

Award Number: DAMD17-01-1-0360

TITLE: Effects of Moderate Aerobic Exercise Combined with
Caloric Restriction on Circulating Estrogens and IGF-I
in Premenopausal Women

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REPORT DATE: October 2002

TYPE OF REPORT: Annual Summary

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

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 this 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 October 2002		3. REPORT TYPE AND DATES COVERED Annual Summary (17 Sep 01 - 16 Sep 02)	
4. TITLE AND SUBTITLE Effects of Moderate Aerobic Exercise Combined with Caloric Restriction on Circulating Estrogens and IGF-I in Premenopausal Women				5. FUNDING NUMBERS DAMD17-01-1-0360	
6. AUTHOR(S) Nancy I. Williams, Sc.D.					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) The Pennsylvania State University University Park, PA 16802-7000 E-Mail: niwl@psu.edu				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012				10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited.					12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 Words) This investigator has received a Career Development Award (DAMD17-01-1-0360) and an IDEA award (DAMD17-01-1-0361) to support her development as a breast cancer researcher, and to conduct a study to test whether a program of moderate aerobic exercise that is combined with a moderate level of dietary restriction will result in significant decreases in two biomarkers of breast cancer, circulating estrogens and IGF-I. The study will test whether a diet/exercise program will produce significant reductions in the peripheral production of estrone by adipose tissue through its impact on the reduction of fat mass. Lastly, validation studies for a novel method of assessing energy status will be performed. The annual summary for this study has been submitted with the IDEA award. The support Dr. Williams has received from the CDA award has allowed her release from 66% of her teaching responsibilities, provided support for travel to the Era of Hope meeting and supported a graduate student. These funds have therefore indirectly helped to support numerous research and training accomplishments that are listed in this report.					
14. SUBJECT TERMS Breast cancer, menstrual cycle, IGF-1, estradiol, exercise					15. NUMBER OF PAGES 26
					16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited		

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102

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Introduction

This proposal entitled "Effects of moderate aerobic exercise combined with caloric restriction on circulating estrogens and IGF-I in premenopausal women" will provide important scientific contributions with respect to the primary prevention of breast cancer in women. Specifically, this study will examine potential mechanisms relating to the role of physical activity in the reduction of the risk of breast cancer by testing whether moderate aerobic exercise can reduced the levels of two hormonal biomarkers, circulating estrogens and insulin-like growth factor I (IGF-I). Since elevated levels of both of these hormones have been associated with an increased risk of breast cancer, and because exercise may modulate circulating levels, we wish to extend previous findings from epidemiological and cross-sectional studies by performing a tightly controlled, prospective clinical study that addresses previously unanswered questions related to the role of exercise in the modulation of estrogen and IGF-I. Although previous studies have shown that negative energy balance, and not other stressful aspects of physical exercise, can modulate reproductive function and therefore circulating estrogen levels, no studies to date have determined the magnitude of energy deficit required for these changes during long-term training, and no studies have attempted to differentiate between the exercise-induced changes in ovarian versus adipose sources of circulating estrogens. Since both estradiol (ovarian) and estrone (adipose tissue) are biologically active, and because the importance of estrone as a risk factor increases with age and adiposity, it is important to consider the degree to which exercise which creates a negative energy balance affects both of these sources of circulating estrogens. Circulating levels of IGF-I correlate with breast cancer risk, yet studies examining the responses of this hormone and its binding proteins to chronic exercise are lacking. Since IGF-I levels are very sensitive to nutritional status, previously reported stimulatory effects of exercise on IGF-I can be overridden if exercise is performed in the face of negative energy balance. In this regard, exercise that promotes weight loss can be viewed as a way to reduced levels of IGF-I, and therefore potentially reduce the risk of breast cancers. To date, no studies have addressed whether a program of moderate aerobic exercise and dietary restriction producing a negative energy balance that is carried out over a long duration will significantly alter IGF-I levels. Further the degree to which these levels might be altered in individuals of differing energy stores has not been addressed. Metabolic energy availability is an important contributing factor in the development of reproductive cancers. However, current methods for assessing energy availability, which include anthropometric measures, calculations of energy balance, evaluation of various serum and urinary biomarkers are prone to measurement error, not sensitive to alterations in energy availability, and are sometimes affected by disease states. The current project centers on the introduction of a novel approach to estimating energy status by measuring metabolic hormones in plasma: insulin, IGF-I, IGFBP-1 and leptin. Recently, dried blood spot (DBS) sample collection techniques have allowed for endocrine based population studies examining a wide variety of ecological factors that contribute to variation in human reproduction. In order to use the proposed method of energy status assessment in large population-based applications, such as those addressing the role of physical activity and or diet in the risk of breast cancer, the battery of metabolic hormones that comprise the proposed method must be amenable to collection and assays. Although the DBS technique has been partially validated for some hormonal assays, it has not yet been properly validated for insulin, IGF-I, IGFBP-1 and leptin, and it is unclear whether the technique is responsive to physiological changes of these compounds. Therefore, the current work calls for the validation of the DBS sampling technique for these assays under physiological conditions. The proposed studies will yield new and important information regarding the degree to which an exercise and diet program that results in an energy deficit will reduce the risk of breast cancer.

Body

Study Design: The study utilizes a prospective, randomized design that tests the effects of a moderate exercise program (4X/wk; 4 months) combined with moderate dietary restriction that results in an average daily energy deficit of -20%-30% kcals (Figure 1). Previously sedentary, eumenorrheic women aged 25-35 years will be assigned to exercise or control groups. Both normal weight (BMI 21-25 kg/m²) and overweight (BMI 26-30 kg/m²) will be assigned to either exercise or control (no exercise, no dietary restriction) groups; 4 groups, n=15

each group. Subjects will be studied for a total of six menstrual cycles, i.e., 2 control followed by 4 cycles with training and dietary restriction.

Recruiting/ Screening	Control 1	Control 2	Exercise 1	Exercise 2	Exercise 3	Exercise 4	Post-Exercise Testing
Beck Depression EDI Medical History Menstrual History Physical Activity Food Frequency Questionnaire	Urine Collection → Menstrual Symptoms → Ovulation Detection Kit Mid-luteal Progesterone VO _{2max} (FP) Body Composition (FP) Physical Exam (FP) Endocrine Screening (FP) MENSES	3-Day Diet Record Ovulation Detection Kit Mid-luteal Progesterone Diet Counseling (LP) Serum E ₁ & E ₂ (Days 3, 6, 8, 10, 12, 14, 16, 19, 22, & 25): Serum & DBS (FP): IGF-I, IGFBP-1, Insulin, T ₃ , leptin Menses	3-Day Diet Record (FP & LP) Body Composition Serum (FP): IGF-I, IGFBP-1, Insulin, T ₃ , leptin Menses	3-Day Diet Record (FP) Body Composition Serum (FP): IGF-I, IGFBP-1, Insulin, T ₃ , leptin Strict Diet & Menses	3-Day Diet Record (FP) Body Composition Serum (FP): IGF-I, IGFBP-1, Insulin, T ₃ , leptin Exercise Control Menses	3-Day Diet Record (FP) Body Composition Serum E ₁ & E ₂ (Days 3, 6, 8, 10, 12, 14, 16, 19, 22, & 25): Serum (FP): IGF-I, IGFBP-1, Insulin, T ₃ , leptin Menses	VO _{2max} Body Composition Serum & DBS (FP): IGF-I, IGFBP-1, Insulin, T ₃ , leptin Menses
	→ = Entire Study FP = Follicular Phase	EDI = Eating Disorder Inventory LP = Luteal Phase E ₁ = Estrone DBS = Dried Blood Spot				E ₂ = Estradiol	

Figure 1. Study Design

Progress According to the Approved Statement of Work:

Note: Human Subjects Approval obtained from DOD October, 2001

- Proposed Month 1**
1. Recruitment of subjects for year 1 of study (n=5 in each of 4 groups)
 - a. Place ads in local newspapers, on tv, radio, announce study on email lists, post signs
 - b. Train research staff to take phone interviews
 2. Get organized
 - a. Make up subject notebooks with instructions for all aspects of study
 - b. Prepare individual subject files and labels and storage for urine collection devices
 - d. Meet with GCRC staff and review study procedures

Actual Month 1: September, 2001

Recruitment was delayed due to delay in human subjects approval. We prepared ads, trained staff to take phone interviews, drew up data forms, made subject notebooks, prepared subject files, and met with GCRC nurses, physicians, and dietary staff to set up procedures.

- Proposed Month 2**
1. Ongoing recruitment
 2. Begin subject information sessions
 3. Begin subject screening/initial testing

Actual Month 2: October, 2001

The subjects were recruited from the local Centre County, PA area using multiple advertising methods. Newspaper ads ran for one week in the local newspaper. Additionally, advertising incorporated flyers and ads on a local rolling news station. As a result, approximately 55 phone and e-mail contacts were made. Four one-hour "Informational Sessions" were held for the subjects to learn more about the study.

