, or broth to keep meat moist and add interesting flavors. If fat must be used in your recipe, replace meat fats with margarine.

When making gravy, soups, stews, sauces, and broths, always remove the fat. Do this by chilling the drippings, etc. in the freezer or by adding ice cubes. Either way the fat will harden and then can be removed. (100 calories from fat is saved per Tablespoon fat removed.)

Braising meat is one of the best ways to remove excess saturated fat. Brown the meat in a vegetable oil first. Then add a small amount of water and simmer until tender. Remove meat and don't forget to take the fat out of the juices prior to using those juices.

Generally meat should not be floured or breaded before browning or roasting because the breading absorbs the meat fats.

Turkeys and chicken should be roasted with a few onions, carrots, or other vegetables in the cavity to add flavor to the bird. Stuffings should be baked separately with fat free broth to

How to Win at the Grocery Store: Shopping Tips

With the increase in food prices and the necessity of eating healthful foods, the following tips may help you to get the most for your food dollar:

1. Make a list based on advertised specials, and on what you are low on. Plan menus for a week based on the specials.

2. Shop on a full stomach. When you shop when you're hungry, you are likely to buy unnecessary items.

3. Compare prices of brands; most of the time the store brand will be cheaper.

4. Buy lean cuts of beef and pork, chicken, turkey, and fish. The following cuts vary from medium lean to very lean:

   Beef: ROUND STEAK (very lean), RUMP ROAST (lean), FLANK STEAK (very lean), SIRLOIN TIP ROAST (very lean), BLADE POT ROAST (medium lean), and ARM POT ROAST (very lean)

   Pork: CENTER HAM SLICE (lean), SIRLOIN ROAST (medium lean), and LOIN CHOP (medium lean)

5. Buy the polyunsaturated vegetable oils. Safflower oil is highest in polyunsaturates, followed by soybean, sunflower, corn, cottonseed, and sesame oils (in that order).

6. Read all labels before buying items. The first ingredients in the list of ingredients is present in the largest amounts. The margarine you buy should begin with the words "liquid _____ oil". Non-dairy creamers often have saturated vegetable oil added; a glance at the label will tell you if these saturated oils are present. Coconut oil and palm oil are high in saturated fats, so label reading will tell you if these are present in many convenience foods.

7. Buy low-fat milk products and cheeses.

8. Commercial baked products often have fats added. Again, label reading will help you.

LEAN MEAT CUTS

3 ounce trimmed, cooked portions of the following meat cuts will provide 200 Calories or less per serving.

BEEF

Top Round
Bottom Round
Eye of Round
Tip
Sirloin
Tenderloin
Top Loin
Chuck Arm
Brisket, Point Portion

PORK

Whole Leg
Leg, Rump Half
Loin, Center Loin Roast or Chop
Canadian Bacon
Boneless Ham, 5-11% fat

VEAL

Cutlet
Arm Steak
Blade Steak
Sirloin Chop
Loin Chop
Rib Roast

LAMB

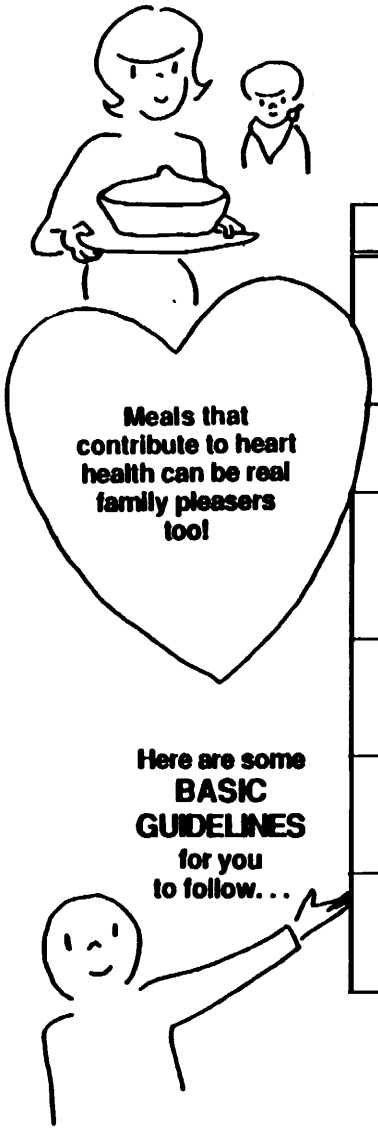
Shank Half Leg Roast
Sirloin Roast
Loin Chops
Blade Chops
Foreshank
Rack (Rib)

Servings Per Pound

Type of Cut:	Number of 3 ounce servings:
Lean, boneless	1 pound=3-4
Some bone and/or some fat	1 pound=2-3
More bone and/or more fat	1 pound=1-2

GUIDELINES TO CONTROLLING FAT AND CALORIES

- ☐ Choose lean meat cuts
- ☐ For beef, buy Choice or Select grades
- ☐ Choose ground beef that is 85% lean (less than 15% fat)
- ☐ Use cooking methods that reduce rather than add fat
- ☐ Trim all fat off meat before eating
- ☐ Consume meat in moderate amounts



GUIDE TO "HEART-Y" EATING

Foods	Good	Go Slow
MEAT group	Moderate size portions of chicken, turkey, veal, fish. Beef, lamb, ham, pork - lean cuts with little marbling. Nuts, beans - use as substitutes. Shellfish occasionally.	Duck, goose - very fatty. Fatty meats, organ meats. More than 4 eggs/week.
FRUIT and VEGETABLE group	All of them. Include 1 dark green or deep yellow vegetable for vitamin A and 1 citrus fruit or juice for vitamin C.	Potato chips and deep fried vegetables.
BREAD and CEREAL group	Whole grain or enriched breads. Whole grain cereals. Most pasta (spaghetti, macaroni).	Pastries; commercial baked goods (high saturated fat content, sugar). Egg-rich breads. Egg noodles. Mixes with high fat content.
MILK PRODUCTS	Low-fat milk products (skim milk, buttermilk, yogurt, low-fat cheeses such as cottage cheese, mozarella, farmer's.	Whole milk and whole milk products. Cream and cream products (including butter, hard cheeses).
FATS and OILS	Liquid oils & margarines high in poly-unsaturates with ratio of 2:1 poly-unsaturated fat to saturated. Salad dressings made with polyunsaturates.	Solid fats and hydrogenated margarines, butter, lard and other animal fats, coconut and palm kernel oil products.
DESSERTS and TREATS	Fruit, gelatin, water-ice desserts. Sherbet, fruit whips, angel food cake, cakes with polyunsaturated oil.	Ice cream and other desserts with whole milk. Puddings, cream pies. Fried snacks. Commercial sweets. Coconut.

Do You Know Your Fat Facts?

Fats are one food source which has been closely linked to coronary heart disease. This nutrient is quite complex in nature and is metabolized in the body through intricate processes. Much has been written about facts with some terms seeming to overlap others. Check yourself on some of these basic definitions:

Fat: the most concentrated source of food energy (calories), each gram supplies about 9 calories, compared with about 4 calories per gram of protein or carbohydrate. Fat can be solid (butter, margarine, lard, or shortening) or liquid (vegetable oil). Fats contain a mixture of monounsaturated, polyunsaturated, and saturated fatty acids.

Lipids: the technical name for a group of substances commonly called fats. Lipids include saturated and unsaturated fatty acids, cholesterol, and triglycerides.

Triglycerides: the main type of fat found in the body and visible in foods.

Fatty Acids: the basic chemical unit in fat; chains of carbon atoms to which hydrogen atoms are attached. Fatty acids may be saturated, monounsaturated, or polynsaturated depending on how many are present.

Saturated Fats: fats that are usually solid at room temperature. Saturated fats are found mainly in foods of animal origin such as dairy products and meat and poultry fats. They are also found in some vegetable oils, including coconut and palm. Saturated fats tend to raise the level of cholesterol in the blood.

Monounsaturated Fats: fats that are usually liquid at room temperature. Examples are olive and peanut oils. Monounsaturated fats appear to have no influence on blood cholesterol levels.

Polyunsaturated Fats and Oils: fats and oils that are usually liquid at room temperature. Polyunsaturated fats are found mainly in foods of plant origin. Safflower, sunflower, corn, soybean, and cottonseed are vegetable oils containing mostly polyunsaturated fat. Polyunsaturated fats and oils tend to lower blood cholesterol.

Cholesterol: a fat-like substance found in the body cells of humans and animals. Cholesterol is needed to form hormones, cell membranes, and other body substances. Unlike fat deposits which are usually concentrated under the skin and around organs, cholesterol is present in all animal tissues.

High-Density Lipoproteins (HDL): substances made up of lipids (fats) and proteins. High-density lipoproteins are thought to remove excess cholesterol from the body. Higher HDL levels in the blood are associated with lower rates of heart disease.

Low-Density Lipoproteins (LDL): substances made up of lipids (fats) and proteins. Low-density lipoproteins carry the major portion of cholesterol in the blood. A high level of LDL is usually associated with an elevated blood cholesterol level and an increased risk of coronary heart disease.

