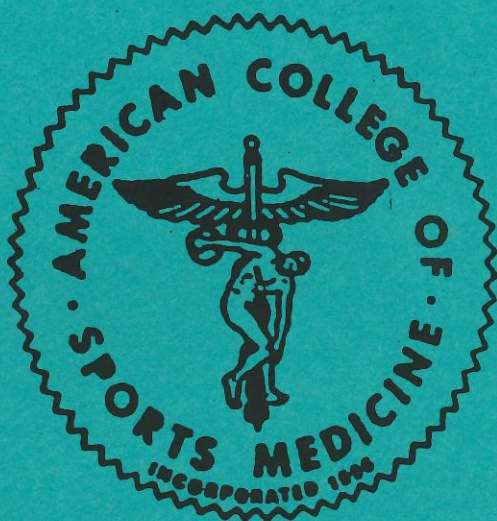AMERICAN COLLEGE OF SPORTS MEDICINE

CENTRAL STATES CHAPTER

1997 ANNUAL MEETING

EMBASSY SUITES
KANSAS CITY, MISSOURI

OCTOBER 30-31, 1997

THURSDAY, OCTOBER 30

11:00 am   Registration   (Lobby)
12:45-1:00   Opening Remarks   (Vera Cruz)

GENERAL SESSION   (Vera Cruz)

1:00-1:40   "Body Weight in Athletes: Consequences & Recommendations"
         Dr. Janet Walberg Rankin (Virginia Tech University)

1:40-2:20   "Putting the Risk of Exercise into Perspective"
         Dr. Barry Franklin (William Beaumont Hospital)

2:20-3:00   "Exercise and the Old Heart: From the Organ to the Gene"
         Dr. Charlotte Tate (University of Houston)

EXERCISE SCIENCE SESSION   (Vera Cruz 1)

3:20-4:00   "Animal Models for the Study of Skeletal Muscle Hypertrophy"
         Dr. Ben Timson (Southwest Missouri State University)

4:00-4:30   "Novel Actions of the Arachidonic Acid Metabolite, Thromboxane A2
in the Peripheral Nervous System"
         Dr. James Orr (University of Kansas)

4:30-5:00   "The Relationship between Diabetes and Cardiac Function in an Animal
Model"
         Dr. Charles Riggs (University of Arkansas - Fayetteville)

CLNICAL SESSION   (Vera Cruz 2)

3:20-4:00   "Beyond 2001: The Physician of the Future and their Understanding of
Optimal Health"
         Dr. Christine Moranetz (Univ. of Kansas Medical Center)

4:00-4:30   "Conditioning Levels of Youth with Chronic Disease/Disability"
         Dr. Ken Pitetti (Wichita State University)

4:30-5:00   "Fit for Function: Exercise Training for the Elderly"
         Dr. Karen Nau (University of Kansas Medical Center)

5:00-6:00 Poster Viewing   (Monterrey 3)
6:00-7:00 Social Hour   (Lobby)

Friday's schedule starts on inside back cover

ABSTRACTS OF RESEARCH PRESENTATIONS

The American College of Sports Medicine's Professional Education
Committee certifies that this Continuing Education offering meets the criteria
for 10 credit hours of ACSM Continuing Education credit.

EFFECT OF ACUTE EXERCISE ON POSTPRANDIAL TRIGLYCERIDE RESPONSE.

Q Zhang and Tom R Thomas, Department of Food Science & Human Nutrition, University of Missouri-Columbia, Columbia, Missouri

Delayed clearance of triglycerides (TG) after a fat meal challenge is highly correlated to cardiovascular disease (CVD) and may have an atherogenic effect. It is possible that exercising at the right time may elevate lipoprotein lipase activity before the postprandial-induced TG elevation, and therefore, blunt postprandial hypertriglyceridemia (PHTG). The purpose of this study was to examine the optimal time to exercise, before or after a fat meal, to attenuate PHTG. Twenty-one recreationally trained men (age=27 ± 1 yrs, VO_2max=48 ± 1 ml-kg^{-1}min^{-1}, mean$\pm$SE) were used as subjects. Each subject performed 1) a control trial (no exercise), 2) a 1h post-meal exercise trial (POST) (exercise 1h after a fat meal), 3) a 1h pre-meal exercise trial (lHPRE) (exercise 1h before a fat meal), and 4) a 12h pre-meal exercise trial (12HPRE) (exercise 12h before a fat meal). In each trial, subjects had a standard fat-rich meal (100 g fat) to induce PHTG. Blood samples were taken at 0h (immediately before the fat meal intake), 2h, 4h, 6h, 8h, and 21h for each trial. In the exercise trials, subjects exercised at 60% of VO_2max for 1h at the designated time in each trial. The TG concentration measured from each sample and the area score under the TG concentration curve (high score indicating a slow removal of TG) were analyzed to compare the differences in TG response among the trials. The results showed that compared to control trial (TG score=358 ± 48), TG area score in lHPRE (167 ± 37) was 114% lower ($p<0.055$); 12HPRE (176 ± 36) was 103% lower ($p<0.05$); while POST (366 ± 54) was 2% higher ($p>0.05$) There was no significant difference in TG scores between 1HPRE and 12HPRE. The TG score in POST was significantly higher ($p<0.05$) than that in both 1HPRE and 12HPRE, but not different from control. The peaks of TG concentration (mg/dl) in both lHPRE (152 ± 14) and 12HPRE (126 ± 13) were significantly ($p<0.05$) lower than that in POST (176 ± 15). The TG peaks in both POST and lHPRE were not significantly different from that in control trial (169 ± 18). These results suggest that exercising either 1h or 12h before a fat-rich meal may have a beneficial effect on the TG response, which may blunt the postprandial induced atherosclerotic process.