- Proposed Month 3**
1. Ongoing recruitment/information sessions
 2. Continue subject screening/initial testing

Actual Month 3; November, 2001

Due to limitations in laboratory personnel, recruiting and sign-up was delayed and a "second phase" of recruiting was planned. Contact was maintained with potential participants through phone and email.

- Proposed Months 4-12*
1. Continue recruitment efforts only if necessary
 2. Continue subject screening/initial testing
 3. Complete subject exercise training/experimental testing

Actual Month 4; December, 2001

Due to limitations in laboratory personnel, recruiting and sign-up was delayed and a "second phase" of recruiting was planned. Contact was maintained with potential participants through phone and email.

Actual Months 5 -6; January and February, 2002

Second phase of recruitment began. We re-contacted our pool of initial contacts, and placed ads in the local newspaper again. We held two more information sessions, and then began study sign-ups. We signed up 20 individuals who were willing to complete the study during Year 1. We had difficulty signing up subjects who would serve as controls, i.e., subjects who would go through all the procedures in the study except receiving dietary counseling to have their food intake reduced and participating in the exercise sessions. Many individuals indicated upon phone screening that they would not participate if they weren't going to lose weight and get in shape. Therefore, we decided to postpone the recruitment of control subjects until our Year 2 cohort. We plan to recruit subjects during Year 2 differently, so that can successfully sign-up women who will not exercise or have their calories reduced, and women who will participate in the diet and exercise groups. We will do this by increasing our recruitment efforts over a longer time period with more ads, and by placing ads that emphasize the other health benefits of the study besides exercise and calorie reduction.

Actual Months 7-11; March-July, 2002

We began exercise training and dietary counseling for several subjects in late February and March, after screening procedures had been completed, and documentation of normal menstrual cyclicity for two complete menstrual cycles with daily urine samples and corroborative testing for ovulation and adequate progesterone levels had occurred. The last woman completed exercise training and post-testing in July, 2002.

Actual Month 12, August, 2002

In August we began aliquotting urine samples from the subjects' collections, preserving the urine samples, and measuring specific gravity. We also began data entry for initial survey and demographic data, daily training, weekly food exchanges, body weight, body composition, resting metabolic rate and diet and physical activity logs.

Actual Month 13, September, 2002

We continued aliquotting and processing urine samples and data entry.

Actual Month 14, October, 2002

We have completed data entry and are beginning preliminary data analysis. We began assaying urine for E1G and PDG, and are beginning to assay metabolic hormones, i.e., insulin, leptin, T3, and IGF-I. We are also preparing data reports for subjects that completed the study, and getting ready to recruit for Year 2.

Preliminary Results From Year 1:

Subjects: Our subjects were previously sedentary, eumenorrheic women (ovulatory menstrual cycles with circulating mid-luteal phase progesterone levels >5 ng/ml) 25-35 years old. They had the following characteristics: non-smoking; not using hormonal contraceptives for at least 6 months prior to the study; gynecological age greater than or equal to 13 years of age; no history of depression, disordered eating, or other affective disorders; no history of weight loss; no apparent disease; not aerobically trained (less than 1 hour a week of aerobic activity); weight stable (less than or equal to 2.3 pound change) in the last year; no medication incompatible with hormonal analyses, exercise or caloric restriction. Out of 30 subjects that signed informed consents, 20 subjects made it through the screening procedures and began the control phase of the study. The twenty women described their ethnicity as the following: 14 Caucasian, 3 Asian, 2 African-American and 1 Other.

Subject Attrition and Compliance: Nine women dropped out at various times during the study for the following reasons: 1 for menstrual abnormality, 5 medical (2 were exercise-related injuries), 3 self (time, intervention, etc.), and 2 for noncompliance. Compliance in the study was excellent, with women completing 3.9 out of 4 workouts per week, and over 85% of their scheduled visits (every other week) with the dietician. Subjects followed the diet as is evidenced by the significant weight loss achieved. Adherence to other testing procedures was excellent, and urine collections were completed with less than 3% of samples missing.

Table 1. Subject Characteristics

Group	Age (yrs)	Weight (kg)	Height (kg)	BMI (kg/m ²)	% Fat	VO ₂ max (ml/kg/min)
Low BMI	31 ± 3	63 ± 6	165 ± 6	23 ± 2	32 ± 4	33 ± 4
High BMI	32 ± 2	75 ± 8	165 ± 6	28 ± 2	39 ± 5	32 ± 6

Values are mean + SD

Subjects met our initial targets for weight, age, BMI and fitness levels. Average menstrual cycle length was 29.7 ± 5 days, and did not change significantly in either Low or High BMI group. Aerobic exercise training was 4 times per week for four consecutive menstrual cycles at 77 ± 3 % of maximum heart rate for 40-60 minutes, resulting in an average of 22% increase in aerobic capacity as defined by VO₂ max (32.6 ± 4.7 to 40.0 ± 10 ml/kg/min; $P < 0.05$ pre vs post, Figure 2). Dietary intake was successfully reduced using the food exchange system (Low BMI = 1889 ± 354 to 1214 ± 239 kcals; High BMI = 2125 ± 287 to 1450 ± 264 kcals; $P < 0.05$ pre vs post in both groups). The combination of moderate exercise and diet produced significant weight loss in both groups (Low BMI -3.3 %; High BMI -7.6% $P < 0.05$, Figure 3). Significant changes in percent body fat occurred in both groups (Low BMI 32 ± 4 % to 25 ± 8 %; High BMI 39 ± 5 to 32 ± 6 %: $P < 0.05$, Figure 4).

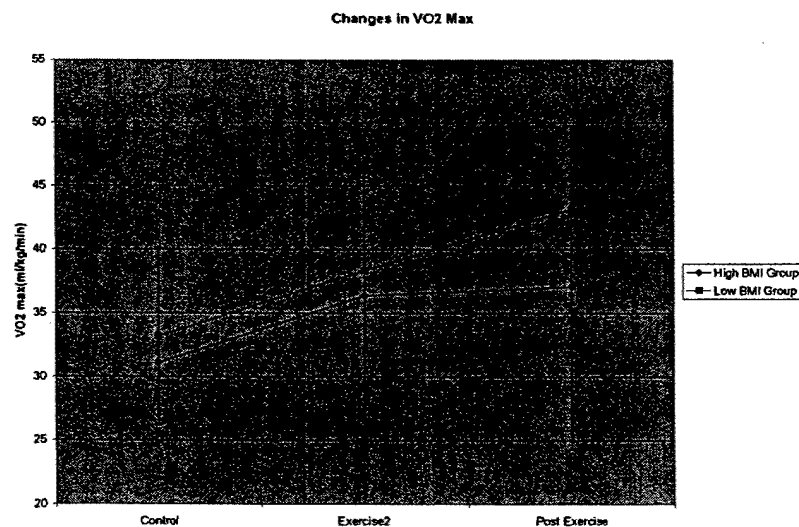


Figure 2. Changes with exercise training in VO₂max (ml/kg/min)

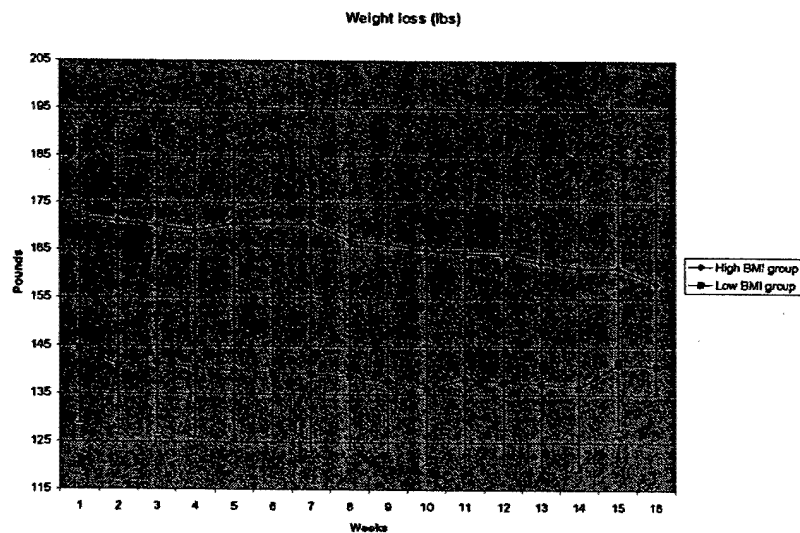


Figure 3. Weight loss with diet and exercise over four menstrual cycles

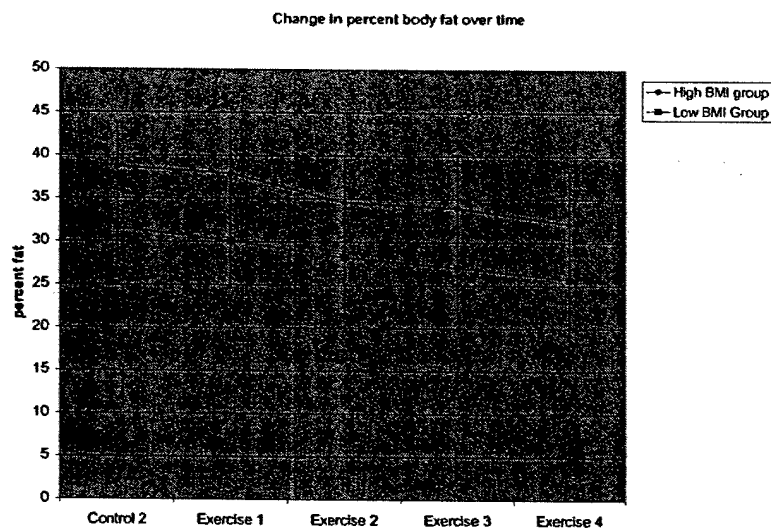


Figure 4. Percent body fat loss with diet and exercise over four menstrual cycles

