EFFECTS OF TWO POPULAR WEIGHT LOSS PROGRAMS ON CHANGES IN BODY COMPOSITION AND VISCERAL ADIPOSE TISSUE IN WOMEN

A Coletta, M Mardock, B Lockard, M Byrd, S Simbo, A Jagim, JY Kresta, C Baetge, YP Jung, M Koozehchian, D Khanna, H Kyul, JM Oliver, M. Greenwood, C Rasmussen, R Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX 77843

Abstract

54 sedentary women (34±8 yrs, 35±6 kg/m^2) were randomized to participate in the Curves (C) or Weight Watchers (W) weight loss programs for 16-wks. Participants in the C program followed a 1,200 kcal/d diet for 1-wk and 1,500 kcal/d diet for 3 wks (30:45 CHO:PRO). Subjects then ingested 2,000 kcals/d for 2-wks (45:30 CHO:PRO) and repeated this diet while participating in the Curves with Zumba program 3-d-wk. Remaining subjects followed the W point-based diet program, received weekly counseling, and were encouraged to exercise. DEXA body composition with visceral adipose tissue (VAT) was determined at 0 & 16 wks. MANOVA revealed a significant time (p<0.001) and group x time (p=0.035) effect. Both groups lost a similar amount of weight (W -6.3±4, C -4.8±4 kg, p=0.17), fat mass (W -3.1±6, C -5.9±6 kg, p=0.13), and VAT mass (W -98±468, C -240±445 g, p=0.26). Subjects in the C group experienced greater gains in FFM (W -3.3±5.9. C +1.2±4.1 kg, p=0.002) and tended to lose more body fat (W -1.1±8, C -4.5±5.5 %, p=0.07). Changes in VAT mass significantly correlated with changes in weight (r=0.38), fat mass (r=0.73), FFM (r=-0.62), and body fat (r=0.64). Results indicate that different types of diets can differentially affect changes in body composition and VAT. *Supported by Curves International (Waco, TX)*

Rationale

According to the CDC, approximately one-third of adult Americans are obese (~34.9%), and the estimated annual medical cost associated with obesity is about $147 billion. Obesity is directly associated with increased risk of multiple adverse health conditions such as cardiovascular disease and type 2 diabetes. Unfavorable body composition and fat deposition (i.e., subcutaneous fat versus visceral fat), resulting from excessive weight gain and subsequent obesity classification, has been associated with increased risk of these conditions. Furthermore, the rise in prevalence of obesity has been attributed to physical inactivity and excessive caloric intake. Multiple weight loss programs have become available in efforts to reduce the prevalence and cost of obesity. Of these programs, both Curves® and Weight Watchers® have been scientifically validated as sound weight loss programs.

PURPOSE: To determine which weight loss program, Curves® or Weight Watchers®, results in more favorable outcomes related to body composition and fat deposition, in previously sedentary, overweight women.

Methods & Procedures

Subjects

- 54 sedentary women (34±8 yrs, 35±6 kg/m^2)
- Subjects were informed of experimental procedures and signed a consent statement in adherence with the human subject guidelines of Texas A&M University.
- A standard medical exam and review of subject medical history was performed by a research RN for clearance to participate in study.
- Subjects were randomized into one of two weight loss programs.

Weight Watchers® Program

- 29 subjects completed the Weight Watchers® program.
- Subjects followed the Weight Watchers® Points Plus program, which consisted of following food plans based on a points system, and attending weekly meetings for weigh-ins and presentations regarding exercise recommendations, tracking methods, and weight reduction strategies.
- Exercise was encouraged but not mandatory.

Methods & Procedures

Curves® Program

- 25 subjects completed the Curves® program
- The Curves® diet consisted of the following macronutrient distribution range: 30% carbohydrate (CHO), 45% protein, & 25% fat.
- The Curves® diet was also cyclical in nature: 1,200kcal/day for 1 week, 1,500kcal/day for 3 weeks, 2,200 kcals for 2 weeks, and repeat cycle for 16 week duration of the study.
- Exercise within the Curves® program consisted of a 30-min resistance based circuit interspersed with calisthenic exercises or Zumba 3 days per week.

Measures

- Body composition and VAT mass was measured via DEXA scan at baseline (0 weeks) and upon completion of the study (16 weeks).

Statistical Analysis

Data were analyzed by MANOVA with repeated measures, using IBM SPSS for Windows version 22.0 software (Chicago, IL). Data is presented as means ± SD, with percent change from baseline to 16 weeks for each group.

Results

- MANOVA revealed a significant time (p<0.001) and group x time (p=0.035) effect.
- Both groups lost a similar amount of weight (W -6.3±4, C -4.8±4 kg, p=0.17), fat mass (W -3.1±6, C -5.9±6 kg, p=0.13), and VAT mass (W -98±468, C -240±445 g, p=0.26).
- The Curves® group demonstrated more favorable trends in reduction of fat and VAT mass from baseline to completion.
- VAT mass was significantly correlated with changes in weight (r=0.38), fat mass (r=0.73), fat free mass (FFM) (r=-0.62), and body fat (r=0.64).
- The Curves® group experienced greater gains in FFM (W -3.3±5.9. C +1.2±4.1 kg, p=0.002) and lost more body fat (W -1.1±8, C -4.5±5.5 %, p=0.07).

Conclusions & Applications

- Results from the present investigation indicate that different types of diet can differentially affect changes in body composition and fat deposition, specifically deposition of visceral adipose tissue.
- Findings suggest participation in the Curves® program, in comparison to Weight Watchers®, results in more favorable changes in body composition and fat deposition.
- Participation in the Curves® program, or a similar program consisting of both structured diet and exercise, including aerobic and resistance exercise, may reduce risk of developing adverse health conditions secondary to reduction in visceral adipose tissue.
- Within a weight loss program, caloric cycling of a higher protein diet may also contribute to more favorable changes in body composition and fat deposition.