What A Label Tells You About the Source of Calories

The number of calories per serving must be listed on the label. Calories depend on the amount of fat, protein and carbohydrate in the food. Fat, which has the most calories, supplies nine calories per gram. Protein and carbohydrate each supply four calories per gram. By multiplying the grams per serving by the calories per gram, you get the total calories per serving for protein (see table). By doing the same for carbohydrate and fat, and adding up the calories in each, you get a total of calories. For example, skim milk contains 85 calories. However, 90 calories for one cup of skim milk is shown on the label because, under current Food & Drug Administration regulations, calories are rounded to the nearest 10.

For example, on the label of Vitamin A & D Skim Milk:

	Grams per serving		Calories per gram	Total Calories
Protein	8	x	4	= 32
Carbohydrate	11	x	4	= 44
Fat	1	x	9	= 9
				85

Reading food labels is especially helpful if you are on a fat-controlled diet. For example, by comparing the contents of skim milk and whole milk, you'll discover that whole milk contains 10 grams of fat per serving, or 90 calories (10 x 9 = 90). This is 81 more calories of fat per one-cup serving than skim milk and a substantial amount as far as the fat-controlled diet is concerned. Whole milk contains about 165 calories per one-cup serving. The label would show 170 calories, or double the calories from skim milk.

Different Kinds of Fat

Present labeling regulations allow only two kinds of fat to be listed, polyunsaturated and saturated. Although monounsaturated fat may make up a considerable part of the total fat in a food, it is not listed separately.

A margarine label will look something like this.

Wonder Spread

MARGARINE

Nutrition Information Per Serving

Serving size	1 tablespoon (14 grams)
Servings per 1 lb. container	32
Calories	100
Protein	0
Carbohydrate	0
Fat	11 grams
Polyunsaturated	4 grams
Saturated	2 grams
Cholesterol	0

By reading the label, you can see that this particular margarine contains 11 grams of fat per serving. Four grams of the total fat are polyunsaturated; two grams are saturated. The remaining five grams of fat are monounsaturated. Remember that all kinds of fat have the same value, nine calories per gram. So, one serving of margarine containing 11 grams of fat would have 100 calories.

Breads

Corn Bread Muffins

1 cup sifted flour
¾ cup yellow corn meal
½ teaspoon salt
2½ teaspoons baking powder
2 tablespoons sugar
1 egg
1 cup skim milk
¼ cup oil

Preheat the oven to 425°F. Sift together the flour, corn meal, salt, baking powder and sugar. Add the egg, milk and oil stirring quickly and lightly until mixed. Do not beat. From the bowl, dip the batter into oiled 2¼-inch muffin tins (or an 8 x 8-inch pan or corn-stick pans), filling each cup 2/3 full. Bake 20 to 30 minutes, or until golden brown. Yield: 12 2¼-inch muffins. Approx. cal/serv.: 130

Flaky Biscuits

2 cups sifted flour
3 teaspoons baking powder
½ teaspoon salt
¼ cup oil
2/3 cup skim milk

Preheat the oven to 475°F. Sift flour, baking powder, and salt together into a mixing bowl. Pour oil or melted shortening and milk into one measuring cup but do not stir. Add all at once to flour mixture. Stir quickly with a fork until dough clings together. Knead the dough lightly about 10 times. Place the dough on a piece of waxed paper 12 inches by 16 inches. Pat dough out to about ½ inch thick. Cut with unfloured medium-sized cookie cutter. Place biscuits on ungreased cookie sheet and bake for 12-15 minutes. Yield: 12 2-inch biscuits. Approx. cal/serv.: 115

Oatmeal Bread

1½ cups boiling water
1 cup rolled oats
1 teaspoon salt
1/3 cup light molasses
1½ tablespoons oil
1 package dry yeast
¼ cup warm water
4-4½ cups all-purpose flour, sifted

Pour the boiling water over the oatmeal. Add the salt, stir, and cool to lukewarm. Dissolve the yeast in the warm water, then add molasses, oil and dissolved yeast to the oatmeal mixture and gradually add the sifted flour until the dough is stiff enough to handle. Knead the dough on a lightly floured board for about 5 minutes or until dough is smooth and elastic. Place dough in a lightly oiled bowl, turning to coat all sides of the dough with oil. Cover with a clean cloth and let rise in a warm place (about 85°F.) until double in bulk. Punch down the dough and knead again for a few minutes. Shape into a loaf and put it in a well-oiled 9 x 5-inch loaf pan. Cover and let rise again (about 1 hour) until doubled in bulk. Bake in a preheated oven at 375°F. for 50 minutes. Remove bread from pan and place on a wire rack to cool. Yield: 1 loaf (16 slices). Approx. cal/serv.: 1 slice = 150

Variation
A ¼ cup of wheat germ and/or ½ cup of seedless raisins may be added. Approx. cal/serv.: 1 slice = 170

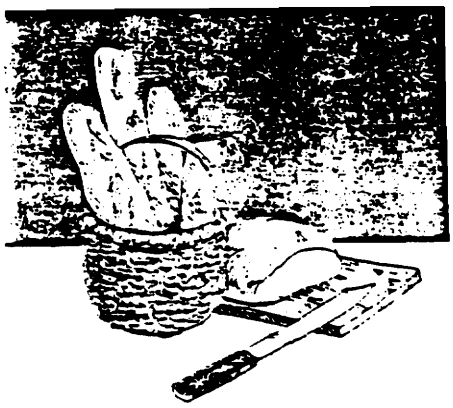


Table 1. Nutritional Analyses of Fast Foods

	Wt (g)	Energy (kcal)	PRO (g)	CHO (g)	Fat (g)	Chol (mg)
LONG JOHN SILVER'S®						
Fish w/Batter (2 pc)	136	366	22	21	22	-
Fish w/Batter (3 pc)	207	549	32	32	32	-
Treasure Chest®	143	506	30	32	33	-
Chicken Planks® (4 pc)	166	457	27	35	23	-
Peg Legs® w/Batter (5 pc)	125	350	22	26	28	-
Ocean Scallops (6 pc)	120	283	11	30	13	-
Shrimp w/Batter (6 pc)	88	268	8	30	13	-
Breaded Oysters (6 pc)	156	441	13	53	19	-
Breaded Clams	142	617	18	61	34	-
Fish Sandwich	193	337	22	49	31	-
French Fryes	85	288	4	33	16	-
Cole Slaw	113	138	1	16	8	-
Corn on the Cob (1 ear)	150	176	5	29	4	-
Hushpuppies (3)	45	153	3	20	7	-
Clam Chowder (8 oz)	170	107	5	15	3	-
Source: Long John Silver's Food Shoppes, Lexington, Kentucky. Nutritional analysis						
McDONALD'S®						
Egg McMuffin®	138	327	19	31	15	229
English Muffin, Buttered	63	186	5	30	5	13
Hotcakes w/Butter & Syrup	214	500	8	94	10	47
Sausage (Pork)	53	206	9	tr	19	43
Scrambled Eggs	98	180	13	3	13	349
Hashbrown Potatoes	55	125	2	14	7	7
Big Mac®	204	563	26	41	33	86
Cheeseburger	115	307	15	30	14	37
Hamburger	102	255	12	30	10	25
Quarter Pounder®	166	424	24	33	22	67
Quarter Pounder® w/Ch	194	524	30	32	31	96
Filet-O-Fish®	139	432	14	37	25	47
Regular Fries	68	220	3	26	12	9
Apple Pie	85	253	2	29	14	12
Cherry Pie	88	260	2	32	14	13
McDonaldland® Cookies	67	308	4	49	11	10
Chocolate Shake	291	383	10	66	9	30
Strawberry Shake	290	362	9	62	9	32
Vanilla Shake	291	352	9	60	8	31
Hot Fudge Sundae	164	310	7	46	11	18
Caramel Sundae	165	328	7	53	10	26
Strawberry Sundae	164	289	7	46	9	20
Source: McDonald's Corporation, Oak Brook, Illinois. Nutritional analysis by Raltech						
TACO BELL®						
Bean Burrito	166	343	11	48	12	-
Beef Burrito	184	466	30	37	21	-
Beefy Tostada	184	291	19	21	15	-
Bellbeefer®	123	221	15	23	7	-
Bellbeefer® w/Ch	137	278	19	23	12	-
Burrito Supreme®	225	457	21	43	22	-
Combination Burrito	175	404	21	43	16	-
Enchirito®	207	454	25	42	21	-
Pintos 'N Cheese	158	168	11	21	5	-
Taco	83	186	15	14	8	-
Tostada	138	179	9	25	6	-

Sources: 1) Menu — Portions. San Antonio, Texas: Taco Bell Co. July 1976. 2) Ada
3) Church FF, Church HN (eds). *Food Values of Portions Commonly Used*, ed 12. Pr