Preliminary Analysis of Urinary Steroid Metabolites

Figure 5 shows the profiles generated by our assays for E1G and PDG, urinary metabolites for estrogen and progesterone, respectively. We should complete these assays for our Year 1 subjects, in addition to those for metabolic hormones insulin, T3, leptin, IGF-I, and IGFBP-1 in the next two –three months.

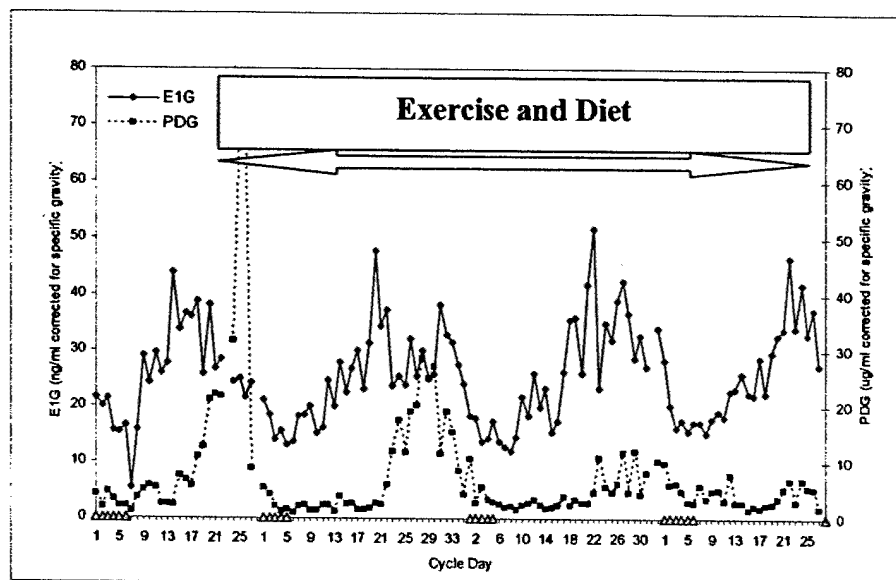


Figure 5. Urinary steroid metabolites for an individual subject during a control cycle and then four menstrual cycles thereafter where caloric restriction and exercise training occurred.

Overall Results from Year 1:

We achieved excellent results from our dietary and exercise intervention. Our only anticipated changes for Year 2 include an expanded recruitment period, and a change in recruitment strategy to attract women who will agree to participate without the diet and exercise intervention. To do this we will structure the advertisements to highlight other aspects of the study from which subjects will benefit. These include diet counseling for non-weight loss purposes. We have developed several educational modules on nutrition topics of interest that do not advocate weight loss. Additionally, we will draw attention to the benefits of learning about one's body composition, fitness level, and reproductive status.

KEY ACCOMPLISHMENTS

Summary of Year 1 of "Effects of moderate aerobic exercise combined with caloric restriction on circulating estrogens and IGF-I in premenopausal women":

This study will test whether a program of moderate aerobic exercise that is combined with a moderate level of dietary restriction will result in significant decreases in two biomarkers of breast cancer, circulating estrogens and IGF-I. We will also test whether this type of diet/exercise program will produce significant reductions in the peripheral production of estrone by adipose tissue through its impact on the reduction of fat mass. Lastly, validation studies for a novel method of assessing energy status will be performed. To date we have completed our first year of the three year study protocol. Our cohort for Year 1 consisted of 20 women (25-35 yrs) divided into high (26-30 kg/m²) and low BMI (21-25 kg/m²) exercise groups. Aerobic exercise training was 4 times per week for four consecutive menstrual cycles at $77 \pm 3\%$ of maximum heart rate for 40-60 minutes, resulting in an average of 22% increase in aerobic capacity as defined by $\text{VO}_2 \text{ max}$ ($P < 0.05$ pre vs post). Dietary intake was successfully reduced using the food exchange system (Low BMI = 1889 ± 354 to 1214 ± 239 kcals; High BMI = 2125 ± 287 to 1450 ± 264 kcals). The combination of moderate exercise and diet produced significant weight loss in both groups (Low BMI $-X\%$; High BMI $-X\%$ $P < 0.05$). Significant changes in body composition occurred in both groups (Low BMI $32 \pm 4\%$ to $25 \pm 8\%$; High BMI 39 ± 5 to $32 \pm 6\%$; $P < 0.05$). As expected, menstrual cycle length in these reproductively mature women did not change significantly with training and weight loss. We are currently conducting biochemical determinations of urinary estrone-3 glucuronide and pregnanediol-3 glucuronide, LH, and FSH, and serum IGF-I, Insulin, T3, Leptin, IGFbp-1, estrone and estradiol. Data reduction and analyses are being completed for dietary intake, energy expenditure, resting metabolic rate. We will begin recruiting for our Year 2 cohort in December, 2002.

REPORTABLE OUTCOMES

Presentations:

The following presentations have resulted from work in N. Williams' laboratory, since funding from DOD.

Note: Funding from DAMD17-01-1-0361 was used to directly support *only* presentation #5.

1. Senior MK, **Williams NI**, McConnell HJ, Clark KC. Screening for subclinical eating disorders in female athletes: validation of an indirect interview technique. (*Presented at the 24th Annual meeting of the Mid-Atlantic Regional Chapter of the American College of Sports Medicine, Bushkill, PA, November 2-3, 2001*).
2. McConnell HJ, **Williams NI**, O'Connor KA, Clark KL, Putukian M. Menstrual irregularities and disordered eating in female athletes: survey vs follow-up clinical and physiological studies. (*Presented at the 24th Annual meeting of the Mid-Atlantic Regional Chapter of the American College of Sports Medicine, Bushkill, PA, November 2-3, 2001*).
3. Mastro AM, **Williams NI**, Ford J, Fuener K, Orsega-Smith E, Kraemer WJ, Bleznak AD, Dixon RH, Underwood J, Miles M, Wagner K. IL-6 and interferon-gamma levels following chemotherapy for breast cancer. *Proceedings of the American Association for Cancer Research Annual Meeting*, San Francisco, CA, April 6-10, 2002
4. Hertel J, **Williams NI**, Gribble PA, McConnell HJ, DiPasquale AA, Putukian M. Changes in risk factors of ACL injuries across the menstrual cycle: A pilot study. *Proceedings of the American College of Sports Medicine Annual Meeting*, St. Louis, MO, May 29-June 1, 2002
5. **Williams NI**, McConnell HM, Gardner JK, Albert AC, Cameron JL. Lifestyle factors such as exercise, caloric intake, and psychological stress: relationship to reproductive hormones and possibly the risk of breast cancer. *Era of Hope* meeting, Department of Defense Breast Cancer Research Program, Orlando, FL, September 25-28, 2002

MANUSCRIPTS

The following manuscripts have been generated from Dr. Williams' laboratory since DOD funding was awarded.

PUBLISHED MANUSCRIPTS

Williams, N.I., Caston-Balderrama, A.L. Helmreich, D.L., Parfitt, D.B., Nosbisch C, Cameron, J.L. Longitudinal changes in reproductive hormones and menstrual cyclicity in cynomolgus monkeys during strenuous exercise training: rapid transition to exercise-induced amenorrhea *Endocrinology* 142: 2381-2389, 2001

Williams NI, DL Helmreich DL, DB Parfitt, Caston-Balderrama AL, JL Cameron. Evidence for a causal role of low energy availability in the induction of menstrual cycle disturbances during strenuous exercise training. *J Clin Endocrinol Metab* 86: 5184-5193, 2001

Miles MP, Mackinnon LT, Grove DS, **Williams NI**, Bush JA, Marx JO, Kraemer WJ, Mastro AM. The relationship of natural killer cell counts, perforin mRNA and CD2 expression to post-exercise natural killer cell activity in humans. *Acta Physiol Scand* 174: 1-9, 2002.

