JUL 29 2004

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	28.Jul.04	THESIS

4. TITLE AND SUBTITLE
THE EFFECTS OF USUAL INTERVENTION VERSUS USUAL INTERVENTION PLUS KNOWLEDGE OF MEASURED RESTING ENERGY EXPENDITURE ON BODY WEIGHT AND BODY FAT IN ACTIVE DUTY AIR FORCE PERSONNEL

5. FUNDING NUMBERS

6. AUTHOR(S)
CAPT NELSON HEATHER A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
UNIVERSITY OF ARIZONA

8. PERFORMING ORGANIZATION REPORT NUMBER
CI04-547

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
THE DEPARTMENT OF THE AIR FORCE
AFIT/CIA, BLDG 125
2950 P STREET
WPAFB OH 45433

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION AVAILABILITY STATEMENT
Unlimited distribution
In Accordance With AFI 35-205/AFIT Sup 1

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

20040806 004

14. SUBJECT TERMS

15. NUMBER OF PAGES
143

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

THE EFFECTS OF USUAL INTERVENTION VERSUS USUAL INTERVENTION PLUS KNOWLEDGE OF MEASURED RESTING ENERGY EXPENDITURE ON BODY WEIGHT AND BODY FAT IN ACTIVE DUTY AIR FORCE PERSONNEL

by

Heather Angela Nelson

A Thesis Submitted to the Faculty of the

DEPARTMENT OF NUTRITIONAL SCIENCES

In Partial Fulfillment of the Requirements
For the Degree of

MASTER OF SCIENCE

In the Graduate College

THE UNIVERSITY OF ARIZONA

2004

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

THE VIEWS EXPRESSED IN THIS ARTICLE ARE THOSE OF THE AUTHOR AND DO NOT REFLECT THE OFFICIAL POLICY OR POSITION OF THE UNITED STATES AIR FORCE, DEPARTMENT OF DEFENSE, OR THE U.S. GOVERNMENT.

ACKNOWLEDGEMENTS

I would like to express my gratitude and appreciation to my advisor, Dr. Cynthia Thomson for her guidance and support throughout my graduate studies at the University of Arizona. Thank you to Dr. James Ranger-Moore for sharing his enjoyment of statistics with me and for his assistance with the analysis of the data. Thanks also to Dr. Wanda Howell and Dr. Scott Going for their expertise in this area of research.

A special thank you to Major Nancy Klein and all the staff of the Health and Wellness Center at Davis-Monthan Air Force Base. Major Klein had the initial idea for this study. Technical Sergeant Ricardo Legaspi provided the nutrition education to all subjects in this study. Tori George, my research assistant, also provided much support during the study.

DEDICATION

To my husband, [redacted] whose patience, love, and encouragement allowed me to reach this goal. Your support allows me to bring all my dreams to fruition and keeps me balanced in life.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS AND TABLES 6
ABSTRACT 8
CHAPTER 1. INTRODUCTION 9
Statement of the Problem 9
Definition of Key Terms 10
Purpose of the Study 12
Hypothesis 13
CHAPTER 2. REVIEW OF LITERATURE 15
CHAPTER 3. METHODS 32
Study Design 32
Population and Sampling 35
Informed Consent 37
Confidentiality 37
Data Collection 38
Data Analysis 45
CHAPTER 4. RESULTS 47
Study Sample 47
Confounding Factors 58
Hypothesis Testing 67
Hypothesis 1 67
Hypothesis 2 69
Hypothesis 3 70
Secondary Outcomes 71
CHAPTER 5. DISCUSSION AND CONCLUSIONS 79
Hypothesis 1 79
Hypothesis 2 82
Hypothesis 3 84
Strengths/Limitations 86
Conclusion and Recommendations 88
APPENDIX A: Study Welcome Letter 90
APPENDIX B: Informed Consent Document 91
APPENDIX C: Health Insurance Portability and Accountability Act Form 96
APPENDIX D: Weight Loss Assessment 99
APPENDIX E: Weight Loss Readiness Test 103
APPENDIX F: RMR Instructions 108
APPENDIX G: What Affects My Resting Metabolic Rate 109
APPENDIX H: Arizona Food Frequency Questionnaire 110
APPENDIX I: Arizona Activity Frequency Questionnaire 126
REFERENCES 139

LIST OF ILLUSTRATIONS

FIGURE 1. Scoring Guide For Six Categories of the Weight Loss Readiness Test...42
FIGURE 2. REE Values During 3 Repeated Measures in the Intervention Group....73
FIGURE 3. REE Values During 3 Repeated Measures in the Intervention Group Shown Without 7 Subjects (Air Conditioning Malfunction)..... 75
FIGURE 4. REE Values During 3 Repeated Measures in the Intervention Group Subjects Enrolled Before 1 October 2003 with Complete Data Sets.....76
FIGURE 5. Mean REE Values Determined By MedGem and Mean Estimated REE Subjects Completing Baseline and 90-Day MedGem Measurements.... 77

LIST OF TABLES

TABLE 1. Baseline Physical Characteristics Comparison Between Groups..... 48
TABLE 2. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Between Groups from Baseline to 90 Days..... 51
TABLE 3a. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Within Control Group from Baseline to 90 Days (All Control Subjects)..... 52
TABLE 3b. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Within Control Group from Baseline to 90 Days (Control Subjects with Complete Data Sets)..... 53
TABLE 4a. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Within Intervention Group from Baseline to 90 Days (All Intervention Subjects)..... 54
TABLE 4b. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Within Intervention Group from Baseline to 90 Days (Intervention Subjects with Complete Data Sets)..... 55
TABLE 5. Mean Changes in Anthropometrics Within Control Group By Gender From Baseline to 90 Days..... 57
TABLE 6. Mean Changes in Anthropometrics Within Intervention Group By Gender From Baseline to 90 Days..... 57
TABLE 7. Mean Change in Weight Within Control Group by Goals and Attitudes Scores From Baseline to 90 Days..... 59
TABLE 8. Mean Change in Weight Within Intervention Group by Goals and Attitudes Scores From Baseline to 90 Days..... 59
TABLE 9. Mean Change in Weight Within Control Group by Hunger Cues Scores From Baseline to 90 Days..... 59
TABLE 10. Mean Change in Weight Within Intervention Group by Hunger Cues Scores From Baseline to 90 Days..... 60

TABLE 11. Mean Change in Weight Within Control Group by Control Over Eating Scores From Baseline to 90 Days..... 60
TABLE 12. Mean Change in Weight Within Intervention Group by Control Over Eating Scores From Baseline to 90 Days..... 60
TABLE 13. Mean Change in Weight Within Control Group by Binging Scores From Baseline to 90 Days..... 61
TABLE 14. Mean Change in Weight Within Intervention Group by Binging Scores From Baseline to 90 Days..... 61
TABLE 15. Mean Changes in Anthropometrics Between Groups From Baseline to 90 Days: Subjects Who Scored ≥12 on Binging Section Excluded..... 62
TABLE 16. Mean Change in Weight Within Control Group by Emotional Eating Scores From Baseline to 90 Days..... 62
TABLE 17. Mean Change in Weight Within Intervention Group by Emotional Eating Scores From Baseline to 90 Days..... 63
TABLE 18. Mean Change in Weight Within Control Group by Exercise Scores From Baseline to 90 Days..... 63
TABLE 19. Mean Change in Weight Within Intervention Group by Exercise Scores From Baseline to 90 Days..... 63
TABLE 20. Mean Changes in Anthropometrics From Baseline to 90 Days Within Control Group By Smoking Status..... 64
TABLE 21. Mean Changes in Anthropometrics From Baseline to 90 Days Within Intervention Group By Smoking Status..... 65
TABLE 22a. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Between Groups From Baseline to 90 Days: Subjects Enrolled Before 1 October 2003..... 66
TABLE 22b. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Between Groups From Baseline to 90 Days: Subjects Enrolled After 1 October 2003..... 67
TABLE 23. Mean REE During 3 Repeated Measures in the Intervention Group..... 73
TABLE 24. Results of Subjects With REE Measured During High Temperatures... 74
TABLE 25. Mean REE During 3 Repeated Measures in the Intervention Group Shown Without 7 Subjects..... 74
TABLE 26. Mean REE During 3 Repeated Measures in the Intervention Group: Subjects Enrolled Before 1 October 2003 with Complete Data Sets..... 76
TABLE 27. Mean Changes in Strength Training Frequency Between Groups from Baseline to 90 Days..... 78

ABSTRACT

Objective: To investigate if knowledge of resting energy expenditure (REE) results will support reductions in body weight and body fat in active duty Air Force personnel.

Design: A 90-day randomized controlled clinical trial.

Subjects/Setting: 76 young adults with BMI: 25.2-36.2, enrolled in a Weight and Body Fat Management program.

Statistical Analysis: Descriptives, 2-sample t-tests, multiple linear regression, and ANOVA for mean differences between groups and time; regression diagnostics for repeated measures of REE.

Results: A subgroup analysis showed that the mean (SD) weight loss of participants in the REE group was greater than the control group: –4.26 (3.32) kg versus –1.78 (3.20) kg respectively ($p<0.02$). Changes in body fat percent, cholesterol, LDL-C and triglycerides were not significantly different by treatment group over time.

Conclusions: Knowledge of REE results during weight loss promoted significantly more weight loss than usual education.

CHAPTER I: INTRODUCTION

STATEMENT OF THE PROBLEM

The prevalence of overweight and obesity is rising in the US population. Thirty-four percent of the US population is overweight and 30.9 percent is obese (Flegal, 2002). The current epidemic of overweight and obesity in the US is also apparent among Air Force personnel. The prevalence of overweight and obese members is estimated at 46% and 8% respectively (Ellin, 2002). The direct costs (increased medical care) and indirect costs (lost workdays) of excess body weight are high among active duty Air Force personnel. These body weight attributable costs were estimated at $19.3 million per year for direct costs and $3.5 million per year for indirect costs (Weight Management, 2003).

Active duty Air Force personnel are required to meet body weight and fat standards or they may be administratively discharged from military service. The Air Force provides a unique environment to study weight changes in that military members have access to medical providers to provide weight control education and there are both incentives and consequences for body weight and fat changes. However there is also the potential for inappropriate weight loss practices related to the desire to meet body weight and fat standards to avoid discharge (Weight Management, 2003).

The purpose of fitness and body composition standards is to select and maintain the individuals that are best suited to the physical requirements of military service. This is based on the assumption that "proper body weight and composition supports good health, physical fitness, and appropriate military appearance" (Atkinson, 2003). During

2001, 486 active duty Air Force personnel (333 males and 153 females) were discharged from military service for failure to meet weight and body fat standards (Weight Management, 2003). These separations resulted in monetary costs to the Air Force in the form of severance pay and additional costs to recruit and train replacements. These costs were estimated at $32.4 million for fiscal year 2001 (Ellin, 2002). The ultimate goal of this study was to increase the overall percentage of military individuals who meet and maintain body weight and body fat standards.

DEFINITION OF KEY TERMS

Total Energy Expenditure (TEE):

The total of all energy expended during a 24-hour day. This is the summation of all oxidative processes in the body. TEE consists of three components including the resting energy expenditure (about 60-75% of TEE), thermic effect of feeding (about 10% of TEE), and energy expended in physical activity (usually 15-30% of TEE but highly variable) (Coulston, 2001 & Stipanuk, 2000).

Basal Metabolic Rate (BMR):

The minimal amount of energy expended per hour in a thermo-neutral environment at complete physical and mental rest with at least a 12-hour fast (including caffeine and tobacco). It represents the energy used by the body for internal mechanical activities and maintenance of body temperature and is measured in the morning before any physical activity (Garrel, 1996 & Coulston, 2001).

Basal Energy Expenditure (BEE):

BMR multiplied by 24 hours resulting in BEE per 24 hours (Coulston, 2001).

Resting Metabolic Rate (RMR):

If any conditions for BMR are not met, the measured energy expenditure is termed RMR. RMR can be measured under less strict conditions that do not meet the precise definition of "basal energy." RMR is resting energy expended per hour. It is typically 5-15% greater than BMR and the difference is RMR includes the energy cost of arousal (increased brain activity and sustaining posture with muscle tone) and may include some thermic effects of food (Garrel, 1996 & Coulston, 2001 & Stipanuk, 2000).

Resting Energy Expenditure (REE):

RMR multiplied by 24 hours resulting in REE per 24 hours. REE that is determined by indirect calorimetry is the best indicator of total energy expenditure (Mifflin, 1990).

Usual Care:

Usual care for this research study refers to attendance at the Air Force Sensible Weigh program classes. A full description of these classes is presented in Chapter III: Methods.

PURPOSE OF THE STUDY

This study was designed to determine the effectiveness of informing participants of their measured REE plus provision of usual care versus providing usual care alone for promoting weight loss in participants in the Air Force Weight and Body Fat Management Program. Specifically, the purpose of this study was to determine if implementation of indirect calorimetry to measure REE and providing this information to the participant resulted in greater reductions in body weight and fat than provision of usual care alone in a population of active duty Air Force members who exceeded Air Force weight and body fat standards.

To this researcher's knowledge, no prior research has examined the effects of providing measured energy requirement information in addition to usual care on weight loss among overweight and obese adults. The goal of this research was to fill gaps in knowledge in this area and to explore the need for additional studies among a larger and more selective population. The rationale for this research was that providing more specific and individualized REE measurement information could potentially empower individuals toward weight loss. Historically it has been too expensive to measure REE in most weight loss settings. However, the MedGem^{TM} handheld device makes it possible to introduce measured REE in weight management programs in a cost-effective and generally convenient manner (Nieman, 2003).

HYPOTHESES

As compared to the group that receives usual care, the group receiving usual care plus measured REE will have:

1. Significantly reduced weight and body mass index (BMI) at the end of a 90-day intervention.
2. Significantly reduced body fat at the end of a 90-day intervention.
3. Significantly decreased total cholesterol, LDL-C, and triglycerides at the end of a 90-day intervention.

And thus will be more successful in meeting Air Force body weight and fat standards.

The magnitude of differences detectable in this research was estimated from previous Air Force results and a review of literature. Control group data was based on changes in body weight reported from the Davis-Monthan Air Force Base weight management program in 2002 (NOMAD database, 2003). In addition, a review of structured weight loss programs in observational studies, with length of education time similar to the usual care program (10 to 12 weeks) showed average weight loss of = 8.0 kg (Anderson, 2001). The degree of differentiation measurable in this research was estimated to be as follows. Mean weight change in control group = -3.0 kg (SD=4.0 kg) compared to intervention group = -6.0 kg. Mean change in BMI in the control group = -1.0 kg/m^2 (SD=1.3 kg/m^2) compared to the intervention group: BMI = -2.0 kg/m^2. Mean percent body fat change in the control group = -2.5% (SD=2.6%) compared to intervention group = -4.5%.

To this researcher's knowledge, there are no published data on implementation of MedGem™ measurement in the context of a weight management program. Therefore estimates for changes in outcome measures for active duty subjects were somewhat arbitrary but were based on general intervention effects reported in the literature as well as the author's clinical experience in this area. To test our hypothesis, Air Force members in the Weight and Body Fat Management Program at Davis-Monthan Air Force Base were selected as the target group.

CHAPTER II: REVIEW OF THE LITERATURE

Air Force Weight and Body Fat Management Program Through 2003

Active duty Air Force personnel must adhere to weight and body fat percentage standards or they may be administratively discharged from military service. Excess body weight is a significant predictor of the Air Force cycle ergometry test failure. The cycle ergometry test was the method of testing Air Force fitness standards through 2003. For men, overweight status was more strongly associated with failure on the cycle ergometry test than any other variable. For women, being overweight was the second most common variable associated with test failure following lack of exercise. Excess body weight also raises risks for chronic diseases including hypertension, cardiovascular disease, diabetes, and certain cancers. All of these factors can affect military readiness (Robbins, 2001).

Air Force Comprehensive Health Measurement Program

Air Force personnel receive official weight and height measurements at least annually. Those who exceed Air Force weight standards have their body fat percentage measured using a circumferential measurement technique with a Gulick tape measure. This method of assessment is the only acceptable method authorized by the Air Force (Air Force Instruction 40-502, 2002).

The Air Force maximum body fat standards are:

a) 20% of total body mass for males 18 to 29 years.

b) 24% of total body mass for males 30 years and above.

c) 28% of total body mass for females 18 to 29 years.

d) 32% of total body mass for females 30 years and above.

Personnel with measurements exceeding these limits are required to enroll in the 90-day weight and body fat reduction program (Air Force Instruction 40-502, 2002).

Prior to starting the weight and body fat reduction program, a medical provider conducts a complete medical evaluation including a patient examination, fasting lipid profile, glucose and thyroid tests, and medical records review. Members are cleared to begin a weight loss program if they do not have a medical reason that prevents them from losing the required body weight or fat each month in a safe and healthy manner. Females are required to lose three pounds of body weight or one percent body fat per month. Males are required to lose five pounds of body weight or one percent body fat per month (Air Force Instruction 40-502, 2002).

Failure to meet standards will result in various forms of reprimand depending on the number of previous failures. These range from verbal reprimand in the mildest form to administrative discharge in the most severe form. On the fourth subsequent month of unsatisfactory progress, the unit commander makes a recommendation to the base commander to retain or discharge the individual. The base commander makes the final decision to retain or discharge the individual. If the member is retained, this process will continue after each subsequent failure (Air Force Instruction 40-502, 2002). Four mandatory discharges occurred at Davis-Monthan Air Force Base during 2002 due to continued failure to meet weight and body fat standards (NOMAD database, 2003).

Personnel that have been medically cleared to enter a weight loss program enter a 90-day exercise and dietary intervention period (this is usual care). They are required to attend a 90-minute introductory weight management class at the Health and Wellness Center within 15 duty days from the date when non-compliance with body weight and body fat standards was established. They are also required to attend four additional education classes within the next 90 days. These classes focus on the areas of diet/nutrition, physical activity, and behavior modification education (Air Force Instruction 40-502, 2002). A full description of the education classes is presented in Chapter III: Methods.

In 2002, Davis-Monthan Air Force Base enrolled 209 individuals in the 90-day exercise and dietary intervention program for not meeting Air Force body weight and fat standards. Outcomes of these individuals at completion of the 90-day program were as follows:

a) 96 individuals (46%) did not meet standards (69 males and 27 females).
b) 53 individuals (25%) met standards (42 males and 11 females).
c) 60 individuals (29%) were unable to complete the 90-day program due to deployments, moving to a different base, or separating from military service (45 males and 15 females).

Air Force Fitness Program from 2004 to present:

A modified Air Force Fitness Program was initiated on 1 January 2004. On the same date, the Air Force Weight and Body Fat Management Program ended. The focus

of the new Fitness Program is to provide year-round structured physical activity intervention that includes aerobic conditioning, strengthening, flexibility training, as well as healthy eating. Weight standards are no longer identified or required. Instead physical fitness is the measured outcome of success because Air Force members need to be physically fit for Air Force missions and body weight and fat do not always insure fitness (Weight Management, 2003). The proposed health benefits of the new program include increased productivity, optimized level of overall health, decreased absenteeism, and improved level of readiness (Air Force Instruction 10-248, 2004).

The components of the new Fitness Program include: aerobic fitness, muscular strength, and body composition as indicators of overall fitness. The fitness score is a composite of four scored tests: 1.5 mile run, abdominal circumference, 1-minute timed push-up test and 1-minute timed sit-up test. Scoring is adjusted for age and gender standards. Weight and height are obtained but are not part of the composite score. Rather, they are used to compute BMI. Individuals with a BMI < 19kg/m^2 are referred for a medical evaluation. A score of 70 (out of 100 possible) represents the minimum accepted health, fitness, and readiness levels. If the score is less than 70, the individual is retested within 90 days during which time they participate in classes to facilitate lifestyle change in dietary patterns and improve physical fitness through increased physical activity (Air Force Instruction 10-248, 2004).

An important caveat to this research project was that individuals enrolled in the study after 1 October 2003 were evaluated against the new standards and thus were not required to complete the mandatory 90-day body weight and fat measurements because

their 90-day follow-up body weight and fat assessment fell on or after 1 January 2004. If an individual receives a composite fitness score of 70 or higher, all ineligibility conditions are removed. This includes a renewed ability for promotions, reenlistments, change of assignment, professional military education, and formal training. In addition, their Unfavorable Information File (UIF) and documents pertaining to the Weight and Body Fat Management Program will be removed when the passing score is achieved (Air Force Instruction 10-248, 2004). Due to the change in the Air Force program, subjects enrolled after 1 October 2003 were not held to the body weight and fat standards.

MedGem™ Indirect Calorimetry:

In the past, it was often cost-prohibitive to purchase and operate indirect calorimetry machines in most clinical settings. On 22 January 2002, the Food and Drug Administration approved a lower cost indirect calorimeter, the MedGem™. The MedGem™ is a handheld indirect calorimeter that weighs about five ounces (healthetech.com, 2004).

To complete an indirect calorimetry measurement using this instrument, the subject holds the MedGem™ unit in a sitting position for ten to 12 minutes. The subject breathes into a mouthpiece attached to the unit. A nosepiece is used during the test and prevents exchange of air through the nose. The operation of the MedGem™ is based on deactivation of ruthenium in the presence of oxygen. The active and reference ruthenium cells in the unit are excited by an internal light source and fluoresce. The reaction is quenched by oxygen and the level of quenching is proportional to the concentration of

oxygen. The oxygen sensor has a rapid response time and the oxygen concentration is sampled at 10 Hz. Sensors inside the unit measure oxygen consumption, ventilation, temperature, humidity, and barometric pressure (Healthetech™: MedGem™ specifications, 2004). Oxygen consumption is converted to REE in calories per day using a constant respiratory quotient of 0.85 and a modified Weir equation without measurement of carbon dioxide. The modified equation is: REE calories per day = 6.931xVO_2 mL/minute (Weir, 1949). The unit provides a readout of REE in kilocalories (kcals) per day and volume of oxygen consumed (VO_2) (healthetech.com, 2004).

The MedGem™ has been validated mechanically and during human-based tests conducted by the Healthetech™ Company as well as independent researchers (Healthetech™ reports #1 and #2, Nieman, 2003 & Melanson, 2003).

The mechanical validation was completed using a "metabolizer" which was based on a pair of motor driven, 3-liter syringes. The syringes simulate inspiration and expiration. The expiratory flow was provided from a tank of calibration gas that was heated and humidified before expiration through the MedGem™. The "metabolizer" can simulate a range of REEs by varying breathing frequency, tidal volume and expired gas concentration (Healthetech™ report #1). Twenty-two MedGem™ devices were tested six to seven times over three days. Use of the mechanical simulation device allowed evaluation of the technical capability without the impact of biological variability of human testing. The mean REE results ranged from 1,264 to 1,283 kcal/day. The intraclass reliability coefficient: r=0.98 showed high stability of performance among the MedGem™ units (Healthetech™ report #2).

BodyGem™ (a device highly similar to the MedGem™) produced by the same company, has been validated against the Douglas Bag technique. The validation and reliability study included 20 male and 43 female subjects who were tested with both the BodyGem™ and Douglas Bag. Mean age was 41.3 years (range: 21-69); mean BMI was 26.5 kg/m^2 (range: 19.1-56.2). Two separate tests were completed with each instrument in a random and counterbalanced order. Prior to each test, subjects fasted from food, beverages, and caffeine for at least four hours. They did not participate in strenuous exercise for at least 24 hours before the test. Within-day reliability for the BodyGem™ on both days was r=0.97. Mean REE results for all four tests of the BodyGem™ and Douglas Bag respectively were 1,657±324 (±SEE) kcal/day and 1,650±307 kcal/day; r=0.91 (Nieman, 2003).

The reliability and validity of the BodyGem™ was also compared to the metabolic cart measurements (SensorMedics: SM-2900 oxygen uptake system) among 47 healthy subjects. Subjects included 14 males with a mean age of 38 years (range: 21-61) and 27 females with a mean age of 42 years (range: 27-59). Mean BMI was 25.9 kg/m^2 for males (range: 20.7-35.0) and 26.2 kg/m^2 for females (range: 20.6-35.4). Tests were measured on two separate mornings after a 12-hour fast and 24-hour abstention from exercise, and were performed in a counterbalanced order. The trial-to-trial reliability for the BodyGem™ was r=0.92. Measurements from the BodyGem™ were highly correlated with the measurements from the SM-2900: r^2=0.79. The REE measured with the BodyGem™ was significantly higher than measurements from the SM-2900. The mean difference was 70±15 (±SD) kcal/day. The authors hypothesized that the higher

REE from the BodyGem™ may be caused by the elevated energy requirements needed to hold the BodyGem™ securely at the mouth. To determine if this caused a difference, ten subjects were measured with the SM-2900 while holding their hand in the simulated BodyGem™ position. The results showed a 15% decrease in mean difference with REE estimated at 61±20 kcal/day higher than the original SM-2900 results. Therefore, a portion of the difference in REE may be attributed to the energy demands of holding the BodyGem™ (Melanson, 2003). Based on the human studies, REE measurements with the MedGem™ will likely be similar to the Douglas bag measurements and be approximately 70 kcal/day higher than the metabolic cart. Based on current findings, no correction needs to be made to the REE measured by the MedGem™.

Thermic Effect of Food:

Dietary thermogenesis is the energy cost of digesting, absorbing, processing and storing nutrients (Saris, 1996). Weststrate, et al measured diet-induced thermogenesis in 103 males and females and determined with indirect calorimetry measurements that the thermic effect of consuming 310 to 620 kcals is nearly completed within three hours (Weststrate, 1993). Reed, et al determined the thermic effect of consuming 650 to 1395 kcals in 131 males and females lasted approximately six hours with indirect calorimetry measurements (Reed, 1996).

Diurnal Differences in REE:

Recent research compared REE measured in the morning and afternoon on repeated days to determine any variability. Twelve male and 25 female subjects who were 21 to 67 years old, had a BMI of 17-34 kg/m^2, and 6-54% body fat (measured with dual-energy X-ray absorptiometry) were enrolled into the study. Each subject received four total REE measurements with the SM-2900 metabolic cart. Two morning measurements were done after a 12-hour fast (including caffeine) and 12 hours post-exercise. Two afternoon measurements were done after a 4-hour fast (including caffeine) and 12 hours post-exercise. The results showed that mean afternoon measurements were significantly higher ($p<0.001$) than the morning measurements with a mean difference of 99 kcal/day. The two morning ($r=0.86$) and two afternoon ($r=0.90$) measurements were highly correlated. The mean morning measurements were 1508 ± 31 ($\pm$SE) kcal/day and 1511 ± 36 kcal/day. The mean afternoon measurements were 1594 ± 36 kcal/day and 1602 ± 29 kcal/day. Based on the study results, the authors suggest that it is acceptable to measure REE under less than standard conditions and that REE measured in the afternoon is expected to be approximately 100 kcal/day higher than REE measured in the morning. Therefore, a four to five hour fast appears to be ample time to decrease the thermic effect associated with food intake on REE (Haugen, 2003).

Trends of Energy Intake and Expenditure:

The prevalence of obesity in the US has increased from 14.5% to 30.9% from 1971 to 2000. During the same time, the energy intake of males increased from

2,450±28.8 (±SE) kcal/day to 2,618±29.6 kcal/day ($p<0.01$). The energy intake of females also increased from 1,542±14.8 kcal/day to 1,877±23.5 kcal/day ($p<0.01$). These results were based on the 24-hour recalls performed during four NHANES surveys during these time periods (CDC, 2004).