Table 1. Nutritional Analyses of Fast Foods

	Wt (g)	Energy (kcal)	PRO (g)	CHO (g)	Fat (g)	Chol (mg)
ARBY'S®						
Roast Beef	140	350	22	32	15	45
Beef and Cheese	168	450	27	36	22	55
Super Roast Beef	263	620	30	61	28	85
Junior Roast Beef	74	220	12	21	9	35
Ham & Cheese	154	380	23	33	17	60
Turkey Deluxe	236	510	28	46	24	70
Club Sandwich	252	560	30	43	30	100
Source: Consumer Affairs, Arby's, Inc, Atlanta, Georgia. Nutritional analysis by Techn						
BURGER CHEF®						
Hamburger	91	244	11	29	9	27
Cheeseburger	104	290	14	29	13	39
Double Cheeseburger	145	420	24	30	22	77
Fish Filet	179	547	21	46	31	43
Super Shef® Sandwich	252	563	29	44	30	105
Big Shef® Sandwich	186	569	23	38	36	81
TOP Shef® Sandwich	138	661	41	36	38	134
Funmeal® Feast	-	545	15	55	30	27
Rancher® Platter*	316	640	32	33	42	106
Mariner® Platter*	373	734	29	78	34	35
French Fries, small	68	250	2	20	19	0
French Fries, large	85	351	3	28	26	0
Vanilla Shake (12 oz)	336	380	13	60	10	40
Chocolate Shake (12 oz)	336	403	10	72	9	36
Hot Chocolate	-	198	8	23	8	30
*Includes salad Source: Burger Chef Systems, Inc, Indianapolis, Indiana Nutritional a						
CHURCH'S FRIED CHICKEN®						
White Chicken Portion	100	327	21	10	23	-
Dark Chicken Portion	100	305	22	7	21	-
Source: Church's Fried Chicken, San Antonio, Texas. Nutritional analysis by Medallion						
DAIRY QUEEN®						
Frozen Dessert	113	180	5	27	6	20
DQ Cone, small	71	110	3	18	3	10
DQ Cone, regular	142	230	6	35	7	20
DQ Cone, large	213	340	10	52	10	30
DQ Dip Cone, small	78	150	3	20	7	10
DQ Dip Cone, regular	156	300	7	40	13	20
DQ Dip Cone, large	234	450	10	58	20	30
DQ Sundae, small	106	170	4	30	4	15
DQ Sundae, regular	177	290	6	51	7	20
DQ Sundae, large	248	400	9	71	9	30
DQ Malt, small	241	340	10	51	11	30
DQ Malt, regular	418	600	15	89	20	50
DQ Malt, large	588	840	22	125	28	70
DQ Float	397	330	6	59	8	20
DQ Banana Split	383	540	10	91	15	30
DQ Parfait	284	460	10	81	11	30
DQ Freeze	397	520	11	89	13	35
Mr. Misty® Freeze	411	500	10	87	12	35
Mr. Misty® Float	404	440	6	85	8	20
"Dilly"® Bar	85	240	4	22	15	10
DQ Sandwich	60	140	3	24	4	10
Mr. Misty Kiss®	89	70	0	17	0	0
Brazier® Cheeseburg	113	330	15	24	19	-
Brazier® Chili Dog	128	330	13	25	20	-

Food	Serving Size	Fat (Gm)	Sat Fat (Gm)	Mono Fat (Gm)	Polysat Fat (Gm)	Chol (Mg)	Food Energy (Cal)
Dairy Products							
milk:							
fluid whole	1 cup	8.2	5.1	2.4	0.3	33	150
skim	1 cup	0.4	0.3	0.1	trace	4	86
cheese:							
cheddar	1 oz	9.4	6.0	2.7	0.3	30	114
cottage—creamed (4% fat)	1 cup	9.5	6.0	2.7	0.3	31	217
cottage—uncreamed (1% fat)	1 cup	2.3	1.5	0.7	0.1	10	164
mozzarella (made from partially skimmed milk)	1 oz	4.5	2.9	1.3	0.1	16	72
"light" cheeses (1% butterfat)	1 oz	0.3	0.2	0.1	0	1.5	40
Fats and Oils							
peanut butter	2 tbsp	16.0	3.0	7.4	4.6	0	190
bacon (cooked crisp)	2 slices	6.2	2.2	3.0	0.7	11	73
butter	1 tbsp	14.2	7.1	3.3	0.4	31	102
tub margarines:							
safflower oil, liquid	1 tbsp	11.4	1.3	3.3	6.3	0	102
corn oil, liquid	1 tbsp	11.4	2.0	5.5	3.4	0	102

Food	Serving Size	Fat (Gm)	Sat Fat (Gm)	Mono Fat (Gm)	Polysat Fat (Gm)	Chol (Mg)	Food Energy (Cal)
Meat, Poultry, Fish:							
lean beef	3 oz	7.7	3.7	3.4	0.2	77	177
lean pork and ham	3 oz	9.4	3.2	4.2	1.1	80	187
poultry, flesh without skin:							
light meat	3 oz	4.7	1.3	1.7	1.1	76	163
dark meat	3 oz	9.9	2.7	3.7	2.4	82	203
fish:							
lean	3 oz	0.5	.08	.07	0.18	43	115
fat	3 oz	5.4	1.0	1.6	2.2	40	138
shellfish:							
lobster	½ cup	1.0	0.1	0.2	0.4	90	68
shrimp	½ cup (11 large)	1.0	0.2	0.3	0.5	96	100
canned fish:							
tuna	3 oz	7.0	1.7	1.4	1.4	55	167
related products:							
beef liver	3 oz	9.0	2.5	3.5	0.9	372	195
frankfurters (all beef—30% fat) 8 per lb.	1	16.8	6.8	8.2	0.7	27	184
eggs (chicken, whole)	1 medium	5.6	1.7	2.2	0.7	274	79

For more information, contact your local American Heart Association.

WENDY'S®						
Single Hamburger	200	470	26	34	26	70
Double Hamburger	285	670	44	34	40	125
Triple Hamburger	360	850	65	33	51	205
Single w/Cheese	240	580	33	34	34	90
Double w/Cheese	325	800	50	41	48	155
Triple w/Cheese	400	1040	72	35	68	225
Chili	250	230	19	21	8	25
French Fries	120	330	5	41	16	5
Frosty	250	390	9	54	16	45

Source: Wendy's International, Inc. Dublin, Ohio. Nutritional analysis by Medallion La

PIZZA HUT®* serving size: 2 slices of medium (13") pizza/4 servings per						
THIN 'N CRISPY®						
Standard Cheese	-	340	19	42	11	22
Superstyle Cheese	-	410	26	45	14	30
Standard Pepperoni	-	370	19	42	15	27
Superstyle Pepperoni	-	430	23	43	19	34
Standard Pork w/Mushr	-	380	21	44	14	35
Superstyle Pork w/Mushr	-	450	26	46	19	40
Supreme	-	400	21	44	17	13
Super Supreme	-	520	30	46	26	44
THICK 'N CHEWY®						
Standard Cheese	-	390	24	53	10	18
Superstyle Cheese	-	450	31	54	14	21
Standard Pepperoni	-	450	25	52	16	21
Superstyle Pepperoni	-	490	27	52	20	24
Standard Pork w/Mushr	-	430	27	53	14	21
Superstyle Pork w/Mushr	-	500	30	54	18	21
Supreme	-	480	29	52	18	24
Super Supreme	-	590	34	55	26	38

* "PIZZA HUT, THIN 'N CRISPY, and THICK 'N CHEWY are all registered trademark
Raltech Scientific Services, Inc (formerly WARF), Madison, Wisconsin.

Fish Sandwich	170	400	20	41	17	
Fish Sandwich w/Ch	177	440	24	39	21	
Super Brazier* Dog	182	518	20	41	30	
Super Brazier* Dog w/Ch	203	593	26	43	36	
Super Brazier* Chili Dog	210	555	23	42	33	
Brazier* Fries, small	71	200	2	25	10	
Brazier* Fries, large	113	320	3	40	16	
Brazier* Onion Rings	85	300	6	33	17	

Source: International Dairy Queen, Inc. Minneapolis, Minnesota. Nutritional ana

KENTUCKY FRIED CHICKEN*

Original Recipe* Dinner*						
Wing & Rib	322	603	30	48	32	133
Wing & Thigh	341	661	33	48	38	172
Drum & Thigh	346	643	35	46	35	180
Extra Crispy Dinner*						
Wing & Rib	349	755	33	60	43	132
Wing & Thigh	371	812	36	58	48	176
Drum & Thigh	376	765	38	55	44	183
Mashed Potatoes	85	64	2	12	1	0
Gravy	14	23	0	1	2	0
Cole Slaw	91	122	1	13	8	7
Rolls	21	61	2	11	1	1
Corn (5.5-inch ear)	135	169	5	31	3	X

* Includes two pieces of chicken, mashed potato and gravy, cole slaw, and roll. Source, Ke

RECIPES FOR EATING RIGHT

HEALTHFUL BEEF AND VEGETABLE SALAD

- 12 ounces cooked beef tip roast cut into thin strips (about 2 2/3 cups)
- 1 carton (8 ounces) low-fat yogurt
- 1/3 cup (2 ounces) pared, seeded, finely chopped cucumber
- 1/4 teaspoon dill weed
- 1 clove garlic, minced
- 2 cups (7 ounces) green beans, cut 1 inch
- 3 cups (10 ounces) cauliflowerets
- 12 cherry tomatoes (8 oz.), halved

To prepare dressing combine yogurt, cucumber, dill weed and garlic in small bowl; cover tightly and refrigerate. Blanch green beans 5 minutes and cauliflowerets 3 minutes. Combine meat strips, green beans, cauliflowerets and cherry tomatoes in 2-quart serving bowl. Cover tightly and refrigerate 2 to 4 hours. Serve with yogurt dressing. 4 servings. 251 calories per serving

YOGURT-MARINATED SIRLOIN STEAK

- 1 beef sirloin steak, cut 1-inch thick (about 2 pounds)
- 1/2 cup plain low-fat yogurt
- 1 tablespoon olive oil
- 1 clove garlic, minced
- 1 1/2 teaspoons curry powder
- 1/2 teaspoon hot pepper sauce
- 1/2 teaspoon salt

Combine yogurt, oil, garlic, curry, hot pepper sauce and salt. Place steak in plastic bag; add marinade, spreading evenly over both sides. Tie bag securely and marinate in refrigerator 6 to 8 hours (or overnight, if desired), turning at least once. Remove steak from marinade. Place steak on grill over ash-covered coals (or on rack in broiler pan) so surface of meat is 4 inches from heat and broil 16 to 20 minutes to desired doneness (rare or medium), turning once. 5 to 6 servings. 202 calories per serving.