McConnell HJ, KA O'Connor, E Brindle, and NI Williams. Validity of methods for analyzing urinary steroid data to detect ovulation in athletes. *Med. Sci. Sports Exerc*, 34(11): 1836-1844, 2002)

Whipple TJ, Petit Moira, Sharkey N, Demers L, Williams NI. Leptin and the skeleton. (*Accepted, Clinical Endocrinology for publication, 2002*)

MANUSCRIPTS IN REVIEW

Williams, NI, Senior MK, McConnell HJ, Clark KL. Screening for subclinical eating disorders in female athletes: an indirect interview (submitted to *Med Sci Sports Exerc*, September, 2002)

Williams, NI, Flecker KL, McConnell. Weight and Diet Concerns in Female Athletes: Association with Menstrual Cycle Length (submitted to *Int J Sports Nut Exerc Metab*, September, 2002)

Whipple TJ, Le B, Demers LM, Petit M, Sharkey N, Williams NI. Analysis of bone cell activity following moderate intensity resistance exercise in untrained young males. (submitted to *Clinical Endocrinology*, October, 2002).

Williams, NI. Experimental disruptions of the menstrual cycle: Lessons from long-term prospective studies (Invited publication of symposium presented at American College of Sports Medicine Meeting, St. Louis, MO, May, 2002; for publication in *Med Sci Sports Exerc*)

ABSTRACTS/PRESENTATIONS

The following abstracts and presentations have been generated from Dr. Williams' laboratory since DOD funding was awarded.

Mastro AM, Williams NI, Kraemer WJ, Orsega-Smith EM, Perry MD, Dixon RH, Bleznak AD, Underwood J. Exercise, quality of life, and the recovery of CD4 (+) lymphocytes following chemotherapy for breast cancer *Proceedings of the American Association for Cancer Research 92nd Annual Meeting*, New Orleans, LA, 42 : 331, March 24-28, 2001

Perry MD, Mastro AM, Orsega-Smith E, Miles MP, Kraemer WJ, Williams NI. Exercise training and immune function following chemotherapy for breast cancer. *Proceedings of the American College of Sports Medicine Annual Meeting*, Baltimore, MD, June 2-6, 2001

Orsega-Smith E, Williams NI (FACSM), Perry MD, Mastro AM, Kraemer WJ, Bleznak A, Dixon R, Underwood J. Fatigue, quality of life and physical function after chemotherapy for breast cancer. *Proceedings of the American College of Sports Medicine Annual Meeting*, Baltimore, MD, June 2-6, 2001

Galucci, AN, Williams NI. Physiological indicators of psychological stress prior to competitive exercise. *Proceedings of the American College of Sports Medicine Annual Meeting*, Baltimore, MD, June 2-6, 2001

McConnell HJ, O'Connor KA, Brindle E, Williams, NI. Assessing reproductive function in exercising women: validity of ovulation detection algorithms. *Proceedings of the Endocrine Society Annual Meeting, Abstract #P2-408*, 2001

Senior MK, Williams NI, McConnell HJ, Clark KC. Screening for subclinical eating disorders in female athletes: validation of an indirect interview technique. (*Presented at the 24th Annual meeting of the Mid-Atlantic Regional Chapter of the American College of Sports Medicine, Bushkill, PA, November 2-3, 2001*).

McConnell HJ, Williams NI, O'Connor KA, Clark KL, Putukian M. Menstrual irregularities and disordered eating in female athletes: survey vs follow-up clinical and physiological studies. (*Presented at the 24th Annual meeting of the Mid-Atlantic Regional Chapter of the American College of Sports Medicine, Bushkill, PA, November 2-3, 2001*).

Mastro AM, Williams NI, Ford J, Fuener K, Orsega-Smith E, Kraemer WJ, Bleznak AD, Dixon RH, Underwood J, Miles M, Wagner K. IL-6 and interferon-gamma levels following chemotherapy for breast cancer. *Proceedings of the American Association for Cancer Research Annual Meeting*, San Francisco, CA, April 6-10, 2002

Hertel J, Williams NI, Gribble PA, McConnell HJ, DiPasquale AA, Putukian M. Changes in risk factors of ACL injuries across the menstrual cycle: A pilot study. *Proceedings of the American College of Sports Medicine Annual Meeting*, St. Louis, MO, May 29-June 1, 2002

Williams NI, McConnell HM, Gardner JK, Albert AC, Cameron JL. Lifestyle factors such as exercise, caloric intake, and psychological stress: relationship to reproductive hormones and possibly the risk of breast cancer. *Era of Hope meeting*, Department of Defense Breast Cancer Research Program, Orlando, FL, September 25-28, 2002

FUNDING APPLIED FOR

The following grant proposals have been generated from Dr. Williams' laboratory since DOD funding was awarded

Penn State University
College of Health and Human Development
Interdisciplinary Seed Grant Program , 1999-2000; \$6000

Co- Investigator: (PI Jay Hertel)
"Changes in risk factors of anterior cruciate ligament ruptures in female collegiate athletes across the menstrual cycle"

Pathology Initiation Grant	January 2002-January 2003	5%
Hershey Medical Center, Dept. Pathology	\$15,170	

Co-Investigator (PI is Williams' Doctoral student, Thomas Whipple, MS, PT)
"The Role of Resistance Exercise and Energy Availability on Bone Metabolism"

Children's Youth and Family Consortium	January 2002- January 2003	5%
Penn State University, CHHD	\$13, 925	

Co-Principal Investigator (with Moira Petit, PhD (PSU-Hershey))
"Designing Intervention Programs to Optimize Bone Development: Application of Bone Markers to Monitor the Short-term Response to Exercise"

NIH

1 RO1 HD39245-01	(Williams)	5/1/01 - 4/30/04	30%
PHS/NICHD		\$ 1,538,361	

Principal Investigator:

"Bioenergetics of Exercise-induced Menstrual Disturbances"

Goal is to test to determine the mechanism whereby low energy availability modulates reproductive function in exercising women

Pending Support

National Institutes of Health (NIH)			
1 RO1	(PI is Hartman, Terryl J.)	7/01/02 - 6/30/07	15%
PHS/NICHD		\$ 811,610	

Co Investigator:

"Nutrition, Fertility and Oxidative Stress"

National Institutes of Health (NIH)

HD-02-012 Cooperative Reproductive Science Research Centers at Minority Institutions

Co-Investigator: \$ 1,160,204 5%

"The efficacy and safety of metformin and lifestyle factors in the amelioration of hyperandrogenemia and its associated symptomology"

DEGREES IN PROGRESS

The following graduate students are receiving training in Dr. Williams' laboratory:

2000	Heather McConnell, MS (In progress) (Physiology)
2002	Megan Senior " MS(Completed) Screening for Subclinical Eating Disorders in Female Athletes: The Use of an Indirect Interview Technique " (Nutrition)
2002	Michael Perry MS (In progress) (Kinesiology)
2002	Kelly Dougherty MS(In progress) (Kinesiology)
2002	Brian Frye MS (In progress) (Kinesiology)

The following undergraduate students are receiving training in Dr. Williams' laboratory:

- 2002 Erica Richard, BS Biology (in progress)
- 2003 Chrissy Rezk, BS Chemistry (in progress)
- 2004 Meredith Snook, BS Nutrition (in progress)

Conclusions:

See Overall Results from Year 1.