Leisure time physical inactivity decreased during 1988 to 2002 based on the Behavioral Risk Factor Surveillance System. Males decreased inactivity from 29% to 22% and females decreased from 32% to 28%. Although physical activity may be increasing, energy intake is also rising resulting in an overall weight increase during this time period (CDC, 2004).

Effects of Negative Energy Balance on REE:

Small increases in REE could have long-term benefits for reducing body weight since REE is the largest component of total energy expenditure (60-75%). Variations in REE occur due to body mass, body composition, gender, age, hormonal status, physical activity, and environmental factors (Coulston, 2001). A study examined potential REE differences in 40 males and females who were formerly obese (but had lost ≥13.6 kg of body weight and maintained the loss for greater than one year) plus 46 subjects who served as weight- and age-matched controls. Subjects had REE measured with indirect calorimetry (SM-2900). After adjusting for lean mass, fat mass, age, and sex, there were no significant differences in mean REE between the two groups. The reduced-obese mean REE was 5926±106 (±SD) kjoules (kj)/day and the control group's mean REE was

6015±104 kj/day (p=0.35). Authors found no evidence of increased energy efficiency in the subjects who had long-term weight loss maintenance (Wyatt, 1999).

A decline in REE may cause a significant decrease in overall daily energy requirements making weight loss and maintenance more difficult. Frey-Hewitt, et al examined 121 sedentary males, 30 to 59 years old who were randomly assigned to one of three groups. 1) Diet group where energy intake was decreased by 300 to 500 kcal/day based on their weight loss goals (no physical activity); 2) Exercise group where participants completed aerobic activity three times per week for 25 to 50 minutes (no restriction in energy intake); and 3) Control group who did not restrict energy or engage in additional physical activity. REE was measured with a standard open-circuit calorimeter after a 12-hour fast and 12 hours post-exercise. Body composition was determined with hydrodensitometry. After one year, the exercise group maintained fat-free mass (FFM) while the diet group lost 2% FFM ($p<0.01$ diet group versus control and exercise groups). The exercise and control groups maintained REE (adjusted for FFM) while the diet group had a 6% decrease in REE ($p<0.01$ diet group versus control group and $p<0.05$ diet group versus the exercise group) (Frey-Hewitt, 1990).

Wadden, et al studied 128 females, 41.1±8.6 (±SD) years old, BMI: 36.5±5.1 kg/m^2 who were placed on a 48-week energy restricted diet that started at 900 kcal/day and were advanced to 1500 kcal/day by Week 22. Authors found no significant differences in REE (measured after a 12-hour fast with DeltaTrac metabolic monitor) between subjects who participated in either aerobic, strength, or a combination of both exercises. The aerobic group's REE decreased by a mean of 20±125 (±SD) kcal/day, the

strength group's REE decreased by a mean of 46±206 kcal/day; and the combination (aerobic and strength training) group's REE decreased by a mean of 7±164 kcal/day from baseline REE (Wadden, 1997).

Kraemer, et al examined a total of 31 females, 35.4±8.5 (±SD) years old, including 25 with ≥120% of ideal body weight and 16 who served as age- and gender-matched controls. REE was measured with indirect calorimetry after a 10-hour fast. Results showed no difference in REE (kcal/kg FFM/day) after 12 weeks when comparing diet alone, diet + aerobic, or diet + aerobic + strength training groups (Kraemer, 1997).

Byrne, et al studied 19 sedentary females, age 18-45 years old, with a mean body fat of: 37.5±0.8% (±SD) measured with hydrodensitometry and determined REE changes (measured with SM-2900) in response to a 20-week physical activity intervention without an energy restriction. Results showed a significant decrease in REE ($p<0.05$) in the resistance training + walking group but no significant change in REE for the resistance training only group. This may be a result of an increased negative energy balance leading to a decreased mean REE in the resistance training + walking group (Byrne, 2001).

A study of nine obese and 11 nonobese subjects was done to determine the affects of a 10% body weight loss on REE. Subjects were placed on a 800-kcal/day energy-restricted diet until 10% of initial body weight was lost. Subsequently, energy intake was adjusted to maintain the new body weight for ≥2 weeks to measure REE at a stabilized lower body weight. REE was measured with indirect calorimetry with use of a Beckman MMC Horizon Metabolic Cart in the postabsorptive state. REE changes from initial body weight to 10% body weight loss (with stabilization of new lower weight) were as

follows: in nonobese subjects, mean REE significantly decreased from 29±3 (±SD) kcal/kg FFM to 26±3 kcal/kg FFM ($p<0.05$); in obese subjects, mean REE significantly decreased from 34±7 kcal/kg FFM to 30±4 kcal/kg FFM ($p<0.05$). This suggested weight loss resulted in a decline in REE (Leibel, 1995). The reduced REE measurements during or immediately after weight loss may show a metabolic adaptation to negative energy balance or the reduced cost of substrate movement caused by reduced energy intake or a combination of both. Additionally, loss of FFM during weight loss will decrease REE (Wyatt, 1999).

Self-Monitoring:

An important aspect of this research was to determine whether the subjects who received information in regard to their REE measurements actually used this information to meet weight loss goals. Self-monitoring has been positively correlated with weight loss. Subjects who consistently self-monitor lose more weight than those who are less consistent and self-monitoring through food records has been shown to positively affect eating behaviors by providing feedback to the individual making changes (Boutelle, 1998).

An essential consideration is that measurement of energy requirements by indirect calorimetry will result in weight reduction if the subject ingests and expends energy at a level that induces an energy deficit (McClave, 2001). If the subject alters energy intake and expenditure appropriately based on the REE measurements, and uses self-monitoring, the desired outcome of weight control will likely occur.

REE Predictive Equations:

A precise calculation of energy requirements is important in clinical settings. Appropriate medical nutrition therapy is especially important for patients with diabetes, cardiovascular disease, obesity, and those at risk for malnutrition. During the last 100 years, over 200 predictive equations for determining REE have been published. Predictive equations used for calculating REE are usually based on age, gender, height, and weight. The equations are useful for determining REE in groups but are not always accurate on the individual level because they often misclassify specific groups including obese children and adults, which can result in considerable error in nutrition recommendations (McClave, 2002).

Previous studies have examined the relationship between predictive equations and REE measured with indirect calorimetry. Garrel, et al studied 39 males and 28 females with a BMI of 19-26 kg/m^2. A comparison was done between indirect calorimetry measured with DeltaTrac and the following predictive equations: Mifflin, Owen, Bernstein, James, Robertson and Reid, Harris-Benedict, and WHO formulas. The Owen equation was the most accurate as 95% males and 82% females were within $\pm$10% of their measured REE (Garrel, 1996).

A 2003 study including 54 males and 76 females with a BMI of 19-97 kg/m^2 was completed to compare indirect calorimetry measured with the DeltaTrac and the following predictive equations: Harris-Benedict, adjusted weight Harris-Benedict, Owen and Mifflin formulas. The adjusted Harris-Benedict was used for subjects with a BMI>30 kg/m^2: adjusted weight = [(actual body weight – ideal body weight) x 0.25] +

ideal body weight. Results showed the Mifflin equation was accurate more often than Harris-Benedict or Owen equations for both obese and non-obese subjects (Mifflin: 78% of subjects were $\pm$10% of measured REE). The adjusted weight Harris-Benedict equation resulted in underestimation of measured REE in 100% of subjects with a BMI>40 kg/m^2. Therefore authors recommended discontinuing the use of adjusted weight in the Harris-Benedict equation (Frankenfield, 2003).

Siervo, et al examined 157 females and compared indirect calorimetry measured with the SM-2900 metabolic cart to the following predictive equations: Harris-Benedict, Owen, Mifflin, WHO, Bernstein, and Robertson-Reid formulas. The results were based on three separate BMI ranges: normal, overweight, and obese. The Owen equation was the most accurate for those with a BMI<25 kg/m^2, Bernstein equation was most precise for females 25$\leq$BMI<30 kg/m^2, and Robertson-Reid was most accurate for those with a BMI$\geq$30 kg/m^2. The most accurate equation in each BMI range had a mean difference between predictive and measured REE of $\leq$1% (Siervo, 2003).

A study of 35 sedentary women with a BMI range of 18.0-50.0 kg/m^2, were measured REE with DeltaTrac metabolic monitor and compared measurements to the following predictive equations: Harris-Benedict, Owen, Mifflin, Bernstein, James, and WHO formulas. All predictive equations were significantly higher than measured REE ($p<0.001$ for all). However, the Mifflin equation [5708.4$\pm$902.8 ($\pm$SD) kj/day] was most highly correlated and had the lowest root mean square error compared to measured REE (4265.8$\pm$676.9 kj/day) (Staten, 2001).

Thirty-one healthy female subjects, 24.0±4.4 (±SD) years old, with a BMI of 31.8±5.0 kg/m^2 were placed on an energy restricted diet for ≥4 weeks until they lost ≥5% of their initial body weight. Mean REE at baseline was 1533.1±243.1 kcal/day and mean REE measured immediately following the loss of body weight was 1311.8±169.6 kcal/day. The REE measured after weight loss was significantly lower ($p<0.001$) than baseline REE. Researchers compared the mean REE results measured at baseline and post-weight reduction to predictive equations and determined that the following equations significantly overestimated REE immediately following body weight loss: Harris-Benedict, Mifflin, Bernstein, World Health Organization, and Robertson-Reid formulas ($p<0.001$ for all). The authors suggested that using REE predictive equations to determine REE during body weight loss may yield an overestimated value for predicted REE (Siervo, 2003). This may be a consideration for the subjects in this study as they were likely in a weight loss phase during REE measurements These results supported the benefits of measured REE as opposed to using a predictive equation for REE, especially during weight loss.

Previous research showed a variety of results for predictive equations used to estimate REE. In the Air Force weight program, energy requirements are estimated by multiplying weight in kg x 25 kcal/kg and deducting 250-500 kcal/day from REE to set energy intake to meet weight loss goals (Air Force Nutrition Care Guidelines, 2003). However, each person has his or her own metabolic requirements. Measuring, rather than calculating requirements, allows for more accurate and individualized energy recommendations (Staten, 2001).

From the research cited, there is a variety of data on validation studies of the MedGem™, changes in REE during periods of body weight change, and the potential inaccuracy of predictive equations to calculate REE compared to REE measured with indirect calorimetry. This study considered past knowledge and contributes to the scientific data by examining the relationship between knowledge of REE measurements and changes in body weight and fat over time (90 days).

CHAPTER III: METHODS

STUDY DESIGN

This study was a randomized intervention trial with two groups: 1) intervention group, which received usual care plus results of REE measurements; and 2) control group, which received usual care. The protocol received approval from the Wilford Hall Medical Center Institutional Review Board, Lackland Air Force Base, San Antonio, Texas on 22 April 2003. To test the hypotheses, the investigator conducted a clinical intervention and followed each subject in both groups for 90 days. All subjects were recruited from participants in a diet and exercise class at the Health and Wellness Center at Davis-Monthan Air Force Base. At the end of the class, a registered dietitian (the principle investigator) invited study participation. Potential subjects were given a study welcome letter (Appendix A). Those interested in the study were asked to return to the Health and Wellness Center within seven days for study enrollment and consents. At that time, participants completed baseline research measurements. Subjects were randomly assigned to one of two intervention groups. A random list of numbers was computer-generated and subjects drew a random number. Those selecting an even number were placed in the intervention group (usual care plus REE measurements). Those selecting an odd number were placed in the control group (usual intervention).

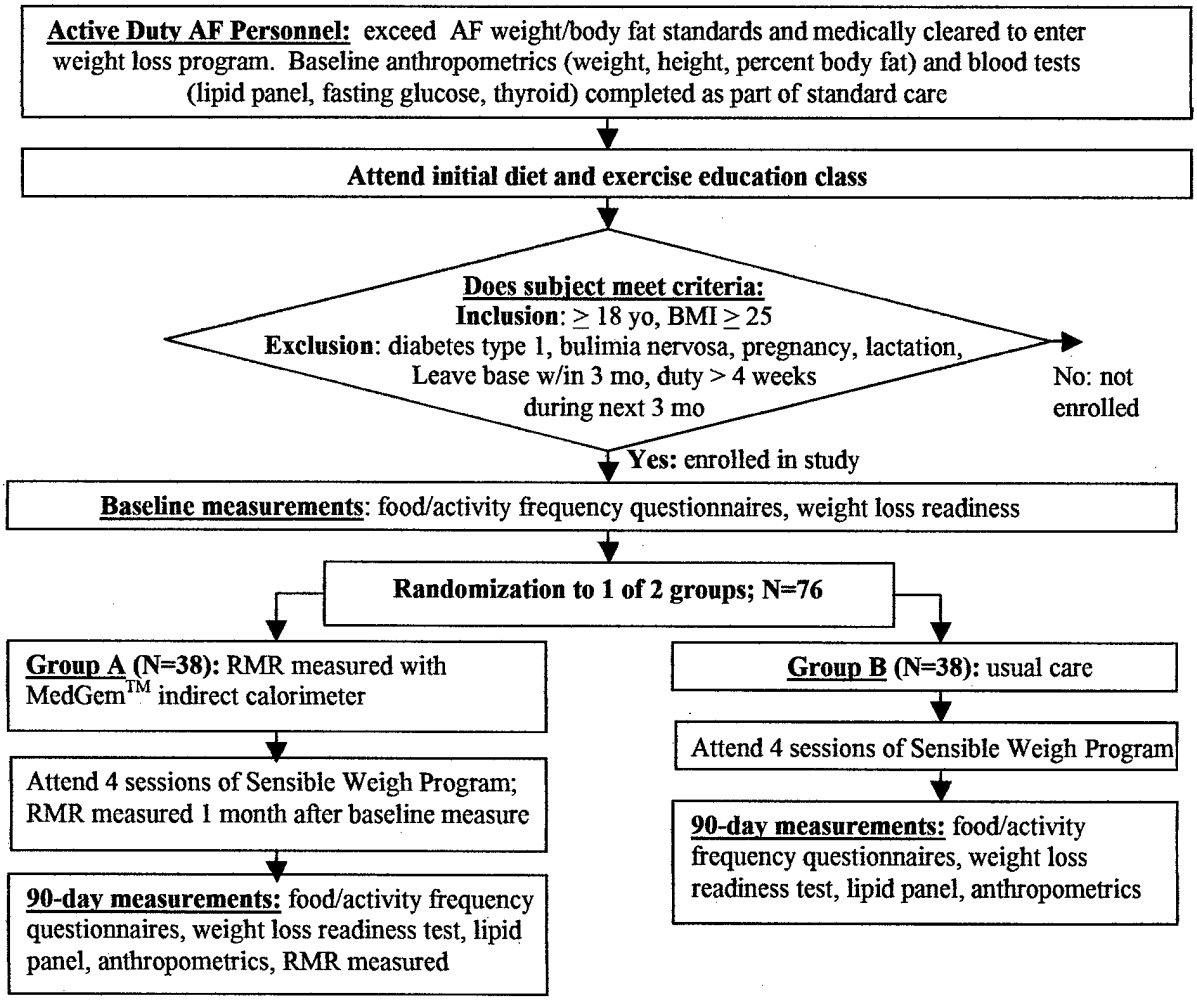
Each group received the intervention as follows:

1. Intervention Group: REE was measured using the MedGem™ handheld indirect calorimeter at baseline, 30 days, and 90 days. Subjects were immediately

informed of their REE results. They also received usual care, which included attendance at the Air Force Sensible Weigh program (full description of program follows).

2. Control Group: Subjects received usual care (attendance at the Air Force Sensible Weigh program.)

STUDY SCHEMATIC:



USUAL CARE: THE SENSIBLE WEIGH PROGRAM

Nutrition/exercise education is a method used by the Air Force to decrease the prevalence of overweight active duty individuals. Air Force personnel who exceed the weight and body fat standards receive a medical evaluation by a medical provider. Personnel who have been medically cleared to enter a weight loss program enter a 90-day exercise and dietary intervention. The program allows each individual 90 days to meet weight and body composition compliance without administrative action. Individuals are required to attend an initial diet and exercise education class and all four classes of the Sensible Weigh Program (Air Force Instruction 40-502, 2002).

The initial diet and exercise class is 90 minutes in length and covers basic weight loss principles, food portion sizes, basic behavior modification and exercise information. Food documentation using food records is emphasized.

Subjects in both groups attended the Sensible Weigh Program. This four-session course includes group education on nutrition (including food record keeping), physical activity, and behavior modification. The program is held at the Health and Wellness Center and the Health Promotion Manager oversees the program. Information and content is standardized for all subjects. The Sensible Weigh program includes the following sessions (each session is 60 minutes in length):

1. **Master Strategies for a Healthy Lifestyle**: This session is taught by a registered dietitian or certified diet therapy technician and provides a program overview, rules of engagement, strategies for a healthy eating plan, energy intake goals, meal planning strategies, goal setting, and a personal food journal. At the

first class, individuals receive energy goals calculated by multiplying their body weight (kg) by 25 kcal/kg and deducting 250 to 500 kcal/day for weight loss (in accordance with Air Force Nutrition Care Guidelines).

2. **Nutrition and Making a Permanent Lifestyle Change**: This session is taught by a registered dietitian or certified diet therapy technician and educates on the role of BMI in health, food label reading, healthy selections when dining out, the pros/cons of fad diets, and tips for maintaining change in eating patterns/behaviors.

3. **Energize Through Exercise**: This session is taught by an exercise physiologist and covers aerobic and resistance training, flexibility, injury prevention, and motivation/tips for success.

4. **Successful Behavior Change**: This session is taught by a life skills provider. Topics include the ABC's of behavior change, healthy self-talk/positive attitudes, preventing relapse and collapse, goal setting, and monitoring your habits (Spahn, 1998).

POPULATION AND SAMPLING

One hundred and ninety-eight active-duty Air Force men and women at Davis-Monthan Air Force Base who exceeded their Air Force body weight and fat standards were invited to participate. Subjects did not receive monetary payment for participation in this study.

The criteria for eligibility included: active duty Air Force personnel who exceeded Air Force body weight and fat standards and were cleared by an Air Force medical provider to enter a weight loss program, $\geq$ 18 years of age, BMI $\geq$ 25 kg/m^2, and provided written consent to participate in this study. The exclusion criteria included diabetes type 1, bulimia nervosa, pregnancy, lactation, knowledge of moving to a new permanent duty location or deployment within the next three months, or knowledge of temporarily going to a different duty location for greater than four weeks during next three months. Military members with diabetes type 1 were excluded because wide variations in REE results and weight fluctuations, based on degree of glucose control, have been reported in this population (McClave, 2002).

Sample size estimation/power analysis: Sample size and power projection were based on Davis-Monthan Air Force Base program results from 2002. During 2002, 28.7% of individuals did not complete the usual care due to deployment, moving to a new permanent duty location, or discharges from the Air Force. Our exclusion criteria did not allow enrollment of those who had knowledge of their inability to stay at Davis-Monthan Air Force Base during the next 90 days. Therefore, the estimated completion rate was estimated to be higher than 2002 results and was estimated at 80%. Enrollment: N=70 subjects x 80% yielded N=56 for study completion (N=28 per group).

Statistical significance was determined at overall 2-sided alpha=0.05 with N=56 total subjects using a 2-sample comparison of means. This study enabled the detection of the following changes for N=28 per group. The estimated power for detecting a mean group difference weight change of 3.0 kg was 80.1%. The estimated power for detecting

a mean group difference in percent body fat of 2.0% was 82.1%. The estimated power for detecting a mean group difference in BMI of 1.0 kg/m^2 was 82.1%.

INFORMED CONSENT

The Wilford Hall Medical Center Institutional Review Board (IRB), Lackland Air Force Base, San Antonio, Texas approved the Informed Consent Document (ICD) (Appendix B) and the Health Insurance Portability & Accountability Act (HIPAA) authorization form (Appendix C). All subjects signed both forms prior to the intervention and the research-driven data collection. The original ICD and HIPPA forms were retained by the primary investigator. One copy was given to each subject, another copy was maintained in outpatient records at Davis-Monthan Air Force Base, a third copy was mailed to the IRB at Lackland Air Force Base and permanently retained (Air Force Instruction 40-402, 2000).

CONFIDENTIALITY

During this study, the confidentiality of all subjects was maintained. All data was identified by a unique study identification number and was not linked to names, social security numbers, or telephone numbers. Identifiers were kept separately from collected data. The study records were maintained by the primary investigator while affiliated with Davis-Monthan Air Force Base. Upon reassignment, records were transferred to Davis-Monthan Air Force Base (Air Force Instruction 40-402, 2000).

DATA COLLECTION

Study Measurements: Trained medical personnel at the Davis-Monthan Air Force Base Medical Clinic and Health and Wellness Center administered/collected the following study measurements.

For Subjects in Both the Control and Intervention Groups:

a. Anthropometrics: were measured prior to attendance at the initial diet and exercise class (baseline) and again at 90 days. These included weight, height, BMI, and body fat percent using Air Force approved circumferential measurements. These measurements were conducted to determine mean changes between groups. Body weight, height and body fat circumference measurements were completed before 10:00 AM. Females were not measured during or three days prior to their menstrual cycle (Air Force Instruction 40-502, 2002).

Weight was measured while the individual wore a uniform with shoes removed. The individual stood on a balance beam scale placed on a non-carpeted surface or Plexiglas. The scale was calibrated every 12 months. Weight was recorded to the nearest 0.25 pound and three pounds were subtracted for the weight of the uniform. Height was measured with shoes removed. The individual stood on a non-carpeted floor or hard fixed surface. The individual faced the measurer and had heels together, straight back, and line of sight was horizontal. A calibrated index marked off in 0.25-inch increments mounted to the wall was used. The measurement was taken against this index using a drafting triangle. The measurement was read directly in front of the drafting triangle. The height was rounded up to the nearest 0.25 inch and was recorded. BMI was

calculated from the weight and height measurements using the formula weight/height^2 (kg/m^2) (Air Force Instruction 40-502, 2002).

Body fat measurements were conducted by trained and certified technicians. Circumferential measures were taken with a Gulick tape measure at the following sites: neck and abdomen for males; neck, waist, and buttocks for females. The measurements were converted to percent body fat with the following formulas (circumference measurements and height are in centimeters):

a) Males:

Density = $-0.191 \times \text{Log}_{10}$(abdomen I* - neck) + $0.155 \times \text{Log}_{10}$(height) + 1.032

Percent fat = $100 \times [(4.95/\text{density}) - 4.5]$ ($R = 0.90$, SEE = 3.52)

b) Females:

Density = $-0.350 \times \text{Log}_{10}$(abdomen II† + hip + neck) + $0.221 \times \text{Log}_{10}$ (height) + 1.296

Percent fat = $100 \times [(4.95/\text{density}) - 4.5]$ ($R = 0.85$, SEE = 3.72)

* **Abdomen I** is the circumference, measured in transverse plane, at the level of the umbilicus.

† **Abdomen II** is the "natural waist" and is defined as the smallest circumference, measured in the transverse plane, obtained between the lower margin of the xiphoid process and the umbilicus (DoD Instruction 1308.3 & Air Force Instruction 40-502, 2002).

b) Weight loss questionnaire: was completed by each subject before the initial diet and exercise class. This included demographics (age, gender, military rank), clinical assessment (medication and vitamin/mineral supplement use), medical history, and self-

reported weight and dieting history. The weight loss assessment was part of standard care for all participants during the first class at the Health and Wellness Center and was conducted to determine whether differences between groups existed at baseline. (Appendix D)

c) Energy intake: was estimated from the Arizona Food Frequency Questionnaire (AFFQ), which was completed by each participant within seven days of study enrollment and again at 90 days. The AFFQ was conducted to determine differences in energy and macronutrient intake between the two groups. The AFFQ is a 153 item semi-quantitative questionnaire that collected information on the types and frequency of foods and beverages consumed using age and gender estimates of portion sizes (small, medium, or large). Each time, subjects were asked to complete the questionnaire based on their previous month's intake. The AFFQ has been previously calibrated against 24-hour dietary recalls (Thomson, 2003) and 4-day food records (Martinez, 1999). (Appendix H)

d) Energy expenditure: was estimated within seven days of study enrollment and again at 90 days by having subjects complete the Arizona Activity Frequency Questionnaire (AAFQ). The AAFQ was conducted to determine differences in energy expenditure compared to weight changes over time between the two groups. The AAFQ groups monthly activities in the following categories: occupation (eight items), sleep (one item), recreation (23 items), leisure (17 items), home maintenance/repairs (six items), household chores (12 items), and personal care (one item). For each activity performed, individuals selected from four frequency and four duration ranges. Metabolic equivalents

were assigned to each activity. The AAFQ was validated with doubly labeled water as a reference (Staten, 2001). Subjects were asked to fill out the forms based on their previous month's activity habits. (Appendix I)

e) Biological samples: at baseline and again at 90 days, a fasting specimen of blood was collected to assess plasma lipoproteins (total cholesterol, LDL-C, HDL-C, and triglycerides) and fasting glucose. These were done to determine changes over time between the two groups. Thyrotropin (TSH) was also performed at baseline to determine potential differences between the two groups. At these times, approximately 16 mL of blood was drawn by a certified laboratory technician after the subject fasted $\geq$12 hours. Laboratory analysis of the blood samples was performed at the Davis-Monthan Air Force Base Clinic Laboratory using Ortho Diagnostics Chemistry Products and Ortho Diagnostics Clinical Chemistry Slides. LDL-C levels were calculated from results of total cholesterol, HDL-C, and triglycerides (Friedwald, 1972). The following formula was used for the calculations:

LDL-C = total cholesterol – HDL-C – triglycerides/5

All specimens kept at the Davis-Monthan Laboratory were handled and disposed of in accordance with federal regulations.

f) The weight loss readiness test: (American Health Publishing Company, 2000) was completed by the subjects at baseline and again at 90 days to determine readiness to change eating behaviors and potential differences between body weight, BMI, and body fat within groups. The test included six categories: 1) Goals and Attitudes; 2) Hunger and Eating Cues; 3) Control over Eating; 4) Binge Eating and Purging; 5) Emotional

Eating; and 6) Exercise Patterns and Attitudes. The scoring guide for the six categories of the weight loss readiness test is found in Figure 1. Permission for use in this study was granted on 4 April 2003 by David L. Hager, CEO, American Health Publishing Company. (Appendix E)

Figure 1. Scoring Guide For Six Categories of the Weight Loss Readiness Test

Category	Score Range	Scoring Guide: Goals and Attitudes
0	24-30	"The path is clear with respect to goals and attitudes."
1	17-23	"You may be close to being ready to begin a program but should think about ways to boost your readiness before you begin."
2	6-16	"This may not be a good time for you to start a weight-loss program. Inadequate motivation and commitment, together with unrealistic goals could block your progress. Think about those things that contribute to this, and consider changing them before undertaking a program."
		Scoring Guide: Hunger Cues
0	10-15	"Some or most of your eating may be in response to thinking about food or exposing yourself to temptations to eat. Think of ways to minimize your exposure to temptations, so that you eat only in response to physical hunger."
1	7-9	"You may have a moderate tendency to eat just because food is available. Weight loss may be easier for you if you try to resist external cues, and eat only when you are physically hungry."
2	3-6	"You might occasionally eat more than you would like, but it does not appear to be a result of high responsiveness to external cues. Controlling the attitudes that make you eat may be especially helpful."
		Scoring Guide: Control Over Eating
0	12-15	"You may be prone to overeat after an event breaks your control or throws you off the track. Your reaction to these eating events can be improved."
1	8-11	"You do not seem to let unplanned eating disrupt your program. This is a flexible, balanced approach."
2	3-7	"You recover rapidly from mistakes. However, if you frequently alternate between eating out of control and dieting very strictly, you may have a serious eating problem and should get

		professional help."
		Scoring Guide: Binging
0	0-1	"It appears that binge eating and purging is not a problem for you."
1	2-11	"Pay attention to these eating patterns. Should they arise more frequently, get professional help."
2	12-19	"You show signs of having a potentially serious eating problem. See a counselor experienced in eating disorders right away."
		Scoring Guide: Emotional Eating
0	12-15	"Emotional ups and downs can stimulate your eating. Try to deal with the feelings that trigger the eating, and find other ways to express them."
1	9-11	"You sometimes eat in response to emotional highs and lows. Monitor this behavior to learn when and why it occurs, and be prepared to find alternative activities."
2	3-8	"You do not appear to let your emotions affect your eating."
		Scoring Guide: Exercise
0	17-20	"It looks like the path is clear for you to be active. Now think of ways to get motivated."
1	11-16	"You need to feel more positive about exercise so you can do it more often. Think of ways to be more active that are fun and fit into your lifestyle."
2	4-10	"You are probably not exercising as regularly as you should. Determine whether your attitudes about exercise are blocking your way, then change what you must and put on those walking shoes."