THE EFFECT OF AN ACUTE BOUT OF RESISTANCE TRAINING ON T-CELL PROLIFERATION AND ACTIVITY IN TRAINED AND UNTRAINED FEMALES.

Haub M.,, Matthew S., Haff G., Chirathaworn C., Omoike O., Chan M., Benedict S., and Potteiger J. University of Kansas, Departments of Health, Sport, and Exercise Sciences and Microbiology.

High intensity aerobic exercise has been shown to depress certain components of the immune system. We wanted to determine the effect of an acute bout of high intensity resistance training on the T-cell proliferation and activity of trained and untrained females. Fourteen females (MEAN ± SE; age = 22.9 ± 0.8y; height = 164.8 ± 1.7cm; weight = 59.8 ± 1.2kg; fat-free mass = 47.0 ± 0.7kg) volunteered to participate in this investigation. The subjects were divided into an untrained group (UT: n=9) and a trained group (TR: n=6) based on their experience with resistance training. The subjects performed 3 sets of 10 repetitions at 89.2 ± 4.6% (UT) and 88.5 ± 3.3% (TR) of their 10 repetition maximum for 7 exercises. Blood samples were collected pre-exercise (PRE), immediately post-exercise (POST), 3h post-exercise (POST-3), and 24h post-exercise (POST-24). Blood was analyzed for creatine kinase (CK), and T-cell proliferation and T-cell activity through exposure to the mitogen phytohemagglutanin (PHA). The results, using paired t-tests, showed a significant decrease in T-cell response to mitogen (PHA) ($p<0.05$) in the UT at POST-3. In addition, the UT experienced a significant decrease in the change in proliferation from PRE to POST-3 ($p<0.01$). CK was significantly ($p<0.05$) elevated in UT following exercise. These results would indicate that this group of TR females did not experience alterations in their immune system relative to T-cell activity and proliferation. In contrast, UT females seem to experience a decrease in immune system effectiveness 3 h post-exercise of high intensity resistance training. This decrease may be related to the increased stress imposed on the UT females as determined by the significantly increased change in CK levels following exercise.

THE EFFECTS OF RESISTANCE TRAINING INTENSITY AND VOLUME ON DELAYED ONSET MUSCLE SORENESS.

Hart C.L. and F.A. Kulling, FACSM. Oklahoma State University, Stillwater, Oklahoma

The quantity of resistance training intensity and volume that elicits delayed onset muscle soreness (DOMS) has not been established. Without a clear understanding of this relationship, it is difficult for exercise personnel to prescribe appropriate loads, repetitions and sets of exercises without subjecting novice resistance trainers to inappropriate levels of DOMS. The purpose of this study was to investigate the relationship between resistance training intensity and volume on DOMS in novice resistance trainers. Prior to participation in this study, the subjects (n=24) were determined to be apparently healthy novice resistance trainers (no resistance training during the previous 6 months). At this time the subjects were evaluated for descriptive characteristics, body composition using Jackson & Pollock skinfold technique, and maximal concentric 1RM bench press strength using a fixed-resistance Universal machine. Two weeks later the subjects performed one of the following workouts: 1) low int-low vol (LL): 1 set of 12 reps @ 50% of 1RM, 2) low int-high vol (LH): 3 sets of 12 reps @ 50% of 1 RM, 3) high int-low vol (HL): 1 set of 8 reps @ 75% of 1 RM, and 4) high in-high vol (HH): 3 sets of 8 reps @ 75% of 1RM. The subjects rated their level of pectoral muscle perceived soreness using the deVries scale of 0 to 3 prior to their workout and 24, 48, and 72 hr post. The soreness ratings were analyzed using a repeated measures ANOVA with a Duncan's Multiple Range Test for training group and time period differences (p<0.05). All subjects reported no soreness prior to exercise. All groups had a significant rise in soreness 24 hr post, and the HH group was significantly higher than other groups (LL = 1.12±0.48; LH = 1.38 ±0.48; HL = 1.25±0.29; HH = 2.0±0.0). All groups had a significant decrease in soreness 48 hr post (LL = 0.25±0.29; LH = 0.88±0.25; HL = 0.88±0.63; HH = 1.38±0.75). The LL group had significantly lower soreness than the others at 48 hr post, and was not significantly higher than rest. At 72 hr post the HH group still had significantly elevated soreness compared to rest, but was not higher than the LH and HL groups (LL = 0.0±0.0; LH = 0.25±0.29; HL = 0.25±0 29; HH = 0.62±0.63). The results of this study demonstrate that 1) mild DOMS occurs using low int-low vol, low int-high vol and high int-low vol training, 2) low int-low vol trainers had no DOMS 48 hr after exercise, 3) low int-high vol and high int-low vol trainers had no DOMS 72 hr after exercise, and 4) high int-high vol trainers experienced moderate DOMS that remained mildly elevated 72 hr after exercise.

A COMPARISON OF THE VALIDITY AND THE RELIABILITY OF RATINGS OF PERCEIVED EXERTION BY 30-70 Y OLD FEMALES DURING WALKING EXERCISE.

Wright, B., J.A. Potteiger and K.L. Nau. Department of Health, Sport, and Exercise Sciences, University of Kansas, Lawrence, Kansas.