References-none

Appendices –Curriculum Vitae

NANCY I. WILLIAMS
Curriculum Vitae

BIOGRAPHICAL

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PII Redacted

EDUCATION

- 1984 B.S. Biology, Bucknell University, Lewisburg, PA
- 1986 M.S. Exercise Physiology, The Ohio State University, Columbus, OH
- 1992 Sc.D. Applied Anatomy & Physiology, Boston University, Boston, MA
- 1992-1996 Postdoctoral fellowship, University of Pittsburgh School of Medicine, Center for the Study of Reproductive Physiology (Judy L. Cameron PhD, mentor)

PROFESSIONAL EXPERIENCE

- 1997-present Assistant Professor Department of Kinesiology and Noll Physiological Research Center
Joint Appointments:
Intercollege Program in Physiology, Department of Nutrition, Life Science Consortium (Nutrition Science Option)
Penn State University
University Park, PA
- 1996-1997 Visiting Assistant Professor Human Anatomy & Physiology
Department of Biological Sciences
Ohio University
Athens, Ohio
- 1992-1996 Postdoctoral Fellow: Center for the Study of Reproductive Physiology
School of Medicine
University of Pittsburgh
Pittsburgh, Pennsylvania
- 1987-1992 Graduate Fellow: Department of Health Sciences
Sargent College
Boston University
Boston, Massachusetts
- Research Projects: NIH grant: "Effects of exercise on pituitary hormone secretion"
NIH grant: "Exercise as an adjunct therapy for persons with mental illness"
- Health/Fitness
Center Coordinator: Faculty/Staff Fitness Program

Department of Health Sciences
Sargent College
Boston University
Boston, Massachusetts

1986-1987 Project Director: Exercise Physiology Laboratory
Department of Exercise Science
The Ohio State University
Columbus, Ohio

NIH Grant: "Effects of chronic exercise training on aging"

1984-1986 Research Assistant: Exercise Physiology Laboratory
Department of Exercise Science
The Ohio State University,
Columbus, Ohio

NIH Grant: "Effects of chronic exercise training on aging"

HONORS AND AWARDS

Fellowship Status: American College of Sports Medicine, 1998

NIH Individual National Research Service Award (NRSA), 1994-1996

Endocrine Society; Women in Endocrinology Travel Award, 1995

Association of Women in Science Education Foundation Award, 1990

American Association of University Women Predoctoral Fellowship, 1990

American College of Sports Medicine, New England Chapter Scholarship Award; 1989

Phi Sigma Biological Honor Society; 1984

Scholar/Athlete of the Year, Southern New Jersey Courier Post, 1980

PROFESSIONAL MEMBERSHIPS

American College of Sports Medicine	1984-present
Endocrine Society	1996-present
New England Chapter ACSM	1987-1992
Association for Women in Science	1987-1992
Mid-Atlantic Chapter ACSM	1997-present

TEACHING

COURSES TAUGHT AT BOSTON UNIVERSITY:

HS 276 *Physiology of Exercise Laboratory*
HS 302 *Exercise Physiology (Lecture)*
HS 535 *Clinical Fitness Evaluation*
HS 573 *Physiology of Activity (Lecture)*
HS 573 *Physiology of Activity (Laboratory)*

COURSES TAUGHT AT OHIO UNIVERSITY:

BIOS 450/550 *Principles of Endocrinology (section on neuroendocrinology)*

BIOS 446/546 *Exercise Physiology Laboratory*

BIOS 345 *Human Physiology*

BIOS 346 *Human Physiology Laboratory*

COURSES TAUGHT AT PENN STATE UNIVERSITY:

<u>Sem/Year</u>	<u>Course</u>	<u>Title</u>	<u>Credits</u>	<u>Enrollment</u>
Fall 1997	Kines 481W	Scientific basis of Exercise for Older Adults	3	50
	Kines 496C	Independent Study	3	1
Spring 1998	Kines 456	Fitness Appraisal	4	96
	Kines 496C	Independent Study	3	5
	Kines 395b	Practicum	3	2
Summer 1998	Kines 496C	Independent Study	1-3	3
Fall 1998	Kines 456	Fitness Appraisal	4	86
	Kines 456h	Fitness Appraisal (honors option)*	4	1
	Kines 496c	JumpStart to Health/Fitness	3	6
	Kines 496c	Independent Study	3	5
	Kines 496c	Independent Study (Schreyer Student)**	3	1
	Kines 596c	Supervised Teaching	3	1
	Kines 597i	Neuroendocrine- Immune Interactions	1	4
	Kines 395b	Practicum	3	1

COURSES TAUGHT ...cont.

<u>Sem/Year</u>	<u>Course</u>	<u>Title</u>	<u>Credits</u>	<u>Enrollment</u>
Spring 99	Kines 456	Fitness Appraisal	4	103
	Kines 424	Female in Exercise and Sport	3	36
	Kines 496c	Independent Study	3	16
Summer 99	Kines 456	Fitness Appraisal	4	14
Fall 99	Kines 424	Female in Exercise and Sport	3	16
	Kines 496c	Independent Study**	3	5
	Physio/Bio 572	Animal Physiology	3	12
Spring 00	Kines 456	Fitness Appraisal	4	78
	Kines 424	Female in Exercise and Sport	3	33
	Kines 496c	Independent Study**	3	5
Summer 00	Kines 456	Fitness Appraisal	4	12
Fall 00	Kines 424	Female in Exercise and Sport	3	35
	Physio/Bio 572	Animal Physiology	3	25
	Kines 496c	Independent Study**	3	5
Spring 01	Kines 424	Female in Exercise and Sport	3	35
	Kines 496c	Independent Study**	3	5
Fall 01	Kines 424	Female in Exercise and Sport	3	35
	Kines 496c	Independent Study**	3	5

*Supervised the writing of new laboratory experiment and handout for Kines 456

** Supervise studentS who work in my laboratory on research project examining the interactions between reproductive function disturbances, eating habits, and body image

STUDENT TRAINING

Preceptor NIH GM08619-07 Research Training in Physiological Adaptations to Stress. National Institute of General Medical Sciences, 1996-2005. Director is PA. Farrell, PhD, Noll Physiological Research Center, Penn State University

Mentor (Pending) Building Interdisciplinary Research Careers in Women's Health; Principal Investigator is Jay Moskowitz, MD, Penn State College of Medicine, Hershey, PA

Committee Chair- Undergraduate Honors Thesis

- 2000 Kathleen Flecker – Shreyer's Honor's College: "Weight and diet concerns among female athletes with menstrual cycle irregularities" (Winner 3rd place Undergraduate Research Exhibition)
- 2002 Chrissy Rezk – Shreyer's Honor's College: "Cognitive restraint and urinary cortisol in athletes with menstrual cycle disturbances"
- 2002 Meredith Snook- Shreyer's Honor's College: To be determined

Committee Chair- Masters Students

- 1999 Paula Wilkins "Body Image, Social Physique Anxiety, and Menstrual Dysfunction in the Female Athlete" (Physiology)
- 2000 Heather McConnell "Determining the validity of ovulation detection methods in an athletic population" (Physiology)

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| 2000 | Angelique Matuch "Quantifying physiological responses prior to competitive exercise" (Kinesiology) |
| 2002 | Megan Senior " Screening for Subclinical Eating Disorders in Female Athletes: The Use of an Indirect Interview Technique" (Nutrition) |
| 2002 | Michael Perry (In progress) (Kinesiology) |
| 2002 | Kelly Dougherty (In progress) (Kinesiology) |
| 2002 | Brian Frye (In progress) (Kinesiology) |

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| 1999 | Jill Bush "Proenkephalin peptide F concentrations in different blood bio-compartments: The effect of an acute resistance exercise protocol" (Kinesiology) |
| 2000 | Heather McConnell, MS (In progress) (Physiology) |
| 2001 | Thomas Whipple, MS, PT, (In progress) (Kinesiology) |

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| 1997 | Scott Mazetti "The influence of direct supervision of heavy resistance training on muscular performance and hormonal responses" (Kinesiology) |
| 1998 | Sang Kyung Kim "The effects of menstrual function on plasma peptide F immunoreactivity in response to high intensity cycle exercise" (Kinesiology) |
| 1998 | Jennifer DeSanto "Body Composition and energy balance: Comparison between eumenorrheic and amenorrheic athletes" (Kinesiology) |
| 1998 | Wallace Baker "Characterization of leukocyte infiltration after muscle damage" (Kinesiology) |
| 1998 | Steve Tokeshi "Maximal isokinetic force generation in upper body musculature during concentric and eccentric actions: a gender comparison" (Kinesiology) |
| 1999 | Jannell MacAulay "Submaximal cycle ergometry as a predictor of maximal aerobic capacity in women on oral contraceptives" (Kinesiology) |
| 2000 | Brittney Salkeld "The effect of oral contraceptive use on measures of fatigue and energy metabolism" (Kinesiology) |

- 1998 Jeff Volek "Fasting and postprandial serum lipoprotein responses to a hypocaloric low carbohydrate diet rich in monounsaturated fat and supplemented with n-3 fatty acids" (Kinesiology)
- 2002 Greg Daniels "Walking and running: Information and energetics" (Kinesiology)
- 2002 Nancy Johnston "Bio-markers of pre-term labor" (Nursing, Physiology minor)

Summer 1998
University

Minority High School Student Research Apprentice Program at Penn State

*Mentored student who helped with research projects in laboratory

RESEARCH

Dudley Allen Sargent Research Fund (intramural): 1988, 1989, 1990
Sargent College of Allied Health Professions
Boston University, Boston, Massachusetts

Principal Investigator:

"Effects of exercise and caloric restriction upon luteinizing hormone secretion"

Penn State University
College of Health and Human Development
Interdisciplinary Seed Grant Program , 1997-1998; \$5000

Principal Investigator:

"Prevalence of Female Athlete Triad Disorders: Estimation by Questionnaires and Subsequent Follow-up with Clinical and Laboratory Assessments of Physiological Status"