Source for Scoring: Brownell, 1997

Intervention Tool for Subjects in Intervention Group only:

The MedGem™ indirect calorimeter was used to assess REE for subjects in the intervention group at baseline, 30 days later, and 90 days after baseline. Subjects in the control group were given a REE assessment after completion of the 90-day follow-up appointment as an incentive to return for this appointment.

Subjects were asked to abstain from food, beverage (except water), caffeine, tobacco, and alcohol for four to six hours before the REE measurement, and no physical exercise for two to four hours before the measurement. Three subjects who did not meet the criteria were rescheduled for the following duty day. Consequently, 100% of subjects reported adherence to these requirements at the time of their REE measurements. Ninety-five percent stated fasting overnight for ≥12 hours from food and beverages (except water) and ≥12 hours post exercise (one subject ingested a caffeine-containing soda six hours before the test; another subject engaged in physical activity four hours before the test). Subjects were provided with written instructions "Resting Metabolic Rate Instructions," before their test. (Appendix F)

Prior to the test, subjects rested in a relaxation chair in a reclined position for at least 15 minutes. The MedGem™ was calibrated prior to each test by placing the unit on a flat surface with no air movement and initiating auto-calibration for five seconds. The subject was instructed to breathe into the MedGem™ mouthpiece naturally and evenly during the duration of the test. Each measurement lasted approximately 10 to 12 minutes and the measurement was repeated once immediately following the first measurement.

Results and interpretation of the test were provided both orally and in writing to each subject. Females received information regarding potential variability of results based on their menstrual cycle. The following calculations were performed:

a) Mean REE was divided by 0.75 to determine total energy expenditure (TEE).

b) 250 to 500 kcal/day were subtracted from TEE to give a daily range for weight loss calories. This range was provided for potential daily fluctuations in activity levels.

The one-page sheet "What Affects My Resting Metabolic Rate" was provided to each intervention subject. (Appendix G)

DATA MANAGEMENT AND ANALYSIS

Data were maintained in an Excel™ file on the desktop computer of the principal investigator. Data were collected/entered by the principal investigator and the associate investigator. To assess quality of data 10% of all data were randomly selected and examined for accuracy by an unbiased staff member. Behavioral Measurement Shared Service (BMSS), Tucson, Arizona, supplied all Arizona Food Frequency Questionnaires (AFFQ) and Arizona Activity Frequency Questionnaires (AAFQ). BMSS provided an accurate and reliable source of technical support for these assessment instruments in the form of optical scanning, quality control/assurance, and data analysis. The AFFQs and AAFQs were double-scanned to ensure accuracy of data entry and checks were done for outliers. AFFQs and AAFQs missing more than ten items would not be included in the results. However this did not apply to any questionnaires in this study. The researcher examined each questionnaire before allowing the subject to depart their appointment. If any questions were not completed, the researcher had the subject complete the missing information. Consequently, no questionnaires were missing items.

Statistical analysis was done with STATA® software (version 8.0, STATA Corporation, College Station, TX) using standard descriptive statistics, two-sample t-tests with equal variances, multiple linear regression and one-way analysis of variance (ANOVA). Statistical significance was set at $p < 0.05$. Demographic and physical characteristics comparison was run between the two groups pre-treatment and included age, military rank, weight, BMI, body fat percent, and biological samples (cholesterol, LDL, HDL, triglycerides, glucose, and thyrotropin).

Primary outcome measures between the two groups were changes from baseline to 90 days in weight, BMI, percent body fat, cholesterol, LDL, HDL, triglycerides, and ability to meet Air Force body fat and weight standards. Secondary outcome measures were mean changes in physical activity level based on results of the Arizona Activity Frequency Questionnaire, and mean changes in energy intake based on the Arizona Food Frequency Questionnaire. Additional comparisons were done to determine if other measurements affected results of the study including weight loss readiness scores and number of education sessions attended. Additionally, changes in REE from baseline to 30 days and 90 days were compared for subjects in the intervention group with a generalized estimating equation (GEE) approach.

CHAPTER IV: RESULTS

STUDY SAMPLE

Seventy-six males and females participated in this research study and were randomized across the two study groups. The subjects were 18-46 years of age, with a body weight range of 65.0-124.1 kg, BMI of 25.2-36.2 kg/m^2, and body fat of 21-44%. The subjects self-reported the following race/ethnic identifications: 65.8% Caucasian, 21.0% Black, and 13.2% Hispanic.

Table 1 shows the baseline physical characteristics of the control and intervention groups. The two-sample t-test comparisons revealed no significant differences in age, gender, anthropometrics (body weight, fat, BMI), blood biochemistries (cholesterol, HDL-C, LDL-C, triglycerides, glucose, TSH), total energy expenditure and military rank between the two groups at baseline. The two-sample t-test comparison shows a significant difference in energy intake between the two groups at baseline ($p=0.04$).

Of the 38 control group subjects, 31 (81.6%) returned for the 90-day anthropometric measurements. Subjects who did not return included: one subject who became pregnant; three who did not return because of medical waivers, or their unit did not appropriately schedule their 90-day appointment; and three who did not return because the Air Force ended the body weight and fat standards on 1 January 2004 and they were not required to return for anthropometric measurements.

Of the 38 intervention group subjects, 29 (76.3%) returned for the 90-day anthropometric measurements. Subjects who did not return include: one subject who

became pregnant; one who was discharged from the Air Force; four who did not return because of medical waivers, or their unit did not appropriately schedule their 90-day appointment; and three who did not return because the Air Force ended the body weight and fat standards on 1 January 2004 and they were not required to return for anthropometric measurements.

Table 1. Baseline Physical Characteristics Comparison Between Groups

Characteristics	Control	Intervention	P
	(N=38)	(N=38)	
Age, y	28.87 (7.68)	29.50 (7.60)	0.72
Men %	65.79%	76.32%	0.32
Women %	34.21%	23.68%	
Weight, kg	90.46 (14.35)	91.27 (13.67)	0.80
BMI, kg/m^2	29.74 (2.39)	29.97 (2.36)	0.67
Body Fat %	29.16 (5.35)	27.76 (4.47)	0.22
Lipids	(N=33)	(N=35)	
Cholesterol, mg/dL	190.91 (39.94)	199.00 (35.87)	0.38
HDL-C, mg/dL	43.30 (16.30)	45.09 (10.62)	0.59
LDL-C, mg/dL	116.23 (34.20)	125.12 (33.29)	0.29
Triglycerides, mg/dL	155.52 (93.22)	141.09 (72.14)	0.48
Glucose, mg/dL	91.30 (11.45)	88.71 (6.21)	0.41
Thyrotropin (TSH), μU/mL	1.50 (0.82)	1.40 (0.83)	0.63
Food Frequency Questionnaire	(N=38)	(N=38)	
Energy, kcal/day	2066.23 (817.26)	2702.85 (1696.67)	0.04
Activity Frequency Questionnaire	(N=38)	(N=38)	
TEE, kcal/day	3482.78 (1014.26)	3526.53 (946.53)	0.85
Rank	(N=38)	(N=38)	
Officer	0%	2.63%	0.32
Junior Enlisted (E-1 to E-4)	42.11%	48.65%	0.58
Senior Enlisted (E-5 to E-9)	57.89%	48.72%	

Values represent mean (±SD) for continuous variables, (%) for categorical variables. P-value determined with two-sample t-test with equal variance.

Table 2 shows the mean changes in anthropometrics, blood chemistries, diet, and physical activity between the control and intervention groups from baseline to 90 days. The two-sample t-test revealed no significant differences between groups in mean changes for physical characteristics (body weight, BMI, and body fat) from baseline to 90 days, although the intervention group had a larger mean decrease in body weight, BMI, and body fat. Additionally, the intervention group had a greater mean decrease in body weight and BMI, which showed a borderline significant p-value for a trend ($p<0.1$) compared to the control group (body weight: –3.40 versus –1.91, intervention versus control group, respectively). There were no significant differences in lipids (cholesterol, HDL-C, LDL-C, and triglycerides), ability to meet Air Force body weight and body standards, or mean changes in physical activity expenditure (leisure, recreation, occupation, or total energy expenditure) based on the Arizona Activity Frequency Questionnaire (AAFQ) results. There were significant between group differences in dietary intake based on the Arizona Food Frequency Questionnaire (AFFQ) results. The intervention group had a significantly greater reduction in mean energy, protein, total fat, saturated fat, monounsaturated fat, polyunsaturated fat, and dietary cholesterol intake as compared to the control group.

Table 3a shows the mean changes in anthropometrics, blood chemistries, diet, and physical activity within all subjects in the control group only from baseline to 90 days. The two-sample t-test revealed no significant differences in change in body weight, BMI, and body fat, lipids (cholesterol, LDL-C, HDL-C, and triglycerides) from baseline to 90 days. In addition, no significant differences in dietary intake based on AFFQ results, or

physical activity expenditure based on AAFQ results were seen over time. Table 3b shows a reanalysis with control subjects who have a complete data set for baseline and 90-day measurements. The two-sample t-test showed a significant decrease in body weight, BMI, and body fat from baseline to 90 days ($p<0.01$ for all). In addition, there was a significant decrease in protein, total fat, carbohydrate, energy intake, fiber, saturated fat, monounsaturated fat, and polyunsaturated fat from baseline to 90 days ($p\leq0.01$ for all).

Table 4a shows the mean changes in anthropometrics, blood chemistries, diet, and physical activity for all subjects within the intervention group from baseline to 90 days. The two-sample t-test comparison revealed significant differences in mean changes in dietary intake results based on the AFFQ for decreased intake of energy, protein, total fat, saturated fat, monounsaturated fat, polyunsaturated fat, and dietary cholesterol from baseline to 90 days. There were no significant differences in mean change scores in physical activity expenditure, anthropometrics (body weight, BMI, body fat), or lipids (cholesterol, HDL-C, LDL-C, triglycerides). Table 4b shows a reanalysis with intervention subjects who have a complete data set for baseline and 90-day measurements. The two-sample t-tests showed significant decreases in body weight, BMI, and body fat from baseline to 90 days ($p<0.0001$ for all). There was also a significant decrease in protein, total fat, carbohydrate, energy intake, fiber, dietary cholesterol, saturated fat, monounsaturated fat, polyunsaturated fat and leisure energy expenditure ($p\leq0.01$ for all).

Table 2. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Between Groups from Baseline to 90 Days

Characteristics	Control	Intervention	P
Physical characteristics	(N=31)	(N=29)	
Weight, kg	-1.91 (2.94)	-3.40 (3.14)	0.06
BMI, kg/m^2	-0.60 (1.01)	-1.07 (1.12)	0.09
Body Fat %	-1.29 (2.57)	-2.00 (2.35)	0.27
Lipids	(N=17)	(N=17)	
Cholesterol, mg/dL	-1.53 (24.52)	-1.12 (17.70)	0.96
HDL-C, mg/dL	+1.71 (6.87)	+2.41 (7.64)	0.78
LDL-C, mg/dL	-2.02 (19.53)	-4.31 (14.27)	0.70
Triglycerides, mg/dL	-6.29 (79.78)	+3.87 (16.63)	0.69
Met Air Force Standards	(N=31)	(N=29)	
Weight	22.58%	13.79%	0.39
Body Fat %	12.90%	20.69%	0.43
Food Frequency Questionnaire	(N=29)	(N=35)	
Protein, g	-15.87 (29.29)	-46.78 (52.01)	0.01
Total Fat, g	-20.34 (35.52)	-45.27 (41.89)	0.01
Carbohydrate, g	-60.54 (118.65)	-111.92 (144.97)	0.13
Energy, kcal	-468.03 (815.01)	-1058.90 (1071.26)	0.02
Fiber, g	-6.54 (10.54)	-6.59 (9.92)	0.98
Dietary cholesterol, mg	-26.07 (121.27)	-162.09 (287.80)	0.02
Saturated fat, g	-6.87 (13.70)	-15.25 (13.70)	0.02
Monounsaturated fat, g	-7.56 (15.01)	-17.83 (16.96)	0.01
Polyunsaturated fat, g	-4.32 (7.85)	-8.72 (9.20)	<0.05
Activity Frequency Questionnaire	(N=28)	(N=34)	
Leisure kcal/day	-61.53 (311.62)	-95.78 (213.10)	0.61
Recreation kcal/day	+69.66 (369.20)	+26.81 (364.22)	0.65
Occupational kcal/day	+6.55 (336.80)	-16.59 (684.73)	0.87
TEE kcal/day	-63.36 (446.03)	-87.56 (660.12)	0.87

Values represent mean (±SD) for continuous variables, (%) for categorical variables.
P-value determined with two-sample t-test with equal variance.

Table 3a. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Within Control Group from Baseline to 90 Days (All Control Subjects)

Characteristics	Baseline	Follow-Up	P
Physical characteristics	(N=38)	(N=31)	
Weight, kg	90.46 (14.35)	88.17 (14.28)	0.51
BMI, kg/m^2	29.74 (2.39)	29.16 (2.70)	0.35
Body Fat %	29.15 (5.35)	27.23 (5.69)	0.15
Lipids	(N=33)	(N=17)	
Cholesterol, mg/dL	190.91 (39.94)	189.94 (30.15)	0.93
HDL-C, mg/dL	43.30 (16.30)	49.71 (21.54)	0.24
LDL-C, mg/dL	116.23 (34.20)	112.00 (29.34)	0.67
Triglycerides, mg/dL	155.52 (93.22)	141.18 (57.90)	0.57
Food Frequency Questionnaire	(N=38)	(N=29)	
Protein, g	83.01 (30.85)	71.73 (38.05)	0.18
Total Fat, g	69.78 (34.69)	56.91 (25.92)	0.10
Carbohydrate, g	288.14 (124.81)	239.01 (145.96)	0.14
Energy, kcal	2066.23 (817.26)	1726.33 (882.91)	0.11
Fiber, g	23.48 (15.13)	17.91 (11.31)	0.10
Dietary cholesterol, mg	222.47 (102.71)	215.95 (131.33)	0.82
Saturated fat, g	23.29 (12.52)	19.06 (9.53)	0.14
Monounsaturated fat, g	26.70 (14.27)	21.93 (9.84)	0.13
Polyunsaturated fat, g	13.91 (8.87)	11.21 (5.38)	0.15
Activity Frequency Questionnaire	(N=38)	(N=28)	
Leisure kcal/day	655.4 (359.98)	602.66 (344.14)	0.55
Recreation kcal/day	416.40 (395.56)	430.44 (312.97)	0.88
Occupational kcal/day	1410.44 (728.07)	1359.68 (771.51)	0.79
TEE kcal/day	3482.78 (1014.26)	3352.86 (927.20)	0.60

Values represent mean (±SD) for continuous variables, (%) for categorical variables.
P-value determined with two-sample t-test with equal variance.

Table 3b. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Within Control Group from Baseline to 90 Days (Control Subjects with Complete Data Sets)

Characteristics	Baseline	Follow-Up	P
Physical characteristics	(N=31)	(N=31)	
Weight, kg	90.08 (13.92)	88.17 (14.28)	<0.01
BMI, kg/m^2	29.77 (2.40)	29.16 (2.70)	<0.01
Body Fat %	28.52 (5.01)	27.23 (5.69)	<0.01
Lipids	(N=16)	(N=16)	
Cholesterol, mg/dL	190.88 (39.10)	187.63 (29.54)	0.60
HDL-C, mg/dL	47.19 (20.60)	48.75 (21.87)	0.39
LDL-C, mg/dL	113.28 (33.89)	112.32 (30.27)	0.85
Triglycerides, mg/dL	152.06 (80.93)	132.75 (47.84)	0.22
Food Frequency Questionnaire	(N=29)	(N=29)	
Protein, g	87.61 (31.89)	71.73 (38.05)	<0.01
Total Fat, g	77.25 (34.62)	56.91 (25.92)	<0.01
Carbohydrate, g	299.54 (137.68)	239.01 (145.96)	0.01
Energy, kcal	2194.38 (867.47)	1726.33 (882.91)	<0.01
Fiber, g	24.47 (16.63)	17.91 (11.31)	<0.01
Dietary cholesterol, mg	242.03 (103.14)	215.95 (131.33)	0.26
Saturated fat, g	25.93 (12.63)	19.06 (9.53)	0.01
Monounsaturated fat, g	29.48 (14.55)	21.93 (9.84)	0.01
Polyunsaturated fat, g	15.54 (9.36)	11.21 (5.38)	<0.01
Activity Frequency Questionnaire	(N=28)	(N=28)	
Leisure kcal/day	664.20 (409.19)	602.66 (344.14)	0.31
Recreation kcal/day	360.78 (336.73)	430.44 (312.97)	0.33
Occupational kcal/day	1353.14 (664.22)	1359.68 (771.51)	0.92
TEE kcal/day	3416.23 (955.81)	3352.86 (927.20)	0.46

Values represent mean (±SD) for continuous variables, (%) for categorical variables.
P-value determined with two-sample t-test with equal variance.

Table 4a. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Within Intervention Group from Baseline to 90 Days (All Intervention Subjects)

Characteristics	Baseline	Follow-Up	P
Physical characteristics	(N=38)	(N=29)	
Weight, kg	91.27 (13.67)	90.18 (12.76)	0.74
BMI, kg/m^2	29.97 (2.36)	29.15 (2.35)	0.16
Body Fat %	27.76 (4.47)	25.59 (4.47)	0.05
Lipids	(N=35)	(N=17)	
Cholesterol, mg/dL	199.00 (35.87)	203.41 (28.23)	0.66
HDL-C, mg/dL	45.09 (10.62)	46.47 (14.78)	0.70
LDL-C, mg/dL	125.12 (33.28)	123.89 (31.50)	0.90
Triglycerides, mg/dL	141.09 (72.14)	149.00 (53.88)	0.70
Food Frequency Questionnaire	(N=38)	(N=35)	
Protein, g	113.64 (72.50)	72.09 (46.77)	0.01
Total Fat, g	101.03 (65.83)	60.69 (44.72)	<0.01
Carbohydrate, g	331.64 (221.71)	237.07 (175.30)	<0.05
Energy, kcal	2702.85 (1696.67)	1780.09 (1232.62)	0.01
Fiber, g	23.73 (15.45)	18.42 (15.15)	0.14
Dietary cholesterol, mg	395.20 (302.27)	250.50 (209.40)	0.02
Saturated fat, g	33.89 (22.27)	20.19 (15.43)	<0.01
Monounsaturated fat, g	39.61 (26.29)	23.76 (17.39)	<0.01
Polyunsaturated fat, g	19.45 (12.70)	11.71 (9.02)	<0.01
Activity Frequency Questionnaire	(N=38)	(N=34)	
Leisure kcal/day	666.54 (293.88)	590.55 (206.64)	0.21
Recreation kcal/day	482.79 (429.04)	548.39 (441.24)	0.52
Occupational kcal/day	1353.28 (727.67)	1404.64 (581.56)	0.74
TEE kcal/day	3526.53 (946.53)	3573.41 (689.50)	0.81

Values represent mean (±SD) for continuous variables, (%) for categorical variables.
P-value determined with two-sample t-test with equal variance.

Table 4b. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Within Intervention Group from Baseline to 90 Days (Intervention Subjects with Complete Data Sets)

Characteristics	Baseline	Follow-Up	P
Physical characteristics	(N=29)	(N=29)	
Weight, kg	93.58 (13.16)	90.18 (12.76)	<0.0001
BMI, kg/m^2	30.22 (2.12)	29.15 (2.35)	<0.0001
Body Fat %	27.59 (4.66)	25.59 (4.47)	<0.0001
Lipids	(N=17)	(N=17)	
Cholesterol, mg/dL	204.53 (23.36)	203.41 (28.23)	0.80
HDL-C, mg/dL	44.06 (11.08)	46.47 (14.78)	0.21
LDL-C, mg/dL	128.10 (31.59)	123.89 (31.50)	0.25
Triglycerides, mg/dL	145.13 (57.63)	149.00 (53.88)	0.82
Food Frequency Questionnaire	(N=35)	(N=35)	
Protein, g	118.86 (72.40)	72.09 (46.77)	<0.001
Total Fat, g	105.95 (65.85)	60.69 (44.72)	<0.0001
Carbohydrate, g	334.00 (222.13)	237.07 (175.30)	0.001
Energy, kcal	2838.99 (1691.58)	1780.09 (1232.62)	<0.0001
Fiber, g	25.01 (15.35)	18.42 (15.15)	<0.001
Dietary cholesterol, mg	412.59 (306.29)	250.50 (209.40)	<0.01
Saturated fat, g	35.45 (22.32)	20.19 (15.43)	<0.0001
Monounsaturated fat, g	41.59 (26.31)	23.76 (17.39)	<0.0001
Polyunsaturated fat, g	20.43 (12.71)	11.71 (9.02)	<0.0001
Activity Frequency Questionnaire	(N=34)	(N=34)	
Leisure kcal/day	686.33 (284.72)	590.55 (206.64)	0.01
Recreation kcal/day	521.58 (436.75)	548.39 (441.24)	0.67
Occupational kcal/day	1421.24 (726.88)	1404.64 (581.56)	0.89
TEE kcal/day	3660.96 (909.08)	3573.41 (689.50)	0.44

Values represent mean (±SD) for continuous variables, (%) for categorical variables.
P-value determined with two-sample t-test with equal variance.

CONFOUNDING FACTORS

There are many factors that may influence body weight and fat changes. Thus, analysis of the data included evaluation of several potential effect modifiers or confounders. In fact, the Air Force Weight and Body Fat program and research-driven tools provided a variety of information about each subject, allowing for examination of those factors. Factors that may have a confounding influence on body weight, BMI, and body fat changes, for which information was available, included: gender, Weight Loss Readiness Test scores, smoking status, and potential differences among subjects enrolled before 1 October 2003 versus after this date due to the transition from the Air Force Weight and Body Fat Management Program to the new Fitness Program.

Gender

Table 5 shows the mean changes in body weight, BMI, and body fat within the control group by gender. The two-sample t-tests showed no significant difference between males and females for the mean changes in body weight, BMI, and body fat in the control group over time (0 to 90 days). Multiple linear regression determined adjusted r^2=0.07 (p=0.81), which showed gender did not improve the prediction of mean changes in body weight, BMI, and body fat in the control group over time.

Table 5. Mean Changes in Anthropometrics Within Control Group By Gender From Baseline to 90 Days

Characteristics	Males	Females	P
Physical characteristics	(N=21)	(N=10)	
Weight, kg	-2.10 (2.87)	-1.52 (3.21)	0.61
BMI, kg/m^2	-0.64 (0.88)	-0.52 (1.30)	0.75
Body Fat %	-1.29 (2.47)	-1.30 (2.91)	0.99

Values represent mean (±SD) for continuous variables.
P-value determined with two-sample t-test with equal variance.

Table 6 shows the mean changes in body weight, BMI, and body fat within the intervention group by gender. The two-sample t-tests showed no significant differences between males and females for the mean differences in body weight, BMI, and body fat in the intervention group over time (0 to 90 days). Multiple linear regression determined adjusted r^2=0.11 (p=0.11), which showed gender did not improve the prediction of mean changes in body weight, BMI, and body fat in the intervention group over time.

Table 6. Mean Changes in Anthropometrics Within Intervention Group By Gender From Baseline to 90 days

Characteristics	Males	Females	P
Physical characteristics	(N=24)	(N=5)	
Weight, kg	-3.65 (3.21)	-2.18 (2.73)	0.35
BMI, kg/m^2	-1.13 (1.16)	-0.82 (1.02)	0.59
Body Fat %	-1.83 (2.44)	-2.80 (1.79)	0.41

Values represent mean (±SD) for continuous variables.
P-value determined with two-sample t-test with equal variance.

Weight Loss Readiness Test Scores

The procedures for the Weight Loss Readiness Test were presented in Chapter III: Methods. An example of the Weight Loss Readiness Test is presented in Appendix E. The questionnaire consists of six categories that are scored separately. The subjects

completed the questionnaires but were not given the results of their scores as this was a research tool and the primary investigator did not intend to impact the usual care. An exception was the three subjects (one in the control group, and two in the intervention group) that scored ≥12 on the "binging" section, which indicates moderate to severe problems with binging behaviors in the past and/or present. The primary investigator did not inform subjects of their score in the binging section but asked if they desired any assistance in this area. In the control group, the one subject who scored in the range of 12-19 is receiving psychological treatment for different reasons and is not diagnosed with bulimia. Two subjects in the intervention group scored in the range of 12-19. One received psychological treatment in the past for bulimic behaviors and stated this was not a present problem; the other stated that she was no longer engaging in the behaviors (the questionnaire asked if an individual had ever engaged in binging/purging behaviors).

Each of the six categories will be presented separately with the baseline results compared to the mean weight changes in the control and intervention groups. The scoring guide for all categories was presented in Chapter III: Methods.

1) Goals and Attitudes: Table 7 shows the mean changes in body weight within the control group by the corresponding "Goals and Attitudes" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section. Table 8 shows the mean changes in body weight within the intervention group by the corresponding "Goals and Attitudes" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section.

Table 7. Mean Change in Weight Within Control Group by Goals and Attitudes Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0	-2.32 (3.95)	14	0.70
1	-1.70 (1.75)	15	
2	-0.57 (2.73)	2	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

Table 8. Mean Change in Weight Within Intervention Group by Goals and Attitudes Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0	-3.80 (3.16)	15	0.29
1	-3.30 (3.03)	13	
2	-1.36 (0)	1	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

2) Hunger Cues: Table 9 shows the mean changes in body weight within the control group by the corresponding "Hunger Cues" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section. Table 10 shows the mean changes in body weight within the intervention group by the corresponding "Hunger Cues" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section.

Table 9. Mean Change in Weight Within Control Group by Hunger Cues Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0	-1.96 (1.84)	6	0.50
1	-1.46 (2.66)	18	
2	-3.03 (4.28)	7	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

Table 10. Mean Change in Weight Within Intervention Group by Hunger Cues Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0	-2.89 (4.51)	4	0.83
1	-3.71 (2.64)	17	
2	-2.99 (3.76)	8	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

3) Control Over Eating: Table 11 shows the mean changes in body weight within the control group by the corresponding "Control Over Eating" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section. Table 12 shows the mean changes in body weight within the intervention group by the corresponding "Control Over Eating" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section.