We examined the validity and reliability to regulate exercise intensity using rating of perceived exertion (RPE) among females in different age groups, by having subjects self-adjust their exercise intensity to reproduce a RPE. Forty healthy subjects: 30-39 y (n=10), 40-49 y (n=10), 50-59 y (n=10), and 60-69 y (n=10) performed three trials at two walking intensities. In the estimation trial (E), subjects walked on a level treadmill for 5 min at 93.8 and 107.2 m·min^{-1} in a randomized order, rating their perceived exertion during the last min of both intensities. During the two production trials (P1 and P2), subjects self adjusted the treadmill speed to find the intensity that matched the RPE levels felt during E. Heart rate (HR), oxygen consumption (VO$_2$), ventilation rate (V$_E$), and treadmill speed were recorded during the last min of all trials. A three-way (age by trial by intensity) ANOVA with post hoc tests was used to identify mean differences (P≤.05). No significant differences were found between trials at both intensities for V$_E$ among the 30, 50 and 60 y olds. However, a significant difference at the higher intensity between trials for V$_E$ in l·min^{-1} (E, 31.4±8.1; P1, 32.8±9.3; P2, 35.3±9.8), was found among the 40 y olds. Significant differences were found among all subjects at both intensities between the P1 to P2 trials for VO$_2$ in ml·kg^{-1}min^{-1} (15.46±2.12 to 14.82±2.11); HR in b·min^{-1} (121±17 to 114±17); and treadmill speed in m·min^{-1} (101.9±5.8 to 99.5±7.5) and between E and P2 for HR in b·min^{-1} (120±17 to 114±17). Although the present data indicate statistical significance, the differences may not be physiologically meaningful. In conclusion, RPE is a valid and reliable method of regulating exercise at both walking intensities among adult age-groups. As individuals grow older they may perceive the intensities to be more strenuous than younger adults, but older adults can regulate their intensity based upon perceived exertion as well as younger adults.

EFFECTS OF OVARIECTOMY AND ESTROGEN REPLACEMENT ON RAT SKELETAL MUSCLE

J.S. Fisher[1], W.M. Kohrt[2], and M. Brown[1]
[2]Program in Physical Therapy and [2]Division of Geriatrics and Gerontology, Washington University, St. Louis, Missouri

Adult (7 mo) female Sprague-Dawley rats were assigned to the following groups: sham-operated controls (SHAM), ovariectomized (OVX) and pair-fed with weight-matched SHAM rats (PF), OVX and fed *ad lib* (AL), OVX and food-restricted to 80% of SHAM diet (FR), and freely eating OVX and estrogen-replaced (E2). Four weeks post-surgery, body weights (g) in AL (311±5) and PF (309±6) were greater (p<0.05) than SHAM (277±4), E2 (272±4), and FR (274±5). SOL, plantaris (PLA), gastroc, peroneus longus (PER), EDL, and quad mass was similar among SHAM, FR, and E2 for all muscles studied, and there were no differences in muscle weight to body weight ratios among any groups for any muscles studied. PLA mass (mg) was greater (p<0.05) in AL (365±11) and PF (361±12) than SHAM (330±7), and PER mass was greater (p<0.05) in PF (165±6) than SHAM (146±4). The combined mass of all six skeletal muscles (mg) was greater (p<0.05) in AL (5348±150) than SHAM (4915±106). There were no consistent differences in muscle protein content (mg/g). Findings suggest that estrogen has no effect on muscle mass in rats other an indirect effects operating through regulation of body weight.

ATHLETES' FEELINGS DURING PEAK PERFORMANCES

B. Christensen, L. Greene, The University of Kansas, Lawrence, Kansas

The purpose of this study was to describe athletes' feelings during peak performances compared to feelings during average performances. Peak performances were defined as behavior in any activity that transcends what normally could be expected in that situation. The 23 male subjects in this study were track and field athletes from an NCAA Division III University. The Peak Performance and Peak Experience Questionnaire was used in this study. The subjects completed the peak performance version about a peak performance first and then completed the average performance version about an average performance. The questionnaire first asked for a written description of the performance. Following the written description were 42 items with a Likert scale from 1 to 5. The athletes were instructed to rate each item as to the importance in their performance. Dependent t-tests were conducted between the responses on the peak performance and average performance. Twenty-two of the 42 items were found to have significant differences at the .01 level of signifiance. Many of the items found to be significant were related to positive changes in perception about the event, clear and strong intentions toward goals, intense concentration, and in-creased self confidence during a peak performance. During a peak perfor-mance, the athletes felt free from outer restrictions, a process seemed to click on, the event had spiritual or mystical quality, the experience was beyond words, and the peak performance had great meaning to the athlete. Peak performances were also found to be their own reward, were fun, and the athlete experienced joy and fulfillment. The athletes in this study clearly understood the concept of a peak performance and viewed them as physi-cally and psychologically different from an average performance. It is suggested that a coach spend time talking about peak performances and training the mental side of athletic performance.

A COMPARISON OF BODY COMPOSITION BETWEEN
HYDROSTATIC WEIGHING AND DUAL ENERGY X-RAY
ABSORPTIOMETRY IN EARLY POSTMENOPAUSAL WOMEN.

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and Sport Sciences, University of Oklahoma, Norman, Oklahoma.

Rapid declines in musculoskeletal tissue as well as age related fat pattern-
ing associated with menopausal estrogen deficiency can significantly alter
body composition. Therefore, the purpose of this study was two-fold: to
determine baseline body composition values for early postmenopausal
women, and to determine if Dual Energy X-Ray Absorptiometry (DEXA)
is comparable to underwater weighing (UWW) for this population group.
Thirty-four subjects were included in the study ranging from 41 to 61 years
in age. The subjects had not been on hormone therapy, and were all within
1 to 7 years postmenopausal. Body fat percentage, fat mass, and fat free
mass were computed using body density from underwater weighing (Siri,
1961) and DEXA (Lunar Model DPX-IQ). Paired t-tests were used to
compare mean values of body fat, fat mass, and fat-free mass between the
two methods, and a Pearson's correlation coefficient was computed to
determine the relationship between the two methodologies. Statistical
significance was set at $p=0.05$.