Acknowledgements and Funding

Supported by Curves International Inc., Waco, TX

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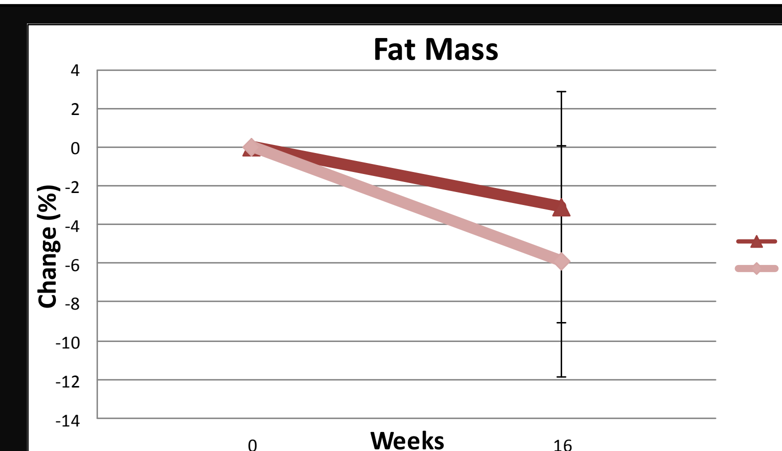

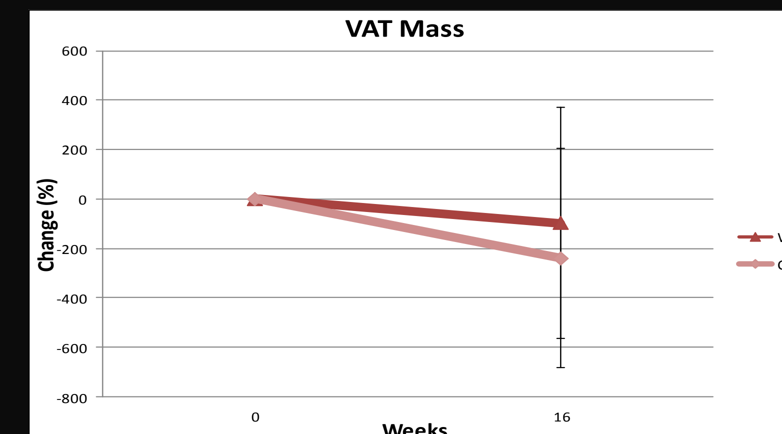

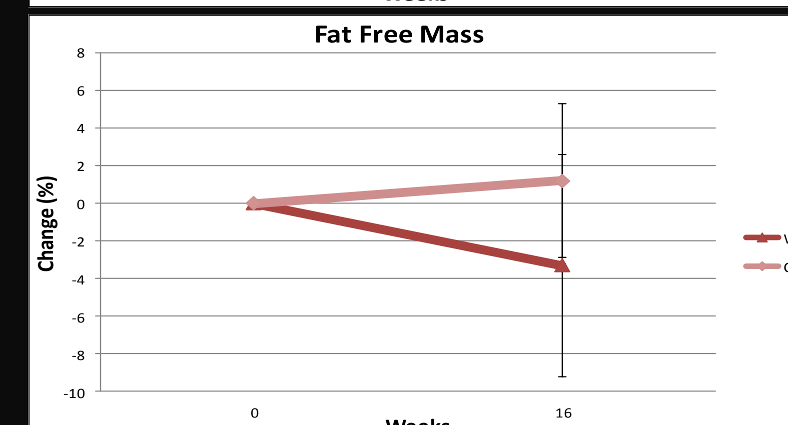

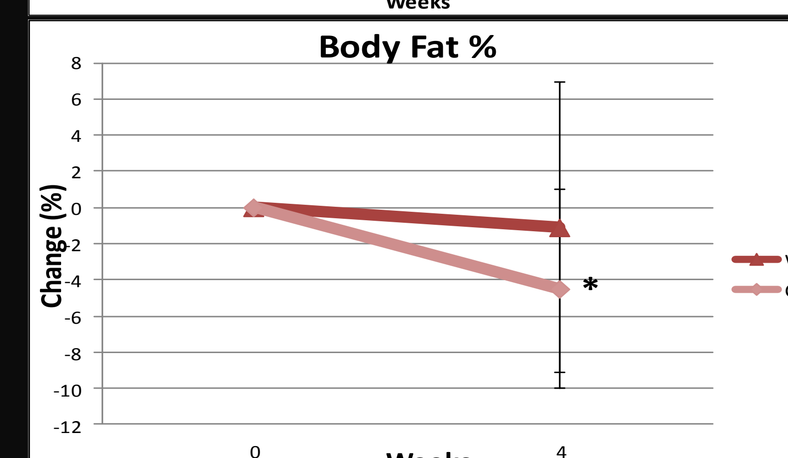

EFFECTS OF TWO POPULAR WEIGHT LOSS PROGRAMS ON CHANGES IN ANDROID AND GYNOID BODY COMPOSITION IN WOMEN

S Simbo, A Coletta, M Mardock, B Lockard, M Byrd, A Jagim, J Kresta, C Baetge, YP Jung, M Koozehchian, D Khanna, H Kyul, JM Oliver, M Greenwood, C Rasmussen, R Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX 77843-4243

Abstract

54 sedentary women (34±8 yrs, 35±6 kg/m2) were randomized to participate in the Curves (C) or Weight Watchers (W) weight loss programs for 16-wks. Participants in the C program followed a 1,200 kcal/d diet for 1-wk and 1,500 kcal/d diet for 3 wks (30:45 CHO:PRO). Subjects then ingested 2,000 kcals/d for 2-wks (45:30 CHO:PRO) and repeated this diet while participating in the Curves with Zumba program 3-d-wk. Remaining subjects followed the W point-based diet program, received weekly counseling, and were encouraged to exercise. DEXA body composition with android (A) and gynoid (G) measurements were analyzed at 0 and 16 wks. MANOVA revealed a significant time (p<0.001) and group x time (p=0.004) effect. Both groups had similar changes in A-FM (W -419±760, C -624±700 g, p=0.31), A-BF (W -2.1±10, C -4.9±6 %, p=0.24), and G-FFM (W -639±1,853, C -9±1,247 g p=0.16). Differences were seen in A-FFM (W -313±614, C 49±403 g, p=0.02), G-FM (W -395±1,657, C -1,398±1,728 g, p=0.03), G-BF (W –0.6±8, C -4.2±5.8 %, p=0.06), and the lean index to height (W -2.4±4.6, C 0.5±1.5 kg/m2, p=0.005). Results indicate that different types of diets can differentially affect changes in A and G body composition.

Supported by Curves International Inc. (Waco, TX)

Rationale

According to the CDC, approximately one-third of adult Americans are obese (~34.9%), and the estimated annual medical cost associated with obesity is about $147 billion. Obesity is directly associated with increased risk of multiple adverse health conditions such as cardiovascular disease and type 2 diabetes. Body composition and fat deposition (i.e., subcutaneous fat versus visceral fat), resulting from excessive weight gain and subsequent obesity classification, has been associated with increased risk of these conditions. Furthermore, the rise in prevalence of obesity has been attributed to physical inactivity and excessive caloric intake. Multiple weight loss programs have become available in efforts to reduce the prevalence and cost of obesity. Of these programs, both Curves® and Weight Watchers® have been scientifically validated as sound weight loss programs.