Table 11. Mean Change in Weight Within Control Group by Control Over Eating Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0	-2.5 (0)	1	0.81
1	-2.34 (2.76)	11	
2	-1.63 (3.16)	19	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

Table 12. Mean Change in Weight Within Intervention Group by Control Over Eating Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0		0	0.62
1	-3.07 (3.28)	13	
2	-3.67	16	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

4) Binging: Table 13 shows the mean changes in body weight within the control group by the corresponding "Binging" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section. Table 14 shows the mean changes in body weight within the intervention group by the corresponding "Binging" scores. ANOVA revealed there was a significant difference in mean body weight changes based on the scores for this section from baseline to 90 days.

Table 13. Mean Change in Weight Within Control Group by Binging Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0	-1.85 (2.84)	18	0.98
1	-1.95 (3.33)	12	
2	-2.50 (0)	1	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

Table 14. Mean Change in Weight Within Intervention Group by Binging Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0	-4.26 (2.46)	14	0.03
1	-3.28 (3.30)	13	
2	+1.84 (0.67)	2	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

Table 15 shows the mean changes between the control and intervention groups after excluding the three subjects who scored ≥12 in their responses to the binging section, which is indicative of moderate to severe problems with binging behaviors in the past and/or present. Two-sample t-tests revealed that the intervention group had a significantly greater decrease in body weight and BMI compared to the control group

over the 90-day study. Although the intervention group also demonstrated a greater mean decrease in body fat than the control group subjects, this decrease did not reach statistical significance.

Table 15. Mean Changes in Anthropometrics Between Groups From Baseline to 90 Days: Subjects Who Scored ≥12 on Binging Section Excluded

Characteristics	Control	Intervention	P
Physical Characteristics	(N=30)	(N=27)	
Weight, kg	-1.89 (2.99)	-3.79 (2.88)	0.02
BMI, kg/m^2	-0.59 (1.03)	-1.22 (1.01)	0.02
Body Fat %	-1.30 (2.61)	-2.11 (2.36)	0.23

Values represent mean (±SD) for continuous variables.
P-value determined with two-sample t-test with equal variance.

5) Emotional Eating: Table 16 shows the mean changes in body weight within the control group by the corresponding "Emotional Eating" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section. Table 17 shows the mean changes in body weight within the intervention group by the corresponding "Emotional Eating" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section.

Table 16. Mean Change in Weight Within Control Group by Emotional Eating Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0	-2.50 (0)	1	0.90
1	-2.58 (2.29)	3	
2	-1.82 (3.09)	27	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

Table 17. Mean Change in Weight Within Intervention Group by Emotional Eating Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0		0	0.77
1	-2.95 (1.31)	4	
2	-3.47 (3.35)	25	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

6) Exercise: Table 18 shows the mean changes in body weight within the control group by the corresponding "Exercise" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section. Table 19 shows the mean changes in body weight within the intervention group by the corresponding "Exercise" scores. ANOVA revealed there was not a significant difference in mean body weight changes based on the scores for this section.

Table 18. Mean Change in Weight Within Control Group by Exercise Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0	-1.36 (4.12)	11	0.66
1	-2.44 (1.92)	14	
2	-1.67 (2.62)	6	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

Table 19. Mean Change in Weight Within Intervention Group by Exercise Scores From Baseline to 90 Days

Category*	Mean Weight, kg (±SD)	N	P
0	-3.30 (1.13)	8	0.57
1	-2.74 (3.07)	11	
2	-4.21 (4.23)	10	

P determined with one-way analysis of variance.
* Scoring guide for each category is presented in Chapter III: Methods.

Smoking Status

Table 20 shows the mean changes in body weight, BMI, and body fat from baseline to 90 days in the control group based on smoking status of the subjects at baseline (current smokers versus nonsmokers). The two-sample t-tests showed no significant differences between current smokers and nonsmokers in the mean differences in body weight, BMI, and body fat in the control group. Multiple linear regression determined adjusted r^2=0.08 (p=0.85), which showed that smoking status did not improve the prediction of changes in body weight, BMI, and body fat in the control group over time.

Table 20. Mean Changes in Anthropometrics From Baseline to 90 Days Within Control Group By Smoking Status

Characteristics	Current Smoker	Nonsmoker	P
Physical characteristics	(N=9)	(N=22)	
Weight, kg	-1.19 (3.50)	-2.21 (2.72)	0.39
BMI, kg/m^2	-0.36 (1.07)	-0.70 (1.00)	0.41
Body Fat %	-1.11 (2.85)	-1.36 (2.52)	0.81

Values represent mean (±SD) for continuous variables.
P-value determined with two-sample t-test with equal variance.

Table 21 shows the mean changes in body weight, BMI, and body fat from baseline to 90 days in the intervention group based on smoking status of the subjects at baseline (current smokers versus nonsmokers). The two-sample t-tests showed no significant differences between current smokers and nonsmokers in the mean differences in body weight, BMI, and body fat in the intervention group. Multiple linear regression determined adjusted r^2=0.01 (p=0.45), which showed that smoking status did not improve

the prediction of changes in body weight, BMI, and body fat in the intervention group over time.

Table 21. Mean Changes in Anthropometrics From Baseline to 90 Days Within Intervention Group By Smoking Status

Characteristics	Current Smoker	Nonsmoker	P
Physical characteristics	(N=6)	(N=23)	
Weight, kg	-4.05 (3.38)	-3.23 (3.13)	0.58
BMI, kg/m^2	-1.22 (1.16)	-1.03 (1.13)	0.72
Body Fat %	-1.33 (3.01)	-2.17 (2.19)	0.44

Values represent mean (±SD) for continuous variables.
P-value determined with two-sample t-test with equal variance.

Transition from Weight and Body Fat Management Program to new Fitness Program

Table 22a shows the mean changes in anthropometrics, blood chemistries, diet, and physical activity between the control and intervention group in a sub-group analysis of subjects enrolled before 1 October 2003 and thus who were required to meet body weight and body fat standards. The two-sample t-test comparisons revealed significant differences between groups for changes in body weight and BMI over time. In addition, reported dietary intake based on the AFFQ for energy, protein, total fat, saturated fat, monounsaturated fat, polyunsaturated fat, and dietary cholesterol were also significantly different across the two groups at 90 days. There were no significant differences in physical activity expenditures based on the AAFQ, lipids (cholesterol, HDL-C, LDL-C, triglycerides), or meeting Air Force body weight or fat standards between the two groups over time.

Table 22a. Mean Changes in Anthropometrics, Blood Chemistries, Diet, and Physical Activity Between Groups From Baseline to 90 Days: Subjects Enrolled Before 1 October 2003 (N=44)

Characteristics	Control	Intervention	P
Physical characteristics	(N=25)	(N=19)	
Weight, kg	-1.78 (3.20)	-4.26 (3.32)	0.02
BMI, kg/m^2	-0.57 (1.11)	-1.38 (1.10)	0.02
Body Fat %	-1.52 (2.79)	-2.79 (2.30)	0.11
Lipids	(N=16)	(N=14)	
Cholesterol, mg/dL	-2.19 (25.17)	-4.29 (13.61)	0.78
HDL-C, mg/dL	+1.88 (7.06)	+1.21 (7.37)	0.80
LDL-C, mg/dL	-1.78 (20.15)	-5.62 (10.60)	0.54
Triglycerides, mg/dL	+1.88 (7.06)	+1.21 (7.37)	0.80
Meet Air Force Standards	(N=25)	(N=19)	
Weight	24.00%	21.05%	0.82
Body Fat %	16.00%	31.58%	0.23
Food Frequency Questionnaire	(N=23)	(N=23)	
Protein, g	-12.84 (28.85)	-48.26 (57.48)	0.01
Total Fat, g	-22.05 (38.66)	-48.38 (48.25)	<0.05
Carbohydrate, g	-59.77 (127.38)	-125.57 (159.38)	0.13
Energy, kcal	-474.14 (882.27)	-1155.00 (1267.10)	0.04
Fiber, g	-6.48 (9.42)	-5.82 (10.75)	0.83
Dietary cholesterol, mg	-16.00 (130.57)	-156.27 (338.36)	0.07
Saturated fat, g	-7.70 (15.22)	-16.05 (16.07)	0.08
Monounsaturated fat, g	-8.12 (16.10)	-19.03 (19.29)	0.04
Polyunsaturated fat, g	-4.62 (8.42)	-9.65 (10.25)	0.08
Activity Frequency Questionnaire	(N=22)	(N=22)	
Leisure kcal/day	-50.40 (258.19)	-93.85 (222.40)	0.55
Recreation kcal/day	+115.87 (360.90)	-52.06 (358.31)	0.13
Occupational kcal/day	+22.62 (351.24)	-9.32 (841.33)	0.87
TEE kcal/day	+9.25 (432.58)	-160.21 (774.10)	0.38

Values represent mean (SD) for continuous variables, (%) for categorical variables.
P-value determined with two-sample t-test with equal variance.

Table 22b shows the mean changes in anthropometrics and blood chemistries between the control and intervention group in a sub-group analysis of subjects enrolled after 1 October 2003 and thus who were not required to meet body weight and body fat

standards. The two-sample t-test comparisons revealed no significant differences between groups for changes in body weight, BMI, and body fat over time.

Table 22b. Mean Changes in Anthropometrics and Blood Chemistries Between Groups From Baseline to 90 Days: Subjects Enrolled After 1 October 2003 (N=16)

Characteristics	Control	Intervention	P
Physical characteristics	(N=6)	(N=10)	
Weight, kg	-2.47 (1.49)	-1.75 (1.98)	0.46
BMI, kg/m^2	-0.67 (0.28)	-0.48 (0.95)	0.65
Body Fat %	-0.33 (1.03)	-0.50 (1.65)	0.83
Lipids	(N=1)	(N=3)	
Cholesterol, mg/dL	+9.00	-13.67 (30.07)	NA
HDL-C, mg/dL	-1.00	-8.00 (7.55)	NA
LDL-C, mg/dL	-6.00	-1.33 (28.18)	NA
Triglycerides, mg/dL	+80.00	+1.21 (7.37)	NA

Values represent mean (SD) for continuous variables.
P-value determined with two-sample t-test with equal variance.

PRIMARY OUTCOMES: HYPOTHESIS TESTING

Hypothesis 1

Hypothesis 1: as compared to the group that receives usual care, the group receiving usual care plus measured REE will have significantly reduced weight and body mass index (BMI) at the end of a 90-day intervention.

Table 2 shows the mean body weight change from baseline to 90 days in the control group (N=31) was –1.91 (±2.94) (±SD) kg and the intervention group (N=29) was –3.40 (±3.14) kg. This was not a significant difference, although showed marginal significance (p=0.06). The mean BMI change from baseline to 90 days in the control

group was –0.60 (±1.01) kg/m^2 and the intervention group was –1.07 (±1.12) kg/m^2. This was not a significant difference, although showed a trend (p=0.09).

Table 22a shows the mean physical change in a subgroup analysis from baseline to 90 days of the subjects that enrolled before 1 October 2003. Subjects enrolled after this date were not required to meet Air Force weight and body fat standards. The mean body weight difference in the control group (N=25) was –1.78 (±3.20) kg and the intervention group (N=19) was –4.26 (±3.32) kg. This was a significant difference (p=0.02). The mean BMI change from baseline to 90 days in the control group was –0.57 (±1.11) kg/m^2 and the intervention group was –1.38 (±1.10) kg/m^2. This was a significant difference (p=0.02).

Table 15 shows the mean physical changes from baseline to 90 days in a subgroup analysis of subjects with a Binging score of ≥12 on the Weight Loss Readiness Test. The mean body weight difference in the control group (N=30) was –1.89 (±2.99) kg and the intervention group (N=27) was –3.79 (±2.88) kg. This difference was significant between groups (p=0.02). The mean BMI changes from baseline to 90 days in the control group was –0.59 (±1.03) kg/m^2 and the intervention group was –1.22 (±1.01) kg/m^2. This was also a significant difference between groups (p=0.02).

Thus, there were significant differences in the mean changes in body weight and BMI in the intervention group versus the control group during a subgroup analysis of: 1) the subjects enrolled before 1 October 2003, and 2) Binging scores ≥12 as determined with two-sample t-tests. Therefore the hypothesis was not rejected.

Hypothesis 2

Hypothesis 2: as compared to the group that receives usual care, the group receiving usual care plus measured REE will have significantly reduced body fat at the end of a 90-day intervention.

Table 2 shows the mean body fat change from baseline to 90 days. The mean difference in the control group (N=31) was –1.29 (±2.57) percent and the intervention group (N=29) was –2.00 (±2.35) percent. This was not a significant difference (p=0.27).

Table 22a shows the mean body fat change from baseline to 90 days in a subgroup analysis of the subjects that enrolled before 1 October 2003. The mean difference in the control group (N=25) was –1.52 (±2.79) percent and the intervention group (N=19) was –2.79 (±2.30) percent. This was not a significant difference (p=0.11).

Table 15 shows the mean body fat change from baseline to 90 days in a subgroup analysis of subjects with a Binging score of ≥12 on the Weight Loss Readiness Test. The mean body fat difference in the control group (N=30) was –1.30 (±2.61) percent and the intervention group (N=27) was –2.11 (±2.36) percent. This difference was not significant between groups (p=0.23).

There were not significant differences in the mean changes in body fat in the intervention group versus the control group as determined with two-sample t-tests so the hypothesis was rejected.

Hypothesis 3

Hypothesis 3: as compared to the group that receives usual care, the group receiving usual care plus measured REE will have significantly decreased total cholesterol, LDL-C, and triglycerides at the end of a 90-day intervention.

Table 2 shows the mean changes in total cholesterol, LDL-C, and triglycerides from baseline to 90 days. The mean total cholesterol difference in the control group (N=17) was –1.53 (±24.52) mg/dL and the intervention group (N=17) was –1.12 (±17.70) mg/dL. This was not a significant difference (p=0.96). The mean LDL-C difference in the control group was –2.02 (±19.53) mg/dL and the intervention group was –4.31 (±14.27) mg/dL. This was not a significant difference (p=0.70). The mean difference in triglycerides in the control group was –6.29 (±79.78) mg/dL and the intervention group was +3.87 (±16.63) mg/dL. This was not a significant difference (p=0.69).

Table 22a shows the mean changes in total cholesterol, LDL-C, and triglycerides from baseline to 90 days in a subgroup analysis of the subjects that enrolled before 1 October 2003. The mean total cholesterol difference in the control group (N=16) was –2.19 (±25.17) mg/dL and the intervention group (N=14) was –4.29 (±13.61) mg/dL. This was not a significant difference (p=0.78). The mean LDL-C difference in the control group was –1.78 (±20.15) mg/dL and the intervention group was –5.62 (±10.60) mg/dL. This was not a significant difference (p=0.54). The mean difference in triglycerides in the control group was +1.88 (±7.06) mg/dL and the intervention group was +1.21 (±7.37) mg/dL. This was not a significant difference (p=0.80).

There were not significant differences in the mean changes in total cholesterol, LDL-C, and triglycerides in the intervention group versus the control group as determined with two-sample t-tests so the hypothesis was rejected.

SECONDARY OUTCOMES

1) Mean Change in Energy Intake

Energy intake was measured with the AFFQ at baseline and again at 90 days. Table 2 shows the mean energy intake change from baseline to 90 days. The mean difference in the control group (N=29) was –468.03 (±815.01) kcal/day and the intervention group (N=35) was –1058.90 (±1071.26) kcal/day. This was a significant difference (p=0.02).

Table 22a shows the mean energy intake change from baseline to 90 days in a subgroup analysis of the subjects that enrolled before 1 October 2003. The mean difference in the control group (N=23) was –474.14 (±882.27) kcal/day and the intervention group (N=23) was –1155.00 (±1267.10) kcal/day. This was a significant difference (p=0.04).

2) Mean Change in Physical Activity

Energy expenditure and physical activity was measured with the AAFQ at baseline and again at 90 days. Table 2 shows the mean energy expenditure change from baseline to 90 days. The mean increase in recreation-based physical activity in the control group (N=28) was +69.66 (±369.20) kcal/day and the intervention group (N=34) was +26.81 (±364.22) kcal/day. This was not a significant difference (p=0.65). The

mean decrease in total energy expenditure in the control group was –63.36 (±446.03) kcal/day and the intervention group was –87.56 (±660.12) kcal/day. This was not a significant difference (p=0.87).

Table 22a shows the mean energy expenditure change from baseline to 90 days in a subgroup analysis of the subjects that enrolled before 1 October 2003. The mean difference in recreation-based physical activity in the control group (N=22) was +115.87 (±360.90) kcal/day and the intervention group (N=22) was –52.06 (±358.31) kcal/day. This was not a significant difference (p=0.13). The mean difference in total energy expenditure in the control group was +9.25 (±432.58) kcal/day and the intervention group was –160.21 (±774.10) kcal/day. This was not a significant difference (p=0.38).

3) Change in REE in Intervention Group

A generalized estimating equation (GEE) approach was used to model the three repeated measures (baseline, 30 days, and 90 days) per subject in the intervention group. Both compound symmetry and unstructured correlation patterns were investigated, with the unstructured chosen due to a better model fit and uneven spacing of the times of measurement. The parameter estimate for the effect of time on REE was tested for statistical significance.

Table 23 shows the mean REE measurements for the 38 intervention group subjects. Figure 2 shows the REE values during the 3 repeated measures in the intervention group.

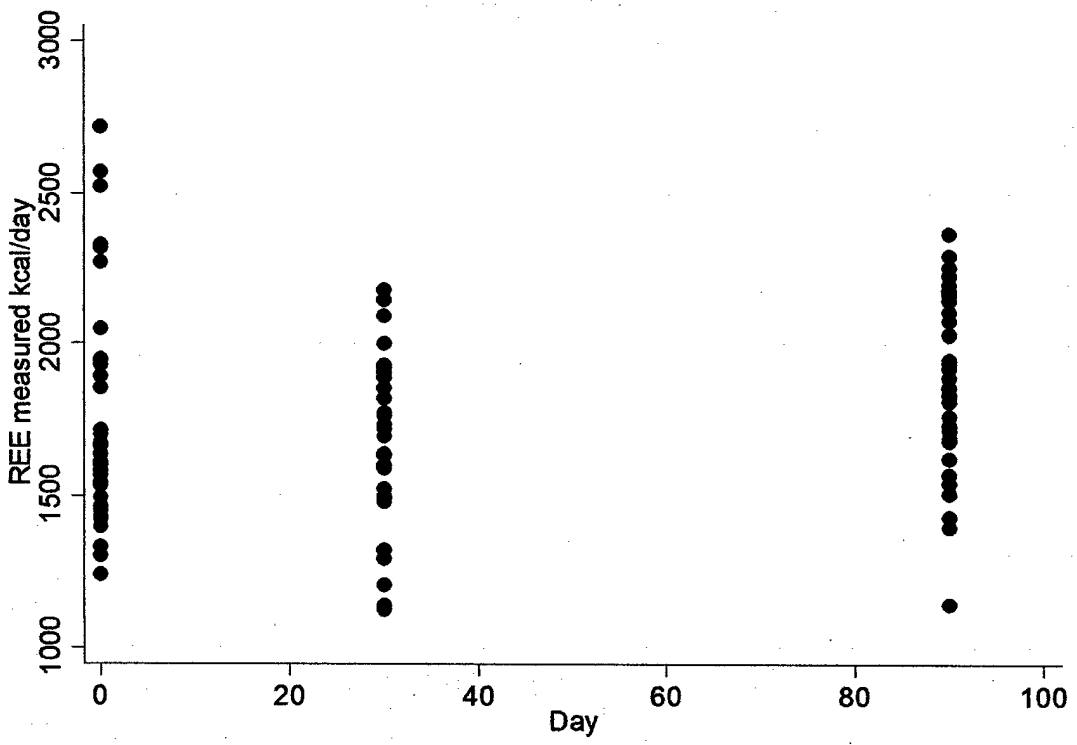
The GEE population-averaged model with unstructured correlation revealed significant differences between the three repeated measures ($p<0.01$). The analysis resulted in a time coefficient: 1.94 kcal/day and constant coefficient: 1691.14 kcal/day. The result was a 10.3% increase in REE during the 90 days. [(1.94x90 days)/1691] x 100%=10.3%

Table 23. Mean REE During 3 Repeated Measures in the Intervention Group

Time (days)	Mean REE, kcal/day (±SD)	Observations
0	1739.34 (369.48)	38
30	1657.17 (298.71)	30
90	1860.00 (300.15)	35

$P < 0.01$ (95% CI: 0.70, 3.18)
P value determined with GEE population-averaged model with unstructured correlation.

Figure 2. REE Values During 3 Repeated Measures in the Intervention Group



Seven subjects had REE measurements performed during extreme high temperatures as a result of failure of the air conditioning system at the Health and Wellness Center for >1 week. Table 24 shows the REE results for these subjects. Table 25 shows the mean REE measurements for the remaining 31 intervention group subjects (with 7 subjects removed). Figure 3 shows the REE values during the 3 repeated measures in the intervention group with N=31 subjects. The GEE population-averaged model with unstructured correlation revealed significant differences between the three repeated measures (p=0.000). The analysis resulted in a time coefficient: 3.59 kcal/day and constant coefficient: 1589.47 kcal/day. The result was a 20.3% increase in REE during the 90 days. [(3.59x90 days)/1589.47] x 100%=20.33%

Table 24. Results of Subjects With REE Measured During High Temperatures

ID	Mean REE of Two Baseline Measurements (kcal/day)
58	2270
59	2320
61	2520
62	2570
63	1430
65	2330
70	2720

REE range: 1430-2720 kcal/day. Mean (±SD): 2308.57 (419.58).

Table 25. Mean REE During 3 Repeated Measures in the Intervention Group Shown Without 7 Subjects *

Time (days)	Mean REE, kcal/day (±SD)	Observations
0	1610.81 (201.20 SD)	31
30	1656.25 (308.76 SD)	24
90	1864.11 (296.42 SD)	28

P = 0.000 (95% CI: 1.80, 5.38)
P value determined with GEE population-averaged model with unstructured correlation.
* 7 subjects removed from second analysis of REE changes. REE measurements were higher than expected as a result of air conditioning malfunction.

Figure 3. REE Values During 3 Repeated Measures in the Intervention Group Shown Without 7 Subjects (Air Conditioning Malfunction)

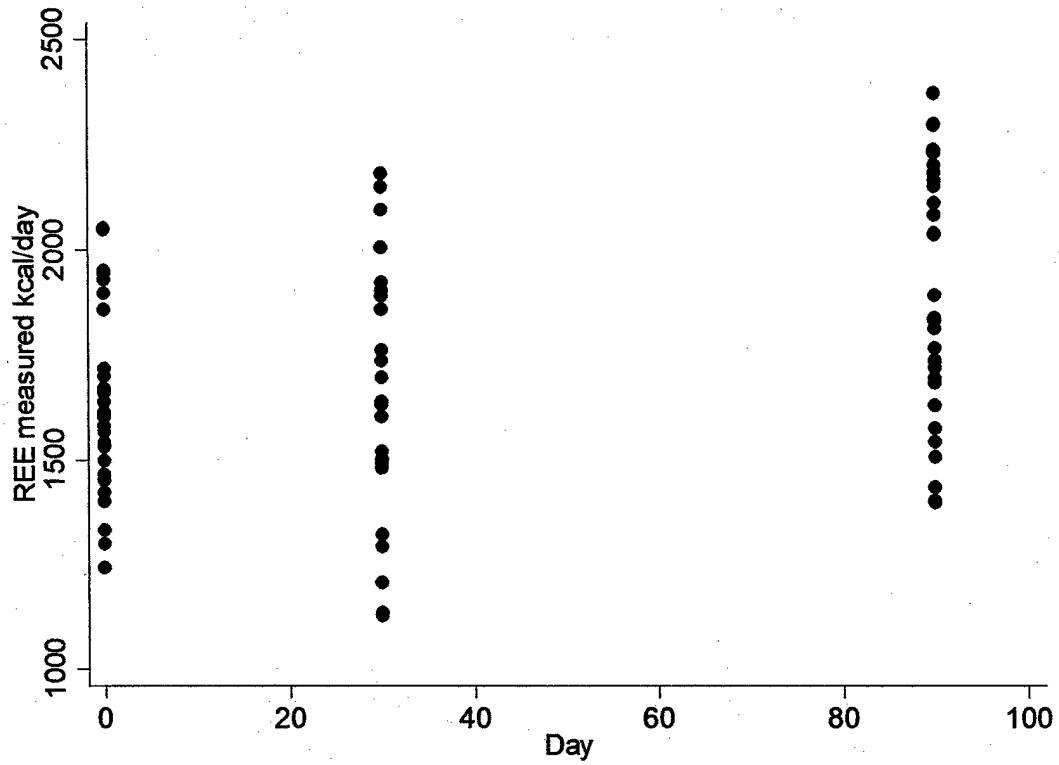


Table 26 shows the mean REE measurements for the 20 intervention group subjects with a complete data set of all three REE measurements. Figure 4 shows the REE values during the 3 repeated measures in the intervention group with N=20 subjects. The GEE population-averaged model with unstructured correlation revealed significant differences between the three repeated measures (p=0.000). The analysis resulted in a time coefficient: 3.02 kcal/day and constant coefficient: 1565.18 kcal/day. The result was a 17.37% increase in REE during the 90 days. [(3.02x90 days)/1565.18] x 100%=17.37%

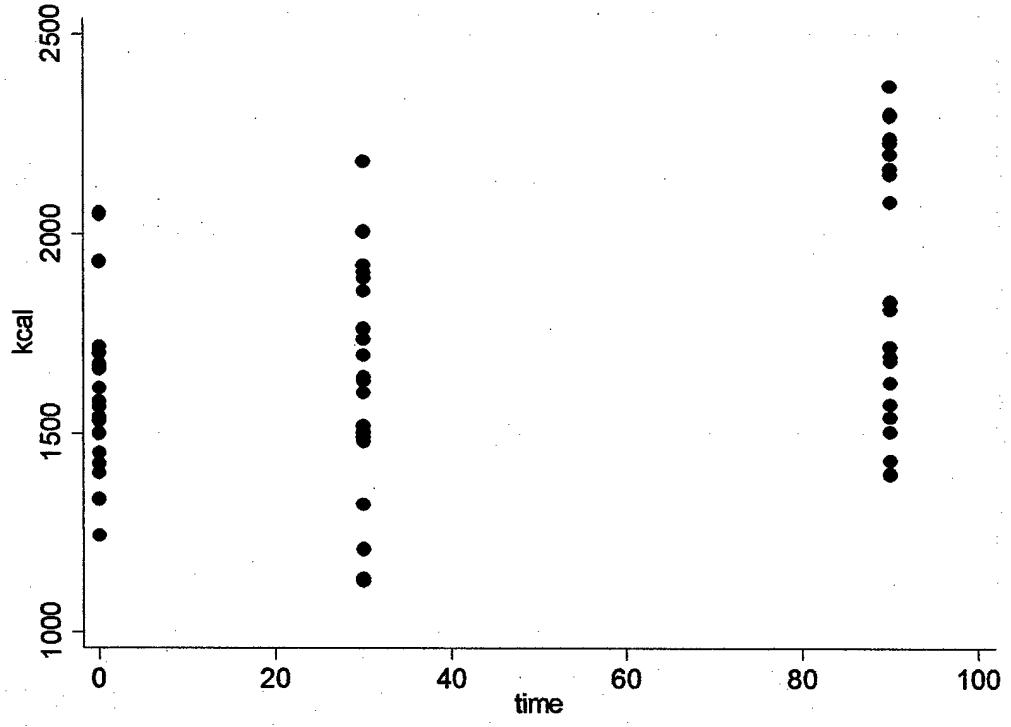
Table 26. Mean REE During 3 Repeated Measures in the Intervention Group: Subjects Enrolled Before 1 October 2003 with Complete Data Sets

Time (days)	Mean REE, kcal/day (±SD)	Observations
0	1583.00 (190.06)	20
30	1629.00 (290.82)	20
90	1845.75 (334.83)	20

P = 0.000 (95% CI: 1.80, 5.38)

P value determined with GEE population-averaged model with unstructured correlation.