	Body Fat	Fat Mass (kg)	Fat-free Mass (kg)
UWW ($x \pm SD$)	43.23 (± 8.9)	31.90 (± 13.5)	39.77 (± 6.4)
DEXA ($x \pm SD$)	39.49 (± 8.4)	29.60 (± 12.2)	42.65 (± 7.5)
UWW vs. DEXA	$p=0.01$	$p=0.01$	$p=0.01$
UWW vs. DEXA	$r=.86$	$r=.96$	$r=.88$

There were statistically significant differences ($p<0.01$) between the two
methods for each variable. In general, percent body fat assessed by UWW
was higher than with DEXA ($p<0.01$), however, a high correlation coeffi-
cient ($r=.86$) between the two methods indicate that subject measures were
linear. In conclusion, care must be taken when choosing an appropriate
method to assess body composition for early postmenopausal women.
Since this populaation group is characterized by the rapid degeneration of
fat free mass, all the assumptions made to determine body composition
from underwater weighing may not hold true. Therefore, further research
must be done in order to determine which method is most valid and reliable
for this group.

EFFECT OF PRIOR RESISTANCE EXERCISE ON FUEL UTILIZATION
DURING RUNNING.

S. Kalsow, R. Allen, A. Gallop, and J. Padfield, Truman State University,
Kirksville, Missouri

The purpose of this study was to investigate the effect of prior resistance
training upon fuel utilization during endurance running. Sixteen
moderately-trained subjects (9 male, 7 female) volunteered to participate in
the study. Subjects were asked to abstain from physical exercise during the
test week and to fast 4 to 6 hours before each test. Each subject performed
two 20-minute treadmill runs at 60 to 70% of his or her maximal aerobic
capacity. (The intensity of exercise was the same for each subject, but there
were mild variations in the intensity of exercise between subjects.) The two
treadmill runs were performed in randomized order, and included one run
without additional exercise, and one run preceded by an exhaustive, upper-
and lower-body weight-training routine. Oxygen cost of exercise (VO_2),
respiratory exchange ratio (RER), heart rate (HR), and calorie expenditure
(KCAL) was recorded during each submaximal test. A dependent t-test
analysis indicated that the RER for running preceded by resistance exercise
(mean 0.96, std 0.03) was significantly ($p<0.05$) lower than that observed for
running alone (mean 0.88, std 0.06). VO_2, HR, and KCAL were not
significantly different between trials. The results of this study indicate that
running preceded by resistance training utilizes a higher percentage of fuel
from fat sources than running alone, when this exercise is performed at the
same sub-maximal intensity.

EFFECTS OF A SIXTEEN WEEK AEROBIC TRAINING PROTOCOL ON HDL AND LDL SUBFRACTIONS IN YUCATAN MINIATURE SWINE.

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Atherosclerosis is related to unhealthy HDL and LDL subfractions. Endurance training may improve these subfractions by increasing HDL2-C and decreasing LDL3-C. The purpose of this study was to evaluate the effects of training on HDL and LDL subfractions using a miniature pig model. Thirty-seven (n=37) Yucatan miniature swine were randomly assigned to either a sedentary (n=20) or training group (n=17). The sedentary group (S) consisted of 9 males and 11 females while the training group (T) consisted of 8 males and 9 females. The training period lasted sixteen weeks; pigs trained 5 days/week on a treadmill. Training began with 25 minutes at 3 mph, and was incrementally progressed to 60 minutes at 5 mph (zero grade) by week sixteen. All pigs were fed a low fat diet (Purina mini pig chow). Plasma TG, TC, HDL-C, HDL2-C, HDL3-C, LDL1-C, LDL2-C, and LDL3-C were measured at the conclusion of the control and training periods. A two way ANOVA to test for the interaction of gender x training was utilized with post hoc Tukey tests performed when appropriate. The level of significance for all statistical tests was $p < 0.05$. The results indicated that training had no significant effect on any subfraction parameter. Although HDL2-C values tended to be elevated in both male and female trained pigs (versus control), the differences were not significant. In contrast, there were significant differences for the main effects of gender on TC, LDL-C, LDL1-C, LDL2-C, and LDL3-C with females demonstrating greater values. For the interaction of gender x training, the results indicated no difference on any parameter, except for TG. The TG response was, however, inconsistent via gender, S males < T males, and S females > T females. The results of this investigation fail to demonstrate a significant effect of training on HDL and LDL subfractions in male and female Yucatan miniature swine. The lack of training effects should be interpreted cautiously, however, due to the low level of power of this study. The results do suggest a gender component to HDL and LDL subfractions with females having more elevated values than males on several parameters.

CORRELATION OF FAT FREE MASS, FAT MASS, AND LOWER BODY STRENGTH TO HIP BONE MINERAL DENSITIES IN EARLY POST-MENOPAUSAL WOMEN.

N. Fetters, D. Bemben, M. Bemben, and N. Nabavi. Department of Health and Sport Sciences, University of Oklahoma, Norman, Oklahoma.

