



# *Curves*<sup>®</sup>

## Research Abstracts

*The Exercise and Sports Nutrition Laboratory at Texas A&M University, led by Dr. Richard Kreider, Ph.D., FACSM, has conducted numerous studies examining the Curves program. The research is sponsored by an unrestricted research grant from Curves.*

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# Exercise Intensity & Energy Expenditure Analysis of Women Participating in the Curves Exercise Program



*G. Farris, J. Wismann, R. Farris, N. Gandy, L. Long, E. Pfau, B. Campbell, P. La Bounty, C. Rasmussen, R. Wilson & R Kreider (Sponsor: D. Willoughby). Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX*

## 2005 FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

The Curves exercise program is a popular form of exercise for women that involves interval resistance-training interspersed with callisthenic exercise. The goal is to maintain an elevated heart rate during resistance-training to efficiently promote aerobic and anaerobic fitness. While the program has been shown to promote fitness gains, the exercise intensities of women participating in this program are unclear. We conducted two studies to determine the exercise intensities of women participating in this program. In the first study, 40 women (49±9 yrs, 91±14 kg, 45±5 % fat, 69±8 RHR, 159±18 max HR) performed the Curves 30-minute workout on two occasions. HR was determined using Polar heart rate monitors. Max HR was obtained during a max treadmill GXT. HR observed during the workouts was compared to max HR and heart rate reserve (HRR). Results revealed that mean HR was 126±15 b/min which was equivalent to 80% max HR or 64 % of HRR. In the second study, 12 post-menopausal women (52±4 yrs, 83±13 kg, 1.76±0.25 L/min VO<sub>2</sub> max, 6.2±1.0 Max METS, 1.27±0.2 L/min VANT, 73±3 % max VANT) performed the Curves 30-min workout on two occasions. Exercise VO<sub>2</sub> and CO<sub>2</sub> measurements were measured using a CosMed K4b portable metabolic measurement system.

### RESULTS:

Results indicated that the mean VO<sub>2</sub> to perform the 30-min workout was 1.14±0.29 L/min representing 65±10% of VO<sub>2</sub> max. Estimated caloric expenditure was 5.7±1.1 kcal/min or 172±35 kcals with a mean RER of 0.94±0.7 for the 30-min workout. Exercise VO<sub>2</sub> for session 1 and 2 were not significantly different and were significantly correlated (r=0.84, p<0.001) indicating the exercise sessions were reliable. Results indicate that the Curves exercise program elicits a mean exercise intensity that meets ACSM and AHA recommendations for improving aerobic fitness in this population of low-fit post-menopausal women.

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## Long-Term Effects of the Curves Fitness & Weight Program on Weight and Fat Loss



*K. Sharp, C. Kerksick, C. Wilborn, B. Campbell, J. Wismann, M. Galbreath, E. Nassar, J. Beckham-Dove, T. Harvey, P. La Bounty, A. Parker, M. Ferreira, M. Cooke, M. Iosia, C. Rasmussen, M. Greenwood, R. Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX*

2007 FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

472 sedentary women (45±11 yrs, 163±7 cm; 93±17 kg; 45±5% body fat) were assigned to an exercise & high calorie diet (HCD) group (2,600 kcals/d for 1 wk at 55% C, 15% P, 30% F; 9 wks at 40% C, 30% P, 30% F; 4 wks at 55% C, 15% P, 30% F); or, a low calorie high carbohydrate (HCHO), high protein (HP), or very high protein (VHP) diet. Diets consisted of 1,200 kcal/d for 1-wk and 1,600 kcal/d for 9 wks and contained 30% fat, 40-55% CHO on the HCD and HCHO diets and 50-63% P on the HP and VHP diets for 14-wks (10 wk diet / 4-wk maintenance). During the maintenance phase, subjects ingested 2,600 kcal/d and dieted for 3-d (1,200 kcal/d) only if they gained weight (3 lbs). Subjects participated in a supervised Curves exercise program 3d/wk. Participants lost an average of 3.7±4.2 kg. After completing the 14-wk study, subjects were invited to continue to exercise for another year and asked to diet for 3-d (1,200 kcal/d) only if they gained weight (3 lbs). Body mass and DEXA body composition data were collected at 0, 10, 14 weeks as well as at 3 (n=105), 6 (n=68), 9 (n=52), and 12 (n=40) months. Data for the exercise only (E), high carbohydrate diet (HCHO), and high protein diets (HP) were analyzed by repeated measures ANOVA and are presented as means ± SD changes from baseline for the E, HCHO, and HP diets, respectively.