Figure 4. REE Values During 3 Repeated Measures in the Intervention Group: Subjects Enrolled Before 1 October 2003 with Complete Data Sets

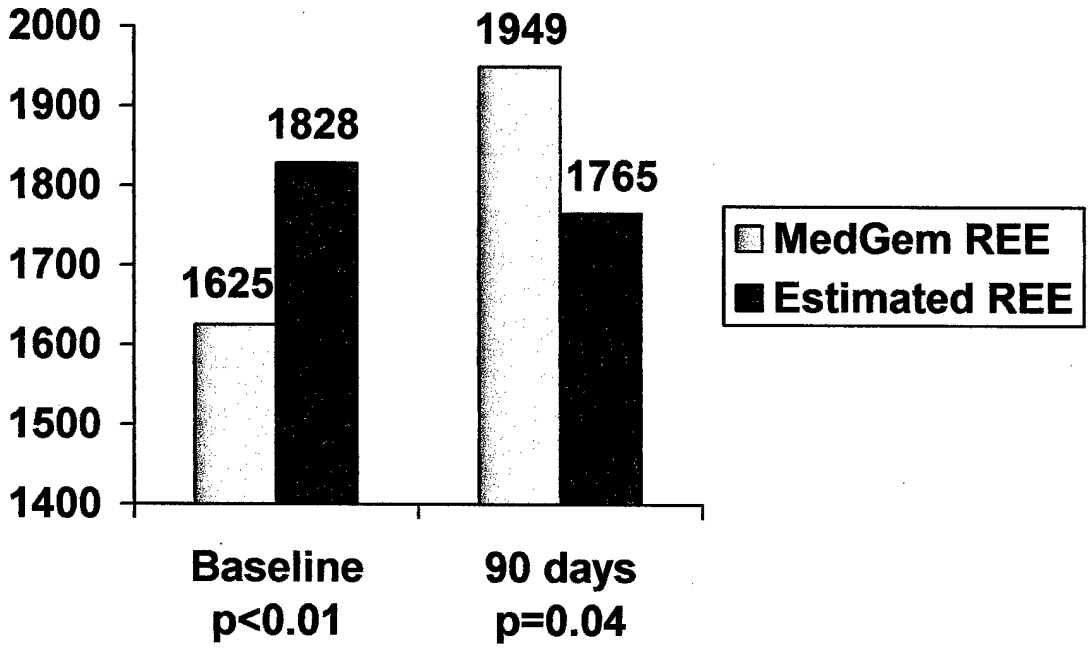


4) Estimated REE Equation Versus Measured REE

Figure 5 shows a comparison of mean measured REE (conducted with the MedGem indirect calorimeter) and mean estimated REE at baseline and 90 days. Estimated REE was determined with the following equation: 25 kcal/kg x body weight (kg) – 500 kcal for weight loss. These results were provided to all subjects at the

Sensible Weigh #1. The MedGem REE results were divided by 0.75 and 500 kcal was subtracted to determine the appropriate energy intake for weight loss. Two-sample t-tests determined that mean baseline MedGem REE measurements were significantly lower than estimated REE measurements ($p<0.01$). However, at 90 days, the mean MedGem REE measurements were significantly higher than estimated REE measurements ($p=0.04$).

Figure 5. Mean REE Values Determined By MedGem and Mean Estimated REE for Subjects Completing Baseline and 90-Day MedGem Measurements (N=23)



5) Changes in Strength Training

Table 27 shows the mean change scores in reported strength training frequency in the control and intervention groups. The scores were reported as part of the Arizona Activity Frequency Questionnaire (AAFQ). The two-sample t-test shows that there were no significant differences in strength training when comparing all subjects enrolled in the

study who completed a AAFQ at baseline and 90 days. However, when comparing only subjects who enrolled before 1 October 2003, the two-sample t-test shows that the intervention group had a significantly higher mean increase in strength training frequency compared to the control group (p=0.01).

Table 27. Mean Changes in Strength Training Frequency Between Groups from Baseline to 90 Days*

Characteristic	Control	Intervention	P
All subjects:	(N=30)	(N=31)	
Strength training frequency changes	0 (1.41)	+0.29 (1.10)	0.37
Subjects enrolled before 1 Oct 03:	(N=23)	(N=21)	
Strength training frequency changes	-0.39 (1.20)	+0.48 (0.98)	0.01

Values represent mean (±SD) for continuous variables.
P-value determined with two-sample t-test with equal variance
* Scores are based on the following frequencies of strength training: 0=no strength training; 1=1-3 times per month; 2=5-10 times per month; 3=11-19 times per month; 4≥20 times per month.

CHAPTER V: DISCUSSION AND CONCLUSIONS

This study sought to investigate the effectiveness of informing participants of their measured REE plus usual care versus providing usual care only to participants in the Air Force Weight and Body Fat Management Program with the goal being significantly decreased body weight. Secondary endpoints included body fat, BMI, and blood biochemistries. The following sections provide a detailed discussion of hypothesis testing and conclusions based on the results.

HYPOTHESIS 1

Data from this research provided evidence to support the hypothesis that the group who received usual care plus measured REE had reduced body weight and BMI at the end of a 90-day intervention compared to the group that received usual care only. When controlling for the confounding factor of subjects enrolled after 1 October 2003, the evidence becomes statistically significant with the intervention group having a larger mean decrease in both body weight and BMI ($p<0.02$ for both).

When eliminating subjects who responded in the highest range for binging (past and/or present), the evidence also becomes statistically significant with the intervention group having larger mean decreases in both body weight and BMI ($p<0.02$ and $p<0.03$ respectively).

Internal validity of this research may have been influenced as a result of the intervention group receiving two additional face-to-face contacts with the primary investigator for their REE measurements at baseline and 30 days. Some previous

research has shown that subjects who received additional contacts, whether face-to-face, or group support had larger decreases in body weight (Rippe, 1998 & Heshka, 2003).

Several studies have been published illustrating this point. A study of 80 women, 120-150% ideal body weight, were randomized to a 12-week weight loss intervention (with group support, 1500 kcal/day energy intake, and 1500 kcal/week physical activity expenditure) or served as controls. The intervention group lost significantly more weight compared to the controls ($p<0.001$): –6.1 (4.0) kg versus –1.3 (1.3) kg (Rippe, 1998).

Another study of 65 men and 358 women with a BMI 27-40 kg/m^2 were randomly assigned to either a self-help group or a weight loss program. The self-help group subjects received a 20-minute consultation with a registered dietitian at baseline and Week 12, and they were provided with written materials for weight loss. The weight loss program group attended weekly group weight loss meetings for two years. At two years, the mean weight loss of subjects in the weight loss program was significantly greater ($p<0.001$) than the self-help group: –2.9 (6.5) kg versus –0.2 (6.5) kg. Therefore subjects who had weekly visits for two years lost significantly more weight than subjects who had only two visits (Heshka, 2003).

However, given that the difference in the number of contacts in this study is only two visits, it is less likely that social support was related to weight loss. Other studies have not shown that a difference in contact between subjects and researchers alters weight loss. For example, the Women's Healthy Eating and Living Study (N=3,088) included an intervention group, which received 18-20 hours of telephone counseling during the first year and a control group, which did not receive telephone counseling.

There were no differences between groups or within each group from baseline to one year in health-related quality of life, perceived social support, and depressive symptoms (Bardwell, 2004).

Additional factors could alter results of the body weight changes. Military personnel have increased pressure to maintain weight-for-height and body composition standards. Data collected Air Force-wide revealed the prevalence of purging behaviors among Air Force personnel while attempting to meet standards were: 20.2% fasting; 13.4% diet pills; 3.4% laxatives, 3.2% vomiting; 2.9% diuretics; and 2.3% exercising greater than twice a day (may have multiple responses per individual). Reasons reported for engaging in these behaviors included: "competitiveness for advancement, concern for weight, being forced into weight control programs, and being harassed by supervisor for weight" (Weight Management, 2003). However, it is likely that both the intervention and control groups had equal pressure to meet standards (due to randomization of the participants) and would strive to meet goals at baseline and 90 days (excluding the subjects enrolled after 1 October 2003). Additionally, baseline weigh-ins may have been more likely to be preceded by these behaviors because of the short notice of the measurement appointment ($\geq$2 days) (Air Force Instruction 40-502, 2002).

If these restricting behaviors were indeed present at baseline, this may explain the significantly lower mean REE measurements conducted with the MedGem indirect calorimeter compared to the mean 90-day REE measurements ($p=0.000$). This may also be the reason for the significantly lower mean baseline REE measurements compared to the mean baseline estimated REE results ($p<0.01$). Leibel, et al found a significant

decrease in mean REE measured in nine obese and 11 non-obese subjects after a ten percent body weight reduction ($p<0.05$). The reduced REE measurements during or immediately following weight loss may show a decreased cost of substrate movement or a metabolic adaptation to the negative energy balance (Leibel, 1995).

An additional consideration for the mean change in weight in the intervention and control groups is a comparison of the energy intake and energy expenditure and the resulting weight loss by subjects in both groups. The mean negative energy balance was 405 kcal/day and 971 kcal/day in the control and intervention groups, respectively. If subjects actually attained this negative energy balance throughout the 90 days of the study, subjects in the control and intervention groups would have lost 4.7 kg and 11.4 kg, respectively. However, subjects lost a mean of 1.9 kg in the control group and 3.4 kg in the intervention group. These results were similar when examining the subjects enrolled before 1 October 2003.

HYPOTHESIS 2

The present study provided no significant evidence to support the hypothesis that the group who received usual care plus measured REE will have significantly reduced body fat at the end of a 90-day intervention as compared to the group that received usual care only. The difference in mean body fat changes showed that the intervention group had a larger mean decrease in body fat but this was not significant ($p>0.2$). The lack of statistical significance may be due to the small sample size. There was no significant difference in mean body fat changes during a subgroup analysis of subjects enrolled

before 1 October 2003 ($p>0.1$) or subjects who responded in the highest category for binging in the past and/or present ($p>0.2$).

The length of this study may not have provided sufficient time to demonstrate significant changes in body fat. A six-month intervention of 39 Navy males assigned to the USS Enterprise was conducted during a deployment. Subjects were randomly assigned to a control group of usual care (exercise alone) or a treatment group of nutrition/cognitive behavioral program plus usual care. The treatment group had a greater reduction in body fat compared to the control group (7% versus 5% respectively) (Dennis, 1999). Extending the length of study time from three to six months may produce similar, larger changes in body fat.

Another consideration was the differences in energy expended during recreation exercise in each group. The subgroup analysis of subjects enrolled before 1 October 2003 showed that the intervention group had a mean decrease in recreation energy expended (-52.1 kcal/day) whereas the control group had a mean increase (+115.9 kcal/day) from baseline to 90 days. These differences were not significant between groups ($p=0.13$). However, an examination of the between group changes in mean strength training frequency may have lead to the changes in body composition. The control group had a mean decrease in strength training frequency score (-0.4) and the intervention group had a mean increase in strength training frequency score (+0.5). These were significantly different between groups ($p=0.01$). This increased strength training from baseline to 90 days could be a factor in the larger decrease in body fat percent in the intervention group over time.

The increase in strength training may have also had an impact on the significant increase in REE measured with the MedGem indirect calorimeter from baseline to 90 days ($p=0.000$). These results were seen in a study of 20 subjects with a BMI: 35.2±2.9 kg/m^2 who were placed on an 800-kcal/day diet for 12 weeks. Subjects were randomly assigned to the aerobic exercise group or the resistance exercise group. Body fat percent decreased significantly ($p<0.05$) in both groups and there no between-group differences in body fat. Measured REE decreased significantly in the aerobic group from 1569±202 kcal/day (±SD) at baseline to 1359±297 kcal/day at 12 weeks ($p<0.05$). Measured REE increased in the strength group from 1737±393 kcal/day at baseline to 1800±362 kcal/day at 12 weeks, although not significantly. The mean difference in REE over time was significantly different between groups ($p<0.05$). Resistance exercise may preserve lean body mass during an energy restriction by lessening protein catabolism and decreasing sensitivity of muscles to catabolic hormones (Bryner, 1999).

HYPOTHESIS 3

The present study provided no evidence to support a hypothesis that the group who received usual care plus measured REE will have significantly decreased total cholesterol, LDL-C, and triglycerides at the end of a 90-day intervention as compared to the group that received usual care ($p>0.9$, $p>0.7$, and $p>0.6$ respectively). An important consideration for the lack of significant changes was the mean lipid values were within normal limits at baseline in both groups (with the exception of a slightly elevated total

cholesterol of 204 mg/dL in a subanalysis of the intervention group at baseline) so attaining significant differences between groups would be unlikely (NCEP, 2002).

Both groups had mean decreased cholesterol and LDL-C, which were typical results during a decrease in body weight (NCEP, 2002). The control group had a mean decrease in triglycerides whereas the intervention group had a mean increase in triglycerides, although neither change was significant within each group.

The intervention group had a larger decreased percentage of energy from total fat, saturated fat, monounsaturated fat (MUFA), and polyunsaturated fat: -2.3%, -0.8%, -0.9%, -0.5%, respectively, than the control group: -0.8%, -0.4%, -0.1%, -0.3%, respectively. The intervention group had a decrease in mean percentage of energy from protein and the control group had a mean increase in percentage of energy from protein (–0.04% versus +0.6% respectively) (NCEP, 2002).

The larger decrease in percent of energy from MUFA in the intervention group and almost a maintenance of percent of energy from MUFA in the control group may have caused the mean rise in triglycerides in the intervention subjects over time and the mean decrease in triglycerides in the control subjects over time. These changes are supported by a randomized, double-blind, five period crossover study design with 22 subjects. Subjects consumed the NCEP Step II diet (12% energy from MUFA) and three separate high-MUFA diets (17-21% energy from MUFA). All diets reduced total cholesterol by 10% and decreased LDL-C by 14%. However, triglycerides decreased 13% with the high MUFA diets and triglycerides increased 11% with the NCEP Step II

diet. HDL-C did not change with the MUFA diets but HDL-C decreased 4% with the NCEP Step II diet (Kris-Etherton, 1999).

STRENGTHS/LIMITATIONS

A strength of this study design was that participants were identified from the target population of military members in the Air Force Weight Management Program, which controlled selection bias. Using a military population minimized potential biases due to the improved ability to locate individuals during the study period, and access to centralized sources of information (including anthropometrics and blood chemistries). Additionally, subjects were interested in taking part in the research and had a high level of commitment to the study. The primary investigator randomly assigned subjects to have exposure to the intervention (REE measurements) or to serve as controls. The randomization controlled for known and unknown influences (bias and confounding effects) on study outcomes. The study population was large enough to provide a degree of assurance about the validity of the results. The method of data collection was highly objective and used closed-ended questions and outcomes.

A limitation of the study design was that study participants volunteered from the target population (Air Force Weight Management Program). The results of the study may not be applicable to the general Air Force population if the intervention only affects individuals who are willing to participate in a voluntary intervention program. The study was not blinded as subjects had knowledge of which group to which they were assigned. There also may have been interactive effects of the intervention; the intervention group

may have been more aware of making behavior modifications to reduce body weight and fat as a result of having two additional appointments with the primary investigator. The study was not double-blinded because researchers were aware of whether the subjects were assigned to the intervention or control group. The study has external validity for other military locations, however results may not be generalizable to the entire population of US adults.

CONCLUSIONS AND RECOMMENDATIONS

This study was carried out to determine if individuals who received measured REE and were informed of the results during a 90-day weight loss program would have greater body weight, BMI, and body fat changes.

The data from this study showed the intervention group had a significantly greater mean decrease in body weight and BMI when the following confounding factors were controlled: subjects enrolled after 1 October 2003, and subjects that scored highest on the binging section of the Weight Loss Readiness Test. The data from this study did not show a significant effect in mean differences of body fat between the two groups. However, the intervention group did have a larger decrease in body fat than the control group. The data from this study did not show an affect on mean differences in cholesterol, LDL-C, or triglycerides.

Future avenues of inquiry may include a similar study in an Air Force population of members who fail to meet fitness standards. The study population would be randomized to one of four groups:

A. Usual care plus REE measurements, informing subjects of measured REE, and using REE results to guide the intervention. Subjects would receive education on modifying behaviors based on changes in monthly REE measurements and individual body weight and fat goals.

B. Usual care plus REE measurements and informing subjects of measured REE. Subjects would not receive special tailored education.

C. Usual care plus REE measurements. Subjects would not receive REE results or tailored education.

D. Usual care only.

Measurements for anthropometrics, blood chemistries (cholesterol, LDL-C, HDL-C, triglycerides), diet, and physical activity would be completed on all subjects at baseline, three, six, and 12 months. Subjects in Groups A, B, and C will have REE measurements conducted at baseline and once each month for 12 months.

This study could allow the multiple comparisons to be made in the mean changes of the primary outcomes of body weight, BMI, and body fat from baseline to 12 months. Group A versus Group B: whether additional behavior modification based on REE measurements and body weight/BMI/body fat goals provided significant reductions in body weight, BMI, and body fat from baseline to 12 months. Group C versus Group D: whether additional contacts with the primary investigator affects reductions in body weight, BMI, and body fat from baseline to 12 months. Groups A, B, and C: allows comparisons in REE changes and determination of how REE varies based on changes in body weight and body fat. All Groups: determine if there is a significant difference in body weight, BMI, and body fat between the four groups from baseline to 12 months. Additionally, this study would determine whether a longer intervention provides different results from this 90-day intervention study. The results of future investigations could be used to support the addition of REE measurements for individuals who fail to meet Air Force standards.

APPENDIX A

STUDY WELCOME SHEET

METABOLIC RATE STUDY

You are invited to participate in this study if you are in the Weight and Body Fat Management Program and do not have type 1 diabetes or bulimia and are not pregnant.

The study is 3 months long. Do any of the following apply to you?

- Will you PCS, separate, or retire during the next 3 months?
- Will you be TDY longer than 4 weeks during the next 3 months?
- Will you deploy within the next 3 months?

If none apply to you, you are invited to join the study!

Half of the people in the study will be randomly selected to have their resting metabolic rate measured with a small hand-held device at the beginning of the study, 1 month later, and at the end of the study (3 months later). The other half will have their resting metabolic rate measured in 3 months.

Here are the appointments you'll have:

- 1st visit (at HAWC): you will complete a food frequency questionnaire, physical activity questionnaire, and weight loss readiness test. This visit will last 60 minutes or less.
- 1st and 2nd visit (at HAWC): in the beginning of the study and 1 month later, you may have your resting metabolic rate measured with an indirect calorimeter (depending on which group you're in). This visit will last up to 30 minutes.
- 3rd visit (at HAWC): approximately 90 days after study enrollment you will complete a food frequency questionnaire, physical activity questionnaire, and weight loss readiness test. Everyone will have their resting metabolic rate measured with an indirect calorimeter. This visit will last 60 to 90 minutes.
- 4th visit (at 355 MDG Laboratory): approximately 90 days after study enrollment. You will have a cholesterol test done.

Questions? Contact Capt Heather Nelson at nelsonh@email.arizona.edu or phone: 979-9165

APPENDIX B
INFORMED CONSENT DOCUMENT

FWH20030112H
355th MEDICAL GROUP, DAVIS-MONTHAN AFB
INFORMED CONSENT DOCUMENT
(ICD Template Version 4. Feb 02)

PRINCIPAL INVESTIGATOR – Capt Heather A. Nelson

If you choose not to participate in this research study, your decision will not affect your eligibility for care or any other benefits to which you are entitled.

DESCRIPTION/PURPOSE OF RESEARCH:

You are being asked to consider participation in this research study. The purpose of this study is to compare changes in weight and body fat in active duty AF personnel. The study is designed to test the effectiveness of measuring your resting metabolic rate, which is about ¾'s of your body's energy needs, with a small hand-held device called the MedGem™ and attending the Sensible Weigh education classes compared to only attending the classes. This study will enroll approximately 70 subjects.

PROCEDURES:

During your participation in this study, you will be asked to return to the 355th Medical Group approximately four times:

1st visit (at HAWC): within 7 days of study enrollment, you will complete a food questionnaire, physical activity questionnaire, and weight loss readiness questionnaire. Depending on which group you are randomly assigned to, you may have your resting metabolic rate measured with an indirect calorimeter. This visit will last 60 to 90 minutes.

2nd visit (at HAWC): Depending on which group you are randomly assigned to, you may have your metabolic rate measured approximately 30 days later. This will last about 30 minutes.

3rd visit (at HAWC): approximately 90 days after study enrollment you will complete a food frequency questionnaire, physical activity questionnaire, and weight loss readiness questionnaire. You may have your resting metabolic rate measured. This visit will last 60 to 90 minutes.

4th visit (at 355 MDG Laboratory): approximately 90 days after study enrollment. You will have blood drawn for a cholesterol test.

You are being invited to participate in this study because you are on the Weight Management Program, are 18 years of age or older, and do not have type 1 diabetes or bulimia, and will be at Davis-Monthan AFB during the study period which is 3 months.

The following procedures are part of your usual care at the 355th Medical Group and will be used for this research study:

1. Your weight, height, and body fat percentage are measured before the initial diet and exercise class. Measurements will be done 90 days later.
2. Health assessment is completed at the initial diet and exercise class. This includes medical history, and weight and dieting history.
3. Your first blood tests are measured prior to attending the initial diet and exercise class. These include tests of your cholesterol, blood sugar, and thyroid hormone level.

The following procedures are for this research study and are done in addition to your usual care at the 355th Medical Group:

1. Energy intake will be measured within seven days of study enrollment with a food questionnaire which asks you to fill out a form about your eating habits and takes about 30 minutes to complete. It will be done again 90 days later.
2. Energy expenditure will be measured within seven days of study enrollment with a physical activity questionnaire, which asks you to fill out a form about your exercise habits and takes about 15 minutes to complete. It will be done again 90 days later.
3. A test of your cholesterol will be done 90 days after study enrollment.
4. The weight loss readiness questionnaire, which asks you to fill out a form about your desire to make changes and takes about 10 minutes to complete, will be done within seven days of study enrollment and 90 days later.

As a participant, you will be randomly assigned to one of two treatment plans. Randomization is a process like flipping a coin and means you will have a chance of being assigned to either of the plans. Subjects in Group A will have their resting metabolic rate measured with a small, handheld device within seven days of study enrollment, 30 days later, and 90 days after first measurement. Each measurement will be repeated twice. The test involves holding a small device while breathing through a mask for 5 to 10 minutes. Sensors in the device measure oxygen breathed in prior to providing a readout of your metabolic rate. For accurate results, you must be in relaxed state for 15-20 minutes before test and abstain from food, beverage, caffeine, tobacco, and alcohol for 4-6 hours before test, and should not participate in strenuous physical exercise for 2-4 hours before test. Results and interpretation of the test will be given to you. Subjects in Group B will receive no additional procedures and will not have their resting metabolic rate measured during the study.

If you need a procedure requiring additional informed consent, a separate consent form will be given to you before that procedure.

RISKS OR DISCOMFORTS:

Blood work will be done at the beginning of the study and approximately 90 days later. You may experience bruising and soreness at the site where blood is drawn. There is also a

slight possibility of infection at the site where the blood is drawn. There may also be unforeseen risks associated with this study.

BENEFITS:
The investigators have designed this study to determine if the new treatment has any positive or negative impact in addition to the usual education classes you receive at the HAWC. However, there is no guarantee or promise that you will receive any benefit from this study.

PAYMENT (COMPENSATION):
You will not receive any compensation (payment) for participating in this study.

ALTERNATIVES TO PARTICIPATION:
Choosing not to participate in this study is your alternative to volunteering for the study.

CONFIDENTIALITY OF RECORDS OF STUDY PARTICIPATION:
Records of your participation in this study may only be disclosed in accordance with federal law, including the Federal Privacy Act, 5 U.S.C. 552a, and its implementing regulations. DD Form 2005, Privacy Act Statement- Military Health Records, contains the Privacy Act Statement for the records.

By signing this consent document, you give your permission for information gained from your participation in this study to be published in medical literature, discussed for educational purposes, and used generally to further medical science. You will not be personally identified; all information will be presented as anonymous data.

Your records may be reviewed by the U.S. Food & Drug Administration (FDA), other government agencies, the Wilford Hall Medical Center (WHMC) Institutional Review Boards, or the Principle Investigator at the 355th Medical Group. Complete confidentiality cannot be promised, particularly for military personnel, because information regarding your health may be required to be reported to appropriate medical or command authorities.

ENTITLEMENT TO CARE:
In the event of injury resulting from this study, the extent of medical care provided is limited and will be within the scope authorized for Department of Defense (DoD) health care beneficiaries.

Your entitlement to medical and dental care and/or compensation in the event of injury is governed by federal laws and regulations, and if you have questions about your rights as a research subject or if you believe you have received a research-related injury, you may contact the Wilford Hall Clinical Research Squadron Commander, (210) 292-7069 or Wilford Hall Medical Center Risk Manager, (210) 292-6004, or 355th Wing Judge Advocate General, (520) 228-5242.

BLOOD & TISSUE SAMPLES:
All specimens kept at 355th Medical Group will be handled and disposed of in accordance with federal regulations. Laboratories outside of 355th Medical Group will not have 355th Medical Group permission to use the samples for any additional research.

VOLUNTARY PARTICIPATION:
The decision to participate in this study is completely voluntary on your part. No one has coerced or intimidated you into participating in this project. You are participating because you want to. The Principal Investigator or one of her associates has adequately answered any and all questions you have about this study, your participation, and the procedures involved. If significant new findings develop during the course of this study that may relate to your decision to continue participation, you will be informed.

You may withdraw this consent at any time and discontinue further participation in this study without affecting your eligibility for care or any other benefits to which you are entitled. Should you choose to withdraw, you must contact the Principle Investigator at the HAWC at (520) 228-2294. Your condition will continue to be treated in accordance with acceptable standards of medical treatment.

The investigator of this study may terminate your participation in this study at any time if she feels this to be in your best interest.

CONTACT INFORMATION:
Principal Investigator (PI)
The Principal Investigator or a member of HAWC staff will be available to answer any questions concerning procedures throughout this study.
Principal Investigator: Capt Heather A. Nelson Phone: (520) 228-2294

Institutional Review Board (IRB)
The WHMC Institutional Review Board (IRB), the hospital committee responsible for safeguarding your rights as a research subject, has assigned a member of the IRB, who is not part of the study team, to serve as an outside monitor for this study (this person is the Medical Monitor). If you have any questions about your rights as a research subject or any other concerns that cannot be addressed by the PI, you can contact the medical monitor, Joseph Schmelz, PhD, RN at (210) 292-5687. Or mail to: 59th Clinical Research Squadron/MSRP, 1255 Wilford Hall Loop, Lackland Air Force Base, Texas 78230.

In addition, if you have any comments, questions, concerns or complaints, you may also contact the Chairperson of the IRB, at (210) 292-7141. Or mail to: 59th Medical Wing/CM, 2200 Bergquist Drive, Lackland Air Force Base, Texas 78230.

Your consent to participate in this study is given on a voluntary basis. All oral and written information and discussions about this study have been in English, a language in which you are fluent.