SKEWERED ROSÉ LAMB

- 1 lamb leg center steak, cut 1-inch thick (approximately 3/4 pound)
- 2 tablespoons rosé wine
- 1 tablespoon olive oil
- 1 clove garlic, minced
- 1/4 teaspoon salt
- Dash freshly ground pepper

Trim outer fat from lamb steak, remove bone. Cut lamb into 1/2-inch wide strips. Combine wine, oil, garlic, salt and pepper. Place lamb strips in plastic bag; add marinade, turning to coat. Close bag securely. Marinate in refrigerator 4 to 6 hours, turning once. Remove lamb from marinade. Thread strips onto four 8-inch skewers, weaving back and forth. Place on rack in broiler pan so surface of meat is 2 to 4 inches from heat. Broil 5 to 7 minutes, turning once. 2 servings. 200 calories per serving.

PORK TENDERLOIN STIR FRY

- 1 1/4 pounds pork tenderloin
- 1 tablespoon oil
- 1/4 teaspoon salt
- 1 package (10 ounces) frozen asparagus pieces, defrosted
- 1/2 cup water
- 1 1/2 cups bean sprouts
- 1 tablespoon soy sauce
- 1 clove garlic, minced
- 1 teaspoon cornstarch
- 1/2 teaspoon minced ginger root
- Dash mace
- 8 cherry tomatoes, each cut into quarters
- 2 cups hot cooked rice

Trim excess fat from pork tenderloin; discard. Cut pork diagonally into slices 1/4-inch thick. Quickly brown pork slices (1/2 at a time) in hot oil, stirring constantly; remove from pan. Sprinkle salt over pork. Reduce heat; add asparagus and 1/4 cup water to frying pan and cook, covered, 5 minutes. Add bean sprouts and continue cooking, covered, 5 minutes. Combine soy sauce, garlic, cornstarch, ginger root and mace with 1/4 cup water; stir into vegetables. Return pork to pan and cook 3 to 4 minutes, stirring occasionally. Stir in cherry tomatoes and heat through. Serve pork stir fry over rice. 4 servings. 353 calories per serving.

ZESTY PORK CHOPS

- 4 pork top loin chops, cut 1 to 1 1/4-inches thick
- 1/2 cup tomato juice
- 2 tablespoons cider vinegar
- 1 tablespoon Worcestershire sauce
- 1 teaspoon prepared mustard
- 1/2 teaspoon sugar
- 1/4 teaspoon garlic salt
- 1/4 teaspoon hot pepper sauce
- 1/4 teaspoon salt

Combine tomato juice, vinegar, Worcestershire sauce, mustard, sugar, garlic salt, hot pepper sauce and salt in a small saucepan; bring to boil and simmer 10 minutes, stirring occasionally. Place pork chops on rack in broiler pan so surface of meat is 4 to 5 inches from heat. Broil at low to moderate temperature 10 minutes on each side. Continue broiling, turning occasionally, and brushing with sauce 10 minutes or until done. 4 servings. 233 calories per serving.

Recipes developed and tested in the National Live Stock and Meat Board Test Kitchens.

Appendix D
Statistical Tables

Summary table for Liklihood Ratio Chi-Square (LRCS) for demographic variables.

Variable	df	LRCS	p
SEX	1	0.568	0.451
AGE GROUP	3	0.749	0.862
MARITAL STAT	3	1.820	0.610
EDUCATION	3	0.946	0.814
EXERCISE LVL	3	0.224	0.974
FIBER SUPLM	1	1.464	0.226
SMOKING	1	0.002	0.967

Summary two way repeated measures ANOVA table for TCH.

Source	df	SS	MS	F	p
Group	1	967.32	967.322	0.65	.4262
Error	34	50714.05	1491.590		
Time	1	419.11	419.11	1.62	.2116
Time*Group	1	876.95	876.95	3.39	.0743
Error	34	8791.50	258.57		

Summary one way ANOVA table for TCH of the control group.

Source	df	SS	MS	F	p
Time	1	44.24	44.24	0.16	.6935
Error	18	4963.51	275.75		

Summary one way repeated measures ANOVA table for TCH of the experimental group.

Source	df	SS	MS	F	p
Time	4	2983.28	745.82	3.14	.0223
Error	64	15190.12	237.35		

Summary ANOVA table of TCH for the experimental group: Time N represents the Nth successive level in time from Week-0

Source	df	SS	MS	F	p
Time 1vs2	1	3991.78	3991.78	19.49	.0004
Error	16	3277.47	204.84		
Time 2vs3	1	3111.76	3111.76	5.93	.0272
Error	16	8398.24	524.89		
Time 3vs4	1	1202.88	1202.88	2.97	.1043
Error	16	6488.12	405.51		
Time 4vs5	1	44.49	44.49	0.06	.8147
Error	16	12540.76	783.80		

Summary ANOVA table for TCH of the experimental group: Time N represents the contrast between the Nth level of time and the first.

Source	df	SS	MS	F	p
Time 2vs1	1	3991.78	3991.78	19.49	.0004
Error	16	3277.47	204.84		
Time 3vs1	1	54.72	54.72	0.20	.6620
Error	16	4414.53	275.91		
Time 4vs1	1	1770.72	1770.72	4.80	.0435
Error	16	5897.53	368.60		
Time 5vs1	1	2376.53	2376.53	4.97	.0405
Error	16	7655.97	478.50		

Summary table for t-tests of initial differences in dietary parameters between experimental and control groups.

Variable	T	df	p
TKCAL	-0.0279	33	.9782
TFAT	-1.0504	33	.3012
%FAT	-2.5353	23.8	.0182
SFAT	-0.6200	33	.5395
PFAT	-1.5253	20.1	.1428
MFAT	-1.1706	33	.2684
P/S	0.1678	33	.8678
M/S	0.0322	33	.9745
D-CH	0.0932	33	.9263

Summary two way repeated measures ANOVA table for TKCAL.

Source	df	SS	MS	F	p
Group	1	182242.50	182242.50	0.05	.8228
Error	31	110782367.94	3573624.77		
Time	2	3081841.36	1540920.68	2.34	.1092
Time*Group	2	1712556.51	856278.25	1.30	.2786
Error	62	40779661.89	657736.48		

Summary one way ANOVA table of the control group for TKCAL: Time N represents the Nth successive difference in time.

Source	df	SS	MS	F	p
Time	2	466072.33	233036.17	0.32	.7037
Error	34	24570098.33	722649.95		
Time 1vs2	1	100352.00	100352.00	0.10	.7605
Error	17	17778116.00	1045771.53		
Time 2vs3	1	398724.50	398724.50	0.34	.5680
Error	17	19985764.50	1175633.21		
Time1vs3	1	899140.50	899140.50	0.43	.5231
Error	17	35946414.50	2114494.97		

Summary one way ANOVA table of the experimental group for TKCAL: Time N represents the Nth successive difference in time.

Source	df	SS	MS	F	p
Time	2	4006471.11	2003235.56	3.46	.0480
Error	28	16209563.56	578912.98		
Time 1vs2	1	7718506.67	7718506.67	6.40	.0240
Error	14	16879159.33	1205654.24		
Time 2vs3	1	844906.67	844906.67	1.18	.2953
Error	14	10005703.33	714693.10		
Time 1vs3	1	3156000.00	3456000.00	2.23	.1580
Error	14	21743828.00	1553130.57		

Summary two way repeated measures ANOVA table for TFAT.

Source	df	SS	MS	F	p
Group	1	10074.41	10074.41	1.20	.2812
Error	31	259619.46	8374.82		
Time	2	19459.55	9729.77	4.79	.0158
Time*Group	2	5936.61	2968.31	1.46	.2412
Error	62	125979.09	2031.92		

Summary one way ANOVA table for the control group of TFAT: Time N represents the Nth successive difference in time.

Source	df	SS	MS	F	p
Time	2	2150.77	1075.39	0.51	.6072
Error	34	72309.34	2126.75		
Time 1vs2	1	3532.76	3532.76	1.00	.3316
Error	17	60128.54	3536.97		
Time 2vs3	1	32.56	32.56	0.01	.9247
Error	17	60163.41	3539.02		
Time 1vs3	1	2886.99	2886.99	0.51	.4857
Error	17	96636.08	5684.48		

Summary one way ANOVA table for the experimental group of TFAT: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	21487.51	10743.75	5.61	.0201
Error	28	53669.75	1916.78		
Time 1vs2	1	33575.43	33575.43	9.88	.0072
Error	14	47575.01	3398.22		
Time 2vs3	1	58.61	58.61	0.04	.8529
Error	14	23001.56	1642.97		
Time 1vs3	1	30828.48	30828.48	4.77	.0464
Error	14	90432.69	6459.48		

Summary two way repeated measures ANOVA table for %FAT.