### RESULTS:

Results revealed that subjects maintained a significant amount of weight loss after 3 m (-1.1±3, -4.7±5, -7.5±11 kg), 6 m (-1.2±4.3, -4.0±6, -5.7±7 kg), 9 m (-2.1±5, -3.1±6, -3.5±6, kg), and 12 m (-3.4±5, 3.8±6, -1.9±5 kg) as well as fat mass loss after 3 m (-0.7±3, -3.8±4, -4.6±4 kg), 6 m (-1.1±4, -4.1±4, -4.5±4 kg), 9 m (-0.6±4, -4.1±4, -2.9±4 kg), and 12 m (-1.4±5, -4.2±3, 1.9±3 kg). Weight and fat loss were maintained better in the HP group until 6 months and in the HCHO group after 6 months. Results indicate that subjects following the Curves fitness and weight loss program can maintain weight loss by maintaining a consistent training program and adhering to intermittent diet strategies.

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# Analysis of Exercise Intensities of Women Using The Curves Hydraulic Training Equipment



*P. La Bounty, C. Wilborn, B. Marcello, B. Campbell, M. Faries, J. Shim, C. Rasmussen & R. Kreider  
(Sponsor: D. Willoughby). Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX*

## 2005 FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

The Curves exercise program is a popular form of exercise for women that involves interval resistance-training using hydraulic machines. While the program has been shown to promote gains in muscular strength and endurance, the relative intensity of women using the hydraulic-resistance training equipment is unclear. Groups of 10 overweight women experienced with training on the Curves resistance-training machines underwent a battery of tests on each machine conducted over a one-week period. Subjects performed 3 x 1 RM tests followed by performing 30-sec bouts of MVC at a cadence of 20 and 30 reps/30 sec. Subjects repeated the testing on 3 separate days to assess reliability. Force output was determined from pressure sensors placed on machines. Data are reported as average percent of 1 RM for the 20 and 30 reps/30 sec bouts, respectively.

### RESULTS:

Results revealed that mean force production for the leg press ( $82 \pm 55$ ;  $75 \pm 46$  % 1RM); hip abductor/adductor ( $76 \pm 23$ ;  $79 \pm 27$  % 1RM); chest/back machine ( $51 \pm 22$ ;  $55 \pm 25$  % 1RM); and, shoulder press/lat pull ( $45 \pm 25$ ;  $60 \pm 26$  % 1RM) met NSCA and ACSM recommended guidelines for resistance training. Additionally, the bouts of exercise were significantly correlated to one another (20 reps/30 sec: 0.99 [day 1:day 2]; 0.87 [day 1:day 3]; 0.91 [day 2:day 3]; 30 reps/30 sec: 0.98 [day 1:day 2]; 0.57 [day 1:day 3]; 0.40 [day 2: day 3]). These findings suggest that the Curves resistance-training machines analyzed elicited recommended amounts of resistance-training workloads and that use of the equipment from day to day is reliable particularly at the slower cadence. Results support contentions that this form of exercise can effectively promote gains in muscular strength and endurance in women.