PURPOSE: To determine which weight loss program, Curves® or Weight Watchers®, results in more favorable outcomes on changes on android and gynoid body composition in previously sedentary, overweight women.

Experimental Design

Subjects

- 54 sedentary women (34±8 yrs, 35±6 kg/m^2)
- Subjects were informed of experimental procedures and signed a consent statement in adherence with the human subject guidelines of Texas A&M University.
- A standard medical exam and review of subject medical history was performed by a research RN for clearance to participate in study.
- Subjects were randomized into one of two weight loss programs.

Weight Watchers® Program

- 29 subjects completed the Weight Watchers® program.
- Subjects followed the Weight Watchers® Points Plus program, which consisted of: following food plans based on a points system, and attending weekly meetings for weigh-ins and presentations regarding exercise recommendations, tracking methods, and weight reduction strategies.
- Exercise was encouraged but not mandatory.

Methods and Procedures

Curves® Program

- 25 subjects completed the Curves® program
- The Curves® diet consisted of the following macronutrient distribution range: 30% carbohydrate (CHO), 45% protein, & 25% fat.
- The Curves® diet was also cyclical in nature: 1,200kcal/day for 1 week, 1,500kcal/day for 3 weeks, 2,000 kcals for 2 weeks, and repeat cycle for 16 week duration of the study.
- Exercise within the Curves® program consisted of a 30-min resistance based circuit interspersed with calisthenic exercises or Zumba 3 days per week.

Measures

- Body composition Android and Gynoid measurements were via DEXA scan at baseline (0 weeks) and upon completion of the study (16 weeks).

Statistical Analysis

- Data were analyzed by MANOVA with repeated measures, using IBM SPSS for Windows version 22.0 software (Chicago, IL). Data is presented as means ± SD, with percent change from baseline to 16 weeks for each group.

Results

- MANOVA revealed a significant time (p<0.001) and group x time (p=0.004) effect.
- Both groups had similar changes in A-FM (W -419±760, C -624±700 g, p=0.31), A-BF (W -2.1±10, C -4.9±6 %, p=0.24), and G-FFM (W -639±1,853, C -9±1,247 g p=0.16).
- Differences were seen in A-FFM (W -313±614, C 49±403 g, p=0.02), G-FM (W -395±1,657, C -1,398±1,728 g, p=0.03), G-BF (W –0.6±8, C -4.2±5.8 %, p=0.06), and the lean index to height (W -2.4±4.6, C 0.5±1.5 kg/m2, p=0.005).

Conclusions and Practical Applications

- Results indicate that different types of diets can differentially affect changes in A and G body composition.
- Findings suggest participation in the Curves® program, in comparison to Weight Watchers®, results in more favorable changes in body composition.
- Participation in the Curves® program, or a similar program including both structured diet and exercise, consisting of both aerobic and resistance exercise, may result in more favorable changes in body composition and fat deposition when participating in a weight loss program.
- Within a weight loss program, caloric cycling of a higher protein diet may also contribute to more favorable changes in body composition.

Acknowledgements and Funding

Supported by Curves International Inc., Waco, TX

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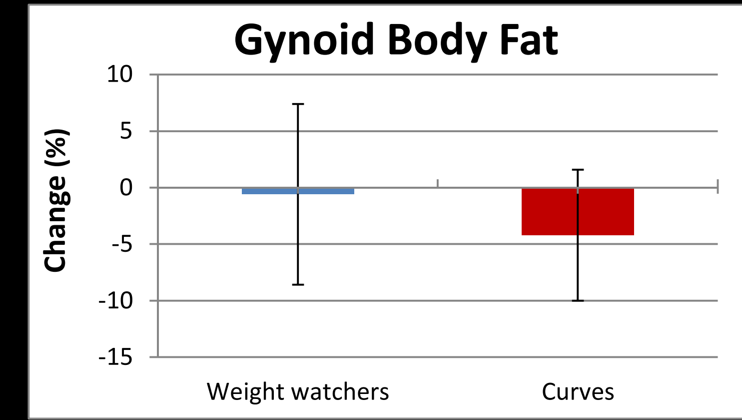
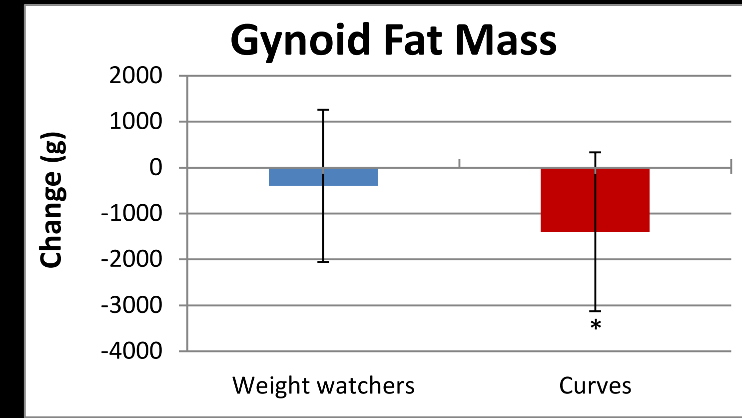
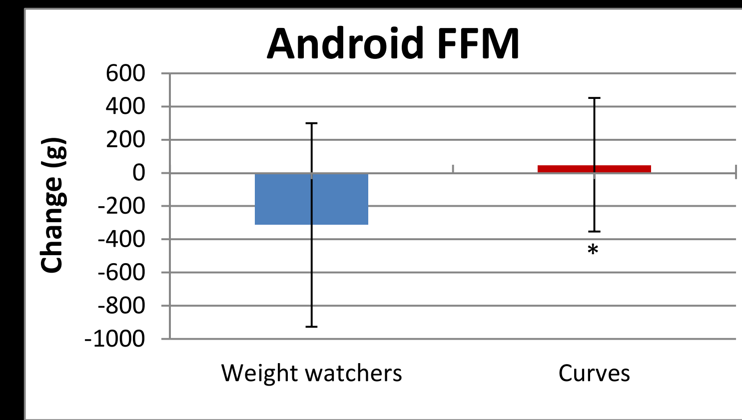
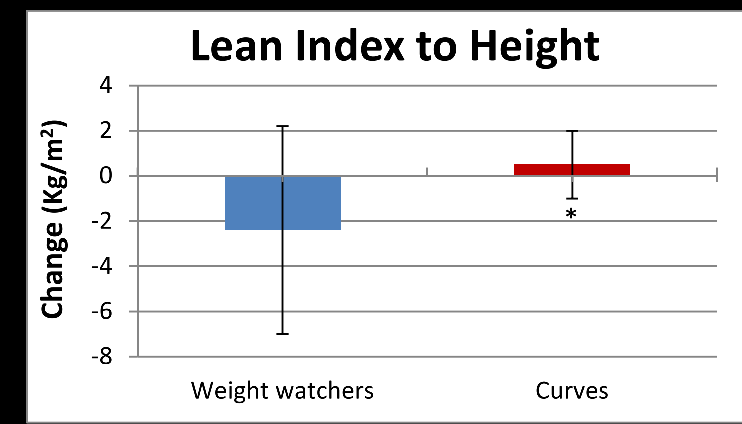
Figures









* Significant difference between groups (p < 0.05).