Source	df	SS	MS	F	p
Group	2	511.05	511.05	4.41	.0440
Error	31	3594.28	115.94		
Time	2	183.83	91.96	3.14	.0588
Time*Group	2	41.00	20.50	0.70	.4795
Error	62	1813.79	29.25		

Summary one way ANOVA table for the control group of %FAT: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	28.70	14.35	0.34	.6765
Error	34	1441.30	42.39		
Time 1vs2	1	34.72	34.72	0.35	.5619
Error	17	1686.28	99.19		
Time 2vs3	1	1.39	1.39	0.04	.8535
Error	17	671.61	39.51		
Time 1vs3	1	50.00	50.00	0.43	.5196
Error	17	1966.00	115.65		

Summary one way ANOVA table for the experimental group of %FAT: Time N represents the Nth level of time.

Source	df	SS	MS	F	p
Time	2	182.18	91.09	6.85	.0056
Error	28	372.49	13.30		
Time 1vs2	1	264.60	264.60	13.03	.0028
Error	14	284.40	20.31		
Time 2vs3	1	0.27	0.27	0.01	.9084
Error	14	271.73	19.41		
Time 1vs3	1	281.67	281.67	7.02	.0190
Error	14	561.33	40.09		

Summary two way repeated measures ANOVA table for SFAT.

Source	df	SS	MS	F	p
Group	1	509.69	509.69	0.46	.5006
Error	31	34019.40	0.46		
Time	2	576.36	288.18	1.11	.3345
Time*Group	2	880.29	440.14	1.69	.1939
Error	62	16115.62	259.93		

Summary one way ANOVA table for the control group of SFAT: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	33.24	16.62	0.05	.9007
Error	34	10475.79	308.11		
Time 1vs2	1	10.55	10.55	0.05	.8280
Error	17	3684.48	216.74		
Time 2vs3	1	23.55	23.55	0.03	.8731
Error	17	15235.59	896.21		
Time 1vs3	1	65.63	65.63	0.09	.7688
Error	17	12507.29	735.72		

Summary one way ANOVA table for the experimental group of SFAT: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	1307.56	653.78	3.25	.0624
Error	28	5639.83	201.42		
Time 1vs2	1	2196.88	2196.88	4.74	.0472
Error	14	6494.98	463.92		
Time 2vs3	1	32.77	32.77	0.17	.6904
Error	14	2774.76	198.20		
Time 1vs3	1	1693.04	1693.04	3.10	.1002
Error	14	7649.74	546.41		

Summary two way repeated measures ANOVA table for PFAT.

Source	df	SS	MS	F	p
Group	1	127.20	127.20	0.44	.5143
Error	31	9058.57	292.21		
Time	2	1723.50	861.75	5.05	.0120
Time*Group	2	631.03	315.51	1.85	.1706
Error	64	10578.03	170.61		

Summary one way ANOVA table for the control group of PFAT: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	185.42	92.71	0.68	.5154
Error	34	4664.20	137.18		
Time 1vs2	1	87.16	87.16	0.29	.5982
Error	17	5137.47	302.20		
Time 2vs3	1	98.37	98.37	0.42	.5258
Error	17	3985.17	234.42		
Time 1vs3	1	370.74	370.74	1.29	.2711
Error	17	4869.96	286.47		

Summary one way ANOVA table for the experimental group of PFAT: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	2003.80	1001.90	4.74	.0308
Error	28	5913.83	211.21		
Time 1vs2	1	2680.02	2680.02	5.37	.0362
Error	14	6988.35	499.17		
Time 2vs3	1	32.15	32.15	0.24	.6284
Error	14	1837.89	131.28		
Time 1vs3	1	3299.23	3299.23	5.18	.0391
Error	14	8915.24	636.80		

Summary two way repeated measures ANOVA table for MFAT.

Source	df	SS	MS	F	p
Group	1	598.93	598.93	0.87	.3571
Error	31	21242.49	695.24		
Time	2	3314.38	1657.19	7.54	.0012
Group*Time	2	972.56	486.28	2.21	.1188
Error	62	13631.38	219.86		

Summary one way ANOVA table for the control group of MFAT: Time N represents the Nth successive level in time.

Source	df	SS	MS	F	p
Time	2	582.92	291.46	1.83	.1761
Error	34	5420.04	159.41		
Time 1vs2	1	297.68	297.68	0.95	.3423
Error	17	5303.10	311.95		
Time 2vs3	1	285.29	285.29	1.01	.3282
Error	17	4785.15	281.48		
Time 1vs3	1	1165.80	1165.80	3.21	.0910
Error	17	6171.87	363.05		

Summary one way ANOVA table for the experimental group of MFAT: Time N represents the Nth successive level in time.

Source	df	SS	MS	F	p
Time	2	3443.93	1721.97	5.87	.0091
Error	28	8211.33	293.26		
Time 1vs2	1	5589.66	5589.66	13.61	.0024
Error	14	5749.87	410.70		
Time 2vs3	1	38.18	38.18	0.08	.7862
Error	14	6988.57	499.18		
Time 1vs3	1	4703.95	4703.95	5.54	.0338
Error	14	11895.56	849.68		

Summary two way repeated measures ANOVA table for P/S.

Source	df	SS	MS	F	p
Group	1	0.18	0.18	.88	.3549
Error	31	6.46	0.21		
Time	2	0.57	0.28	3.12	.0513
Time*Group	2	0.03	0.01	0.16	.8516
Error	62	5.64	0.09		

Summary one way ANOVA table for the control group of P/S: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	0.21	0.10	1.05	.3619
Error	34	3.42	0.100		
Time 1vs2	1	0.11	0.11	0.57	.4621
Error	17	34.3	0.20		
Time 2vs3	1	0.10	0.10	0.50	.4874
Error	17	3.27	0.19		
Time 1vs3	1	0.42	0.42	2.01	.1746
Error	17	3.57	0.21		

Summary one way ANOVA table for the experimental group of P/S: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	0.37	0.18	2.34	.1145
Error	28	2.22	0.08		
Time 1vs2	1	0.06	0.06	0.33	.5771
Error	14	2.49	0.18		
Time 2vs3	1	0.36	0.36	2.51	.1355
Error	14	1.98	0.14		
Time 1vs3	1	0.70	0.70	4.50	.0521
Error	14	2.18	0.16		

Summary two way repeated measures ANOVA table for M/S.

Source	df	SS	MS	F	p
Group	1	0.07	0.07	0.65	.4276
Error	31	3.39	0.11		
Time	2	0.75	0.37	5.66	.0055
Time*Group	2	0.02	0.01	0.12	.8835
Error	62	4.09	0.07		

Summary one way ANOVA table for the control group of M/S: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	0.42	0.21	3.20	.0589
Error	34	2.21	0.07		
Time 1vs2	1	0.15	0.15	0.83	.3759
Error	17	3.17	0.19		
Time 2vs3	1	0.27	0.27	2.29	.1484
Error	17	1.98	0.12		
Time 1vs3	1	0.83	0.83	0.83	.3759
Error	17	1.48	0.09		

Summary one way ANOVA table for the experimental group of M/S: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	0.35	0.18	2.62	.0903
Error	28	1.88	0.07		
Time 1vs2	1	0.32	0.32	2.34	.1486
Error	14	1.92	0.14		
Time 2vs3	1	0.06	0.06	0.40	.5350
Error	14	2.25	0.16		
Time 1vs3	1	0.67	0.67	6.36	.0244
Error	14	1.48	0.11		

Summary two way repeated measures ANOVA table for D-CH.

Source	df	SS	MS	F	p
Group	1	25526.46	25526.46	0.24	.6245
Error	31	3237751.19	104443.59		
Time	2	504955.39	252477.69	4.47	.0193
Time*Group	2	50167.36	25083.68	0.44	.6210
Error	62	3504350.48	56521.78		

Summary one way ANOVA table for the control group of D-CH: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	265908.30	132954.15	1.89	.1762
Error	34	2397429.09	70512.62		
Time 1vs2	1	478871.39	478871.39	7.28	.0152
Error	17	1118289.69	65781.75		
Time 2vs3	1	297323.31	297323.31	1.93	.1823
Error	17	2613377.65	153728.10		
Time 1vs3	1	21530.20	21530.20	0.11	.7490
Error	17	3460619.92	203565.88		

Summary one way ANOVA table for the experimental group of D-CH: Time N represents the Nth successive level of time.

Source	df	SS	MS	F	p
Time	2	287272.27	143636.13	3.63	.0434
Error	28	1106921.39	39532.91		
Time 1vs2	1	531420.35	531420.35	6.84	.0203
Error	14	1087151.39	77653		
Time 2vs3	1	34095.97	34095.97	0.69	.4187
Error	14	687673.41	49119.53		
Time 1vs3	1	296300.48	296300.48	2.68	.1237
Error	14	1545939.38	110424.24		

Summary table for t-test of changes in weight of control, experimental and differences between both, groups over the eight week intervention.

Group	T	p
CONTROL	1.12	.2797
EXPERIMENTAL	-.27	.7938
BETWEEN	0.74	.4653

Summary ANOVA table for reliability of the Reflotron.