Penn State University
College of Health and Human Development
Interdisciplinary Seed Grant Program , 1998-1999; \$6000

Principal Investigator:

"Disturbances in Reproductive Function caused by Metabolic Stress: Possible Increased Susceptibility in Individuals with Elevated Levels of Perceived Psychological Stress "

Penn State University
College of Health and Human Development
Interdisciplinary Seed Grant Program , 1999-2000; \$6000

Co- Investigator: (PI Jay Hertel)

"Changes in risk factors of anterior cruciate ligament ruptures in female collegiate athletes across the menstrual cycle"

Pathology Initiation Grant
Hershey Medical Center, Dept. Pathology

January 2002-January 2003
\$15,170 5%

Co-Investigator (PI is Williams' Doctoral student, Thomas Whipple, MS, PT)
"The Role of Resistance Exercise and Energy Availability on Bone Metabolism"

Children's Youth and Family Consortium
Penn State University, CHHD

January 2002- January 2003
\$13, 925 5%

Co-Principal Investigator (with Moira Petit, PhD (PSU-Hershey))

"Designing Intervention Programs to Optimize Bone Development: Application of Bone Markers to Monitor the Short-term Response to Exercise"

EXTRAMURALLY FUNDED GRANTS

NIH National Research Service Award (NRSA), 1994-1996
Center for the Study of Reproductive Physiology
School of Medicine
University of Pittsburgh
Pittsburgh, Pennsylvania

Principal Investigator:

"Metabolic cues governing reproductive hormone secretion"

Pharmavite Corporation, Seattle, Washington
Research Grant-in-Aid, 1998-1999; \$20,000

Principal Investigator:

"Consumer Taste and Education of a Nutritional Sports Supplement"

US Army Medical Research and Materiel Command	1998-2001	5%
US Army Breast Cancer Program	\$292,539	

Co-Investigator:

"Use of Exercise to Increase CD4 Lymphocytes following Chemotherapy Treatment for Breast Cancer "

NIH		
1 RO1 HD39245-01	(Williams)	5/1/01 - 4/30/04 30%
PHS/NICHD		\$ 1,538,361

Principal Investigator:

"Bioenergetics of Exercise-induced Menstrual Disturbances"

Goal is to test to determine the mechanism whereby low energy availability modulates reproductive function in exercising women

US Army Medical Research and Materiel Command	9/17/01- 9/16/04	50%
US Army Breast Cancer Program (IDEA AWARD)	\$408,878	

Principal-Investigator:

"Effects of Moderate Aerobic Exercise Combined with Caloric Restriction on Circulating Estrogens and IGF-1 in Premenopausal Women (IDEA Award) "

US Army Medical Research and Materiel Command	9/17/01- 9/16/05
US Army Breast Cancer Program (CAREER DEVELOPMENT AWARD)	\$312,081

Principal-Investigator:

"Effects of Moderate Aerobic Exercise Combined with Caloric Restriction on Circulating Estrogens and IGF-1 in Premenopausal Women (Salary Only)"

Retirement Research Foundation	2000-2001	2%
	\$56.832	

Co-Investigator: (PI is J.L. Cameron, PhD)

"Physical Exercise and Brain Aging"

Pending Support

National Institutes of Health (NIH)			
1 RO1	(PI is Hartman, Terry J.)	7/01/02 - 6/30/07	15%
PHS/NICHD		\$ 811,610	

Co Investigator:

"Nutrition, Fertility and Oxidative Stress"

National Institutes of Health (NIH)
 HD-02-012 Cooperative Reproductive Science Research Centers at Minority Institutions
 Co-Investigator: \$ 1,160,204 5%

“The efficacy and safety of metformin and lifestyle factors in the amelioration of associated symptomology”

RESEARCH REPORTS

Williams NI, Christante DH, Swavely K, Laufer E, McBrearty C, and Clark KC. Penn State Univeristy JogMate Study: Product Effectiveness and Consumer Appeal
Submitted to Pharmavite Corp, Seattle, WA, July 15, 1999

PUBLISHED MANUSCRIPTS

Skrinar, G.S., N.I. Williams, B.A. Bullen, J.W. McArthur, and N.M. Mihok. Changes in body consciousness relate to regularity of exercise training. *Perceptual and Motor Skills*. 75: 696-698, 1992

Bloomfield, S.A., N.I. Williams, D.R. Lamb, FACSM, and R.D. Jackson. Non-weight bearing exercise may increase lumbar spine bone mineral density in healthy post menopausal women. *Amer. J. Phys. Med. Rehabil.* 72: 204-209, 1993

Williams, N.I., J. McArthur, B. Turnbull, B. Bullen, G. Skrinar, I.Z. Beitins, G.M. Besser, L.H. Rees, I. Gilbert, D. Cramer, L. Perry, D.S. Tunstall-Pedoe. Effects of follicular phase exercise on LH pulse characteristics in sedentary eumenorrheic women. *Clinical Endocrinology* 41: 787-794, 1994

Williams, N.I., J. Young, J. McArthur, B. Bullen, G. Skrinar, and B. Turnbull. Strenuous exercise with caloric restriction: Effect on luteinizing hormone secretion. *Med. Sci. Sports Exerc.* 27 (10): 1390-1398, 1995

Williams, N.I., M.J. Lancas, and J.L. Cameron. Stimulation of luteinizing hormone (LH) secretion in male rhesus monkeys by food intake: Evidence against a role for insulin. *Endocrinology* 137(6): 2565-2571, 1996

Williams, N.I. Low energy availability and reproductive disturbances: a review of clinical and hormonal effects. *Dance Medicine and Science* 2:(1) 19-31, 1998

Williams, N.I., B.A. Bullen, J.W. MacArthur, G.S. Skrinar, and B.A. Turnbull. Effects of short-term strenuous endurance exercise upon corpus luteum function". *Med. Sci. Sports Exerc* 31(7): 949-958, 1999.

Sharkey, N.A., Williams, N.I., Guerin, J.B.: The role of exercise in the prevention and treatment of osteoporosis and osteoarthritis. *Nursing Clinics of North America*, 35 (1): 209-221, 2000

Williams, N.I., Caston-Balderrama, A.L. Helmreich, D.L., Parfitt, D.B., Nosbisch C, Cameron, J.L. Longitudinal changes in reproductive hormones and menstrual cyclicity in cynomolgus monkeys during strenuous exercise training: rapid transition to exercise-induced amenorrhea *Endocrinology* 142: 2381-2389, 2001

Williams NI, DL Helmreich DL, DB Parfitt, Caston-Balderrama AL, JL Cameron. Evidence for a causal role of low energy availability in the induction of menstrual cycle disturbances during strenuous exercise training. *J Clin Endocrinol Metab* 86: 5184-5193, 2001

Miles MP, Mackinnon LT, Grove DS, Williams NI, Bush JA, Marx JO, Kraemer WJ, Mastro AM. The relationship of natural killer cell counts, perforin mRNA and CD2 expression to post-exercise natural killer cell activity in humans. *Acta Physiol Scand* 174: 1-9, 2002.

McConnell HJ, KA O'Connor, E Brindle, and NI Williams. Validity of methods for analyzing urinary steroid data to detect ovulation in athletes. *Med. Sci. Sports Exerc*, 34(11): 1836-1844, 2002)

MANUSCRIPTS IN PRESS

Whipple TJ, Petit Moira, Sharkey N, Demers L, Williams NI. Leptin and the skeleton. (*Accepted, Clinical Endocrinology for publication*, 2002)

ACCEPTED MANUSCRIPTS

MANUSCRIPTS IN REVIEW

Williams, NI, Senior MK, McConnell HJ, Clark KL. Screening for subclinical eating disorders in female athletes: an indirect interview (submitted to *Med Sci Sports Exerc*, September, 2002)

Williams, NI, Flecker KL, McConnell. Weight and Diet Concerns in Female Athletes: Association with Menstrual Cycle Length (submitted to *Int J Sports Nut Exerc Metab*, September, 2002)

Whipple TJ, Le B, Demers LM, Petit M, Sharkey N, Williams NI. Analysis of bone cell activity following moderate intensity resistance exercise in untrained young males.

Williams, NI. Experimental disruptions of the menstrual cycle: Lessons from long-term prospective studies (Invited publication of symposium presented at American College of Sports Medicine Meeting, St. Louis, MO, May, 2002; for publication in *Med Sci Sports Exerc*)

MANUSCRIPTS IN PROGRESS

Williams NI, Berga SL, Cameron JL. Mild metabolic stress potentiates the suppressive effect of psychological stress on reproductive function in female cynomolgus monkeys

Williams NI, Galucci AN. Physiological indicators of psychological stress prior to competitive exercise

Williams NI, McConnell HJ, Galucci AN, Clark KL. Menstrual irregularities and disordered eating in female athletes: survey vs follow-up physiological studies.