A copy of this form has been given to you.

VOLUNTEER'S SIGNATURE **VOLUNTEER'S SSN** **DATE**

VOLUNTEER'S PRINTED NAME **FMP** **SPONSOR'S SSN** **DOB**

VOLUNTEER'S ADDRESS (street, city, state, zip)

ADVISING INVESTIGATOR'S SIGNATURE **DATE** **PHONE NUMBER**

PRINTED NAME OF ADVISING INVESTIGATOR

WITNESS' SIGNATURE **DATE**
(Must witness ALL signatures)

PRINTED NAME OF WITNESS

Subject's Stamp Plate
PRIVACY ACT OF 1974 APPLIES.
DD FORM 2005 FILED IN MILITARY HEALTH RECORDS

APPENDIX C
HIPPA FORM

FWH20030112H
355th MEDICAL GROUP, DAVIS-MONTHAN AFB
AUTHORIZATION TO USE AND DISCLOSE PROTECTED HEALTH INFORMATION FOR RESEARCH
(APHI Template Version 1, Apr 03)

You are being asked for permission to use or disclose your protected health information for research purposes in the research study entitled ***THE EFFECTS OF MEASURED ENERGY REQUIREMENTS VERSUS USUAL CARE ON BODY WEIGHT AND FAT IN ACTIVE DUTY AF PERSONNEL.***

The Privacy Law, the Health Insurance Portability & Accountability Act (HIPAA), protects your individually identifiable health information (protected health information). This law requires the researchers obtain your authorization (by signing this form) to be able to use or disclose your protected health information for research purposes in the study listed above.

Your protected health information that may be used and disclosed in this study includes:

- Demographic information (age, sex, rank)
    - ***Medical history, weight, height, and body fat measurements.***
- Laboratory results of cholesterol, glucose, and thyroid test.
- Results of questionnaires on eating and exercise habits, and readiness to change questionnaire.

Your protected health information will be used for:

A study designed to compare changes in weight and body fat in active duty AF personnel. The study will test the effectiveness of measuring resting metabolic rate, which is about ¾'s of your body's energy needs, with a small hand-held device called the MedGem™ and attending the education classes compared to only attending the classes.

The disclosure of your protected health information is necessary in order to be able to conduct the research project described. Records of your participation in this study may only be disclosed in accordance with federal law, including the Federal Privacy Act, the Health Insurance Portability and Accountability Act of 1996, 5 U.S.C.552a, and its implementing regulations. DD Form 2005, Privacy Act Statement - Military Health Records, contains the Privacy Act Statement for the records. Note: Protected health information of military service members may be used or disclosed for activities deemed

necessary by appropriate military command authorities to ensure the proper execution of the military mission.

By signing this authorization, you give your permission for information gained from your participation in this study to be published in medical literature, discussed for educational purposes, and used generally to further medical science. You will not be personally identified; all information will be presented as anonymous data.

The Principal Investigator may use and share your health information with:

- The BAMC/WHMC Institutional Review Board
- Government representatives, when required by law
- **BAMC, WHMC or Department of Defense representatives**
- Study investigators at 355 MDG, Davis-Monthan AFB
- Research advisors at the University of Arizona, Nutritional Sciences Department

The researchers agree to protect your health information by using and disclosing it only as permitted by you in this Authorization and as directed by state and federal law.

If your protected health information is disclosed to anyone outside of this study, the information may no longer be protected under this authorization.

You do not have to sign this Authorization. If you decide not to sign the Authorization:

- It will not affect your treatment, payment or enrollment in any health plans or affect your eligibility for benefits.
- You may not be allowed to participate in the research study.

After signing the Authorization, you can change your mind and:

- Notify the researcher that you have withdrawn your permission to disclose or use your protected health information (revoke the Authorization).
- If you revoke the Authorization, you will send a written letter to Capt Heather A. Nelson, 355 AMDS/SGPZ, 4175 S Alamo Ave, Davis-Monthan AFB AZ 85707, phone number (520) 228-2294 to inform her of your decision.
- If you revoke this Authorization, researchers may only use and disclose the protected health information already collected for this research study.
- If you revoke this Authorization your protected health information may still be used and disclosed should you have an adverse event (a bad effect).
- If you withdraw the Authorization, you may not be allowed to continue to participate in the study.

This Authorization does not have an expiration date.
If you have not already received a copy of the Military Health System Notice of Privacy Practices, you may request one. If you have any questions or concerns about your privacy rights, you should contact the Brooke Army Medical Center Privacy Officer at phone number (210) 916-1029 or Wilford Hall Medical Center Privacy Officer at (210) 292-4599.

You are the subject of this study. You have read this information, and you will receive a copy of this form after it is signed.

Volunteer's Signature	**Volunteer's SSN**	**Date**
Signature of Witness		**Date**

APPENDIX D
WEIGHT LOSS ASSESSMENT PACKAGE

PRIVACY ACT STATEMENT

AUTHORITY: Title 10 U.S.C. 55, Medical and Dental Care, and E.O. 9397. **PURPOSE:** Information will be used to assist health providers in assessing personal health and dietary history of patients. **ROUTINE USES:** Records from this system of records may be disclosed for any of the blanket routine uses published by the Air Force. **DISCLOSURE:** Furnishing the information is voluntary.

PERSONAL DATA

Name (*Last, First, MI*) _____ SSN _____

Organization (Active Duty) _____

Work Phone: _____ Home Phone: _____

Age: _____ Gender: _____

Status: ____ Active Duty (Rank: ____) ____ Retired ____ AD/Dep ____ Ret/Dep

On Meal Card? _____ Yes _____ No

Please draw a circle around any of the following that you may have had or have at the present.

High Blood Pressure	High Cholesterol Level	Stroke
Heart Disease or Condition	High Triglyceride Level	Sleep Apnea
Kidney (Renal) Problems	Diabetes or High Blood Sugar	Osteoarthritis
Eating Disorder	Gastrointestinal Disorders	Allergies
Gastro-esophageal Reflux	Cancer	Gallstones
Osteoporosis	Hypoglycemia	Depression
Thyroid Condition	Psychiatric Treatment	

Do you have any diseases or conditions not listed above? Please describe.

Are you currently on any medication? _____ Yes _____ No If yes, please list:

Drug:	Dose:	Drug:	Dose:
_____	_____	_____	_____
_____	_____	_____	_____

Do you take any vitamins, minerals, herbs, or any other food or nutritional supplement?
_____Yes _____No. If yes, please list:

Have the following members of your family experienced problems with excess weight, or diabetes or premature death (before age 55) due to a heart attack or stroke?

			Describe
___ Yes	___ No	Mother	_____
___ Yes	___ No	Mother's Parents	_____
___ Yes	___ No	Father	_____
___ Yes	___ No	Father's Parents	_____
___ Yes	___ No	Brothers	_____
___ Yes	___ No	Sisters	_____
___ Yes	___ No	Children	_____

Do you smoke? _____Yes _____No
If yes, how much? _____

WEIGHT AND DIETING HISTORY

At what age did you first experience a problem with being overweight?_____years old

Has your weight changed over the past year? _____Yes _____No. If yes, please describe how: _____
_____.

What has been your lowest weight range as an adult? _____lbs.

How many serious attempts have you made to lose weight in: the last 12 months ____?
Over the last 10 years _____?

ACTIVE DUTY:
Have you ever been on the Weight Management Program before? Yes No

If yes, briefly describe your experience and what method/program you used to lose the weight/% body fat:

Please describe below methods you have used in the past to lose weight.

Method	How long ago?	Did you lose weight?	If yes, how many lbs lost / lbs regained		What do you attribute your success or failure to?
Self-Help Program (i.e., book, magazine, tape):					
_____	____	Y N	_____	_____	_____
_____	____	Y N	_____	_____	_____
Commercial Program (i.e., Weight Watchers, Herbal Life):					
_____	____	Y N	_____	_____	_____
_____	____	Y N	_____	_____	_____
Hospital Based Program:					
_____	____	Y N	_____	_____	_____
_____	____	Y N	_____	_____	_____
Liquid Diet Program (i.e., Slimfast):					
_____	____	Y N	_____	_____	_____
_____	____	Y N	_____	_____	_____
Other Methods:					
_____	____	Y N	_____	_____	_____
_____	____	Y N	_____	_____	_____
_____	____	Y N	_____	_____	_____

What factors do you believe were important in helping you succeed in your prior weight loss efforts? Explain.

What were the contributing factors that caused you to regain weight in the past? Explain.

Please pick from the following the amount of exercise that best describes what you typically do:

____ Sedentary: No specific exercise routine
____ Light exercise: 3 or more times per week, does casual exercise (walk, bike ride, gardening) – never really have to "huff and puff"
____ Moderate exercise: 3 or more times per week performs exercise for 20-30 min that causes you to take a deep breath occasionally and you may break into a light sweat
____ Heavy exercise: 3 or more times per week performs exercise lasting 30-60 min that results in extensive "huffing and puffing" and moderate to heavy sweating. Activities may include jogging, speed walking, stair step, cycling, etc.
____ Strenuous: 5 or more times per week exercise with high intensity or for a long duration such as 1-3 hours. Unless you are training for an endurance or speed competition you are most likely not in this category.

What type of activity do you enjoy most? _____
Do you like these activities alone or with others? _____

What barriers do you see to engaging in regular physical activity if any? For example: lack of time, health status, lack of skill, no access to exercise facilities, low motivation:

_____
_____

Are you interested in becoming more physically active?
_____ Yes, right now!
_____ Yes, but I can't right now.
_____ No, but I will think about it.
_____ No, not now.

If yes, what type of physical activity could you see yourself doing regularly?

If no, why:

What factors are present now that you believe will help you succeed at weight loss?

What factors are present now that you believe will make losing weight difficult?

APPENDIX E
THE WEIGHT LOSS READINESS TEST

Reprinted from the LEARN Program for Weight Management, 2000, American Health Publishing Company, Kelly D. Brownell, Ph.D. Permission for use in this study was granted on 4 April 2003 by David L. Hager, CEO, American Health Publishing Co.

PRIVACY ACT STATEMENT

AUTHORITY: Title 10 U.S.C. 55, Medical and Dental Care, and E.O. 9397. **PURPOSE:** Information will be used to assist health providers in assessing personal health and dietary history of patients. **ROUTINE USES:** Records from this system of records may be disclosed for any of the blanket routine uses published by the Air Force. **DISCLOSURE:** Furnishing the information is voluntary.

Answer the questions below to see how well your attitudes equip you for a weight loss program. For each question, circle the answer that best describes your attitude. As you complete each of the six sections, add the numbers of your answers and record in the area provided at the end of each section.

Name (*Last, First, MI*) _____ SSN _____

Section 1: Goals and Attitudes

1. Compared to previous attempts, how motivated are you to lose weight at this time?
   1 Not at all motivated
   2 Slightly motivated
   3 Somewhat motivated
   4 Quite motivated
   5 Extremely motivated

2. How certain are you that you will stay committed to a weight loss program for the time it will take to reach your goal?
   1 Not at all certain
   2 Slightly certain
   3 Somewhat certain
   4 Quite certain
   5 Extremely certain

3. Consider all outside factors at this time in your life (the stress you're feeling at work, your family obligations, etc.). To what extent can you tolerate the effort required to stick to a program?
   1 Cannot tolerate
   2 Can tolerate somewhat
   3 Uncertain
   4 Can tolerate well
   5 Can tolerate easily

4. Think honestly about how much weight you hope to lose and how quickly you hope to lose it. Figuring a weight loss of one to two pounds per week, how realistic is your expectation?
   1 Very unrealistic
   2 Somewhat unrealistic
   3 Moderately unrealistic
   4 Somewhat realistic
   5 Very realistic
5. While losing weight, do you fantasize about eating a lot of your favorite foods?
   1 Always
   2 Frequently
   3 Occasionally
   4 Rarely
   5 Never

6. While losing weight, do you feel deprived, angry and/or upset?
   1 Always
   2 Frequently
   3 Occasionally
   4 Rarely
   5 Never

Section 1 - TOTAL Score _____

Section 2: Hunger and Eating Cues

7. When food comes up in conversation or in something you read, do you want to eat even if you are not hungry?
   1 Never
   2 Rarely
   3 Occasionally
   4 Frequently
   5 Always

8. How often do you eat because of **physical hunger**?
   1 Always
   2 Frequently
   3 Occasionally
   4 Rarely
   5 Never

9. Do you have trouble controlling your eating when your favorite foods are around the house?
   1 Never
   2 Rarely
   3 Occasionally
   4 Frequently
   5 Always

Section 2 - TOTAL Score _____

Section 3: Control Over Eating

If the following situation occurred while you were on a weight loss program, would you be likely to eat **more** or **less** immediately afterward and for the rest of the day?

10. Although you planned on skipping lunch, a friend talks you into going out for a midday meal?
    1 Would eat much less
    2 Would eat somewhat less
    3 Would make no difference
    4 Would eat somewhat more
    5 Would eat much more

11. You "break" your diet by eating a fattening "forbidden" food.
    1 Would eat much less
    2 Would eat somewhat less
    3 Would make no difference
    4 Would eat somewhat more
    5 Would eat much more

12. You have been following your diet faithfully and decide to test yourself by eating something you consider a treat.
    1 Would eat much less
    2 Would eat somewhat less
    3 Would make no difference
    4 Would eat somewhat more
    5 Would eat much more

Section 3 - TOTAL Score _____

Section 4: Weight Control Habits

13. Aside from holiday feasts, have you ever eaten a large amount of food rapidly and felt afterward that this eating incident was excessive and out of control?
    2 Yes
    0 No

14. If you answered yes to Question 13 above, how often have you engaged in this behavior during the last year?
    1 Less than once a month
    2 About once a month
    3 A few times a month
    4 About once a week
    5 About three times a week
    6 Daily

15. Have you ever purged (used laxatives, diuretics or induced vomiting) to control your weight?
    5 Yes
    0 No

16. If you answered yes to Question 15 above, how often have you engaged in this behavior during the last year?

1 Less than once a month
2 About once a month
3 A few times a month
4 About once a week
5 About three times a week
6 Daily

Section 4 - TOTAL Score _____

Section 5: Emotional Eating

17. Do you eat more than you would like to when you have negative feelings, such as anxiety, depression, anger, or loneliness?

1 Never
2 Rarely
3 Occasionally
4 Frequently
5 Always

18. Do you have trouble controlling your eating when you have positive feelings--do you celebrate feeling good by eating?

1 Never
2 Rarely
3 Occasionally
4 Frequently
5 Always

19. When you have unpleasant interaction with others in your life, or after a difficult day at work, do you eat more than you would like?

1 Never
2 Rarely
3 Occasionally
4 Frequently
5 Always

Section 5 - TOTAL Score _____

Section 6: Exercise Patterns and Attitudes

20. How often do you exercise?

1 Never
2 Rarely
3 Occasionally
4 Frequently
5 Always

21. How confident are you that you can exercise regularly?

1 Not at all confident
2 Slightly confident
3 Somewhat confident
4 Quite confident
5 Extremely confident

22. When you think about exercise, do you develop a positive or negative picture in your mind?
    1 Completely negative
    2 Somewhat negative
    3 Neutral
    4 Somewhat positive
    5 Completely positive

23. How certain are you that you can work regular exercise into your daily schedule?
    1 Not at all certain
    2 Slightly uncertain
    3 Somewhat certain
    4 Quite certain
    5 Extremely certain

Section 6 - TOTAL Score: _____

Results of Readiness Assessment

After completion, please fill in your score for each of the sections of the Weight Loss Readiness Test:

_____ Section 1: Goals and Attitudes
_____ Section 2: Hunger and Eating Cues
_____ Section 3: Control Over Eating
_____ Section 4: Weight Control Habits
_____ Section 5: Emotional Eating
_____ Section 6: Exercise Patterns and Attitudes

APPENDIX F
RESTING METABOLIC RATE INSTRUCTIONS

4-6 hours before: no food, beverage (except water), caffeine, tobacco, or alcohol

2-4 hours before: no exercise

15 minutes before: be in a "relaxed state" (enjoy the relaxation chair)

Your test is scheduled for _____ at the HAWC with Capt Heather Nelson (phone: 979-9165, email: nelsonh@email.arizona.edu)

APPENDIX G
WHAT AFFECTS MY RESTING METABOLIC RATE?

1. Body Size: larger people have a higher metabolic rate than people of smaller size.
2. Body Composition: people with more muscle mass have a higher metabolic rate.
3. Gender: males have a higher metabolic rate.
4. Age: older people have a lower metabolic rate.
5. Physical Fitness: more muscle development causes metabolic rate to be higher.
6. Hormonal status (females): female metabolic rate varies with menstrual cycle. The lowest point is one week before ovulation and the highest point is just before the start of menstruation. Metabolic rate varies an average of 359 calories between these two points.
7. Environmental: people living in a tropical climate or very cold environment usually have a higher metabolic rate than those living in a more moderate area.

3 parts of your total energy requirements:

1. Resting metabolic rate (measured by MedGem): 60-75% of total
2. Calories burned digesting food: 10% of total
3. Calories burned during exercise: 15-30% of total

Determine your total energy requirements:

$$\frac{\text{Resting metabolic rate}}{0.75} = \text{Desired calories for weight maintenance}$$

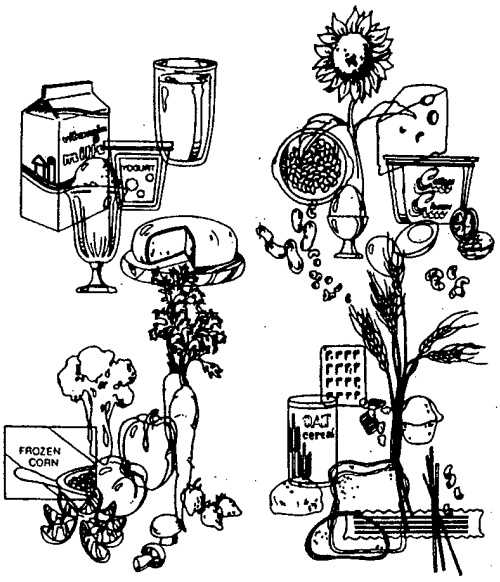
To lose weight: subtract 250-500 calories per day

Date: _____

Your resting metabolic rate: _____ / 0.75 = _____ - _____ (Weight loss) = _____ (Actual goal for daily calories)

Courtesy of the Health and Wellness Center, Davis-Monthan AFB, phone: (520) 228-2294

APPENDIX H
ARIZONA FOOD FREQUENCY QUESTIONNAIRE



AFFQ
ARIZONA
FOOD FREQUENCY
QUESTIONNAIRE

UNIVERSITY OF ARIZONA, TUCSON, AZ

© 1990 Arizona Board of Regents (version 5; 1/96)

PLEASE PRINT YOUR NAME, TODAY'S DATE, AGE, SEX: M OR F, HEIGHT AND WEIGHT IN THE BOXES PROVIDED.

LAST NAME | FIRST NAME | MI

TODAY'S DATE: MO. | DAY | YEAR

AGE

SEX: MALE (M) | FEMALE (F)

HEIGHT: Ft. | Inches

WEIGHT

FOR OFFICE USE

ID NUMBER

STUDY

PLEASE DO NOT WRITE IN THIS AREA

31433

DIRECTIONS	EXAMPLES
• USE NO. 2 PENCIL ONLY. • DO NOT USE INK OR BALLPOINT PEN. • MAKE NO STRAY MARKS. • FILL THE CIRCLES COMPLETELY.	CORRECT MARK ● INCORRECT MARKS ⊘ ⊗ ◒ ⊙

FOOD HABITS

Please answer the following questions according to your eating habits during the period of time you were asked to consider.

1. When you ate chicken or turkey, how often did you eat the skin?

- ○ Did not eat chicken or turkey
- ○ Almost always
- ○ Sometimes
- ○ Rarely/Never

2. When you ate beef or pork, how often did you eat the fat?

- ○ Did not eat beef or pork
- ○ Almost always
- ○ Sometimes
- ○ Rarely/Never

3. When you ate hamburger or other ground meat, what type did you usually eat?

- ○ Did not eat hamburger or other ground meat
- ○ Regular
- ○ Lean
- ○ Extra lean
- ○ Don't know

4. When you ate canned tuna, what type did you usually eat?

- ○ Did not eat canned tuna
- ○ Water-packed
- ○ Oil-packed
- ○ Don't know

5. When you ate fruit, was it usually…

	Almost Always	Some-times	Rarely/ Never
a) Fresh, Frozen	○	○	○
b) Canned in natural juices	○	○	○
c) Canned in light syrup	○	○	○
d) Canned in heavy syrup	○	○	○

6. When you drank milk or milk beverages (not including milk used on cereal or in coffee or tea), what type did you usually drink?

- ○ Did not drink milk
- ○ Whole milk
- ○ 2% milk
- ○ 1% milk
- ○ Nonfat or Skim milk
- ○ Soy milk

7. When you used milk, cream or creamer on cereal, what type did you usually use? (May have two answers)

- ○ Did not use milk, cream or creamer on cereal
- ○ Cream or Half and half
- ○ Whole milk
- ○ 2% milk
- ○ 1% milk
- ○ Nonfat or Skim milk
- ○ Soy milk
- ○ Non-dairy creamer

8. When you used milk, cream or creamer in coffee or tea, what type did you usually use? (May have two answers)

- ○ Did not use milk, cream or creamer in coffee or tea
- ○ Cream or Half and half
- ○ Whole milk
- ○ 2% milk
- ○ 1% milk
- ○ Nonfat or Skim milk
- ○ Evaporated milk
- ○ Soy milk
- ○ Non-dairy creamer

9. When you used salad dressing, what type did you usually use?

- ○ Did not use salad dressing
- ○ Regular
- ○ Low Fat or Reduced Calorie
- ○ Fat-Free

PLEASE DO NOT WRITE IN THIS AREA

FOOD HABITS (continued)

10. When you used mayonnaise, what type did you usually use?

- ○ Did not use mayonnaise
- ○ Regular
- ○ Low Fat or Reduced Calorie
- ○ Fat-Free

11. When you ate popcorn, how was it prepared?

- ○ Did not eat popcorn
- ○ Popped in oil or pre-popped
- ○ Regular microwave
- ○ Light microwave
- ○ Air-popped

12. How often did you use fat or oil in cooking?

- ○ 3 or more times a day
- ○ 1 to 2 times a day
- ○ 4 to 6 times a week
- ○ 2 to 3 times a week
- ○ Once a week
- ○ 1 to 3 times a month
- ○ Less than once a month
- ○ Rarely/Never

13. When you used butter or margarine, what type did you usually use?

- ○ Regular
- ○ Low Fat
- ○ Fat-Free

14. What kind of fat did you usually use to deep fry, pan fry, or sauté foods? (May have two answers)

- ○ Did not deep fry, pan fry, or sauté foods
- ○ Margarine
- ○ Butter
- ○ Shortening (Crisco®, lard, bacon fat or drippings, salt pork, ham hock)
- ○ Olive or Canola oil
- ○ Other oils (vegetable, corn, peanut, safflower)
- ○ Non-stick spray (Pam®)

15. What kind of fat did you usually add to your foods at the table?

- ○ Did not add fat to foods at the table
- ○ Margarine
- ○ Butter

16. What kind of fat did you usually use when cooking beans, rice, vegetables and potatoes? (May have two answers)

- ○ Did not use fat when cooking
- ○ Margarine
- ○ Butter
- ○ Shortening (Crisco®, lard, bacon fat or drippings, salt pork, ham hock)
- ○ Olive or Canola oil
- ○ Other oils (vegetable, corn, peanut, safflower)
- ○ Non-stick spray (Pam®)

17. Are you currently on a special diet? (May have two answers)

- ○ No
- ○ Yes, Weight Loss
- ○ Yes, Weight Gain
- ○ Yes, Vegetarian
- ○ Yes, Low Salt
- ○ Yes, Low Cholesterol
- ○ Yes, For Medical Condition (Specify:_____)

18. Have you gained or lost at least five pounds in the past year? (May have two answers)

- ○ No
- ○ Lost 5-15 lbs
- ○ Lost more than 15 lbs
- ○ Gained 5-15 lbs
- ○ Gained more than 15 lbs

19. Please describe your cigarette smoking behavior:

- ○ Never smoked
- ○ Don't smoke now, quit in the last 6 months
- ○ Don't smoke now, quit between 6 months and 5 years ago
- ○ Don't smoke now, quit more than 5 years ago
- ○ Smoke less than 10 cigarettes per day
- ○ Smoke 1/2 to 1 pack of cigarettes per day
- ○ Smoke more than 1 pack and up to 2 packs of cigarettes per day
- ○ Smoke more than 2 packs of cigarettes per day

20. Please describe other tobacco use:

- ○ Do not use other tobacco products
- ○ Smoke a pipe
- ○ Smoke a cigar
- ○ Chew tobacco or Use snuff
- ○ Other tobacco products

PLEASE DO NOT WRITE IN THIS AREA

31433

INSTRUCTIONS

Please do not fold, cut, staple, punch, or separate pages.

This questionnaire asks about your USUAL eating habits. Think back over the past few months, or over the period of time you have been asked to review, and ask yourself how often you usually ate the foods listed on the next several pages.

Look at the example on the bottom of this page while reading the following instructions.

1) **Fill in the circle that describes your AVERAGE SERVING SIZE for each food listed as compared to other people your same age and gender. You may choose Small (S), Medium (M), or Large (L).**

2) **Some lines include several foods (for example, "bread, rolls, bagels, etc."). For the serving size, fill in the circle corresponding to the food you ate most often.**

3) **Fill in the circle that describes your AVERAGE USE. If you rarely or never ate the food, fill in the circle under Rarely/Never.**

****Remember, TWO CIRCLES MUST BE FILLED IN FOR EACH FOOD LINE. However, when you select the RARELY/NEVER response, no serving size is necessary. DO NOT SKIP LINES.**

EXAMPLES
A) YOU ATE A MEDIUM SERVING OF WHOLE GRAIN CEREALS TWICE A WEEK.
B) YOU NEVER ATE HIGHLY FORTIFIED CEREALS.