Source	df	SS	MS	F	p
Model	1	60452.07	60452.07	679.36	.0000
Error	70	6228.913	88.98		

Root Mean Square Error	9.4332
Mean of Dependant Variable	239.9861
Coefficient of Variation	.0393071

Appendix E
RAW DATA

SUBJECT	GROUP	SEX	AGE	MARTL STAT_	EDUCTN LVL ___	EXER LVL	FIBER SUPL_	SMOKE
05	C	F	65	W	3	1	N	Y
09	C	F	69	W	4	3	N	N
12	C	F	52	M	3	3	N	N
16	C	F	69	M	4	2	N	N
19	C	F	59	M	3	2	N	N
21	C	F	69	W	2	4	N	N
26	C	F	66	M	.	3	N	N
27	C	F	75	M	2	2	Y	N
32	C	M	68	M	4	3	N	N
34	C	F	62	M	2	3	N	N
35	C	F	73	W	3	1	N	N
39	C	F	47	D	3	1	.	.
40	C	M	67	M	3	1	N	N
45	C	F	66	S	1	2	N	N
47	C	F	65	W	2	3	N	N
48	C	M	65	M	4	3	N	N
56	C	M	46	M	4	2	N	N
66	C	F	59	M	3	2	N	N
72	C	F	60	M	3	2	N	N
13	E	F	48	M	1	4	N	N
17	E	F	.	M	3	2	Y	N
23	E	F	72	W	2	2	N	N
24	E	F	57	M	2	1	N	N
28	E	F	66	M	2	2	N	N
29	E	F	59	M	4	3	N	N
30	E	F	73	D	3	2	N	Y
33	E	M	60	M	4	2	Y	N
44	E	F	80	W	2	1	.	N
49	E	F	48	M	3	2	N	N
51	E	F	50	M	2	3	N	N
52	E	F	62	M	3	3	N	N
59	E	F	66	M	3	1	N	N
60	E	F	67	W	3	1	N	N
61	E	F	61	M	3	2	Y	N
65	E	F	69	M	2	3	N	N
75	E	M	68	M	4	3	N	N

Subject Characteristics: Marital Status (MRTL STAT): widowed (W); married (M); divorced (D); single (S) Education Level (EDUCTN LVL): grade school (1); high school (2); college (3); post college (4) Exercise Level (EXER LVL): 1-2X/week (1); 3-4X/week (2); 5- 6X/week (3); 7+X/week (4) Fiber Supplementation (FIBER SUPL): currently taking a supplement yes (Y) or no (N)

SUBJECT	TCH0	TCH2	TCH4	TCH6	TCH8
13	274.0	247	300	307	224.5
17	233.0	207	202	208	188.5
23	259.0	246	270	254	280. 0
24	207.5	187	239	187	216. 0
28	216.5	210	222	216	225.5
29	235.0	204	227	219	243.0
30	246.0	231	252	202	217. 0
33	270.5	261	273	285	272.0
44	215.0	176	213	198	187.0
49	230.5	211	239	240	236.5
51	232.5	256	231	209	223.5
52	265.0	256	249	267	264.5
59	243.5	239	222	218	207.5
60	270.0	239	259	276	234.0
61	202.5	196	199	194	209.0
65	250.5	232	249	226	244.5
75	277.5	220	202	199	204.5

SUBJ	GROUP	CH-0	CH-8
05	C	290.0	284.5
09	C	222.5	188.5
12	C	229.0	112.0
16	C	272.0	321.0
19	C	256.5	277.5
21	C	280.0	277.0
26	C	256.5	277.5
27	C	240.0	259.0
32	C	258.5	257.0
34	C	246.0	240.0
35	C	239.5	275.0
39	C	218.0	199.0
40	C	210.5	192.5
45	C	200.5	202.0
47	C	231.5	188.5
48	C	233.5	231.5
56	C	250.5	277.0
66	C	225.5	244.0
72	C	204.5	202.5
13	E	274.0	224.5
17	E	233.0	188.5
23	E	259.0	280.0
24	E	207.5	216.0
28	E	216.5	225.5
29	E	235.0	243.0
30	E	246.0	217.0
33	E	270.5	272.0
44	E	215.0	187.0
49	E	230.5	236.5
51	E	232.5	223.5
52	E	265.0	264.5
59	E	243.5	207.5
60	E	270.0	234.0
61	E	202.5	209.0
65	E	250.5	244.5
75	E	227.5	204.5

Comparison of baseline TCH measurement (CH-0) with average TCH measurement at week 8 (CH-8)

SUBJECT	GROUP	ABSOL CHG	PCT CHG
05	C	-5.5	-1.8
09	C	-34.0	-15.0
12	C	-17.0	-7.0
16	C	49.0	18.0
19	C	21.0	8.0
21	C	-3.0	-1.0
26	C	21.0	8.0
27	C	19.0	7.9
32	C	-1.5	0.0
34	C	-6.0	-2.0
35	C	35.5	14.8
39	C	-19.0	-8.7
40	C	-18.0	-8.5
45	C	1.5	0.0
47	C	-43.0	-18.5
48	C	-2.0	0.0
56	C	26.5	10.5
66	C	18.5	8.0
72	C	-2.0	0.0
13	E	-49.5	-18.0
17	E	-44.5	-19.0
23	E	21.0	8.0
24	E	8.5	4.0
28	E	9.0	4.0
29	E	8.0	3.0
30	E	-29.0	-11.0
33	E	1.5	0.0
44	E	-28.0	-13.0
49	E	6.0	2.0
51	E	-9.0	-3.0
52	E	-.5	0.0
59	E	-36.0	-14.7
60	E	-36.0	-15.0
61	E	7.0	3.0
65	E	-6.0	-2.0
75	E	-23.0	-10.0

Comparison of absolute change (ABSOL CHG) and percent of change (PCT CHG) from baseline to week 8

SUBJECT	GROUP	TKCAL 1	TKCAL 2	TKCAL 3
05	C	2718	4376	3539
09	C	4240	4228	5429
12	C	7984	....	....
16	C	4730	5090	3859
19	C	4553	5835	3367
21	C	6435	6217	5181
26	C	3237	3982	5189
27	C	3409	4210	4017
32	C	4944	5238	5774
34	C	5400	4638	3816
35	C	3764	4704	4748
39	C	4507	4087	3265
40	C	7183	6925	6684
45	C	3824	3515	3477
47	C	6518	5158	4411
48	C	8902	6534	6071
56	C	4648	4866	6468
66	C	4442	2824	2716
72	C	5546	5229	6966
13	E	....	2186	2068
17	E	5784	5952	5694
23	E	7177	3595	4029
24	E	4762	3625	4205
28	E	4599	4351	4385
29	E	4531	4314	....
30	E	3950	3581	4404
33	E	7688	5849	5819
44	E	4277	3744	2798
49	E	3116	3343	1836
51	E	4761	3700	4552
52	E	6095	5160	4820
59	E	4197	5264	5573
60	E	5746	5107	5357
61	E	3752	4082	4557
65	E	3932	3295	5455
75	E	7534	5963	6686

Comparison of the total amount of kilocalories (TKCAL) consumed over the three day recorded period at 0,4,8 weeks

SUBJECT	GROUP	TFAT 1	TFAT 2	TFAT 3
05	C	099.68	117.86	137.79
09	C	123.20	136.56	100.80
12	C	318.92	.....	.....
16	C	155.10	139.70	93.31
19	C	162.80	196.70	128.30
21	C	223.10	157.20	99.65
26	C	100.70	94.11	181.60
27	C	101.50	99.17	100.10
32	C	120.70	155.50	194.30
34	C	204.20	148.10	136.90
35	C	145.60	101.00	85.17
39	C	133.60	220.10	170.20
40	C	261.70	257.30	247.80
45	C	130.00	186.90	150.00
47	C	219.50	217.20	157.80
48	C	417.40	259.20	228.10
56	C	124.30	70.87	153.70
66	C	158.00	48.94	166.50
72	C	161.10	183.60	282.20
13	E	.....	55.02	56.70
17	E	207.60	205.60	250.40
23	E	359.90	182.50	151.72
24	E	196.60	150.60	144.40
28	E	195.50	150.80	196.80
29	E	127.30	111.80	.....
30	E	142.10	102.50	111.20
33	E	312.60	204.40	155.40
44	E	172.80	111.13	85.08
49	E	102.70	108.70	51.58
51	E	240.20	147.10	184.00
52	E	293.70	202.30	165.40
59	E	173.50	221.00	219.90
60	E	327.80	254.70	274.20
61	E	129.60	153.30	141.30
65	E	107.10	114.10	205.10
75	E	207.20	150.50	152.40

Comparison of the total amount of fat (TFAT) consumed over the three day recorded period at 0,4,8 weeks