Hertel J, Williams NI, Gribble PA, McConnell HJ, DiPasquale AA, Putukian M. Changes in risk factors of ACL injuries across the menstrual cycle.

ABSTRACTS

N.I. Williams, K.A. Greaves, G.R. Brodowicz, T.E. Kirby, and D.R. Lamb, FASCM. Cardiovascular effects of endurance training during submaximal exercise in elders. Exercise Physiology Laboratory, The Ohio State University, Columbus, Ohio, 43210. (research abstract presented at the Midwest American College of Sports Medicine Winter Meeting, Boyne Mountain, Michigan, February, 1986)

N.I. Williams, K.A. Greaves, and D.R. Lamb, FACSM. "Cardiovascular function in lean and obese children during acute submaximal exercise". Exercise Physiology Laboratory, The Ohio State University, Columbus, Ohio, 43210. (research abstract presented at the Midwest American College of Sports Medicine Winter Meeting, Boyne Mountain, Michigan, February, 1987)

Williams, N.I., K.A. Greaves, T.E. Kirby and D.R. Lamb. Exercise training and cardiovascular function in the elderly. (presented at Federation for the Society of Experimental Biology meetings in Washington, DC, 1987) *FASEB Proceedings*, Vol. 46, p. 492, 1987

Williams, N.I., J. McArthur, B. Turnbull, B. Bullen, G. Skrinar, I. Gilbert, G.M. Besser, and L.H. Rees. Early effects of follicular phase exercise on LH pulse characteristics in sedentary eumenorrheic women. (presented at the American College of Sports Medicine Annual Meeting, Orlando, FL, May 29-June 1, 1991) *Med. Sci. Sports Exerc.* 23(4), p. S93, 1991

Williams, N.I., J. McArthur, B. Bullen, G. Skrinar, B. Turnbull, and J. Young. Slowed LH pulse frequency in trained eumenorrheic women due to caloric restriction combined with heavy training. (presented at the American College of Sports Medicine Annual Meeting, Dallas, TX, May 27-May 30, 1992) *Med. Sci. Sports Exerc.* 24(5), p. S36, 1992

Peachey, S., G. Skrinar, E. Kuligowska, B. Bullen, N. Williams, B. Turnbull, and J. McArthur. Effect of enhanced follicular phase endurance training on follicular maturation in women. (presented at the American College of Sports Medicine Annual Meeting, Dallas, TX May 27-May 30, 1992) *Med. Sci. Sports Exerc.* 24(5), p. S171, 1992

Skrinar, G.S., D. Hutchinson, and N. Williams. Exercise: An adjunct therapy for persons with psychiatric disabilities. (presented at the American College of Sports Medicine Annual Meeting, Dallas, TX, May 27-May 30, 1992) *Med. Sci. Sports Exerc.* 24(5), p. S36, 1992

Bullen, B., B. Turnbull, J. McArthur, G. Skrinar, N. Williams, and I. Beitins. Exercise and Diet: Correlates with the onset of menstrual disorders. *Proceedings of the Second IOC World Congress on Sport Sciences*, Barcelona, Spain. p. 155, 1992

Williams, N.I., A.L. Caston, and J.L. Cameron. Induction and reversal of exercise-induced amenorrhea: Temporal correlation with plasma T₃ levels. (presented at the 76th Proceedings of the National Endocrine Society, Anaheim, CA, June, 1994) *Endocrine Society Abstract*, #1775, 1994

- Williams, N.I., M.J. Lancas, and J.L. Cameron. Stimulation of luteinizing hormone (LH) secretion in male rhesus monkeys by food intake: Evidence against a role for insulin. (presented at the 77th Proceedings of the National Endocrine Society, Washington, DC, June, 1995) Abstract, #OR22-3, 1995
- Williams, N.I., and J.L. Cameron. Stimulation of luteinizing hormone (LH) secretion in male rhesus monkeys by food intake: Role of circulating triiodothyronine (T₃) (presented at the 10th International Congress of Endocrinology/78th Proceedings of the National Endocrine Society, San Francisco, CA, June, 1996) International Congress of Endocrinology/Endocrine Society, #P2-505, 1996.
- Williams, N.I., Berga, S.L., and J.L. Cameron. Mild metabolic stress potentiates the suppressive effect of psychological stress on reproductive function in female cynomolgus monkeys. (presented at the 79th Proceedings of the National Endocrine Society, Minneapolis, MN, June, 1997 Endocrine Society Abstract #P1-367, 1997.
- Williams, N.I., Bullen B.A., McArthur J.W., Skrinar G.S., and Turnbull B.A. Effects of short-term strenuous exercise on corpus luteum function. (presented at the American College of Sports Medicine Annual Meeting, Orlando, FL June 3-6, 1998) Med. Sci. Sports Exerc. 30 (5), p. S324, 1998
- Williams, N.I. Bullen B.A., McArthur J.W., Skrinar G.S., and Turnbull B.A. Effects of short-term strenuous exercise on corpus luteum function. (presented at the American College of Sports Medicine Annual Meeting, Orlando, FL June 3-6, 1998 Med. Sci. Sports Exerc. 30 (5), p. S324, 1998
- Williams NI, Clark KL, Mihalko SL, Matuch AN, McConnell HJ. Body image, disordered eating, exercise, and depression in athletes and non-athletes: association with menstrual status. (presented at the American College of Sports Medicine Annual Meeting, Seattle, WA June 3-6, 1999 Med Sci Sports Exerc 31(5), S65, 1999
- Miles MP, Mackinnon LT, Williams NI, Bush JA, Marx JO, Mastro AM, Kraemer WJ. NK cell activity and LFA-2 expression after running (presented at the American College of Sports Medicine Annual Meeting, Seattle, WA June 3-6, 1999)
- Mackinnon LT, Miles MP, Williams NI, Bush JA, Mastro AM. Effects of prolonged exercise on natural killer (NK) cell cytotoxic activity and LFA-2 expression. Book of abstracts. Fifth IOC World Congress, Sydney, Australia, Oct 31-Nov 5, 1999, p. 51.
- Mackinnon LT, Miles MP, Grove DS, Williams NI, Bush JA, Marx JO, Kraemer WJ. Effects of prolonged exercise on expression of perforin mRNA in peripheral blood natural killer (NK) cells (presented at Sports Medicine Australia, 1999)
- Williams NI, Clark KL, McConnell, Matuch A, O'Connor KA. Menstrual irregularities and disordered eating in female athletes: survey vs follow-up physiological studies (presented at the American College of Sports Medicine Annual Meeting, Indianapolis, IN, June 3-6, 2000 Med Sci Sports Exerc 32 (5), S64, 2000
- Mastro AM, Williams NI, et al. Exercise and Recovery of CD4 (+) cells after chemotherapy for breast cancer (presented at Era of Hope Meeting of US Army Medical Research and Materiel Command, June 8-12, 2000, Atlanta, GA)
- Flecker KA, Williams NI. Body Image, disordered eating and menstrual status in collegiate athletes. (presented at the National Conference for Undergraduate Research (NCUR), University of Montana, Missoula, Montana, April 27-29, 2000)
- Miles MP, MacKinnon LT, Grove DS, Williams NI, Bush JA, Marx JO, Kraemer WJ, Mastro AM. Potential mechanisms of post-exercise Suppression of NK cell activity: Cell number, Perforin mRNA and CD2. (research abstract presented at the 2000 American Physiological Society Meeting "The Integrative Biology of Exercise", Portland, ME, September 20-23, 2000.
- Mastro AM, Williams NI, Kraemer WJ, Orsega-Smith EM, Perry MD, Dixon RH, Bleznak AD, Underwood J. Exercise, quality of life, and the recovery of CD4 (+) lymphocytes following chemotherapy for breast cancer Proceedings of the American Association for Cancer Research 92nd Annual Meeting, New Orleans, LA, 42 : 331, March 24-28, 2001
- Perry MD, Mastro AM, Orsega-Smith E, Miles MP, Kraemer WJ, Williams NI. Exercise training and immune function following chemotherapy for breast cancer. Proceedings of the American College of Sports Medicine Annual Meeting, Baltimore, MD, June 2-6, 2001
- Orsega-Smith E, Williams NI (FACSM), Perry MD, Mastro AM, Kraemer WJ, Bleznak A, Dixon R, Underwood J. Fatigue, quality of life and physical function after chemotherapy for breast cancer. Proceedings of the American College of Sports Medicine Annual Meeting, Baltimore, MD, June 2-6, 2001
- Galucci, AN, Williams NI. Physiological indicators of psychological stress prior to competitive exercise. Proceedings of the American College of Sports Medicine Annual Meeting, Baltimore, MD, June 2-6, 2001