The preservation of bone mass is crucial after estrogen levels decrease during menopause. The purpose of this investigation was to examine the relationship between fat-free mass (FFM), fat mass (FM), and lower body strength to hip bone mineral densities in early postmenopausal women. Thirty-four postmenopausal women participated in the study. The subjects ranged in age from 41 to 61 years and were not taking hormone replacement therapy. Bone mineral density (BMD) of the hip region (neck, trochanter, Ward's, shaft, and total) was measured using Dual Energy X-ray Absorptiometry (DEXA, Lunar Model DPX-IQ). Body composition was assessed using the hydrostatic weighing technique and body density was converted to % body fat using the Siri equation (1961). Lower leg strength measures (leg press, hip abduction, and hip adduction) were assessed by 1-Repetition Maximum (1-RM) using Cybex isotonic machines. Zero-order correlation coefficients were used to determine the relationship between the BMD, FFM, FM, and strength variables. The group means and standard errors for % body fat, weight, and height were $43.2 \pm 1.5\%$, 73.2 ± 3.0 kg, and $163.40 \pm .9$ cm, respectively. Table 1 shows the mean $\pm$ SE for the BMD, FFM, FM, and strength variables. Significant positive correlations ($p < .05$) were found for all the hip BMD sites with hip abduction and FFM.

Neck BMD g/cm^2)	Troch BMD (g/cm^2)	Ward's BMD (g/cm^2)	Shaft BMD (g/cm^2)	Total BMD (g/cm^2)	FFM (kg)	FM (kg)	Leg Press 1 RM lbs.	Hip Abd 1 RM lbs.	Hip Add 1 RM lbs.
0.918 ±0.024	0.762 ±0.023	0.759 ±0.026	1.127 ±0.032	0.955 ±0.025	40.0 ±1.1	32.0 ±2.3	160.7 ±7.6	81.3 ±4.4	71.5 ±3.1

The strongest relationship was between FFM and the trochanter (r=.79). Leg press and FM were significantly correlated (p<.05) with shaft (r=.38, r=.38, respectively), trochanter (r=.40, r=.47, respectively), and total hip (r=.39, r=.40, respectively) sites. There were no significant correlations between hip adduction strength and the hip BMD sites. In conclusion, FFM and hip abduction strength were significantly related to hip BMD. These results suggest that exercises that strengthen the hip region and enhance fat free mass may be important for the maintenance of bone mass in early postmenopausal women.

DIETARY INTAKE, ENERGY BALANCE, AND MENSTRUAL STATUS OF ELITE HIGH SCHOOL FEMALE CROSS-COUNTRY RUNNERS

J. Padfield and R. Dowdy, Truman State University, Kirksville, Missouri; and University of Missouri, Columbia, Missouri

Recent attention has been paid to the possible role of a negative energy balance in athletic amenorrhea and the development of the female athletic triad. To further investigate this topic, three-day dietary and exercise records were obtained from 44 female high school cross-country athletes identified in national (US) publications as being either 1) nationally-ranked individual athletes, or 2) members of nationally-ranked high school teams. The runners were instructed in the recording of dietary information, and the diets were analyzed using the Mosby Diet Simple computer program. Statistical analysis was performed using an analysis of variance (ANOVA) procedure. The runners in this study averaged 16.28 years in age (std 1.03), had a low Body Max Index (mean 18.53, std 1.93), and experienced menarche somewhat later than their mothers (mean age 14.11, std 1.32 vs. mean age 13.70, std 1.22). Thirteen of the runners (30%) met the clinical definition for primary or secondary amenorrhea. The average daily energy expenditure from exercise training was 518.54 kcal (std 208.93) for the amenorrheic group and 425.38 kcal (std 130.12) for the eumenorrheic group. The average daily available energy (daily caloric intake minus energy expended during exercise, per kilogram of body weight) was 36.92 kcal/kg (std 21.88) for amenorrheic runners and 36.32 kcal/kg (std 9.27) for the eumenorrheic runners. The amenorrheic and eumenorrheic runners showed no significant differences in their exercise energy expenditure, energy availability, or Body Mass Index. The runners' mean dietary intakes of key minerals were: calcium 1033.50 mg (std 320.94), iron 18.43 mg (std 6.94), and zinc 9.18 mg (std 2.85). The percentage of runners who fell below the US RDA for these minerals were calcium - 66%; iron- 36%; and zinc- 86%. The results of this study indicate that factors other than energy availability may have a role in the development of athletic amenorrhea in adolescent distance runners, and that runners on the elite high school level may not be obtaining adequate nutritional levels of calcium, iron, and zinc by dietary means.

STRENGTH DIFFERENCES ASSOCIATED WITH FOUR PHASES OF THE MENSTRUAL CYCLE

B.H. Jacobson and W. Lentz, School of Applied Health and Educational Psychology, Oklahoma State University , Stillwater, Oklahoma

The purpose of this investigation was to compare strength performance during four phases of the menstrual cycle. Six varsity athletes selected by purposive sampling for menstrual cycle regularity agreed to serve as participants. Subjects' cycle phases were monitored for one month prior to the onset of the study to assure normal cycle patterns. During the subsequent three months, subjects were tested four times per month on the fourth day of each calculated seven day menstrual phase: 1. Menstrual, 2. Post-menstrual, 3. Inter-menstrual, and 4. Pre-menstrual. Voluntary strength data collection included knee extension of the dominant leg performed on an isokinetic computerized strength testing apparatus and was performed at randomly staggered stages of the cycle to avoid a learning effect. Prior to testing, all subjects were allowed a total body warm-up and a warm-up trial consisting of four repetitions at 60°/sec. Testing consisted of three sets of five repetitions at 60°/sec with 60 sec rests between sets. A repeated measures ANOVA statistical analysis followed by a Neuman-Keuls pos hoc test yielded significantly lower (p<.05) voluntary strength means during the menstrual phase when compared to the other phases. Although not significant (p=.08), the greatest strength means were found during the inter-menstrual phase. It was concluded that the maximal voluntary strength output performance may be affected during the different menstrual phases.