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# Effects of the Curves Fitness & Weight Loss Program I: Body Composition



*M. Cooke, C. Kerksick, B. Campbell, C. Wilborn, M. Galbreath, R. Li, M. Ferreira, E. Nassar, T. Harvey, A. Parker, K. Sharp, M. Iosia, C. Rasmussen, M. Greenwood, R. Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX*

## 2007 FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

467 sedentary women (45±11 yrs, 163±7 cm; 93±17 kg; 45±5% body fat) were assigned to a control group (C), an exercise & no diet group (E); an exercise & high calorie diet (HCD) group (2,600 kcal/d for 1 wk at 55% C, 15% P, 30% F; 9 wks at 40% C, 30% P, 30% F; 4 wks at 55% C, 15% P, 30% F); or, a low calorie high carbohydrate (HCHO), moderately high protein (HP), or very high protein (VHP) diet. Diets consisted of 1,200 kcal/d for 1-wk and 1,600 kcal/d for 9 wks and contained 30% fat, 40-55% CHO on the HCD and HCHO diets and 50-63% P on the HP and VHP diets. During the maintenance phase, subjects ingested 2,600 kcal/d and dieted for 3-d (1,200 kcal/d) only if they gained weight (3 lbs). Subjects participated in a supervised Curves exercise program 3-d per wk. DEXA body composition measurements were obtained at 0, 10, and 14 weeks and were analyzed by repeated measures ANOVA. Data are presented as means ± SD changes from baseline for the C, E, HCD, HCHO, HP and VHP groups, respectively.

## RESULTS:

After 10 weeks, subjects who dieted experienced a significantly greater ( $p < 0.001$ ) loss in total scanned mass (0.8±2.3; -0.5±2.0; -1.6±3.9; -3.6±3.1; -3.3±5.1; -4.8±4.6 kg) and fat mass (0.0±2.1; -0.8±1.9; -1.1±2.7; -2.8±2.3, -2.6±3.8, -3.8±3.6 kg). Intermittent dieting maintained losses in scanned mass (0.6±2.7; -0.5±2.4 -2.2±5.0; -3.8±4.2; -3.8±4.6; 4.7±2.4 kg) and fat mass (0.0±2.6; -1.1±2.1; -1.1±2.1; -3.1±3.1; -3.3±4.0, -3.9±3.3 kg). Scanned and fat mass loss was greatest in the VHP group. Results indicate that the Curves fitness and weight loss program is effective to promote and maintain weight loss particularly when following a VHP diet.

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## Effects of the Curves Fitness & Weight Loss Program II: Resting Energy Expenditure



*R. Li, C. Kerksick, B. Campbell, C. Wilborn, B. Marcello, M. Ferreira, J. Wismann, J. Beckham-Dove, M. Galbreath, T. Harvey, P. LaBounty, K. Sharp, A. Parker, E. Nassar, M. Iosia, M. Cooke, C. Rasmussen, M. Greenwood, R. Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX*

### 2007 FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

466 sedentary women (45±11 yrs, 163±7 cm; 93±17 kg; 45±5% body fat) were assigned to a control group (C), an exercise & no diet group (E); an exercise & high calorie diet (HCD) group (2,600 kcals/d for 1 wk at 55% C, 15% P, 30% F; 9 wks at 40% C, 30% P, 30% F; 4 wks at 55% C, 15% P, 30% F); or, a low calorie high carbohydrate (HCHO), high protein (HP), or very high protein (VHP) diet. Diets consisted of 1,200 kcal/d for 1-wk and 1,600 kcal/d for 9 wks and contained 30% fat, 40-55% CHO on the HCD and HCHO diets and 50-63% P on the HP and VHP diets. During the maintenance phase, subjects ingested 2,600 kcal/d and dieted for 3-d (1,200 kcal/d) only if they gained weight (3 lbs). Subjects participated in a supervised Curves exercise program 3-d per wk. Body weight and fasting REE measurements were obtained at 0, 10, and 14 weeks. Data were analyzed by repeated measures ANOVA and are presented as means ± SD changes from baseline for the C, E, HCD, HCHO, HP and VHP groups, respectively.