COMPARATIVE EFFECTIVENESS OF POPULAR DIET PROGRAMS ON CHANGES IN BODY COMPOSITION AND VISCERAL ADIPOSE TISSUE IN WOMEN

YP Jung, B Lockard, C Baetge, K Levers, E Galvan, A Jagim, S Simbo, M Byrd, J Oliver, M Koozehchian, R Dalton, D Khanna, B Sanchez, J Kresta, K Horrell, T Leopold, M Cho, S Springer, A Rivera, C Cerda, C Chang, C Rasmussen, R Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX

Abstract

127 sedentary women (46±12 yr, 45.5±5% body fat, 35.1±5 kg/m^2) were randomized to participate in a control group (C) or the Curves Complete® program with online support (CC), Weight Watchers® Points Plus (WW), Jenny Craig® (JC), or Nutrisystem® Advance Select™ (NS) weight loss programs for 12-wks. DEXA body composition with VAT determination was obtained at 0 & 12 wks. MANOVA revealed significant (p=<0.001) time and group x time (p=<0.001) effects. Participants in the CC group experienced greater loss in fat mass (C -0.0±2.1; CC -4.6±3.7; WW -2.2±2.7; JC -3.5±3.3; NS -2.1±2.7 kg, p<0.001), less loss in FFM (C 0.2±2.3; CC -0.3±2.7; WW -1.7±2.4; JC -1.8±2.3; NS -1.8±2.4 kg, p=0.01), and greater reductions in percent body fat (C -0.0±1.7; CC -3.1±2.5; WW -0.7±2.6; JC -1.4±2.5; NS -0.5±1.7 %, p<<0.001). VAT mass, volume and area decreased over time (p=0.004) with no significant differences among groups. Changes in VAT mass significantly correlated with changes in fat mas (r=0.20) and body fat (r=0.22). Results indicate that different types of diets can differentially affect changes in body composition but promote proportional changes in VAT. Supported by Curves International Waco, TX

Rationale

Energy-deficient diets and physical inactivity have led to a worldwide epidemic of obesity. The alarming rise in the prevalence of obesity calls for the identification of weight loss programs that utilize proven weight loss strategies to affectively lead to changes in body composition and improve markers of fitness and health. Jenny Craig, Inc., Nutrisystem, Weight Watchers International, Inc. and Curves International, Inc. are four widely recognized commercial companies that provide weight management services that are based on scientifically validated principles.

PURPOSE: To determine the effects of following either the control group (C) or the Curves Complete® 90-day Challenge (CC), Weight Watchers® Points Plus (WW), Jenny Craig® (JC), or Nutrisystem® Advance Select™ (NS) weight loss programs for 12-wks on health and fitness markers in previously sedentary overweight women.

Experimental Design

- Subjects were informed as to the experimental procedures and signed informed consent statements in adherence with human subject guidelines.
- 127 sedentary women (46±12 yr, 45.5±5% body fat, 35.1±5 kg/m^2) participated in this study.
- Subjects were assigned to a Control group (n=20), a Curves group (n=23),a Weight Watchers group (n=29), a Jenny Craig group (n=27), or a Nutrisystem group (n=28).
- Subjects in the CC group participated in a supervised 30-min resistance circuit training program with that was interspersed with calisthenic exercises and Zumba performed 4-d per week.
- Subjects in the WW group followed the Weight Watchers Points Plus Program, which consisted of food plans based on a points system and weekly meetings where exercise recommendations, tracking methods, and weight reductions strategies were presented and weekly weights were attained. Exercise was encouraged but not mandatory.
- Subjects in the JC or NS programs received meals for 12 weeks and were able to speak with a consultant each week regarding their weight changes and exercise protocol, as well as use online tracking methods. Exercise was encouraged but not mandatory.

Methods & Procedures

- Subjects were recruited to participate in this study through flyers, newspaper ads, and radio advertisements.
- Body mass and height, body composition via DEXA scan, anthropometric measurements, resting blood pressure and HR were obtained at 0, 4, 8, & 12 wks utilizing standard procedures.
- VO_2 max was determined with treadmill test by Bruce protocol at 0 & 12wks.
- 1RM of upper and lower body strength and muscular endurance (80% 1RM) were assessed at 0 & 12 wks.
- Fasting serum insulin levels were determined using commercially available immuno-absorbent (ELISA) kits in conjunction with a ultraviolet microplate reader.
- All measurements throughout the study were obtained by lab personnel.
- Self-reported 4-day dietary records were recorded 1-wk prior to baseline testing.

Statistical Analysis

- Data were analyzed by MANOVA with repeated measures using IBM SPSS for Windows version 20.0 software (Chicago, IL) and are presented as means ± SD % change from baseline for each group.

Results

- MANOVA revealed significant (p=<0.001) time and group x time (p=<0.001) effects.
- Participants in the CC group experienced greater loss in fat mass (C -0.0±2.1; CC -4.6±3.7; WW -2.2±2.7; JC -3.5±3.3; NS -2.1±2.7 kg, p<0.001), less loss in FFM (C 0.2±2.3; CC -0.3±2.7; WW -1.7±2.4; JC -1.8±2.3; NS -1.8±2.4 kg, p=0.01), and greater reductions in percent body fat (C -0.0±1.7; CC -3.1±2.5; WW -0.7±2.6; JC -1.4±2.5; NS -0.5±1.7 %, p<<0.001).
- VAT mass, volume and area decreased over time (p=0.004) with no significant differences among groups.
- Changes in VAT mass significantly correlated with changes in fat mas (r=0.20) and body fat (r=0.22).

Conclusions

- These findings indicate that different types of diets can differentially affect changes in body composition but promote proportional changes in VAT.

Practical Applications

- Sedentary individuals who participate in a structured diet and exercise program can improve their body mass, body composition, and health and fitness markers.