SUBJECT	GROUP	SFAT 1	SFAT 2	SFAT 3
05	C	23.59	32.09	32.63
09	C	27.62	26.05	33.04
12	C	139.32	.....	.....
16	C	30.02	32.39	22.24
19	C	50.47	55.59	34.00
21	C	56.24	33.14	30.01
26	C	36.52	23.73	38.58
27	C	19.35	16.19	15.35
32	C	29.85	25.34	61.97
34	C	66.13	46.12	32.87
35	C	44.58	37.11	35.07
39	C	33.12	58.09	27.20
40	C	74.70	82.55	115.10
45	C	29.99	39.76	37.21
47	C	65.11	89.96	45.29
48	C	109.30	116.10	60.23
56	C	22.60	13.13	39.38
66	C	34.12	16.26	84.75
72	C	30.10	53.59	72.86
13	E	.....	15.70	18.23
17	E	46.11	53.19	61.28
23	E	89.04	61.46	41.34
24	E	76.61	30.53	54.32
28	E	58.45	32.01	57.23
29	E	25.35	28.71	.....
30	E	42.53	31.86	36.41
33	E	82.14	62.81	44.73
44	E	40.44	36.30	38.04
49	E	14.84	13.44	10.85
51	E	75.45	38.54	43.24
52	E	89.73	53.16	40.45
59	E	34.16	75.80	66.02
60	E	83.03	76.68	73.27
61	E	27.40	21.94	20.83
65	E	35.63	29.41	51.45
75	E	52.64	49.54	49.38

Comparison of the total amount of saturated fat (SFAT) consumed over the three day recorded period at 0,4,8 weeks

SUBJECT	GROUP	PFAT 1	PFAT 2	PFAT 3
05	C	20.07	27.79	32.21
09	C	12.58	8.28	11.02
12	C	16.97	.....	.....
16	C	42.49	27.84	17.56
19	C	20.87	34.77	23.97
21	C	23.61	20.22	10.41
17	C	17.24	16.17	33.55
27	C	23.63	10.05	20.09
32	C	35.49	40.50	20.40
34	C	30.60	31.52	31.71
35	C	40.26	12.36	5.51
39	C	21.47	25.88	17.48
40	C	25.09	34.89	15.47
19	C	19.36	70.12	41.07
47	C	25.10	15.72	25.20
48	C	46.57	31.76	10.54
56	C	35.66	14.18	22.72
66	C	21.74	6.27	18.54
72	C	41.38	35.28	64.07
13	E	.....	15.50	9.33
17	E	35.24	30.86	50.38
23	E	104.40	22.50	14.57
24	E	29.67	24.47	22.08
28	E	34.44	14.42	28.94
29	E	24.10	17.15	.....
30	E	16.81	19.34	21.16
33	E	53.88	25.97	15.74
44	E	37.80	8.49	3.49
49	E	21.48	20.91	4.66
51	E	35.65	27.25	18.84
52	E	43.93	33.52	31.75
59	E	31.88	24.80	34.08
60	E	60.41	38.78	45.27
61	E	18.45	31.38	13.67
65	E	12.89	11.33	21.41
75	E	23.85	26.24	12.28

Comparison of the total amount of polyunsaturated fat consumed over the three day recorded period at 0,4,8 weeks

SUBJECT	GROUP	MFAT 1	MFAT 2	MFAT 3
05	C	29.51	39.83	39.24
09	C	22.08	21.89	13.12
12	C	83.26	.....	.....
16	C	33.13	27.01	18.01
19	C	43.98	57.93	38.95
21	C	46.53	33.73	27.21
26	C	31.70	22.26	34.73
27	C	26.48	8.70	14.06
32	C	29.49	50.97	56.40
34	C	57.00	45.56	29.15
35	C	44.90	27.58	24.60
39	C	27.08	55.73	23.50
40	C	69.75	56.30	54.19
45	C	30.59	54.54	34.70
47	C	55.71	43.92	44.73
48	C	87.44	56.87	24.19
56	C	40.92	13.36	43.78
66	C	30.62	11.69	35.91
72	C	42.17	48.01	47.75
13	E	.....	13.80	19.21
17	E	58.85	51.87	78.32
23	E	122.50	53.72	30.59
24	E	40.36	28.72	28.74
28	E	51.17	25.40	31.46
29	E	29.61	23.95	.....
30	E	34.49	27.26	27.66
33	E	85.22	56.37	24.70
44	E	44.43	15.54	20.08
49	E	17.70	12.85	9.77
51	E	62.34	42.82	32.16
52	E	77.05	56.86	47.65
59	E	41.37	33.13	53.25
60	E	93.94	39.57	92.60
61	E	34.96	29.95	9.23
65	E	26.95	17.85	43.84
75	E	31.49	41.35	27.14

Comparison of the total amount of monounsaturated fat (MFAT) consumed over the three day recorded period at 0,4,8 weeks

SUBJECT	GROUP	%FAT 1	%FAT 2	%FAT 3
05	C	30	25	34
09	C	26	29	17
12	C	32	..	..
16	C	29	24	21
19	C	32	30	33
21	C	31	23	17
26	C	27	20	31
27	C	26	21	22
32	C	21	26	30
34	C	32	27	30
35	C	34	19	16
39	C	26	48	46
40	C	33	33	33
45	C	30	46	38
47	C	29	37	32
48	C	42	35	34
56	C	23	13	21
66	C	31	15	7
72	C	25	31	35
13	E	..	22	24
17	E	32	30	39
23	E	44	33	33
24	E	36	31	27
28	E	38	32	39
29	E	25	23	..
30	E	32	26	25
33	E	36	31	24
44	E	36	26	27
49	E	30	29	25
51	E	44	35	37
52	E	43	35	30
59	E	37	37	35
60	E	50	45	45
61	E	29	25	27
65	E	24	30	33
75	E	24	22	20

Comparison of percent of total calories from fat (%FAT) over the three day recorded period at 0,4,8 weeks

SUBJECT	GROUP	D-CH 1	D-CH 2	D-CH 3
05	C	827	263	390
09	C	770	717	362
12	C	2040	...	...
16	C	130	223	197
19	C	402	633	249
21	C	416	659	478
26	C	333	184	257
27	C	478	164	298
32	C	442	238	1429
34	C	711	321	381
35	C	284	248	519
39	C	756	315	407
40	C	735	641	799
45	C	584	303	408
47	C	308	360	313
48	C	1465	746	377
56	C	457	333	689
66	C	424	281	1107
72	C	345	306	584
13	E	...	236	229
17	E	626	454	681
23	E	262	411	686
24	E	871	433	865
28	E	705	384	471
29	E	465	263	...
30	E	404	526	427
33	E	1086	940	403
44	E	418	316	255
49	E	184	259	407
51	E	495	309	283
52	E	1015	269	260
59	E	859	809	918
60	E	836	298	520
61	E	182	89	162
65	E	317	486	395
75	E	1103	556	523

Comparison of the total amount of dietary cholesterol (D-CH) consumed over the three day recorded period at 0,4,8 weeks

SUBJECT	GROUP	WEIGHT T-0	WEIGHT T-8
05	C	141	140
09	C	162	156
12	C	156	151
16	C	136	132
19	C	198	196
21	C	136	137
26	C	144	146
27	C	191	195
32	C	208	208
34	C	134	133
35	C	208	198
39	C	152	...
40	C	188	188
45	C	218	217
47	C	118	119
48	C	187	191
56	C	187	187
66	C	165	168
72	C	117	115
13	E	235	238
17	E	175	175
23	E	126	129
24	E	131	131
28	E	154	154
29	E	151	159
30	E	128	126
33	E	174	172
44	E	116	115
49	E	214	...
51	E	179	176
52	E	158	156
59	E	128	125
60	E	192	191
61	E	121	122
65	E	116	...
75	E	174	176

Comparison of weight as measured in pounds taken at baseline (T-0) and week 8 (T-8)

OBSERVATION	TRIAL 1	TRIAL 2
1	287	293
2	224	234
3	268	276
4	231	235
5	252	261
6	252	266
7	214	201
8	232	248
9	217	216
10	270	271
11	253	244
12	222	214
13	207	214
14	210	220
15	232	229
16	233	232
17	255	246
18	242	245
19	268	272
20	196	209
21	196	209
22	248	253
23	225	226
24	202	207
25	285	284
26	192	185
27	214	210
28	225	224
29	336	306
30	196	181

Replicate measures taken by technician A used to verify the reproducibility of the Reflotron

OBSERVATION	TRIAL 1	TRIAL 2
31	278	277
32	284	270
33	285	275
34	214	218
35	284	271
36	271	247
37	225	226
38	245	241
39	218	216
40	264	250
41	273	271
42	244	236
43	278	272
44	202	196
45	196	189
46	189	185
47	208	196
48	190	187
49	234	229
50	245	228
51	230	217
52	265	264
53	285	269
54	210	205
55	237	231
56	214	204
57	249	240
58	255	233
59	203	202
60	208	201

Replicate measures taken by technician A used to verify the reproducibility of the Reflotron continued

OBSERVATION	TRIAL 1	TRIAL 2
1	229	216
2	274	274
3	288	272
4	263	250
5	240	230
6	249	243
7	267	250
8	243	249
9	198	203
10	235	228
11	242	225
12	272	258
13	226	229

Replicate measures taken by technician B used to verify the reproducibility of the Reflotron

Appendix F
Letters to Physicians

September 11, 1989

((Physician's Name and address))

Dear Dr. ((Name)):

As you are undoubtedly aware, the National Institute of Health is currently sponsoring a campain to increase the public's awareness of the dangers of hypercholesterolemia and to facilitate access to both pharmacological and non-pharmacological interventions. As part of an ongoing research project examining ways to promote dietary induced modification of serum cholesterol levels, we are conducting a study with participants in the New River Valley Mall Walking Program. The purpose of this study is to examine the effectiveness of bi-weekly feedback describing changes in one's current serum cholesterol level to enhance motivation to adhere to a Step One dietary program.