EFFECTS OF TEST FAMILIARIZATION ON CARDIORESPIRATORY VARIABLES DURING MAXIMAL EXERCISE TESTING.

M. McBride, V. Walsh, M. Gelatt, and R. Sabath. The Children's Mercy Hospital, Kansas City, Missouri.

It is generally accepted that test familiarization is important in achieving optimal results during maximal exercise testing. In clinical settings it is often not practical due to monetary and time considerations to perform repeated tests on a given patient. Twenty-nine survivors of childhood cancer, 14 males (X±SD) age=12.3±4.3(yrs), ht=152.2±23.2(cm), wt=45.8±22.4(kg), BSA=1.36±0.4(m^2) and 15 females age=13.6±4.1(yrs), ht=149.9±14.7(cm), wt=52.0±19.6 (kg), BSA=1.44± 0.3(m^2) underwent maximal treadmill testing (MTT) on two separate occasions. Treadmill testing was performed using a Quinton Q65 treadmill and Q4500 ECG monitor. ECG was monitored continuously with a 12 lead recording being made at the end of each stage. BP was measured by auscultation every 2 min. A sensorMedics 2900 metabolic cart was used to measure VO_2. Each subject performed either a walking, Balke-type protocol or a running protocol based on his/her perceived fitness level. Results of treadmill testing were as follows:

	Female (X±SD)		Male (X±SD)	
	T1	T2	T1	T2
VO_2 (L/min)	1.36±0.5	1.37±0.6	1.56±1.1	1.62±1.1
VO_2 (ml-kg-min^{-1})	27.1±6.0	27.4±6.0	32.1±12.6	32.5±12.4
RER	1.09±0.07	1.11±0.07	1.05±0.11	1.06±0.09
HR (bpm)	179±20	188±11	182±19	182±18
RPE	181.4	19±1.0	17±1.7	18±1.5
SaO_2(%)	98±0.7	97±0.8	97±1.1	97±0.7

These data suggest that in survivors of childhood cancer test familiarization does not have any clinically significant effect on VO_2, SaO_2, HR, RPE, or RER.

THE EFFECT OF BREATHE RIGHT NASAL STRIPS™ ON EXERCISE RECOVERY HEART RATE IN ACTIVE YOUNG ADULTS

S. Derks, J. Cunningham, C. Kohler, and J. Padfield, Truman State University, Kirksville, Missouri

The use of Breathe Right Nasal Strips™ (BRNS) is reported to improve ventilation volume by 20 to 30% by reducing nasal resistance. The purpose of this study was to determine the effect of BRNS use on aerobic performance and recovery. Nine subjects volunteered to participate in the study (4 male, 5 female). Each subject performed two maximal treadmill tests in randomized order, one with the BRNS, and one without. Test were separated by at least 48 hours of rest. Resting heart rate (HR) was recorded prior to exercise testing. Performance and recovery heart rates were recorded every 30 seconds using a Polar heart rate monitor. Each subject exercised until exhaustion using a Bruce treadmill protocol, and then entered a standardized recovery protocol of 10 minutes of walking at 2 mph at 0% grade. Aerobic performance was measured as time to exhaustion (TE). TE was 11.89 minutes (std 1.5) for exercise with the BRNS and 12.39 min (std 1.47) without the BRNS. Statistical analysis using paired t-tests indicated that there was no significant difference in TE or in recovery heart rate during the BRNS trial. These results suggest that the BRNS have no effect on aerobic performance or the recovery time in active, young adult runners.

THE EFFECT OF SPECIFIC WARM-UP AND/OR STRETCHING PROTOCOLS ON FLEXIBILITY AND PERFORMANCE

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Warm-up and stretching exercise are essential for any sport or exercise program to be successful. The benefits include injury prevention, enhancing athletic performance, increasing range of motion (ROM), and alleviating muscle soreness. Controversy still exists in the literature concerning the type of warm-up or stretching that will produce optimal gains in ROM or improvement in performance. The purpose of this study was to investigate the effectiveness of specific warm-up and/ or stretching protocols on lower extremity joint ROM and muscle extensibility, and performance improvement as measured by the standing long jump (SLJ). Subjects were 18 male and female college students between the ages of 18 and 35 years. Each subject participated in a counter-balance design by performing each of the protocols in random order. The protocols included a stretch (S) group, a jog and stretch (JS) group, a jog only (J) group, and a control (CL) group. ROM of the hip and ankle were measured with the Leighton flexometer while hamstring extensibility was measured via the Wells-Dillon sit and reach test. Paired t-tests at an experiment wise alpha of 0.05 were done on the pre and posttest measure for the ankle, hip, hamstring extension, and SLJ. The results of the study were: (1) no significant improvement in any group from pre to post test on hip ROM; (2) only the (S) group showed improvement from pre to posttest on ankle ROM; (3) all warm-up/stretch groups improved significantly in hamstring extensibility; and (4) all warm-up/stretch groups improved in SLJ performance. It was concluded that warming up or stretching improved the extensibility of hamstring extensibility to the point where improvement in the SLJ was noted.