Acknowledgements and Funding

Supported by Curves International Inc., Waco, TX
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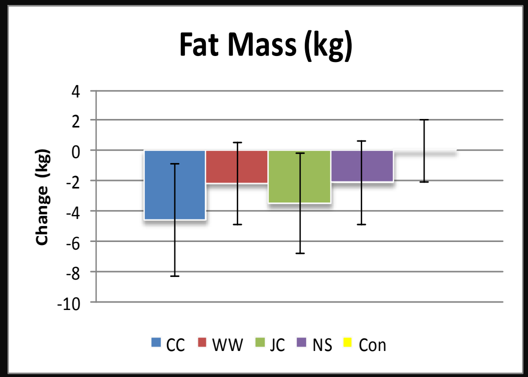
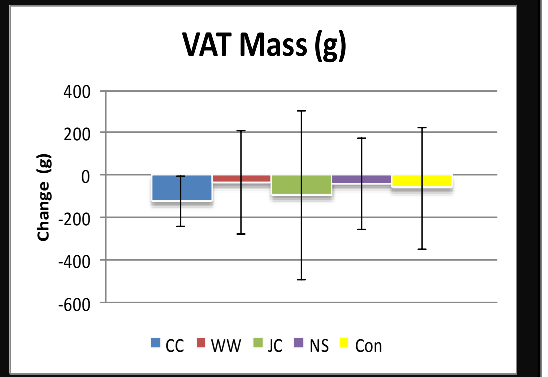
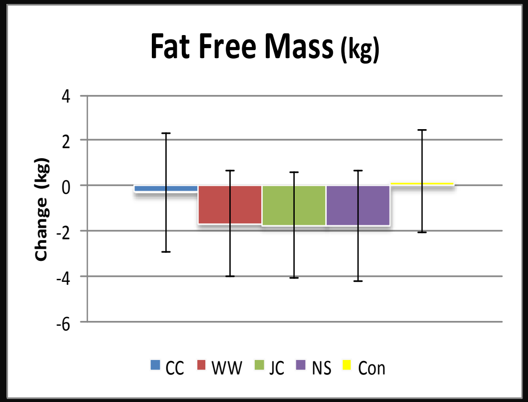
Figures



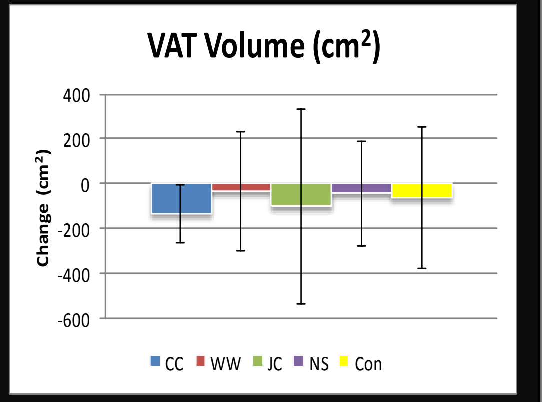
CC –4.6±3.7; WW –2.2±2.7; JC –3.5±3.3; NS –2.1±2.7; Con –0.0±2.1; p<0.001



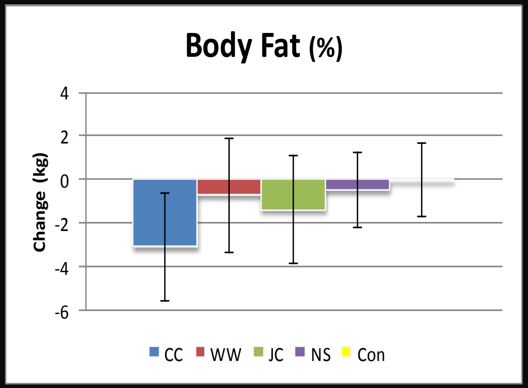
CC –123.9±120.2; WW –37.1±244.9; JC –95.4±401.3; NS –41.5±218.7; Con –60.3±288.0; p=0.75



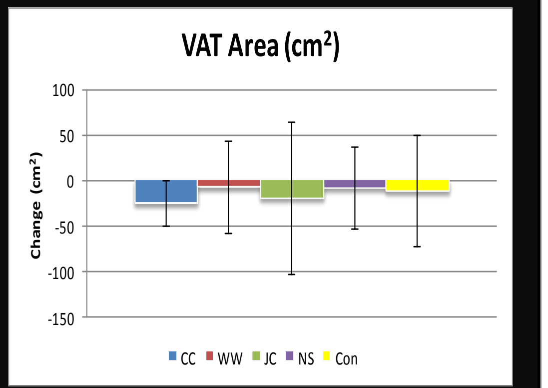
CC –0.3±2.7; WW –1.7±2.4; JC –1.8±2.3; NS –1.8±2.4; Con 0.2±2.3; p=0.01



CC –133.8±130.0; WW –41.1±264.2; JC –102.9±434.0; NS –44.8±236.4; Con –62.6±317.9; p=0.76



CC –3.1±2.5; WW 0.7±2.6; JC –1.4±2.5; NS –0.5±1.7; Con -0.0±1.7; p<0.001



CC –25.5±24.8; WW –7.6±50.7; JC –19.7±83.3; NS –8.5±45.3; Con –12.0±61.1; p=0.75

COMPARATIVE EFFECTIVENESS OF POPULAR DIET PROGRAMS ON CHANGES IN ANDROID AND GYNOID BODY COMPOSITION IN WOMEN

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Abstract

127 sedentary women (46±12 yr, 45.5±5% body fat, 35.1±5 kg/m2) were randomized to participate in a control group (C) or the Curves Complete® program with online support (CC), Weight Watchers® Points Plus (WW), Jenny Craig® (JC), or Nutrisystem® Advance Select™ (NS) weight loss programs for 12-wks. DEXA body composition with android (A) and gynoid (G) measurements were obtained. MANOVA revealed a significant time (p<0.001) and group x time (p=0.006) effects. Participants in the CC group generally lost more A-FM (C -8±421; CC -479±462; WW -162±410; JC -275±406; NS -237±456 g, p=0.01), A-BF (C -0.3±2.6; CC -2.9±3.6; WW -0.4±3.7; JC -1.3±3.2; NS -1.2±2.5 %, p<0.04), G-FM (C 73±335; CC -823±658; WW -392±458; JC -709±871; NS -430±631 g, p<0.001), and G-BF (C 0.0±2.1; CC -3.3±2.9; WW -0.7±2.6; JC -1.6±2.4; NS -0.6±1.9 %, p<0.001) with less loss in G-FFM (C 112±476; CC -10±605; WW -319±559; JC -285±451; NS -335±540 g, p=0.01). No significant differences were seen among groups in A/G ratio, trunk/leg body fat ratio, or trunk/leg lean mass ratio. Results indicate that different types of diets can differentially affect changes in A and G body composition.