A number of your patients who are participants in the Walking Program have expressed an interest in this study. Based upon a free cholesterol screening we provided last week, it appears that their serum cholesterol may be above the level recommended by the American Heart Association. We would like to offer them an opportunity to participate in our study and would appreciate your consideration as to whether they would be appropriate. We also wish to avoid interference in any ongoing treatment you might be providing.

In brief, all participants in the study would receive a class on how to monitor dietary intake as well as a class describing the A.H.A.'s Step One cholesterol lowering diet. All participants would also receive dietary updates in the form of handouts every two weeks for the duration of the 10 week study; and feedback regarding their cholesterol levels at baseline as well as at the end of 10 weeks. In addition to the above, participants randomized to the Enhanced Care Group would receive feedback every two weeks regarding their serum cholesterol levels based upon Reflotron measures. Previous research in our laboratory suggests that the Reflotron is an accurate and reliable instrument well suited to providing frequent feedback regarding cholesterol levels.

Enclosed you will find a form listing individuals wishing to participate in the study who indicated that you were their primary physician. To the best of our ability, we have excluded all individuals taking lipid lowering medications and included only those with cholesterol levels in the 200-300 mg/dl range. We would greatly appreciate your consideration as to whether these individuals are appropriate for this study. Please indicate your perspective by checking either "YES" or "NO" for each individual. Appropriate release of information forms have been signed and are enclosed. At the study's conclusion, we hope to provide you with a graphic summary of cholesterol values for each of your patients who participates in the study.

Your assistance in facilitating this timely research is greatly appreciated. Please feel free to call me at 231-4254 if you would like additional information regarding this study. Thank you!

Sincerely,

Douglas R. Southard, Ph.D., M.P.H.
Assistant Professor of Health and Psychology

Katie Roseveare
Project Director

Physician's Name: ______________________________ **Date:** ___/___/___

Patient's Name	Age	Screening Cholesterol	Appropriate for Research Study? YES	NO

September 28, 1989

^F1^, MD
^F2?^
^F3^
^F4^ ^F5^ ^F6^

Dear Dr. ^F7^:

As you may recall, I contacted you several weeks ago requesting your review of the appropriateness of several of your patients for a research study on cholesterol lowering. I would like to thank you for your prompt reply to that request.

Several additional patients of yours have expressed an interest in joining the study. I have enclosed their information release authorizations along with a form for you to express your perspective on their suitability for the study by checking "Yes" or "No". If you would, please place your signature in the space provided at the top of the form and return the form in the enclosed envelope.

Again, your assistance in facilitating this timely research is greatly appreciated. Please feel free to call me at 231-4254 if you would like additional information regarding this study. Thank you!

Sincerely,

Douglas R. Southard, Ph.D., M.P.H.
Assistant Professor of Health and Psychology

Appendix G
Data Sheets

ID#:_____ Screening CH:_____/_____

Name:_____

Address:_____

_____

Phone #: (Day)_____ (Evening)_____

Age:_____ Sex:_____ Marital Status:_____

Level of Education (please circle the highest level completed):

Grade School	1	2	3	4	5	6	7	8
High School	9	10	11	12				
College	13	14	15	16				
Graduate Work	17	18	19	20				

Physician's Name:_____

Address (if known):_____

_____

Phone Number (if known):_____

Are you currently taking any cholesterol lowering medications? Yes No

What is your current weight? _____

Are you on a weight reduction diet? Yes No

If so, how many pounds have you lost in the past month?_____

What is your current exercise level?

1-2 times/week 3-4 times/week 5-6 times/week More Frequent

These activities consist of:_____

_____

Please circle the morning and time you would prefer to come for your follow-up visits?

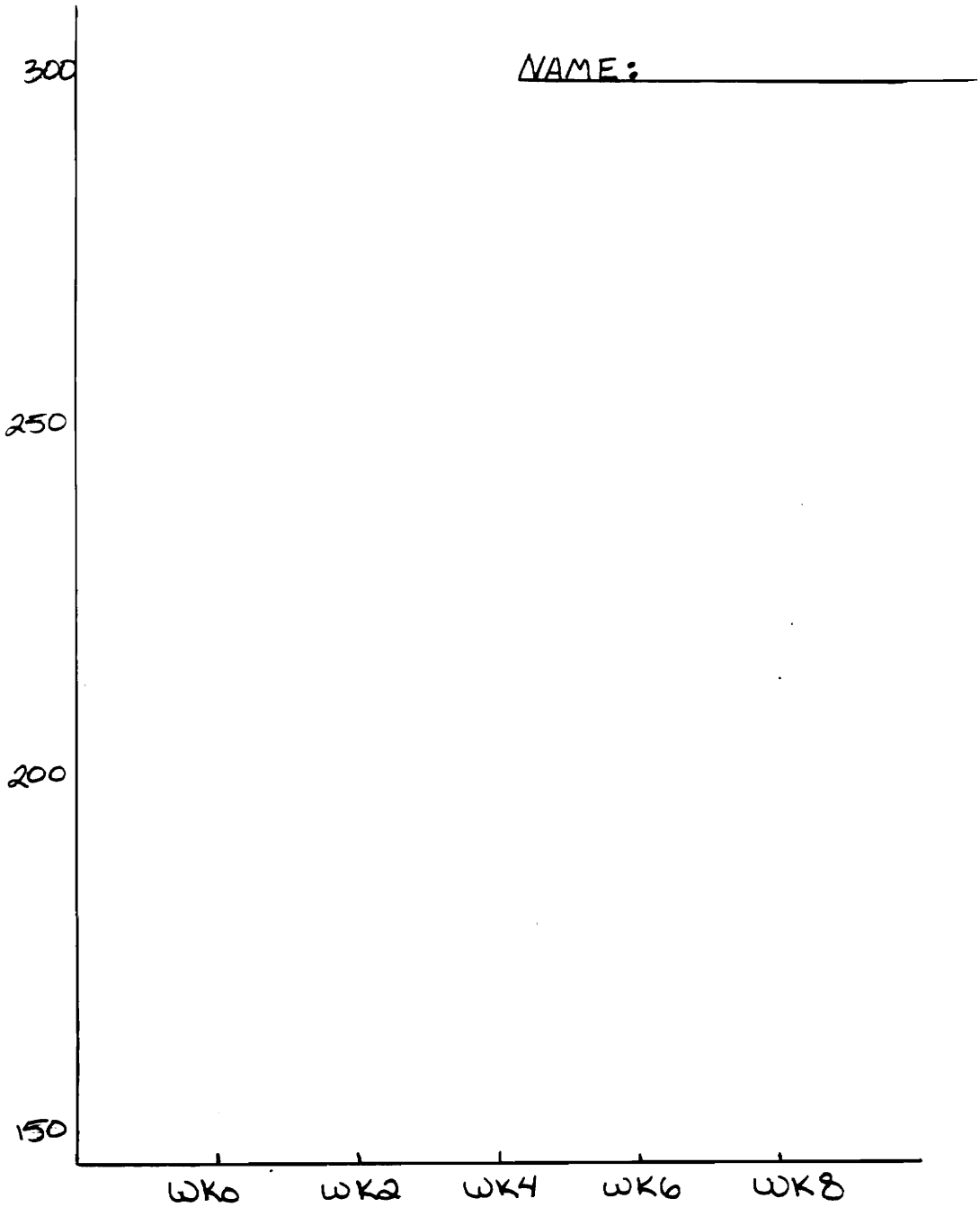
Tuesdays	7:00-8:00	8:00-9:00	9:00-10:00
Thursdays	7:00-8:00	8:00-9:00	9:00-10:00

THANK YOU !

Supplemental Information Sheet

NAME: _____

1. Are you currently taking any Metamusil or other fiber additive substance? yes no
2. Are you taking niacin? yes no
   If so, how much? _____
3. Do you smoke? yes no
   How much? less than 5/day 6-15/day 1 pack
   1 1/2 packs 2 packs more
4. How much alcohol do you consume in a week?
   _____
   _____
5. Please list current prescribed medications:
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____



TCH Graph

VITA

Kathryn A. Donckers-Roseveare currently resides in Roanoke, Virginia. During her 25 years of life she has moved 10 times. It isn't suprising that she can't answer question "So, where are you from?".

She completed her Bachelor of Arts degree at The University of Virginia in 1987. She majored in Rhetoric and Communications and minored in Women's Studies. Upon completion of this thesis, Katie will receive her Master's degree in Exercise Physiology from VPI & SU. Her course work has concentrated on aspects of counseling and behavioral medicine.

Her hobbies include biking, hiking, reading, dancing, and sewing. She has a variety of work experiences including teaching jazz, ballet, and aerobics classes, facilitating public relations at a shelter for abused women and children, and assisting the Health Educator at Virginia Tech.

Katie was married to Ronald N. Roseveare in December of 1988, just after her first semester of graduate school. They have both been commuting from Roanoke, Ronny to Lynchburg and Katie to Blacksburg, to achieve their goals. Currently, they are hoping to relocate in Lynchburg or at least some place where it takes less than 20 minutes to get to work.