- McConnell HJ, O'Connor KA, Brindle E, Williams, NI. Assessing reproductive function in exercising women: validity of ovulation detection algorithms. *Proceedings of the Endocrine Society Annual Meeting, Abstract #P2-408, 2001*
- Senior MK, Williams NI, McConnell HJ, Clark KC. Screening for subclinical eating disorders in female athletes: validation of an indirect interview technique. (Presented at the 24th Annual meeting of the Mid-Atlantic Regional Chapter of the American College of Sports Medicine, Bushkill, PA, November 2-3, 2001).
- McConnell HJ, Williams NI, O'Connor KA, Clark KL, Putukian M. Menstrual irregularities and disordered eating in female athletes: survey vs follow-up clinical and physiological studies. (Presented at the 24th Annual meeting of the Mid-Atlantic Regional Chapter of the American College of Sports Medicine, Bushkill, PA, November 2-3, 2001).
- Mastro AM, Williams NI, Ford J, Fuener K, Orsega-Smith E, Kraemer WJ, Bleznak AD, Dixon RH, Underwood J, Miles M, Wagner K. IL-6 and interferon-gamma levels following chemotherapy for breast cancer. *Proceedings of the American Association for Cancer Research Annual Meeting, San Francisco, CA, April 6-10, 2002*
- Hertel J, Williams NI, Gribble PA, McConnell HJ, DiPasquale AA, Putukian M. Changes in risk factors of ACL injuries across the menstrual cycle: A pilot study. *Proceedings of the American College of Sports Medicine Annual Meeting, St. Louis, MO, May 29-June 1, 2002*
- Williams NI, McConnell HM, Gardner JK, Albert AC, Cameron JL. Lifestyle factors such as exercise, caloric intake, and psychological stress: relationship to reproductive hormones and possibly the risk of breast cancer. *Era of Hope meeting, Department of Defense Breast Cancer Research Program, Orlando, FL, September 25-28, 2002*
- Dougherty, K., Galucci AN, McConnell HJ, Williams NI. Cortisol and testosterone levels prior to competitive exercise. (Submitted for presentation at the 2003 American College of Sports Medicine Annual Meeting, San Francisco, CA, June, 2003).
- Williams NI, McConnell HJ, Gardner JK, Cameron JL, Schuchert MK, Richard EL, Snook ML. Susceptibility of menstrual cycle to various stressors: correlation with baseline luteal progesterone levels. (Submitted for presentation at the 2003 American College of Sports Medicine Annual Meeting, San Francisco, CA, June, 2003).

INVITED PRESENTATIONS

- "Cardiovascular/Medical Applications for Aerobic Exercise", *Aerobics and Fitness Association of America (AFAA), National Primary Certification Workshop, Boston, Massachusetts, October 3, 1987.*
- "Principles and Benefits of Exercise Training for Seniors", *Annual Health Program, Leo Yassenoff Jewish Community Center, Columbus, Ohio, June 6, 1987.*
- "ACSM Certification, Tracts Offered and Benefits Provided", *American College of Sports Medicine, New England Chapter Annual Meeting, Worcester, Massachusetts, November 2-3, 1989.*
- "Special Topics for Students", *American College of Sports Medicine, New England Chapter Annual Meeting, Worcester, Massachusetts, November 2-3, 1989.*
- "Exercise Testing and Prescription", *Harvard Medical School Department of Continuing Education Conference: "Current Advances in Nutritional Medicine and Disease Prevention: Medical Treatment Strategies", Boston, Massachusetts, April 25, 1991*
- "Eating Disorders and Body Image With Special Emphasis on the Female Athlete", *New York State Association of Physician's Assistants, Calicoon, NY, April 18, 1998.*
- "Exercise and Female Hormones: What are the Health Risks and Benefits?" *American College of Sports Medicine Health Fitness Summit, April 14-18, 1999, New Orleans, LA*
- "Women's Health and Fitness Issues" *Panel Discussion at American College of Sports Medicine Health Fitness Summit, April 14-18, 1999, New Orleans, LA*
- "Modulation of Reproductive Function by Metabolic Cues", invited speaker for *Bucknell University Biology Department Seminar Series, March 3, 2000. Bucknell University, Lewisburg, PA*
- "Career Development for Women" *Women and Sciences and Engineering (WISE) program for potential college students from surrounding area and other states, June 19, 2000, Penn State University*

"Low Energy Availability and the Menstrual Cycle: Clinical and Physiological Implications" *Society for the Study of the Menstrual Cycle, Bi-Annual meeting*, June, 2001, Hartford Connecticut

"Physiological Connections Between Factors of the Female Athlete Triad" *Penn State Athletic Training Conference*", April 12, 2002, Penn State University, University Park, PA

"Exercise and Women's Health: Lessons from the Female Athlete Triad", Department of Health and Exercise Science, April 25, 2002, *Wake Forest University*, Winston-Salem, NC

"Subclinical Eating Disorders and Menstrual Cycle Irregularities in Female Athletes" *Eating Disorders on Campus, The Institutional Response*, June 7, 2002, Eighth Annual Conference, Penn Stater Conference Center Hotel, Penn State University, University Park, PA

SYMPOSIUM PRESENTATIONS

Chairperson, Symposium on "Special Topics of Interest to Students in ACSM", *American College of Sports Medicine, New England Chapter Annual Meeting*, Worcester, Massachusetts, November 2-3, 1989.

Menstrual Disturbances in Athletes: Lessons from Prospective Experiments on Animals and Humans (Chairperson Anne B. Loucks, PhD) Lessons from Experimental Disruptions of the Menstrual Cycle in Primates and Humans, N. Williams (*American College of Sports Medicine Annual Meeting*, St. Louis, MO, May 30, 2002)

SERVICE

PROFESSIONAL SERVICE

COMMITTEES

American College of Sports Medicine Student Affairs Committee,
Student Representative for New England Chapter, 1988-1990

American College of Sports Medicine Executive Committee,
Member at Large, New England Chapter, 1990-1991

American College of Sports Medicine, Strategic Health Initiative Committee: Women, Sports and Physical Activity, June 2000-2002

REVIEWER

Journals	<i>Journal of Applied Physiology, ACSM Health Fitness Journal</i>
Grants	Dissertation Awards, Susan B. Komen Foundation for Breast Cancer Research (2001-2003)
Editorial Board	American College of Sports Medicine <i>Health and Fitness Journal</i> (2002-present)

Fellow American College of Sports Medicine, June, 1998

Participant "Biopsychology of Infertility Workshop"
Sponsored by National Institutes of Health (National Institute of Child Health and Human Development); September 21-22, 1995; NIH Campus, Bethesda, Maryland

UNIVERSITY SERVICE

Advisory Board: The Tremin Trust Research Program on Women's Health, Penn State University, University Park, PA, 2001-present

University Committees

Faculty Senate (Spring 2002-present)-Senate Committee on Intra-University Relations

College Committees (College of Health and Human Development)

College of Health and Human Development Seed Grant Review Committee (Fall 00)
Faculty Council (Fall 00- present)

Intercollege Program Committee (Physiology)

Candidacy Exam Committee (Intercollege Program in Physiology) (Spring 01-present)

Department Committees (Department of Kinesiology)

Curriculum Committee	Fall, 1998 to present
Candidacy Committee	Fall, 1998 to 2002
Search Committee (Noll Laboratory Exercise Physiology positions)	Fall, 1998
Search Committee (General Education Fitness Position)	Spring 99
Search Committee (Department of Kinesiology Chair)	Fall 01-Spring 02
Curriculum Revisions (ad hoc)	Spring 01-Spring 02
Advisory Committee for Fitness Assessment Program	Spring 02-present

University Presentations

Fall 1997	Kinesiology Proseminar	"Professional Development"
Fall 1998	Kinesiology Proseminar	"Professional Development"
Fall 1997	Nutrition Ingestive Behavior Journal Club	"Reproductive disturbances and low energy availability: aberrant eating habits"
Fall 1997	Kinesiology Colloquium	"Low energy availability and the female athlete: Clinical and Hormonal Effects"
Fall 1997	Population Research Institute	"Modulation of Reproductive Function by Metabolic Cues"
Spring 1998	Nutrition Dept. Colloquium	"Modulation of Reproductive Function by Metabolic Cues"
Spring 1998	Biobehavioral Health Colloquium	Dept. "Reproductive disturbances caused by low energy availability: Interaction with psychological stressors"

OTHER SERVICE

News article, Kinesiology Today, Spring 1999 issue, "Study links Body Image to Athletes' Fertility"

Interview/article, The Penn Stater, September/October 1999 issue "Research and Discovery Section" by Nick McCarthy

Interview/article, The Penn Stater, 2000 issue of undergraduate research, "Research and Discovery"

Interview/article, Intercom, July, 1999. featured in "Focus on Research" article, by Barbara Hale.

2000 Undergraduate Exhibition

Served as Judge for the 2000 Undergraduate Exhibition in April, 2000.