Supported by Curves International Inc. (Waco, TX)

Rationale

Obesity affects more than 1/3 of US adults, including 2 million more women than men. Gynoid-Fat Mass (G-FM) surrounds the hip and thigh region of the body, whereas Android-Fat Mass (A-FM) surrounds the abdominal region. High A-FM is correlated with elevated rates of disease development, to include CVD and T2DM. Curves®, Jenny Craig®, Nutrisystem®, and Weight Watchers® are four widely recognized commercial companies that provide weight management services based on scientifically validated principles.

PURPOSE: To compare the efficacy of these programs on changes in android and gynoid body compositions in previously sedentary overweight women.

Experimental Design

Subjects

- 127 sedentary women (46±12 yr, 45.5±5% body fat, 35.1±5 kg/m2) participated in the study.
- The CC group followed a high protein diet of 45:30 (% pro:cho), consuming 1,200 kcal/day for 1-wk and 1,500 kcal/d for 11 wks. Additionally the CC participants completed a 30-min resistance based circuit interspersed with calisthenic exercises or Zumba 4-d per week.
- WW participants followed the Weight Watchers® Points Plus Program. Exercise was encouraged but not mandatory.
- Subjects in JC and NS received meals delivered to their home for 12 weeks. Exercise was encouraged but not mandatory.
- The C group was encouraged to maintain normal activity and nutrition patterns.

Methods and Procedures

- Subjects were recruited to participate in this study through flyers, newspaper ads, and radio advertisements.
- Subjects were informed as to the experimental procedures and signed informed consent statements in adherence with human subject guidelines.
- Body composition was determined at 0, 4, 8, & 12 wks utilizing the Hologic Discovery W series Dual Energy X-ray Absorptiometry (DEXA) system (Watham, MA).

Statistical Analysis

- Data were analyzed by MANOVA with repeated measures using IBM SPSS for Windows version 22.0 software (Chicago, IL) and are presented as means ± SD % change from baseline for each group after 4, 8, & 12 weeks.

Results

CC experienced significant differences in the following:

- Android-Fat Mass (g) (p=0.001)
  - C: -8±421
  - CC: -479±462
  - WW: -162±410
  - JC: -275±406
  - NS: -237±456
- Android-Body Fat (%) (p<0.04)
  - C: -0.3±2.6
  - CC: -2.9±3.6
  - WW: -0.4±3.7
  - JC: -1.3±3.2
  - NS: -1.2±2.5
- Gynoid-Fat Mass (g) (p<0.001)
  - C: 73±335
  - CC: -823±658
  - WW: -392±458
  - JC: -709±871
  - NS: -430±631
- Gynoid-Body Fat (%) (p<0.001)
  - C: 0.0±2.1
  - CC: -3.3±2.9
  - WW: -0.7±2.6
  - JC: -1.6±2.4
  - NS: -0.6±1.9
- Less loss in Gynoid-Free Fat Mass G-FFM (kg) (p=0.01)
  - C: 112±476
  - CC: -10±605
  - WW: -319±559
  - JC: -285±451
  - NS: -335±540

No significant differences were seen among groups in A/G ratio, trunk/leg body fat ratio, or trunk/leg lean mass ratio.

Conclusions

- Results indicate that the CC program provides more favorable changes in body composition in both the A and G region than the other weight loss programs. Sedentary individuals who participate in a structured diet and exercise program can improve their body fat mass. Results indicate that different types of diets can differentially affect changes in A and G body composition.

Acknowledgements and Funding

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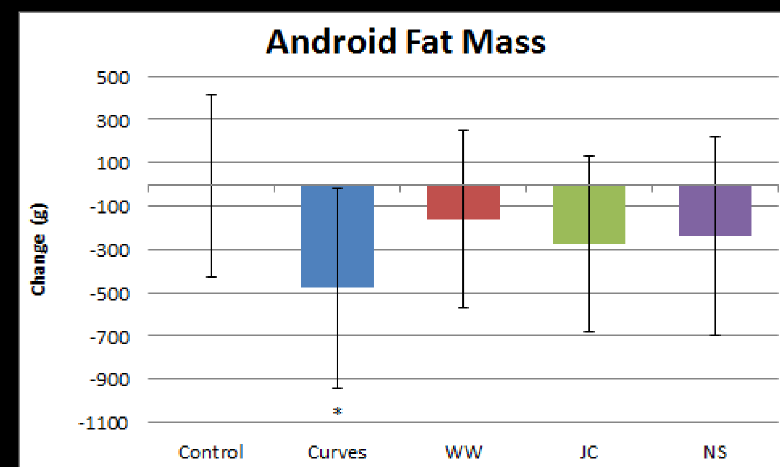

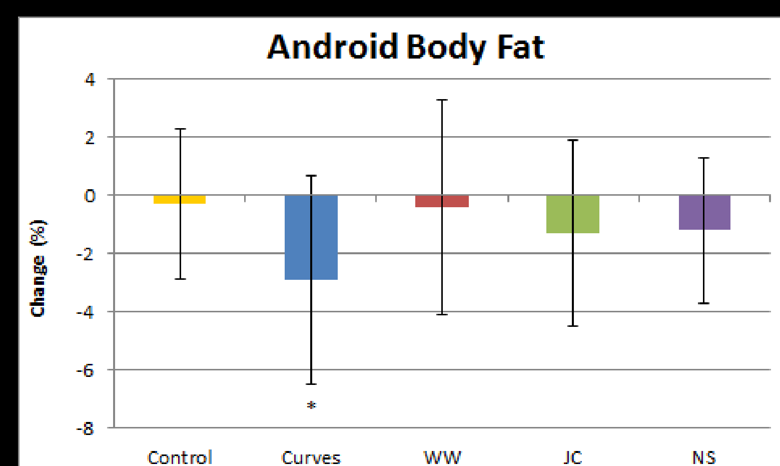

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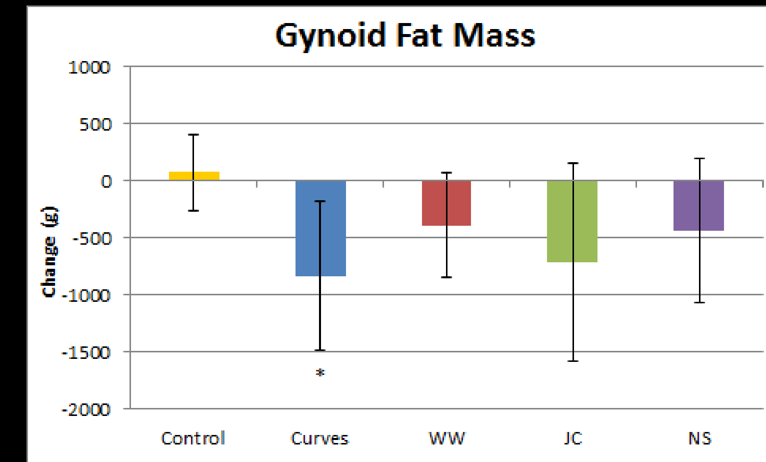

