

ENERGY EXPENDITURE ANALYSIS OF WOMEN PARTICIPATING IN A COMPUTERIZED HYDRAULIC CIRCUIT TRAINING PROGRAM

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Hydraulic-based resistance-exercise interspersed with low-impact calisthenics exercise performed without rest in a circuit-training manner has become a popular form of exercise among middle-aged sedentary women. Until recently, the equipment used in this program did not provide force or work data and was effort dependent. While previous research showed that this equipment was effective in promoting gains in strength and muscular endurance, there was no way to quantify work performed or energy expenditure. Technological advances have allowed for attachment of calibrated light sensors on the hydraulic cylinders which now can determine force and piston displacement data. Subjects perform 3 x 1RM's on each machine so that proper intensity can be established. During workouts, infrared technology is used so that the machines recognize the subject and therefore knows how much force is needed to achieve desired strength outcomes. Subjects must lift hard enough to illuminate a green light indicating that the appropriate intensity was achieved based on their fitness level. If the individual did not push or pull hard enough, a yellow or red light illuminates based on the percentage of 1RM achieved. Training intensity is progressed using log₁₀ rhythms based on results observed in the prior 3 workouts. Force, power, and work data are collected for each repetition and set on each piece of equipment throughout the circuit. Energy expenditure during recovery stations have been based on metabolic testing of average MET levels as well as on HR data obtained during the circuit. Data are then stored via computer and accessible via internet data capturing capabilities. **PURPOSE:** To determine the average energy expenditure of women participating in this 30-minute circuit-training program and whether energy expenditures differed among sites. **METHODS:** 1,031 women (49.3±14 yrs; 174±40 lbs; 64.3±3 in) at 7 sites outfitted with this "Smart" equipment participated in this study. Energy expenditure data for each workout were recorded and downloaded into from each site. Women who completed 10 x 30 minute workouts from this data base (n=675) were included in the analysis. Data were analyzed by repeated measures ANOVA. **RESULTS:** The average energy expenditure to complete 10 x 30 minute workouts was 314±102 kcals (mean and SD). A trend toward a significant increase in energy expenditure over time was observed (p=0.07). Significant differences were observed among sites (p=0.001) in average 10 workout energy expenditure with a low of 238±9 (mean and SEM) and a high of 435±10 (mean and SEM). **CONCLUSIONS:** Results indicate that this type of training can elicit recommended energy expenditure ranges to promote fitness and weight loss. Additionally, differences may be observed among sites depending on the age and fitness level of the population participating in the program. **PRACTICAL APPLICATIONS:** This type of training can elicit energy expenditures comparable to other moderate to intense fitness activities. It is possible to computerized this type of resistance-training equipment for large-scale data collection capabilities. **ACKNOWLEDGMENTS:** This study was funded by Curves International, Waco, TX.