### RESULTS:

After 10 wks, subjects significantly lost weight (-0.7±2.3; -0.5±1.9; -1.7±4.2; -4.0±3.6; -3.9±3.4; -4.9±3.8 kg) while REE was maintained or increased (-0.3±3.3; 0.4±2.0; 2.4±3.1; 0.5±2.5; 0.8±2.7; 0.0±2.1 kcal/d/kg). Weight loss (0.5±2.9; -0.4±2.3; -2.4±5.2; -4.1±3.8; -4.2±3.8; -5.0±4.3 kg) and REE were maintained during the maintenance phase (-0.8±1.8; -0.2±2.7; 3.1±3.5; 0.8±2.5; 1.4±4.1; 0.5±2.4 kcal/kg/d). Results indicate that it is possible to experience significant weight loss without reducing REE.

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# Effects of the Curves Fitness & Weight Loss Program IV: Health Markers



*J. Wismann, M. Galbreath, C. Wilborn, L. Taylor, B. Campbell, E. Nassar, J. Beckham-Dove, T. Harvey, C. Kerksick, P. La Bounty, A. Parker, M. Ferreira, M. Cooke, M. Iosia, R. Chandran, C. Rasmussen, M. Greenwood, R. Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX*

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335 sedentary women (45±10 yrs, 164±7 cm; 92±16 kg; 45±5% body fat) were assigned to an exercise group or an exercise & high calorie diet (HCD) group (2,600 kcals/d for 1 wk at 55% C, 15% P, 30% F; 9 wks at 40% C, 30% P, 30% F; 4 wks at 55% C, 15% P, 30% F); or, a low calorie high carbohydrate (HCHO), high protein (HP), or very high protein (VHP) diet. Diets consisted of 1,200 kcal/d for 1-wk and 1,600 kcal/d for 9 wks and contained 30% fat, 40-55% CHO on the HCD and HCHO diets and 50-63% P on the HP and VHP diets for 14-wks (10 wk diet / 4-wk maintenance). During the maintenance phase, subjects ingested 2,600 kcal/d and dieted for 3-d (1,200 kcal/d) only if they gained weight (3 lbs). Subjects participated in a supervised Curves exercise program 3-d per wk. At 0, 2, 10, and 14 weeks, subjects were weighed, donated fasting blood samples, and had waist and hip measurements determined. Subjects were also questioned about side effects on a weekly basis. Data were analyzed by repeated measures ANOVA and are presented as means ± SD from baseline at weeks 2, 10, and 14, respectively.

## RESULTS:

Significant time and/or interaction effects were observed in total cholesterol (-6.6±14; -3.4±15; -2.0±15 %), LDL-c (-6.4±19; -2.8±20; -1.8±21 %), triglycerides (-7.1±35; -1.5±37; 0.2±40 %), and glucose (-1.6±13; -1.0±14; -2.9±15 %) with the greatest impact during the diet phases. No significant differences were observed in the cholesterol to HDL ratio. Subjects experienced significant decreases in waist (-1.9±6; -3.4±8; -4.5±7 %) and hip (-1.0±5; -2.3±5; -2.7±5 %) measurements (n=444) with diet groups experiencing greater effects. Although some hematological variables changed over time, there were no clinically significant findings observed in a comprehensive panel of hematological markers evaluated. No clinically significant side effects or adverse events related to the study were reported. Results indicate that participation in the Curves fitness and weight loss program improves some health-related blood profiles and decreases hip and waist measurements without adversely affecting general markers of health status.

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## Effects of the Curves Fitness & Weight Loss Program VI: Quality of Life



*T. Harvey, E. Nassar, R. Bowden, M. Davis, L. Long, J. Opusunju, B. Lanning, J. Beckham-Dove, J. Wismann, M. Galbreath, B. Campbell, C. Kerksick, P. La Bounty, M. Ferreira, C. Wilborn, J. Crixell, M. Iosia, M. Cooke, C. Rasmussen, R. Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX*