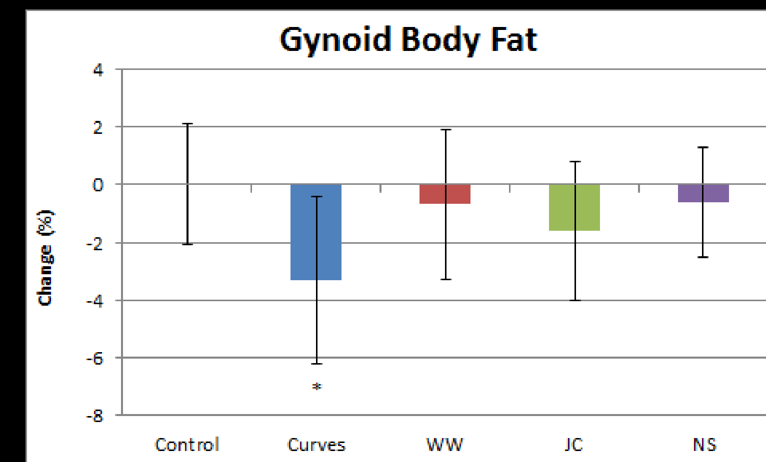

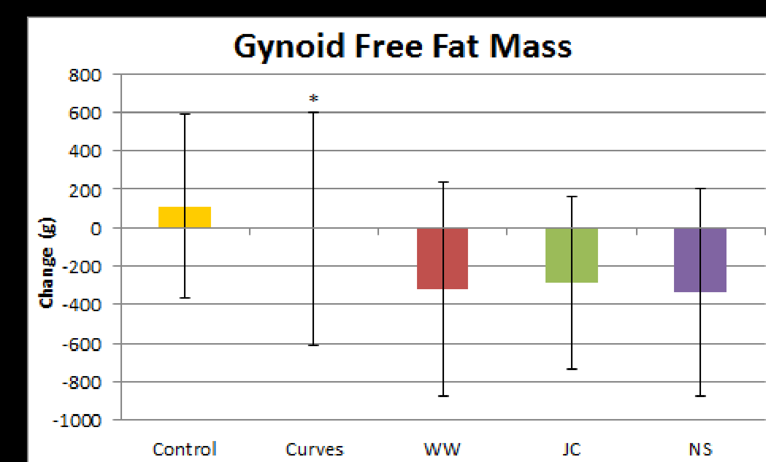

* Significant difference between Curves and other study groups (p < 0.05).

ANALYSIS OF THE VALIDITY OF A CARBOHYDRATE INTOLERANCE QUESTIONNAIRE I

A O'Connor, K Levers, E Galvan, A Coletta, R Dalton, P Jung, C Goodenough, S Simbo, C Seesselberg, B Bonin, M Koozehchian, B Sanchez, N Barringer, C Rasmussen, M Greenwood, R Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX 77843-4243

Abstract

108 women donated fasting blood samples, completed a carbohydrate intolerance questionnaire (CI), had body composition and health measures determined, and underwent a 75g, 2-h OGTT. Pearson product correlations were performed to determine correlations to CI questions. Being more than 25 lbs overweight correlated with OGTT G90 (r=0.22), G120 (r=0.25), glucose AUMC (r=0.19), age (r=0.43), weight (r=0.57), waist circumference (r=0.66), hip circumference (r=0.59), BMI (r=0.72), fat mass (r=0.60), body fat % (r=0.51), and insomnia (r=0.30). Being overweight throughout their life correlated with OGTT G30 (r=-0.28), glucose AUC (r=-0.20), weight (r=0.47), waist (r=0.31) and hip circumference (r=0.49), BMI (r=0.44), BMC (r=0.33), FFM (r=0.31), fat mass (r=0.42), body fat % (r=0.31), and fatigue/exhaustion (r=-0.21). Being overweight since youth correlated with OGTT G30 (r=-0.28), G60 (r=-0.24), G90 (r=-0.22), glucose AUC (r=-0.24), weight (r=0.35), waist circumference (r=0.22), hip circumference (r=0.36), BMI (r=0.32), BMC (r=0.32), FFM (r=0.25), fat mass (r=0.30), and body fat % (r=0.22). Poor appetite and skipping meals correlated with the glucose/insulin ratio (r=0.22), height (r=-0.22), and BMI (r=0.20).

Supported by Curves International Inc. (Waco, TX)

Rationale

The alarming rise of obesity and type 2 diabetes calls for identification of health and demographic factors that demonstrate a correlation to HOMA and insulin resistance. Preliminary assessment indicated that components of the carbohydrate intolerance questionnaire (CIQ) weakly correlated with fasting HOMA levels, however there has not been an association made between CIQ answers and the results of an oral glucose tolerance test (OGTT) as the current gold standard for determining insulin resistance in the field.

PURPOSE: To determine which CIQ items correlated to OGTT and HOMA markers of insulin resistance because carbohydrate restricted diets are recommended for the carbohydrate intolerant population to aid in healthy weight management or weight loss.

Experimental Design

Subjects

- 108 women (31.6±13 yr, 34.7±7% body fat, 25.3±4 kg/m^2) with a 8-10-hr fasting blood glucose level < 100 mg/dL were recruited for this study through flyers, newspaper ads, and radio advertisements.
- Subjects were informed of experimental procedures and signed a consent statement in adherence with the human subject guidelines of Texas A&M University.
- A standard medical exam and review of subject medical history was performed by a research RN for clearance to participate in study.

Testing Protocol

- Subjects donated fasting blood samples, completed a CIQ, had body composition analyzed, health measures determined, and underwent an OGTT with a standardized 75g carbohydrate beverage in which blood glucose samples and perceptions of CI symptoms were obtained at 0, 30, 60, 90, and 120 minutes.