BREADS AND GRAIN PRODUCTS	SERVING SIZE			AVERAGE USE							
	SMALL	MEDIUM	LARGE	3 OR MORE TIMES A DAY	1-2 TIMES A DAY	4-6 TIMES A WEEK	2-3 TIMES A WEEK	ONCE A WEEK	1-3 TIMES A MONTH	LESS THAN ONCE/MONTH	RARELY/NEVER
Whole Grain Cereals (such as Cheerios®, Shredded Wheat)	S	●	L	○	D	○	●	W	○	M	N
Highly Fortified Cereals (such as Product 19®, Total®)	S	M	L	○	D	○	○	W	○	M	●

PLEASE DO NOT WRITE IN THIS AREA

BREADS AND GRAIN PRODUCTS

ON THE AVERAGE, HOW OFTEN DID YOU EAT BREADS AND GRAIN PRODUCTS?	SERVING SIZE: SMALL	SERVING SIZE: MEDIUM	SERVING SIZE: LARGE	AVERAGE USE: 3 OR MORE TIMES A DAY	AVERAGE USE: 1-2 TIMES A DAY	AVERAGE USE: 4-6 TIMES A WEEK	AVERAGE USE: 2-3 TIMES A WEEK	AVERAGE USE: ONCE A WEEK	AVERAGE USE: 1-3 TIMES A MONTH	AVERAGE USE: LESS THAN ONCE/MONTH	AVERAGE USE: RARELY/NEVER
White Breads, including Rolls, Bagels, Flour Tortillas, English Muffins	S	M	L	O	D	O	O	W	O	M	N
Dark Grain Breads, including Rolls, Bagels, Flour Tortillas, English Muffins (such as Whole Wheat, Rye, etc.)	S	M	L	O	D	O	O	W	O	M	N
Corn Tortillas, Corn Bread, Corn Muffins	S	M	L	O	D	O	O	W	O	M	N
Oat Bran Muffins, Wheat Bran Muffins	S	M	L	O	D	O	O	W	O	M	N
Other Muffins, (such as Blueberry, Cranberry)	S	M	L	O	D	O	O	W	O	M	N
Low Fat Pop-Tarts®, Breakfast Bars, and Granola Bars	S	M	L	O	D	O	O	W	O	M	N
Pop-Tarts®, Breakfast Bars, Granola Bars	S	M	L	O	D	O	O	W	O	M	N
Biscuits, Croissants, Scones	S	M	L	O	D	O	O	W	O	M	N
Pancakes, Waffles, French Toast	S	M	L	O	D	O	O	W	O	M	N
100% Wheat Bran Cereals (such as All-Bran®, Fiber One®)	S	M	L	O	D	O	O	W	O	M	N
Other Bran Cereals (such as Raisin Bran, Corn Bran)	S	M	L	O	D	O	O	W	O	M	N
Whole Grain Cereals (such as Cheerios®, Shredded Wheat)	S	M	L	O	D	O	O	W	O	M	N
Highly Fortified Cereals (such as Product 19®, Total®)	S	M	L	O	D	O	O	W	O	M	N
Low Fat Granola Cereals (such as Kellogg's Low Fat Granola®)	S	M	L	O	D	O	O	W	O	M	N
Granola, Cereals Containing Nuts (such as Quaker 100% Natural®, Basic 4®)	S	M	L	O	D	O	O	W	O	M	N
Other Cold Cereals (such as Corn Flakes, Rice Krispies®)	S	M	L	O	D	O	O	W	O	M	N
Oatmeal, Other Cooked Cereals	S	M	L	O	D	O	O	W	O	M	N

IF YOU ATE COLD CEREAL, WHAT KIND DID YOU EAT MOST OFTEN?

1. _____

PLEASE DO NOT WRITE IN THIS AREA

31433

FRUITS AND FRUIT JUICES

ON THE AVERAGE, HOW OFTEN DID YOU EAT FRUITS AND DRINK FRUIT JUICES?	SERVING SIZE			AVERAGE USE							
	SMALL	MEDIUM	LARGE	3 OR MORE TIMES A DAY	1-2 TIMES A DAY	4-6 TIMES A WEEK	2-3 TIMES A WEEK	ONCE A WEEK	1-3 TIMES A MONTH	LESS THAN ONCE/MONTH	RARELY/NEVER
	S	M	L	O	D	O	O	W	O	M	N
Apples, Pears	S	M	L	O	D	O	O	W	O	M	N
Applesauce	S	M	L	O	D	O	O	W	O	M	N
Bananas	S	M	L	O	D	O	O	W	O	M	N
Peaches, Apricots, Nectarines	S	M	L	O	D	O	O	W	O	M	N
Oranges, Tangerines	S	M	L	O	D	O	O	W	O	M	N
Grapefruit	S	M	L	O	D	O	O	W	O	M	N
Grapes	S	M	L	O	D	O	O	W	O	M	N
Cantaloupe	S	M	L	O	D	O	O	W	O	M	N
Watermelon	S	M	L	O	D	O	O	W	O	M	N
Honeydew	S	M	L	O	D	O	O	W	O	M	N
Kiwi	S	M	L	O	D	O	O	W	O	M	N
Strawberries	S	M	L	O	D	O	O	W	O	M	N
Blueberries, Cranberries	S	M	L	O	D	O	O	W	O	M	N
Other Berries (such as Raspberries, Blackberries)	S	M	L	O	D	O	O	W	O	M	N
Raisins, Prunes	S	M	L	O	D	O	O	W	O	M	N
Dried Bananas	S	M	L	O	D	O	O	W	O	M	N
Other Dried Fruits (such as Apples, Apricots)	S	M	L	O	D	O	O	W	O	M	N
Orange Juice	S	M	L	O	D	O	O	W	O	M	N
Grapefruit Juice	S	M	L	O	D	O	O	W	O	M	N
Grape Juice	S	M	L	O	D	O	O	W	O	M	N
Other Fruit Juices	S	M	L	O	D	O	O	W	O	M	N

ANY OTHER FRUITS OR FRUIT JUICES, PLEASE USE THE LINE BELOW:

2._____	S	M	L	O	D	O	O	W	O	M	N

PLEASE DO NOT WRITE IN THIS AREA

VEGETABLES AND VEGETABLE JUICES

ON THE AVERAGE, HOW OFTEN DID YOU EAT VEGETABLES AND DRINK VEGETABLE JUICES? (NOT INCLUDING POTATOES)	SERVING SIZE: SMALL	MEDIUM	LARGE	AVERAGE USE: 3 OR MORE TIMES A DAY	1-2 TIMES A DAY	4-6 TIMES A WEEK	2-3 TIMES A WEEK	ONCE A WEEK	1-3 TIMES A MONTH	LESS THAN ONCE/MONTH	RARELY/NEVER
Broccoli	S	M	L	O	D	O	O	W	O	M	N
Carrots	S	M	L	O	D	O	O	W	O	M	N
Cauliflower, Brussels Sprouts	S	M	L	O	D	O	O	W	O	M	N
String Beans	S	M	L	O	D	O	O	W	O	M	N
Corn	S	M	L	O	D	O	O	W	O	M	N
Peas	S	M	L	O	D	O	O	W	O	M	N
Summer Squash, Zucchini	S	M	L	O	D	O	O	W	O	M	N
Winter Squash	S	M	L	O	D	O	O	W	O	M	N
Green Peppers, Green Chiles, Jalapeños	S	M	L	O	D	O	O	W	O	M	N
Red Peppers, Yellow Peppers, Red Chiles	S	M	L	O	D	O	O	W	O	M	N
Onions, Garlic	S	M	L	O	D	O	O	W	O	M	N
Cucumbers	S	M	L	O	D	O	O	W	O	M	N
Mixed Vegetables (containing Carrots)	S	M	L	O	D	O	O	W	O	M	N
Other Mixed Vegetables	S	M	L	O	D	O	O	W	O	M	N
Cabbage, Cole Slaw	S	M	L	O	D	O	O	W	O	M	N
Mustard Greens, Turnip Greens, Collards (Cooked)	S	M	L	O	D	O	O	W	O	M	N
Spinach (Cooked)	S	M	L	O	D	O	O	W	O	M	N
Raw Spinach, Dark Green Leafy Lettuce	S	M	L	O	D	O	O	W	O	M	N
Iceberg Lettuce, Celery	S	M	L	O	D	O	O	W	O	M	N
Tomatoes, Tomato Based Juice, V-8®	S	M	L	O	D	O	O	W	O	M	N
Carrot Based Juice	S	M	L	O	D	O	O	W	O	M	N
Other Vegetable Juices (not Carrot or Tomato Based)	S	M	L	O	D	O	O	W	O	M	N

ANY OTHER VEGETABLES OR VEGETABLE JUICES, PLEASE USE THE LINE BELOW:

3. _____	S	M	L	O	D	O	O	W	O	M	N

PLEASE DO NOT WRITE IN THIS AREA

31433

	SERVING SIZE			AVERAGE USE							
	SMALL	MEDIUM	LARGE	3 OR MORE TIMES A DAY	1-2 TIMES A DAY	4-6 TIMES A WEEK	2-3 TIMES A WEEK	ONCE A WEEK	1-3 TIMES A MONTH	LESS THAN ONCE/MONTH	RARELY/NEVER
SIDE DISHES											
ON THE AVERAGE, HOW OFTEN DID YOU EAT STARCHY SIDE DISHES?				O	D	O	O	W	O	M	N
Low Fat Refried Beans	S	M	L	O	D	O	O	W	O	M	N
Refried Beans	S	M	L	O	D	O	O	W	O	M	N
Lentils, Other Beans (such as Garbanzo, Baked, Pinto, Kidney, Lima)	S	M	L	O	D	O	O	W	O	M	N
French Fries, Fried Potatoes, Hash Browns	S	M	L	O	D	O	O	W	O	M	N
Other Potatoes (include Boiled, Baked, Mashed)	S	M	L	O	D	O	O	W	O	M	N
Sweet Potatoes, Yams	S	M	L	O	D	O	O	W	O	M	N
Brown Rice, Wild Rice	S	M	L	O	D	O	O	W	O	M	N
White Rice	S	M	L	O	D	O	O	W	O	M	N
MEAT, POULTRY, FISH, AND MIXED DISHES											
ON THE AVERAGE, HOW OFTEN DID YOU EAT MEAT, POULTRY, FISH, AND MIXED DISHES?				O	D	O	O	W	O	M	N
Beef Steaks, Roasts	S	M	L	O	D	O	O	W	O	M	N
Hamburgers, Cheeseburgers, Meat Loaf	S	M	L	O	D	O	O	W	O	M	N
Pork (Chops, Roasts)	S	M	L	O	D	O	O	W	O	M	N
Bacon, Pork Sausage	S	M	L	O	D	O	O	W	O	M	N
Chicken, Turkey (Baked, Stewed, Broiled)	S	M	L	O	D	O	O	W	O	M	N
Fried Chicken	S	M	L	O	D	O	O	W	O	M	N
Liver (Beef, Pork, Chicken)	S	M	L	O	D	O	O	W	O	M	N
Baked or Broiled Fish (such as Halibut, Sole, Salmon, Tuna)	S	M	L	O	D	O	O	W	O	M	N
Shell Fish such as Shrimp, Lobster, Crab, Oysters (not fried)	S	M	L	O	D	O	O	W	O	M	N
Fried Fish, Fish Sandwich, Fried Shell Fish	S	M	L	O	D	O	O	W	O	M	N
Egg Substitutes	S	M	L	O	D	O	O	W	O	M	N
Eggs	S	M	L	O	D	O	O	W	O	M	N

PLEASE DO NOT WRITE IN THIS AREA

MEAT, POULTRY, FISH AND MIXED DISHES (continued)	SERVING SIZE			AVERAGE USE							
	SMALL	MEDIUM	LARGE	3 OR MORE TIMES A DAY	1-2 TIMES A DAY	4-6 TIMES A WEEK	2-3 TIMES A WEEK	ONCE A WEEK	1-3 TIMES A MONTH	LESS THAN ONCE/MONTH	RARELY/NEVER
Chicken Salad, Tuna Salad, Egg Salad	S	M	L	O	D	O	O	W	O	M	N
Lean Lunchmeats (such as Ham, Turkey, Chicken, Low Fat Hot Dogs)	S	M	L	O	D	O	O	W	O	M	N
Lunchmeats (such as Bologna, Salami, Spam®)	S	M	L	O	D	O	O	W	O	M	N
Hot Dogs (Regular), Polish Sausage, Bratwurst	S	M	L	O	D	O	O	W	O	M	N
Meat Substitutes (such as Tofu, Veggie Burgers)	S	M	L	O	D	O	O	W	O	M	N
Pizza	S	M	L	O	D	O	O	W	O	M	N
Spaghetti, Other Pasta with Tomato Sauce (no Meat)	S	M	L	O	D	O	O	W	O	M	N
Spaghetti, Other Pasta with Meat Sauce	S	M	L	O	D	O	O	W	O	M	N
Pasta Dishes with Cheese, Cream Sauce, or Pesto Sauce (such as Macaroni and Cheese, Lasagna, Fettucine Alfredo)	S	M	L	O	D	O	O	W	O	M	N
Stews, Pot Pies, Casseroles containing Meat, Poultry, or Fish	S	M	L	O	D	O	O	W	O	M	N
Vegetarian Chili	S	M	L	O	D	O	O	W	O	M	N
Chili with Meat	S	M	L	O	D	O	O	W	O	M	N
Mexican Dishes	S	M	L	O	D	O	O	W	O	M	N
Chinese Dishes	S	M	L	O	D	O	O	W	O	M	N
Vegetable Soups, Minestrone, Tomato Soup	S	M	L	O	D	O	O	W	O	M	N
Cream Soups (such as Potato, Broccoli, Clam Chowder)	S	M	L	O	D	O	O	W	O	M	N
Other Soups (such as Turkey Noodle, Chicken and Rice)	S	M	L	O	D	O	O	W	O	M	N

PLEASE DO NOT WRITE IN THIS AREA

SPREADS AND SAUCES	SERVING SIZE			AVERAGE USE							
	SMALL	MEDIUM	LARGE	3 OR MORE TIMES A DAY	1-2 TIMES A DAY	4-6 TIMES A WEEK	2-3 TIMES A WEEK	ONCE A WEEK	1-3 TIMES A MONTH	LESS THAN ONCE/MONTH	RARELY/NEVER
Low Fat Peanut Butter	S	M	L	O	D	O	O	W	O	M	N
Peanut Butter	S	M	L	O	D	O	O	W	O	M	N
Low Sugar Jams, Jellies, Syrup	S	M	L	O	D	O	O	W	O	M	N
Jams, Jellies, Syrup, Honey	S	M	L	O	D	O	O	W	O	M	N
Sugar, Brown Sugar	S	M	L	O	D	O	O	W	O	M	N
Artificial Sweeteners	S	M	L	O	D	O	O	W	O	M	N
Butter, Margarine	S	M	L	O	D	O	O	W	O	M	N
Mayonnaise, Sandwich Spread	S	M	L	O	D	O	O	W	O	M	N
Reduced Fat Sour Cream	S	M	L	O	D	O	O	W	O	M	N
Sour Cream (Regular)	S	M	L	O	D	O	O	W	O	M	N
Salad Dressings (All Types)	S	M	L	O	D	O	O	W	O	M	N
White Sauce, Gravies made with Meat Drippings	S	M	L	O	D	O	O	W	O	M	N
Guacamole, Avocados	S	M	L	O	D	O	O	W	O	M	N
Salsa, Taco Sauce, Barbeque Sauce	S	M	L	O	D	O	O	W	O	M	N

DAIRY PRODUCTS

ON THE AVERAGE, HOW OFTEN DID YOU EAT OR DRINK DAIRY PRODUCTS?				O	D	O	O	W	O	M	N
Milk (All Types)	S	M	L	O	D	O	O	W	O	M	N
Nonfat Cheeses (such as Alpine Lace®, Healthy Choice®, Nonfat Cream Cheese, Nonfat and Low Fat Cottage Cheese)	S	M	L	O	D	O	O	W	O	M	N
Low Fat Cheeses (such as Mozzarella, Low Fat Cream Cheese)	S	M	L	O	D	O	O	W	O	M	N
Ricotta, Cottage Cheese (Regular)	S	M	L	O	D	O	O	W	O	M	N
Other Cheeses (such as Cheddar, Swiss, Monterey Jack, Regular Cream Cheese)	S	M	L	O	D	O	O	W	O	M	N
Low Fat Cheese Spreads (such as Reduced Fat Cheez Whiz®)	S	M	L	O	D	O	O	W	O	M	N
Cheese Spreads (such as Cheez Whiz®, Velveeta®)	S	M	L	O	D	O	O	W	O	M	N
Nonfat and Low Fat Yogurt (not Frozen)	S	M	L	O	D	O	O	W	O	M	N
Other Yogurt (not Frozen)	S	M	L	O	D	O	O	W	O	M	N

PLEASE DO NOT WRITE IN THIS AREA

31433

BEVERAGES

NOTE: AVERAGE USE CHOICES ARE DIFFERENT FROM THE PREVIOUS SECTIONS

	SERVING SIZE			AVERAGE USE								
	SMALL	MEDIUM	LARGE	6+ TIMES A DAY	3-5 TIMES A DAY	TWICE A DAY	ONCE A DAY	5-6 TIMES A WEEK	2-4 TIMES A WEEK	ONCE A WEEK	1-3 TIMES A MONTH	RARELY/NEVER
Water	S	M	L	O	O	O	D	O	O	W	O	N
Soft Drinks without Caffeine (such as Sprite®, Root Beer, Caffeine Free Coca-Cola®)	S	M	L	O	O	O	D	O	O	W	O	N
Soft Drinks with Caffeine (such as Pepsi®, Mountain Dew®)	S	M	L	O	O	O	D	O	O	W	O	N
Diet Soft Drinks without Caffeine	S	M	L	O	O	O	D	O	O	W	O	N
Diet Soft Drinks with Caffeine	S	M	L	O	O	O	D	O	O	W	O	N
Non-Carbonated Fruit and Tea Drinks (such as Snapple®, Gatorade®, Kool-Aid®, Lemonade)	S	M	L	O	O	O	D	O	O	W	O	N
Light Beer	S	M	L	O	O	O	D	O	O	W	O	N
Beer	S	M	L	O	O	O	D	O	O	W	O	N
Wine	S	M	L	O	O	O	D	O	O	W	O	N
Liquor	S	M	L	O	O	O	D	O	O	W	O	N
Coffee (Decaffeinated)	S	M	L	O	O	O	D	O	O	W	O	N
Coffee (Regular)	S	M	L	O	O	O	D	O	O	W	O	N
Hot Tea (Decaffeinated or Herbal)	S	M	L	O	O	O	D	O	O	W	O	N
Hot Tea (Regular)	S	M	L	O	O	O	D	O	O	W	O	N
Iced Tea (Decaffeinated)	S	M	L	O	O	O	D	O	O	W	O	N
Iced Tea (Regular)	S	M	L	O	O	O	D	O	O	W	O	N
Milk, Cream, Creamer in Coffee or Tea	S	M	L	O	O	O	D	O	O	W	O	N

PLEASE DO NOT WRITE IN THIS AREA

SNACKS AND DESSERTS

NOTE: AVERAGE USE CHOICES ARE DIFFERENT FROM THE PREVIOUS SECTIONS

	SERVING SIZE			AVERAGE USE								
	SMALL	MEDIUM	LARGE	6+ TIMES A DAY	3-5 TIMES A DAY	TWICE A DAY	ONCE A DAY	5-6 TIMES A WEEK	2-4 TIMES A WEEK	ONCE A WEEK	1-3 TIMES A MONTH	RARELY/NEVER
Low Fat or Fat Free Potato Chips, Tortilla Chips, Pretzels, and Crackers (such as Baked Tostitos®, Saltines, Harvest Crisps®)	S	M	L	O	O	O	D	O	O	W	O	N
Potato Chips, Corn Chips, Tortilla Chips, Crackers (such as Fritos®, Doritos®, Wheat Thins®)	S	M	L	O	O	O	D	O	O	W	O	N
Popcorn	S	M	L	O	O	O	D	O	O	W	O	N
Shelled Nuts (include Peanuts)	S	M	L	O	O	O	D	O	O	W	O	N
Reduced Fat Ice Cream, Ice Milk, Frozen Yogurt, Sherbet	S	M	L	O	O	O	D	O	O	W	O	N
Ice Cream	S	M	L	O	O	O	D	O	O	W	O	N
Reduced Fat Puddings and Custards	S	M	L	O	O	O	D	O	O	W	O	N
Custards, Puddings, Flan	S	M	L	O	O	O	D	O	O	W	O	N
Reduced Fat Cakes, Pastries, and Doughnuts (such as Angel Food Cake, Sponge Cake, Entenmann's® Low Fat Pastries)	S	M	L	O	O	O	D	O	O	W	O	N
Cakes, Pastries, Doughnuts	S	M	L	O	O	O	D	O	O	W	O	N
Reduced Fat Cookies (such as Vanilla Wafers, Graham Crackers, SnackWell's® Cookies, Fig Bars)	S	M	L	O	O	O	D	O	O	W	O	N
Cookies	S	M	L	O	O	O	D	O	O	W	O	N
Pumpkin Pie, Sweet Potato Pie	S	M	L	O	O	O	D	O	O	W	O	N
Other Pies	S	M	L	O	O	O	D	O	O	W	O	N
Chocolate Candy and Candy Bars	S	M	L	O	O	O	D	O	O	W	O	N
Other Candy (such as Jelly Beans, SweeTTarts®, Life Savers®)	S	M	L	O	O	O	D	O	O	W	O	N

FOR OFFICE USE

4a) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4b) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4c) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4d) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4e) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4f) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4g) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4h) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4i) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4j) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4k) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4l) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4m) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4n) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

4o) 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9 / 0 1 2 3 4 5 6 7 8 9

PLEASE DO NOT WRITE IN THIS AREA

31433

ADDITIONAL FOODS

Are there any foods not listed on the questionnaire that you ate at least once a month? The Additional Foods List has been provided to help prompt your memory. Write these foods in the spaces provided. Fill in the circles indicating the serving size and average use for each food. You are not limited to the foods on this list.

	SERVING SIZE			AVERAGE USE							
	SMALL	MEDIUM	LARGE	3 OR MORE TIMES A DAY	1-2 TIMES A DAY	4-6 TIMES A WEEK	2-3 TIMES A WEEK	ONCE A WEEK	1-3 TIMES A MONTH	LESS THAN ONCE/MONTH	RARELY/NEVER
A. _____	S	M	L	O	D	O	O	W	O	M	N
B. _____	S	M	L	O	D	O	O	W	O	M	N
C. _____	S	M	L	O	D	O	O	W	O	M	N
D. _____	S	M	L	O	D	O	O	W	O	M	N
E. _____	S	M	L	O	D	O	O	W	O	M	N
F. _____	S	M	L	O	D	O	O	W	O	M	N
G. _____	S	M	L	O	D	O	O	W	O	M	N
H. _____	S	M	L	O	D	O	O	W	O	M	N
I. _____	S	M	L	O	D	O	O	W	O	M	N
J. _____	S	M	L	O	D	O	O	W	O	M	N
K. _____	S	M	L	O	D	O	O	W	O	M	N
L. _____	S	M	L	O	D	O	O	W	O	M	N
M. _____	S	M	L	O	D	O	O	W	O	M	N
N. _____	S	M	L	O	D	O	O	W	O	M	N
O. _____	S	M	L	O	D	O	O	W	O	M	N

Additional Foods List

Artichokes
Asparagus
Beets
Instant Breakfast/Slim Fast®
Italian Ice
Jello®
Lamb
Lemons, Lemon Juice
Mangoes
Milkshakes
Papayas
Parmesan Cheese
Pineapple
Plums
Rice Cakes
Sauerkraut
Seeds
Supplemental Beverages (e.g., Ensure®)
Tortillas (Low Fat)
Veal

PLEASE DO NOT WRITE IN THIS AREA

APPENDIX I
ARIZONA ACTIVITY FREQUENCY QUESTIONNAIRE

AAFQ
ARIZONA
ACTIVITY FREQUENCY
QUESTIONNAIRE

THE UNIVERSITY OF ARIZONA, TUCSON

© 1996 Arizona Board of Regents

Study Name _____

PLEASE PRINT YOUR NAME, SEX, HEIGHT, WEIGHT, BIRTH DATE AND TODAY'S DATE IN THE BOXES BELOW.

LAST NAME	FIRST NAME	MI

SEX
MALE (M)
FEMALE (F)

HEIGHT	
Ft.	Inches

WEIGHT
Lbs.

BIRTH DATE		
MO.	DAY	YEAR

TODAY'S DATE		
MO.	DAY	YEAR

STUDY	ID NUMBER	VISIT

FOR OFFICE USE

PLEASE DO NOT WRITE IN THIS AREA

12990

PLEASE READ BEFORE FILLING OUT THIS QUESTIONNAIRE

- This questionnaire asks about activities which you have carried out in the last FOUR WEEKS (28 days).

OCCUPATIONAL ACTIVITIES

In this questionnaire, daily activity is divided into two types: occupational and non-occupational activities. This page deals with occupational activities. For the purposes of this survey, occupational activities include both work related activities and weekly volunteer activities. These activities tend to follow a routine. The second portion of this questionnaire deals with non-occupational activities which for most people tend to be more variable. Please answer questions on this page in alphabetical order.

DIRECTIONS	EXAMPLES
• USE NO. 2 PENCIL ONLY. • DO NOT USE INK OR BALLPOINT PEN. • MAKE NO STRAY MARKS. • FILL THE CIRCLES COMPLETELY.	CORRECT MARK ● INCORRECT MARKS ⊘ ⊗ ◒ ⊙

A. Are you currently employed?

○ Yes ○ No

B. How long has it been since your last employment?

○ less than one year ○ five to ten years
○ one to five years ○ more than 10 years

C. Do you do weekly volunteer work?

○ Yes ○ No

IF YOU ANSWERED "NO" TO BOTH QUESTIONS A AND C, PLEASE SKIP TO THE TOP OF PAGE 3.

D. How many days a week do you work and/or do volunteer work?

○ 1 - 2 days ○ 5 days
○ 3 - 4 days ○ 6 - 7 days

E. When you work/volunteer, how many hours a day do you work?

○ 10 - 12 hours ○ 4 - 5.9 hours
○ 8 - 9.9 hours ○ 2 - 3.9 hours
○ 6 - 7.9 hours ○ Less than 2 hours

F. How much time in a day do you spend sitting while working/volunteering?

○ 10 - 12 hours ○ 4 - 5.9 hours
○ 8 - 9.9 hours ○ 2 - 3.9 hours
○ 6 - 7.9 hours ○ Less than 2 hours

G. How much time in a day do you spend walking and carrying items or standing and doing moderate-effort work while working/volunteering?

○ More than 8 hours ○ 30 - 59 minutes
○ 6 - 7.9 hours ○ 15 - 29 minutes
○ 4 - 5.9 hours ○ Less than 15 minutes
○ 2 - 3.9 hours ○ Never
○ 1 - 1.9 hours

H. How much time in a day do you spend doing hard and/or heavy intensity work, such as moving, pushing and lifting heavy objects and/or doing hard physical labor?

○ More than 8 hours ○ 30 - 59 minutes
○ 6 - 7.9 hours ○ 15 - 29 minutes
○ 4 - 5.9 hours ○ Less than 15 minutes
○ 2 - 3.9 hours ○ Never
○ 1 - 1.9 hours

NON-OCCUPATIONAL ACTIVITIES

The following section refers to your non-occupational activities, those activities that you do outside of work and regular volunteer work. Activities are divided into leisure, personal care, recreational, household chores, and household maintenance.

INSTRUCTIONS

This questionnaire asks about your activity pattern over the past four weeks (28 days). Ask yourself how often you did each activity in the past four weeks.

Look at the examples below while reading the following instructions.

Step 1) Read through the entire list of activities and fill in the "YES" bubbles for those activities you have done in the past month and the "NO" bubbles for those activities you have not done in the past month.

Step 2) After completing Step 1, return to the top of page 4. If you marked "YES" for an activity, mark the column which corresponds to the number of times you have done that activity in the past 28 days AND mark the column which corresponds to the average amount of time you spent on that activity on each occasion.

EXAMPLES
A) You read the newspaper for 30 minutes every morning.
B) You did not play cards, bingo or board games in the past month.

LEISURE ACTIVITIES	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	NO	1-4	5-19	20-27	≥ 28	< 1 hr	1 hr but < 2 hrs	2 hrs but < 3 hrs	≥ 3 hrs
Reading	●	○	○	○	○	●	●	○	○	○
Play cards, bingo or board games	○	●	○	○	○	○	○	○	○	○

PLEASE NOTE

- Record only the amount of time you spent actually doing an activity. For example, if you take an aerobics class for exercise do not count the time you spend changing clothes or chatting before or after the class.