### 2007 FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

287 sedentary women (48±10 yrs, 164±7 cm; 91±16 kg; 45±4% body fat) were assigned to an exercise & no diet group (E); an exercise & high calorie diet (HCD) group (2,600 kcals/d for 1 wk at 55% C, 15% P, 30% F; 9 wks at 40% C, 30% P, 30% F; 4 wks at 55% C, 15% P, 30% F); or, a low calorie high carbohydrate (HCHO), high protein (HP), or very high protein (VHP) diet. Diets consisted of 1,200 kcal/d for 1-wk and 1,600 kcal/d for 9 wks and contained 30% fat, 40-55% CHO on the HCD and HCHO diets and 50-63% P on the HP and VHP diets. Subjects then ingested 2,600 kcal/d and dieted for 2-d (1,200 kcal/d) only if they gained 3 lbs during a 4-wk maintenance phase. Subjects participated in a supervised Curves exercise program 3 d/wk. The SF-36 Quality of Life (QOL) inventory was administered at 0, 10, and 14 wks. Data were analyzed by repeated measures ANOVA and are presented as means ± SD changes from baseline after 10 and 14 wks, respectively.

### RESULTS:

Results revealed that physical functioning (29.6±141, 24.4±122 %, p=0.002), social functioning (11.1±56, 11.1±69 %, p=0.005), vitality (25.5±88, 23.0±91 %, p=0.001), and mental health (8.5±27, 7.3±28 %, p=0.001) scores significantly increased over time in all groups. Bodily pain (32.2±296, 28.6±297 %, p=0.23), general health (3.0±163, -21.7±271 %, p=0.58), role physical (-4.1±56, -0.2±58 %, p=0.12), and role emotional scores (0.9±59, 3.0±60 %, p=0.79) were not significantly changed over time. No significant interactions were observed among groups with the exception that role physical scores decreased to a greater degree in the HP group. These findings indicate that the Curves fitness and weight loss program improves select markers of QOL.

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## Effects of the Curves Fitness & Weight Loss Program VII: Body Image & Self Esteem



*M. Davis, B. Lanning, E. Nassar, L. Long, J. Opusunju, R. Bowden, J. Beckham-Dove, J. Wismann, M. Galbreath, B. Campbell, T. Harvey, C. Kerksick, P. La Bounty, M. Ferreira, C. Wilborn, J. Crixell, M. Iosia, M. Cooke, C. Rasmussen, R. Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX*

### 2007 FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

287 sedentary women (48±10 yrs, 164±7 cm; 91±16 kg; 45±4% body fat) were assigned to an exercise & no diet group (E); an exercise & high calorie diet (HCD) group (2,600 kcal/d for 1 wk at 55% C, 15% P, 30% F; 9 wks at 40% C, 30% P, 30% F; 4 wks at 55% C, 15% P, 30% F); or, a low calorie high carbohydrate (HCHO), high protein (HP), or very high protein (VHP) diet. Diets consisted of 1,200 kcal/d for 1-wk and 1,600 kcal/d for 9 wks and contained 30% fat, 40-55% CHO on the HCD and HCHO diets and 50-63% P on the HP and VHP diets. Subjects then ingested 2,600 kcal/d and dieted for 2-d (1,200 kcal/d) only if they gained 3 lbs during a 4-wk maintenance phase. Subjects participated in a supervised Curves exercise program 3 d/wk. The Social Physique Anxiety (SPA) scale, a Rosenberg self-esteem scale (RSE), and a Cash Body Image Questionnaire were obtained at 0, 10, and 14 wks. Data were analyzed by repeated measures ANOVA and are presented as means ± SD changes after 10 and 14 wks, respectively.

### RESULTS:

Results revealed that appearance evaluation (18.9±39, 19.5±34 %, p=0.001), body area satisfaction (13.9±29, 15.8±31 %, p=0.001), and overweight preoccupation (18.6±67, 15.8±74 %, p=0.005) significantly increased with no differences among groups. Self-Classified-Weight scores (-2.5±36, -7.3±27%, p=0.001) significantly decreased with no differences among groups. Appearance orientation (-0.5±18, 0.6±16 %, p=0.63), total RSE (7.4±24, 6.1±59 %, p=0.20), and SPA (1.5±26, -0.7±25 %, p=0.68) scores were unchanged. Results indicate that participation in the Curves fitness and weight loss program improves some aspects of body image and self-esteem.

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