EFFECTS OF A POPULAR FITNESS AND WEIGHT LOSS PROGRAM IN SENIOR-AGED WOMEN: GLUCOSE AND INSULIN KINETICS

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Obesity and sarcopenia are prominent problems in senior-aged women, so wellness programs that can decrease body fat, while maintaining lean mass are of utmost importance. Additionally, decreasing diabetes incidence and complications of insulin resistance are important to this population. **PURPOSE:** To determine the effects of dieting with different macronutrient profiles and resistance exercise on glucose and insulin levels. **METHODS:** 55 senior-aged women (66 ± 5 yrs, 79 ± 11 kg; $44 \pm 4\%$ body fat) participated in a 3-d/wk resistance-training program for 14 wks. Subjects were assigned to an exercise only group (E) or a high carbohydrate (HC) or high protein (HP) diet group. Diets consisted of 1,200 kcal/d for 1wk, 1,600 kcal/d for 9wks, followed by a 2,100 kcal/d maintenance phase for 4wks. The HC group diet contained 55% CHO, 15% PRO, and 30% Fat while the HP diet contained 7-15% CHO, 55-63% PRO, and 30% Fat. The maintenance diet was 55% CHO, 15% PRO, and 30% Fat. Data were analyzed by repeated measures ANOVA and are presented as means \pm SD changes from baseline for the E, HC, and HP groups after 10 and 14wks, respectively. **RESULTS:** After 10 weeks, women who followed the HP diet experienced a significantly greater ($p < 0.003$) loss in total scanned mass (-0.3 ± 1.6 ; -1.3 ± 1.8 ; -2.9 ± 2.5 kg), fat mass (-0.8 ± 1.3 ; -1.5 ± 1.3 ; -2.8 ± 1.9 kg), and body fat (-1.0 ± 1.6 ; -1.2 ± 1.4 ; $-2.1 \pm 1.6\%$). Intermittent dieting maintained losses in scanned body mass (-0.5 ± 1.6 ; -1.3 ± 2.1 ; -3.1 ± 2.7 kg), fat mass (-0.8 ± 1.1 ; -1.9 ± 1.4 ; -3.3 ± 2.0 kg), and body fat (-0.9 ± 1.5 ; -1.8 ± 1.5 ; -2.7 ± 1.5 kg). No differences were seen in fat free mass after 10 or 14wks (0.5 ± 1.4 , 0.36 ± 1.5 ; 0.12 ± 1.4 , 0.58 ± 1.6 ; -0.11 ± 1.3 , 0.22 ± 1.5 kg, $p = 0.41$). There were no significant differences observed in serum glucose, although these levels tended to increase more in the HC group (-1.0 ± 9.5 , -2.5 ± 10.3 ; 3.4 ± 9.4 , 5.9 ± 16.3 ; 0.30 ± 6.4 , -2.2 ± 7.1 %, $p = 0.096$). Serum insulin levels significantly increased after 10wks and 14wks (34.5 ± 82.7 ; 85.4 ± 127.4 %, $p = 0.001$) with insulin tending to increase to a greater degree in the HP, than HC group (46.5 ± 82.5 , 62.5 ± 59.3 ; -11.7 ± 44.4 , 73.6 ± 71.9 ; 77.9 ± 94.6 , 124.2 ± 208.9 %, $p = 0.098$). The glucose to insulin ratio (GIR) significantly decreased after 10 and 14 wks (-0.8 ± 50.1 ; -27.9 ± 41.8 %, $p = 0.001$) while the ratio tended to decrease to a greater degree in the HP group (-13.1 ± 40.7 , -36.2 ± 16.1 ; 29.8 ± 55.0 , -26.2 ± 29.5 ; -24.4 ± 35.1 , -20.5 ± 68.8 %, $p = 0.091$). The homeostatic model assessment of insulin resistance (HOMA-IR) significantly increased after 10wks and 14wks (35.2 ± 82.1 ; 82.8 ± 127.9 %, $p = 0.001$) with no significant differences among groups (44.9 ± 90.2 , 60.6 ± 76.6 ; -4.3 ± 38.7 , 77.8 ± 80.8 ; 72.8 ± 95.0 , 114.6 ± 204.6 %, $p = 0.252$). **CONCLUSION:** Senior-aged women experienced greater fat loss while following a HP diet during resistance-training. Resistance training and dieting also increased fasting insulin levels and decreased general markers of insulin sensitivity. The increase in insulin and reduction in insulin sensitivity contrasts prior studies in younger populations and therefore may be an age-related change. **PRACTICAL APPLICATION:** The combination of a high protein diet and resistance training promotes fat loss, tends to decrease fasting glucose, and increases fasting insulin levels. **ACKNOWLEDGEMENTS:** This study was funded by Curves International, Waco, TX.