- **Explanation of symbols and abbreviations:**

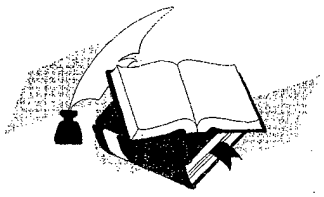
  < less than; > greater than; ≤ less than or equal to; ≥ greater than or equal to; **hr** is hour; **min** is minute

PLEASE DO NOT WRITE IN THIS AREA

12990

NON-OCCUPATIONAL ACTIVITIES

***Remember if you select YES for an activity, THREE CIRCLES MUST BE FILLED IN ON THAT LINE. If you select NO, no other columns need to be marked on that line.

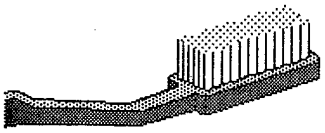


LEISURE ACTIVITIES	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	NO	1-3	4-17	18-27	≥ 28	< 1 hr	1 hr but < 2 hrs	2 hrs but < 3 hrs	≥ 3 hrs
Painting/Drawing	O	O	O	O	O	O	O	O	O	O
Handcrafts (such as knitting, sewing, quilting, crocheting, building models, stained-glass work)	O	O	O	O	O	O	O	O	O	O
Writing, typing, or working on a computer	O	O	O	O	O	O	O	O	O	O
Attending church, social and/or service club meetings, visiting with others, or talking on the telephone. (Do not include time spent doing handcrafts or dancing.)	O	O	O	O	O	O	O	O	O	O
Reading	O	O	O	O	O	O	O	O	O	O
Playing games (such as cards, board games, bingo, etc.)	O	O	O	O	O	O	O	O	O	O
Fishing (such as trolling or fishing from the shore. Do not include fly fishing)	O	O	O	O	O	O	O	O	O	O
Watching television (Do not include time spent doing handcrafts, reading or eating.)	O	O	O	O	O	O	O	O	O	O
Attending a sporting event, concert, ballet, movie, lecture, or presentation	O	O	O	O	O	O	O	O	O	O
Sitting/waiting at a doctor/dentist's office, a beauty parlor/barber shop or other location	O	O	O	O	O	O	O	O	O	O
Driving or riding in a vehicle while running errands around town (average time per day)	O	O	O	O	O	O	O	O	O	O
Driving or riding in a vehicle while traveling	O	O	O	O	O	O	O	O	O	O
Resting	O	O	O	O	O	O	O	O	O	O
Playing billiards/pool	O	O	O	O	O	O	O	O	O	O
Playing a musical instrument while sitting	O	O	O	O	O	O	O	O	O	O

NON-OCCUPATIONAL ACTIVITIES

LEISURE ACTIVITIES	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	NO	1-3	4-17	18-27	≥ 28	< 1 hr	1 hr but < 2 hrs	2 hrs but < 3 hrs	≥ 3 hrs
Playing a musical instrument while standing	O	O	O	O	O	O	O	O	O	O
Singing	O	O	O	O	O	O	O	O	O	O

Please note these values have changed



PERSONAL CARE ACTIVITIES	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	NO	< 14	14-27	28	≥ 29	< 15 mins	15-29 mins	30-59 mins	≥ 1 hr
Personal hygiene including shaving, bathing/ showering, hair care, makeup, dressing	O	O	O	O	O	O	O	O	O	O

Please note these values have changed

RECREATIONAL ACTIVITIES	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	NO	1-3	5-10	11-19	≥ 20	< 12 mins	13-29 mins	30-44 mins	≥ 45 mins
Walking up stairs or using a stair climber machine	O	O	O	O	O	O	O	O	O	O
Aerobics, jazzercise	O	O	O	O	O	O	O	O	O	O
Calisthenics	O	O	O	O	O	O	O	O	O	O
Dancing	O	O	O	O	O	O	O	O	O	O
Jogging (continuous)	O	O	O	O	O	O	O	O	O	O
Jog/Walk combination	O	O	O	O	O	O	O	O	O	O
Walking (include walking on a treadmill and walking to the store)	O	O	O	O	O	O	O	O	O	O
Racquetball, basketball, volleyball	O	O	O	O	O	O	O	O	O	O
Ski machine (such as NordicTrack™), or cross-country skiing	O	O	O	O	O	O	O	O	O	O

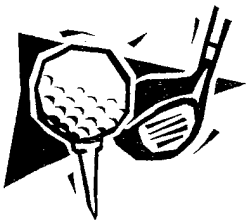
PLEASE DO NOT WRITE IN THIS AREA

12990

NON-OCCUPATIONAL ACTIVITIES

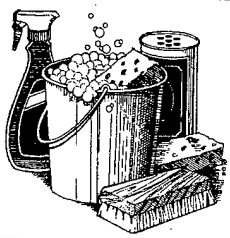
RECREATIONAL ACTIVITIES	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	NO	1-3	5-10	11-19	≥ 20	< 12 mins	13-29 mins	30-44 mins	≥ 45 mins
Floor exercise	O	O	O	O	O	O	O	O	O	O
Lifting free weights, using Nautilus™ equipment	O	O	O	O	O	O	O	O	O	O
Water aerobics (not laps)	O	O	O	O	O	O	O	O	O	O
Swimming	O	O	O	O	O	O	O	O	O	O
Bowling (1 game = 10 minutes)	O	O	O	O	O	O	O	O	O	O
Tennis - singles	O	O	O	O	O	O	O	O	O	O
Tennis - doubles	O	O	O	O	O	O	O	O	O	O
Active fishing and/or hunting (such as fly-fishing, standing while repeatedly casting, hunting that involves continuous hiking and/or carrying a heavy load)	O	O	O	O	O	O	O	O	O	O
Yoga, meditation	O	O	O	O	O	O	O	O	O	O

Please note these values have changed



OTHER RECREATIONAL ACTIVITIES	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	NO	1-2	3-5	6-11	≥ 12	< 30 mins	30 mins but < 1.5 hrs	1.5 hrs but < 3 hrs	≥ 3 hrs
Bicycling for pleasure or transportation (include riding exer-cycle or stationary bike)	O	O	O	O	O	O	O	O	O	O
Golf - riding cart (generally 9 holes = 1 hour 30 minutes, and 18 holes = 3 hours)	O	O	O	O	O	O	O	O	O	O
Golf - walking, clubs on cart (generally 9 holes = 1 hour 30 minutes, and 18 holes = 3 hours)	O	O	O	O	O	O	O	O	O	O
Golf - walking, carrying clubs (generally 9 holes = 2 hours, and 18 holes = 3 hours 30 minutes)	O	O	O	O	O	O	O	O	O	O
Hiking	O	O	O	O	O	O	O	O	O	O

NON-OCCUPATIONAL ACTIVITIES



HOUSEHOLD CHORES

Please note these values have changed

	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	*NO*	*1-3*	*4-5*	*6-19*	*≥ 20*	*1-29 mins*	*30-59 mins*	*1 hr but < 1½ hrs*	*≥ 1½ hrs*
Light cleaning (such as dusting, changing bed linens, vacuuming, watering indoor plants, sweeping and straightening up)	O	O	O	O	O	O	O	O	O	O
Making beds (do NOT include changing bed linens, which is included above)	O	O	O	O	O	O	O	O	O	O
Grocery shopping (include only time in store)	O	O	O	O	O	O	O	O	O	O
Other shopping (include only time in store and time walking between stores)	O	O	O	O	O	O	O	O	O	O
Doing laundry (include actual loading, unloading, sorting, and folding, as well as sitting/standing while waiting for laundry, if using laundromat)	O	O	O	O	O	O	O	O	O	O
Preparing meals and/or doing baking projects for yourself or others	O	O	O	O	O	O	O	O	O	O
Eating	O	O	O	O	O	O	O	O	O	O
Washing dishes (include rinsing dishes and/or loading a dishwasher. Do NOT include time that the dishwasher is running)	O	O	O	O	O	O	O	O	O	O
Ironing	O	O	O	O	O	O	O	O	O	O
Major cleaning (such as cleaning a garage, car, rugs, or windows, scrubbing floors or walls)	O	O	O	O	O	O	O	O	O	O
Taking care of small children	O	O	O	O	O	O	O	O	O	O
Taking care of an elderly or disabled adult	O	O	O	O	O	O	O	O	O	O

NON-OCCUPATIONAL ACTIVITIES

HOME MAINTENANCE AND REPAIRS

Please note these values have changed

	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	NO	1	2	3	≥ 4	1-29 mins	30-59 mins	1 hr but <2 hrs	≥ 2 hrs
Painting inside/outside of house or wallpapering	O	O	O	O	O	O	O	O	O	O
Carpentry	O	O	O	O	O	O	O	O	O	O
Mowing lawn using a riding lawnmower	O	O	O	O	O	O	O	O	O	O
Mowing lawn walking behind a power lawnmower	O	O	O	O	O	O	O	O	O	O
Light yard work (such as weeding, planting, cultivating a garden, pruning or trimming bushes or trees, raking yard, vacuuming leaves, sweeping outside, edging yard, watering yard or plants)	O	O	O	O	O	O	O	O	O	O
Heavy yard work (such as spading, digging, filling in a garden, chopping down trees or bushes, chopping wood, using a push lawnmower)	O	O	O	O	O	O	O	O	O	O

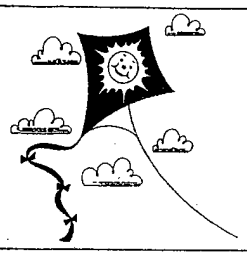
PLEASE take a few moments to look back over pages 4-8. Check that you have marked "YES" or "NO" for <u>each activity</u>. If you have marked "YES", make sure that you have filled in the columns "How many times. . ." and "How much time. . ."

If this questionnaire has covered all of your activities, turn to page 10. If you feel that some of your activities have been omitted, please fill in the "Activities Not Mentioned" section on page 9.

PLEASE DO NOT WRITE IN THIS AREA

12990

NON-OCCUPATIONAL ACTIVITIES



ACTIVITIES NOT MENTIONED	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	NO	1-2	3-5	6-9	≥ 10	< 1 hr	1 hr but < 3 hrs	3 hrs but < 6 hrs	≥ 6 hrs
Activities requiring mostly sitting (may include some arm movement) (specify):										
a. _____	O	O	O	O	O	O	O	O	O	O
b. _____	O	O	O	O	O	O	O	O	O	O
c. _____	O	O	O	O	O	O	O	O	O	O
Activities requiring about 50% sitting and 50% standing or walking (specify):										
a. _____	O	O	O	O	O	O	O	O	O	O
b. _____	O	O	O	O	O	O	O	O	O	O
c. _____	O	O	O	O	O	O	O	O	O	O

Please note these values have changed

ACTIVITIES NOT MENTIONED	Did you do it in the last 4 weeks (28 days)?		How many times did you do it in the last 4 weeks (28 days)?				How much time did you spend on this activity *each time* (on average)?			
	YES	NO	1	2-3	4-7	≥ 8	< 1 hr	1 hr but < 2 hrs	2 hrs but < 4 hrs	≥ 4 hrs
Activities requiring standing and walking in any proportion (may include some arm movements) (specify):										
a. _____	O	O	O	O	O	O	O	O	O	O
b. _____	O	O	O	O	O	O	O	O	O	O
c. _____	O	O	O	O	O	O	O	O	O	O
Activities requiring rapid or strenuous walking or jogging (include strenuous activities involving arm movements) (specify):										
a. _____	O	O	O	O	O	O	O	O	O	O
b. _____	O	O	O	O	O	O	O	O	O	O
c. _____	O	O	O	O	O	O	O	O	O	O

ACTIVITY PATTERNS

Is the total activity you have recorded your USUAL level of activity for this time of year?

○ YES ○ NO If NO, why not?
- ○ Out of town
- ○ Extra time commitments
- ○ Illness of self or spouse
- ○ Other. Please specify: _____

During a usual day and night, about how many hours do you spend sleeping or lying down with your feet up? Be sure to include the time you spend sleeping or trying to sleep at night and resting or napping.

○ 0-2	○ 6-8	○ 12-14
○ 2-4	○ 8-10	○ 14-16
○ 4-6	○ 10-12	○ More than 16

Are you unable to undertake exercise for any reason?

○ YES ○ NO

If YES, please explain: _____

PLEASE TURN TO PAGE 11

PLEASE DO NOT WRITE IN THIS AREA

12990

LIFETIME OCCUPATIONAL ACTIVITY PATTERN

Please think about the jobs you have had throughout your lifetime. For each decade of life, rate on a scale from light to vigorous activity how much exertion your occupation required. For example, occupations are classified as light activity when the majority of time is spent sitting (clerical, computer programmer), moderate activity when more movement is involved (nursing, sales), and vigorous activity when there is hard labor (construction, delivery).

Example: An individual who is currently 80, who worked in construction in his teens and 20's would mark the vigorous activity column for those two decades. He worked in a sporting goods store during his 30's through retirement at age 65. He would mark moderate activity during 30's, 40's, 50's, and retired in 60's, 70's and 80's.

How would you rate the activity level of your occupation during each of the following decades?

IN YOUR:	Light activity	Moderate activity	Vigorous activity	Retired
Teens	O	O	O	O
20's	O	O	O	O
30's	O	O	O	O
40's	O	O	O	O
50's	O	O	O	O
60's	O	O	O	O
70's	O	O	O	O
80's	O	O	O	O
90's and above	O	O	O	O

LIFETIME NON-OCCUPATIONAL ACTIVITY PATTERN

Now think about the recreational activities you have done throughout your lifetime. For each decade of life, rate on a scale from light to vigorous activity how much exertion your recreational activities required. Light activities include watching television and reading. Moderate activities include golf and raking the lawn. Vigorous activities include jogging and digging in the garden.

IN YOUR:	Light activity	Moderate activity	Vigorous activity
Teens	O	O	O
20's	O	O	O
30's	O	O	O
40's	O	O	O
50's	O	O	O
60's	O	O	O
70's	O	O	O
80's	O	O	O
90's and above	O	O	O

Comments: _____

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE!

PLEASE DO NOT WRITE IN THIS AREA

12990

Mark Reflex® by NCS MM203616-1 32 ED08 Printed in U.S.A.

ADDITIONAL FOODS

Are there any foods not listed on the questionnaire that you ate at least once a month? The Additional Foods List has been provided to help prompt your memory. Write these foods in the spaces provided. Fill in the circles indicating the serving size and average use for each food. You are not limited to the foods on this list.

	SERVING SIZE			AVERAGE USE							
	SMALL	MEDIUM	LARGE	3 OR MORE TIMES A DAY	1-2 TIMES A DAY	4-6 TIMES A WEEK	2-3 TIMES A WEEK	ONCE A WEEK	1-3 TIMES A MONTH	LESS THAN ONCE/MONTH	RARELY/NEVER
A. _____	S	M	L	O	D	O	O	W	O	M	N
B. _____	S	M	L	O	D	O	O	W	O	M	N
C. _____	S	M	L	O	D	O	O	W	O	M	N
D. _____	S	M	L	O	D	O	O	W	O	M	N
E. _____	S	M	L	O	D	O	O	W	O	M	N
F. _____	S	M	L	O	D	O	O	W	O	M	N
G. _____	S	M	L	O	D	O	O	W	O	M	N
H. _____	S	M	L	O	D	O	O	W	O	M	N
I. _____	S	M	L	O	D	O	O	W	O	M	N
J. _____	S	M	L	O	D	O	O	W	O	M	N
K. _____	S	M	L	O	D	O	O	W	O	M	N
L. _____	S	M	L	O	D	O	O	W	O	M	N
M. _____	S	M	L	O	D	O	O	W	O	M	N
N. _____	S	M	L	O	D	O	O	W	O	M	N
O. _____	S	M	L	O	D	O	O	W	O	M	N

Additional Foods List

Artichokes
Asparagus
Beets
Instant Breakfast/Slim Fast®
Italian Ice
Jello®
Lamb
Lemons, Lemon Juice
Mangoes
Milkshakes
Papayas
Parmesan Cheese
Pineapple
Plums
Rice Cakes
Sauerkraut
Seeds
Supplemental Beverages (e.g., Ensure®)
Tortillas (Low Fat)
Veal

PLEASE DO NOT WRITE IN THIS AREA

FOR OFFICE USE

5a) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5b) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5c) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5d) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5e) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5f) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5g) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5h) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5i) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5j) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5k) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5l) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5m) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5n) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5o) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

5p) ① ② ③ ④ Ⓐ Ⓑ Ⓒ
① ② ③ ④ ① ② ③

FOR OFFICE USE

1)
⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

2)
⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

3)
⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
⓪ ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

PLEASE DO NOT MARK IN THIS AREA

201452-1-2/4

PLEASE DO NOT WRITE IN THIS AREA

31433

VITAMIN AND MINERAL SUPPLEMENTS

1. **Fill in the circle next to any multiple vitamins or individual supplements consumed.**
2. **Write in the <u>BRAND NAME</u> and the <u>NUMBER OF PILLS PER WEEK</u> for each <u>MULTIPLE VITAMIN</u>.**
3. **Write in the <u>DOSAGE</u> and the <u>NUMBER OF TIMES PER WEEK</u> for each <u>INDIVIDUAL SUPPLEMENT</u>.**

PREPARATION	BRAND NAME	FREQUENCY # pills / week
Multiple Vitamin		
a. ○ Multi Vitamin with Minerals		
b. ○ Multi Vitamin without Minerals		
c. ○ Therapeutic, Stress or High Potency Formula		
d. ○ B-Complex		
Individual Supplements	**DOSAGE**	**times / week**
e. ○ Beta-Carotene		
f. ○ Vitamin A		
g. ○ Vitamin C		
h. ○ Vitamin E		
i. ○ Vitamin B_6		
j. ○ Calcium - type (e.g. oyster shell) _____		
k. ○ Zinc		
l. ○ Selenium		
m. ○ Iron		
n. ○ Other type _____		
o. ○ Other type _____		
p. ○ Other type _____		

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE. PLEASE TAKE A MOMENT TO FINISH ANY QUESTIONS YOU MAY HAVE SKIPPED.

PLEASE DO NOT WRITE IN THIS AREA

REFERENCES

Air Force Instruction 10-248, Fitness Program, 1 January 2004.

Air Force Instruction 40-402, Protection of Human Subjects in Biomedical and Behavioral Research, 1 September 2000.

Air Force Instruction 40-502, The Weight and Body Fat Management Program, 3 April 2002.

Anderson JW, Konz EC, Fredrich RC, Wood CL. Long-term weight-loss maintenance: a meta-analysis of US studies. *Am J Clin Nutr*. 2001;74:579-84.

Assessing Readiness in Military Women: The Relationship of Body, Composition, Nutrition, and Health, Institute of Medicine. The National Academies Press; 1998.

Atkinson RL, Vanderveen JE, Dietz WH, Fernstrom JD, Frank A, Hansen BC, Heymsfield SB, Kanarek RB, Moore BJ. Weight Management: State of the Science and Opportunities for Military Programs. National Academy of Sciences; 2003.

Bardwell WA, Rock CL, Natarajan L, Newman VA, Chilton JA, Pierce JP. Does a dietary intervention with counseling result in changes in psychosocial functioning in women treated for breast cancer. Unpublished. 2004.

Boutelle K, Kirschenbaum D. Further support for consistent self-monitoring as a vital component of successful weight control. *Obesity Research*. 1998;6:219-224.

Brownell KB. The LEARN® Program for Weight Control. American Health Publishing Company; 1997.

Bryner RW, Ullrich IH, Sauers J, Donley D, Hornsby G, Kolar M, Yeater R. Effects of resistance vs. aerobic training combined with an 800 calorie liquid diet on lean body mass and resting metabolic rate. *Am Coll Nutr*. 1999;18:115-121.

Byrne HK, Wilmore JH. The effects of a 20-week exercise training program on resting metabolic rate in previously sedentary, moderately obese women. *Int J Sport Nutr*. 2001;11:15-31.

Coulston AM, Rock CL, Monsen ER. Nutrition in the Prevention and Treatment of Disease. Academic Press; 2001.

CDC. Trends in intake of energy and macronutrients – United States, 1971-2000. *MMWR*. 2004;53:80-86.

Department of Defense (DoD) Instruction 1308.3, DoD Physical Fitness and Body Fat Programs Procedures, 5 November 2002.

Dennis KE, Pane KW, Adams BK, Qi BB. The impact of a shipboard weight control program. *Obesity Research*. 1999;7:60-67.

Ellin, D. Costs of preventable separations. WARFIT; HQ AFSPC/SG, 2002. Referenced from AFMS, Shape Your Future...Your Weigh! ™

Flegal KM, Carroll MD, Odgen CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999-2000. *JAMA*. 2002;288:1723-1727.

Frankenfield DC, Muth ER, Rowe WA. The Harris-Benedict studies of human basal metabolism: History and limitations. *J Am Diet Assoc*. 1998;98:439-445.

Frankenfield DC. Rowe WA. Smith JS. Cooney RN. Validation of several established equations for resting metabolic rate in obese and nonobese people. *J Am Diet Assoc*. 2003;103:1152-1159.

Frey-Hewitt B, Vranizan KM, Dreon DM, Wood PD. The effects of weight loss by dieting or exercise on resting metabolic rate in overweight men. *International Journal of Obesity*. 1990;14:327-34.

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

Garrel DR. Jobin N. De Jonge LH. Should we still use the Harris and Benedict Equations? *Nutr Clin Pract*. 1996;11:99-103.

Haugen HA, Melanson EL, Tran ZV, Kearney JT, Hill JO. Variability of measured resting metabolic rate. *Am J Clin Nutr*. 2003;78:1141-1144.

HealtheTech™ Technical Report #1: Validation of the Metabolic Simulator, "Metabolizer." Available at: http://www.healthetech.com. Accessed 17 March 2003.

HealtheTech™ Technical Report #2: Comparison of the BodyGem™ to a Mechanical Simulation Device. Available at: http://www.healthetech.com. Accessed 17 March 2003.

HealtheTech™: MedGem Indirect Calorimeter Specifications and Customer Support. Available at: http://www.healthetech.com. Accessed 20 February 2004.

Heshka S, Anderson JW, Atkinson RL, Greenway FL, Hill JO, Phinney SD, Kolotkin RL, Miller-Kovach K, Pi-Sunyer FX. Weight loss with self-help compared with a structured commercial program. *JAMA*. 2003;289:1792-1798.

Kraemer WJ, Volek JS, Clark KL, Gordon SE, Incledon T, Puhl SM, Triplett-McBride NT, McBride JM, Putukian M, Sebastianelli WJ. Physiological adaptations to a weight-loss dietary regimen and exercise programs in women. *J App Physiol*. 1997;83:270-9.

Kris-Etherton PM, Pearson TA, Wan Y, Hargrove RL, Moriarty K, Fishell V, Etherton TD. High-monounsaturated fatty acid diets lower both plasma cholesterol and triacylglycerol concentrations. *Am J Clin Nutr*. 1999;72:853-856.

Leibel RL, Rosenbaum M, Hirsch J. Changes in energy expenditure resulting from altered body weight. *N Engl J Med*. 1995;332: 621-8.

Lifestyle Counselor's Guide for Weight Control. Blair SN, Brownell KD, Hager DL, O'Neil PM, Rhodes SK, St. Jeor S, Wolfe, BL. American Health Publishing Company; 1996.

Martinez ME, Marshall JR, Graver E, Whitacre RC, Woolf K, Ritenbaugh C, Alberts DS. Reliability and validity of a self-administered food frequency questionnaire in a chemoprevention trial of adenoma recurrence. *Cancer Epidemiol Biomark Prev*. 1999;8:941-946.

McClave SA, McClain CJ, Snider HL. Should indirect calorimetry be used as part of nutritional assessment. *J Clin Gastroenterology*. 2001;33:14-19.

McClave SA, Snider HL, Ireton-Jones C. Can we justify continued interest in indirect calorimetry? *Nutr Clin Pract*. 2002;17:133-136.

Melanson EL, Coelho LB, Tran ZV, Haugen HA, Kearney JT, Hill JO. Validation of the BodyGem™ hand-held indirect calorimeter. Nutrition Week, 2003. San Antonio, Texas.

Mifflin MD, St Jeor ST, Hill LA, Scott BJ, Daugherty SA, Koh YO. A new predictive equation for resting energy expenditure in healthy individuals. *Am J Clin Nutr*. 1990;51:241-247.

Nieman DC, Trone GA, Austin MD. A new handheld device for measuring resting metabolic rate and oxygen consumption. *J Am Diet Assoc*. 2003;103:588-593.

Nutrition Outcomes Management Analysis Database (NOMAD). Available at: http://www.citpo.org/citpoIntra/login.cfm. Accessed 28 March 03.

Reed GW, Hill JO. Measuring the thermic effect of food. *Am J Clin Nutr*. 1996;63:164-169.

Rippe JM, Price JM, Hess SA, Kline G, DeMers KA, Damitz S, Kreidieh I, Freedson P. Improved psychological well-being, quality of life, and health practices in moderately overweight women participating in a 12-week structured weight loss program. *Obesity Research*. 1998;6:208-218

Robbins AS, Chao SY, Fonseca VP, Snedecor MR, Knapik JJ. Predictors of low physical fitness in a cohort of active-duty Air Force members. *Am J Prev Med*. 2001;20(2):90-96.

Saris WH. Physical inactivity and metabolic factors as predictors of weight gain. *Nutrition Reviews*. 1996;54:S110-5.

Siervo M. Boschi V. Falconi C. Which REE prediction equation should we use in normal-weight, overweight and obese women? *Clin Nutr*. 2003;22(2):193-204.

Staten KL, Taren DL, Howell WH, Tobar M, Poehlman ET, Hill A, Reid PM, Ritenbaugh C. Validation of the Arizona Activity Frequency Questionnaire using doubly labeled water. *Med Sci Sports Exerc*. 2001;33:1959-1967.

Spahn J. Air Force: The Sensible Weigh Leader's Guide (1998). Available at: http://www.afman.satx.disa.mil. Accessed 2 February 03.

Stipanuk MH. Biochemical and Physiological Aspects of Human Nutrition. W. B. Saunders Company; 2000.

Third Report of the National Cholesterol Education Program (NCEP), Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. National Institutes of Health, 2002.

Thomson CA, Giuliano A, Rock CL, Ritenbaugh CK, Flatt SW, Faerber S, Newman V, Caan B, Graver E, Hartz V, Whitacre R, Parker F, Pierce JP, Marshall JR. Measuring dietary change in a diet intervention trial: comparing food frequency questionnaire and dietary recalls. *Am J Epidemiol*. 2003;157:754-762.

Vinken AG, Bathalon GP, Sawaya AL, Dallal GE, Tucker KL, Roberts SB. Equations for predicting the energy requirements of healthy adults aged 18-81 y. *Am J Clin Nutr*. 1999;69:920-926.

Wadden TA, Vogt RA, Andersen RE. Exercise in the treatment of obesity: effects of four interventions on body composition, resting energy expenditure, appetite, and mood. *J Couns Clin Psych*. 1997;65:269-277.

Weight Management: State of the Science and Opportunities for Military Programs, Institute of Medicine. The National Academies Press; 2003.

Weir JB. New methods for calculating metabolic rate with special reference to protein metabolism. *J Physiol.* 1949;109:1-9.

Weststrate J. Resting metabolic rate and diet-induced thermogenesis: a methodological reappraisal. *Am J Clin Nutr.* 1993;58:592-601.

Wyatt HR, Grunwald GK, Seagle HM, Klem ML, McGuire MT, Wing RR, Hill JO. Resting Energy Expenditure in Reduced-Obese Subjects in the National Weight Control Registry. *Am J Clin Nutr.* 1999;69:1189-1193.