THE EFFECTS OF MUSCLE FATIGUE ON LOWER QUARTER PROPRIOCEPTION AND MOTOR CONTROL

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Limiting the athletic rehabilitation program to the restoration of muscular strength and joint flexibility without any integration of the neuromuscular mechanism is sometimes overlooked. The oversight often results in an incomplete restoration of athletic ability and quite possibly an increased risk of re-injury. The purpose of this study was to examine the effect of muscle fatigue on the conscious awareness of joint position sense and kinesthesia as it relates to motor control, and to determine if there was a difference in limb dominance and motor control. Twenty-three subjects without a history of lower quarter pathology participated. All subjects signed informed consent documents approved by the university human experimentation committee. Each was seated on an isotonic Hammer Strength plate-loaded leg press machine (Central States Fitness Systems, Lee's Summit, MO) with the testing leg positioned in 90 degrees of knee flexion. A Right Weigh Exercise Guidance System (Baltimore Therapeutic Exercise, Baltimore, MD) was attached perpendicular to the leg press machine. Following two practice trials, a third test trial score of active baseline motor control performance was recorded. The performance score was an exercise rating ranging from 0.0-9.9 based upon accuracy of movement, smoothness of movement, and complete range of motion. Following a fatigue protocol, motor control scores were reassessed. Testing order was randomized in regard to leg dominance. A significant difference (p=.001) was detected between pre-and post-fatigue motor control scores (pre=7.24; post=6.78) when all legs were combined. When both legs were analyzed independently, no significant differences (p>.05) in motor control were detected between dominant and nondominant extremities with both the prefatigue and post-fatigue testing (pre-dom=7.18; pre-non=7.30; post-dom-6.77; post-non=6.80). It was concluded that lower quarter proprioception is diminished in the presence of muscle fatigue, suggesting clinical rehabilitation protocols must emphasize increasing muscular endurance. Also it was concluded that because there was no difference in dominant and nondominant legs, the uninvolved limb (non-injured) can be used as a baseline comparative measure.

A COMPARISON OF PERIODIZED AND CONSTANT INTENSITY TRAINING ON BODY COMPOSITION, MUSCULAR STRENGTH AND PERFORMANCE.

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We examined the effects of manipulating training intensity on body composition, strength,and performance in trained Army Reserve Officers Training Corps (ROTC) cadets. Fourteen male, college-aged ROTC cadets, were pre- and post-tested for percent body fat (% .FAT), and one-repetition maximal strength (1 RM) on the bench press, and parallel squat. Performance was measured via the physical fitness components of the Army Ranger Challenge, and consisted of: push-ups, sit-ups, 2-mile run, and 10 km ruck-run. Subjects were matched according to years of military experience and randomly assigned to a periodized model (n=6), or a constant intensity model (n=8) for 10 weeks of 4 d/wk-1 resistance training. Data were analyzed using an ANCOVA for between group differences, with post-hoc paired t-tests for within group differences. Significance was set at $p < 0.05$. Total training volume was not significantly different between groups. The training volumes were $30,612 \pm 2236$ kg and $36,924 \pm 3463$ kg for bench press and parallel squat, in the periodized group and $32,743 \pm 2591$ kg and $40,468 \pm 3430$ kg for the bench press and parallel squat, in the constant intensity group. The periodized group significantly increased in 1 RM bench press (8.3%), 1 RM parallel squat (9.7%), push-ups (15.5%), and significantly decreased % FAT (11.6% to 9.9% pre- to post-test) and time to complete the ruck-run (9.5%). The constant intensity group significantly increased I RM parallel squat (11.2%) and push-ups (17.9%), and significantly decreased the time to complete the 2-mile run (5.5%) and the ruck-run (4.7%). A significant difference was found between groups for the ruck run with the periodized group completing the run faster. The results indicate that following a 10 week training cycle with previously trained subjects, significant improvements in body composition, strength, and performance can be obtained using two different training programs that have equal total relative training volume.

HIGH INTENSITY RESISTANCE TRAINING INFLUENCES IMMUNOGLOBULIN LEVELS IN TRAINED AND UNTRAINED FEMALES

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The purpose of this study was to examine immunoglobulin (IgA, IgG, IgM) levels following high intensity resistance training exercise. Nine untrained (UT) (age = 22.9 ± 0.9 y, height = 164.8 ± 0.71 cm, body mass (BM) = 59.4 ± 1.3 kg, fat free mass (FFM) = 47.3 ± 0.6 kg) and six trained (TR) (age = 22.8 ± 1.6 y, BM = 60.4 ± 2.6 kg, height = 164.8 ± 1.4 cm, FFM = 46.7 ± 1.4 kg) females participated in the study. Resistance training was performed at $89\pm5\%$ for UT and $88\pm3\%$ for TR, of each subject's 10 RM on seven Universal machines. Blood samples taken via the antecubital vein were analyzed for IgA, IgG, and IgM at pre, immediately post, 1.5, 3.0, and 24 h post exercise. Creatine kinase (CK) activity was determined pre- and 24 h post-exercise. Mean values between groups were analyzed using a repeated measures ANOVA. No significant differences existed for: IgA, IgG, IgM and CK between groups. Mean values between groups for total training volume (kg) were correlated with IgA, IgG, IgM. and CK using the Pearson's Product moment correlation coefficient. Significant negative correlations existed for CK and IgG 1.5 post ($p< 0.01$), CK and IgM immediately post ($p< 0.02$), and CK and IgM 24 h post ($p< 0.03$) for the TR group. When the groups were collapsed there were significant negative correlations for total training volume (kg) and IgM 24 h post ($p< 0.03$). There were near significant negative correlations for CK 24 h post exercise and IgM immediately post exercise ($p= 0.06$), and IgM 1.5 h post ($p= 0.06$), and total training volume (kg) and IgA 24 h post ($p= 0.08$). In the TR subjects a near significant negative correlation for CK and IgA 1.5 h post ($p= 0.09$) and CK and IgA 24 h post ($p= 0.06$) were found. IgG and IgM levels appeared to be decreased following high intensity resistance training. This decreased activity may be related to tissue damage incurred during exercise as indicated by the significant negative correlations between CK levels and Ig levels.