EFFECTS OF A POPULAR FITNESS AND WEIGHT LOSS PROGRAM IN SENIOR-AGED WOMEN: LEPTIN, GHRELIN, & ADIPONECTIN LEVELS

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Obesity and sarcopenia are prominent problems in senior-aged women, so wellness programs that can decrease body fat, while maintaining lean mass are of utmost importance. Additionally, determining how these programs affect appetite-related hormone levels may be beneficial to helping this population maintain an appropriate body composition. **PURPOSE:** To determine the effects of dieting with different macronutrient profiles and resistance exercise on leptin, ghrelin, and adiponectin levels. **METHODS:** 55 senior-aged women (66 ± 5 yrs, 79 ± 11 kg; $44 \pm 4\%$ body fat) participated in a 3-d/wk resistance-training program for 14wks. Subjects were assigned to an exercise only group (E) or a high carbohydrate (HC) or high protein (HP) diet group. Diets consisted of 1,200 kcal/d for 1wk, 1,600 kcal/d for 9wks, followed by a 2,100 kcal/d maintenance phase for 4wks. The HC group diet contained 55% CHO, 15% PRO, and 30% Fat while the HP diet contained 7-15% CHO, 55-63% PRO, and 30% Fat. The maintenance diet was 55% CHO, 15% PRO, and 30% Fat. Data were analyzed by repeated measures ANOVA and are presented as means \pm SD changes from baseline for the E, HC, and HP groups after 10 and 14wks, respectively. **RESULTS:** After 10wks, women who followed the HP diet experienced a significantly greater ($p < 0.003$) loss in total scanned mass (-0.3 ± 1.6 ; -1.3 ± 1.8 ; -2.9 ± 2.5 kg), fat mass (-0.8 ± 1.3 ; -1.5 ± 1.3 ; -2.8 ± 1.9 kg), and body fat (-1.0 ± 1.6 ; -1.2 ± 1.4 ; $-2.1 \pm 1.6\%$). Intermittent dieting maintained losses in scanned body mass (-0.5 ± 1.6 ; -1.3 ± 2.1 ; -3.1 ± 2.7 kg), fat mass (-0.8 ± 1.1 ; -1.9 ± 1.4 ; -3.3 ± 2.0 kg), and body fat (-0.9 ± 1.5 ; -1.8 ± 1.5 ; -2.7 ± 1.5 kg). No differences were seen in fat free mass after 10 or 14 wks (0.5 ± 1.4 , 0.36 ± 1.5 ; 0.12 ± 1.4 , 0.58 ± 1.6 ; -0.11 ± 1.3 , 0.22 ± 1.5 kg, $p = 0.41$). Serum leptin concentrations were significantly decreased after 10wks (-21.4 ± 42.3 ; $0.8 \pm 52.7\%$, $p = 0.001$) with a significantly larger reduction in the HP group than the HC or E groups (-8.6 ± 51.9 , 1.3 ± 33.1 ; -17.8 ± 44.0 , 38.4 ± 60.2 ; -37.9 ± 21.8 , $-39.5 \pm 24.3\%$, $p = 0.001$). Ghrelin levels increased slightly after 10wks, but were significantly reduced over the 4wk maintenance period (11.5 ± 43.6 ; $-3.5 \pm 55.0\%$, $p = 0.048$) with a significantly larger reduction in the HP group than the HC or E groups (19.9 ± 40.5 , 0.8 ± 44.5 ; 26.8 ± 44.1 , 24.9 ± 63.9 ; -14.6 ± 36.4 , $-40.5 \pm 28.7\%$, $p = 0.007$). Adiponectin concentrations did not significantly change over time (-10.5 ± 45.9 ; $4.3 \pm 54.6\%$, $p = 0.45$), but decreased significantly more in the diet groups than E group (11.0 ± 52.0 , 33.4 ± 57.9 ; 12.1 ± 31.4 , -45.3 ± 13.3 ; -51.0 ± 14.4 , $23.0 \pm 45.1\%$, $p = 0.012$). **CONCLUSION:** Senior-aged women experienced greater fat loss while following a HP diet during resistance-training. Additionally, changes in leptin and ghrelin were more favorably altered in subjects following the HP diet. **PRACTICAL APPLICATION:** The combination of a high protein diet and resistance training is recommended for senior-aged women needing to lose body fat, while maintaining fat free mass. Weight loss may be associated with improved hormonal regulation of appetite. **ACKNOWLEDGEMENTS:** This study was funded by Curves International, Waco, TX.