THE INFLUENCE OF DIFFERENT WORK/REST INTERVALS ON ANAEROBIC POWER PERFORMANCE IN FEMALES

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Little experimental data are available regarding appropriate work/rest intervals for maximizing anaerobic power production. The purpose of this preliminary study was to investigate the effects of three work/rest intervals (1-2, 1-6, 1-10) on the performance of five sprints of anaerobic cycling. Five trained females (age: 28.2 ± 3.3 y, height: 165.4 ± 2.8 cm, weight 56.5 ± 2.1 kg, VO_2max: 46.4 ± 2.6 ml-kg^{-1}min^{-1}) participated in a VO_2max test and three randomly assigned testing trials. Testing consisted of performing five 20 s sprints on a cycle ergometer, interfaced with a microcomputer, at a resistance of 0.075 kg kg fat-free mass^{-1} with selected rest intervals. Heart rate (HR) and ratings of perceived exertion (RPE) were collected at rest, prior to, and immediately after each sprint. Blood samples were collected via a finger stick procedure and analyzed for lactate concentration ([La]) at rest, and immediately after sprints 1, 3, and 5. Each sprint was analyzed for peak power (PP) and average power (AP). Repeated measures ANOVA's with appropriate follow-up tests were used to analyze HR, RPE. [La], PP, and AP. No significant difference existed among the three work/rest intervals for AP, and PP. Prior to sprints 2, 3, 4 and 5 the HR was significantly higher in the 1-2 work bout ($P < 0.05$) than the 1-6 or 1-10 rest intervals. No significant difference was found between the 1-6 and 1-10 rest intervals for HR. No difference was found ($P < 0.05$) in HR immediately post exercise among the three work/rest intervals. No difference was found among the three intervals in [La]. For each work/rest interval [La] was significantly higher ($P < 0.01$) at the end of sprint 5 than at rest, sprint 1, and sprint 3. The HR data indicate that HR decreases to the same extent in work/rest intervals of 1-6 or 1-10. These results indicate that in these trained females the rest interval chosen did not effect power performance in spite of differences in pre-exercise heart rate.

FRIDAY, OCTOBER 31

7:45-8:45 am   Student Meeting   (Vera Cruz 1)

7:45-8:45 am   Business Meeting   (Vera Cruz 2)

9:00-10:15   Oral Presentations   (Vera Cruz)

9:00-9:15   "Effect of Acute Exercise on Postprandial Triglyceride Response"
Q. Zhang and Tom R. Thomas

9:15-9:30   "The Effect of an Acute Bout of Resistance Training on T-cell Proliferation and Activity in Trained & Untrained Females"
M. Haub, S. Mathew, G. Haff, C. Chirathaworn, O. Omoike, M. Chan, S. Benedict, and J. Potteiger

9:30-9:45   "The Effects of Resistance Training Intensity and Volume on Delayed Onset Muscle Soreness"
C.L. Hart and F.A. Kulling

9:45-10:00   "A Comparison of the Validity and the Reliability of Ratings of Perceived Exertion by 30-70 y Old Females During Walking Exercise"
B. Wright, J.A. Potteiger, and K.L. Nau

10:00-10:15   "Effects of Ovariectomy and Estorgen Replacement on Rat Skeletal Muscle"
J.S. Fisher, W.M. Kohrt, and M. Brown

EXERCISE SCIENCE SESSION   (Vera Cruz 1)

10:30-11:00   "Resistance to Exercise: Sedentary Lifestyles in Contemporary Society"
Dr. Mary McElroy (Kansas State University)

11:00-11:30   "Biomechanics of Stretching and Flexibility"
Dr. Carole Zebas (University of Kansas)

11:30-12:00   "Muscle Fiber Type Influences Cardiorespiratory Responses to Exercise"
Dr. Tom Barstow (Kansas State University)

Friday's schedule concludes on outside back cover

CLINICAL SESSION   (Vera Cruz 2)

10:30-11:00   "The Future of Health Care Distribution Systems and its Impact on
                Exercise Physiologists"
                                Dr. Jean Gagnon (Hoechst Marion Roussel)

11:00-11:30   "Adaptations to Exercise in People with Physical Disabilities:
                What We Know, What We Don't Know, and What We Need to Know"
                                James Laskin (University of Oklahoma Medical Center)

11:30-12:00   "Exercise Induced Asthma: Recognition, Testing, and Treatment:
                A Brief Overview"
                                Dr. Richard Sabath (Children's Mercy Hospital)

12:00-1:00   Lunch   (Morelia)

GENERAL SESSION   (Vera Cruz)

1:15-1:45   "The American College of Sports Medicine: Historical Perspective and
             Future Directions"
                                Dr. Charlotte Tate (University of Houston)

2:00-2:45   "Physical Activity and Public Health: Recent Recommendations for
             Adults and Youth"
                                Dr. Russ Pate (University of South Carolina)

2:45-3:15   "Effects of Resistance Training in Hospitalized, Disabled Elderly"
                                Dr. Tim Wall (University of Arkansas - Little Rock)

3:15-3:45   "Delivering Cardiac Rehabilitation Services in a Managed Care
             Environment"
                                Dr. Jeff Roitman (Research Medical Center)