Acknowledgements and Funding

Supported by Curves International Inc., Waco, TX
www.ExerciseAndSportNutritionLab.com

Methods and Procedures

- Body mass and height, body composition via DEXA scan, anthropometric measurements, resting blood pressure and HR were obtained during the baseline testing session prior to administration of the 2-hr OGTT.
- Subjects donated fasting blood samples, completed a CIQ, had body composition analyzed, health measures determined, and underwent an OGTT.
- Blood glucose levels were determined from fasting serum samples and standard finger stick procedures using a portable blood glucose monitor during the OGTT.
- Fasting serum insulin levels were determined using commercially available immuno-absorbent (ELISA) kits in conjunction with a ultraviolet microplate reader.
- All measurements throughout the study were obtained by lab personnel.
- Self-reported 4-day dietary records were recorded 1-wk prior to baseline testing.

Statistical Analysis

- Correlations between participant answers to the CIQ and AUC responses to the OGTT in addition to other dependent measures were analyzed via Pearson product correlation using IBM SPSS for Windows version 22.0 software (Chicago, IL).

Results

- Results revealed significant correlations between being more than 25 lbs overweight correlated with OGTT G90 (r=0.22), G120 (r=0.25), glucose AUMC (r=0.19), age (r=0.43), weight (r=0.57), waist circumference (r=0.66), hip circumference (r=0.59), BMI (r=0.72), fat mass (r=0.60), body fat % (r=0.51), and insomnia (r=0.30). Being overweight throughout their life correlated with OGTT G30 (r=-0.28), glucose AUC (r=-0.20), weight (r=0.47), waist (r=0.31) and hip circumference (r=0.49), BMI (r=0.44), BMC (r=0.33), FFM (r=0.31), fat mass (r=0.42), body fat % (r=0.31), and fatigue/exhaustion (r=-0.21). Being overweight since youth correlated with OGTT G30 (r=-0.28), G60 (r=-0.24), G90 (r=-0.22), glucose AUC (r=-0.24), weight (r=0.35), waist circumference (r=0.22), hip circumference (r=0.36), BMI (r=0.32), BMC (r=0.32), FFM (r=0.25), fat mass (r=0.30), and body fat % (r=0.22). Poor appetite and skipping meals correlated with the glucose/insulin ratio (r=0.22), height (r=-0.22), and BMI (r=0.20). ($p<0.05$) in GAUC (264±46 mg/hr/dL) to G120 AUC (r=0.60), glucose AUMC (r=0.97), Cmax (r=0.91), fasting insulin (r=0.26), HOMA (r=0.30), height (r=-0.28), resting HR (r=0.19), BMC (r=-0.36), BMD (r=-0.32), FFM (r=-0.28), being overweight since very young (r=0.27), and slowly gaining weight after age 30.

Conclusions and Practical Applications

- These findings indicate that carbohydrate intolerance questionnaires correlate to OGTT and can be used as guides for determining insulin resistance. Strong correlations ($p<0.01$) between a history of being overweight and BMI, BMC, fat mass, hip circumference, and body fat %. In addition, the CIQ correlated with results from the OGTT administered, demonstrating the validity of the CIQ as a method of determining insulin resistance and health.
- Based on the results of this validation study, it seems that there is a correlation between specific CIQ answers, body composition measures, and the glucose area under the curve (GAUC) resulting from an OGTT in determining insulin resistance. The CIQ may be used to assess carbohydrate intolerance and to prescribe a carbohydrate restricted diet in conjunction with an active lifestyle.

Dependent Variable Correlation Matrix

	CIQ T1 Q19	CIQ T1 Q20	CIQ T1 total yes	CIQ T1 total no	CIQ T2 Q1	CIQ T2 Q2	CIQ T2 Q3	CIQ T2 Q4	CIQ T2 Q5	CIQ T2 Q6	CIQ T2 Q7	CIQ T2 Q8
OGTTglucoseAVG 0min	.014	.065	.062	-.062	.109	-.112	-.089	.164	.068	-.025	.070	.058
OGTTglucoseAVG 30min	.025	.054	.155	-.155	-.037	-.279**	-.280**	.095	-.014	-.087	-.005	.076
OGTTglucoseAVG 60min	-.032	-.124	-.063	.063	.053	-.168	-.236*	.010	-.141	-.100	-.030	-.034
OGTTglucoseAVG 90min	-.093	-.071	-.071	.071	.224*	-.084	-.220*	.001	-.114	-.112	.010	-.044
OGTTglucoseAVG 120min	-.049	-.058	-.070	.070	.246*	.033	-.045	.005	-.013	-.051	.040	-.034
? AUC (mg*hr/dL)	.084	-.097	-.087	.087	.005	-.196*	-.240*	-.036	-.113	-.063	-.008	-.012
? AUMC (mg*hr2/dL)	-.123	.137	-.025	.025	.194*	.098	.141	-.082	.064	-.120	-.026	-.108
t1GIRatio	-.098	-.063	.053	-.053	-.020	.086	.102	.223*	.076	-.016	-.048	.082
Age	.015	.011	.105	-.105	.425**	.167	.087	.128	.125	.077	.226*	.101
FAM_ht (cm)	-.066	-.073	-.073	.073	-.114	.143	.112	-.215*	-.031	-.075	.023	-.072
t1_wt (kg)	-.001	-.031	.040	-.040	.572**	.467**	.347**	.084	.109	-.010	.078	-.027
t1_waist (in)	.001	.059	.201*	-.201*	.658**	.310**	.216*	.159	.098	.044	.280**	.111
t1_hip (in)	-.009	-.053	.071	-.071	.586**	.492**	.356**	.110	.143	.020	.044	-.017
t1_BMI	.050	.005	.086	-.086	.720**	.439**	.321**	.204*	.131	.034	.076	.013
t1_bmc (kg)	.030	-.121	-.013	.013	.036	.334**	.317**	-.053	.144	.076	-.062	-.061
t1_ffm (kg)	-.067	-.107	-.091	.091	.169	.307**	.245*	.065	.081	.049	.018	-.142
t1_fm (kg)	-.014	.040	.088	-.088	.596**	.422**	.302**	.088	.103	-.008	.102	.060
t1_bodyfat%	.009	.086	.127	-.127	.507**	.313**	.216*	.032	.064	.005	.121	.121
CIQ T1 Q1	.026	.327**	.502**	-.502**	.302**	-.025	.033	.059	.086	.111	.010	.368**
Carbohydrate Intol Questionnaire T1 Q2	.282**	.190*	.562**	-.562**	.005	-.013	.000	-.030	.235*	.106	-.031	.403**
Carbohydrate Intol Questionnaire T1 Q3	.388**	.392**	.577**	-.577**	.037	-.126	-.076	-.060	.131	.048	-.075	.374**
Carbohydrate Intol Questionnaire T1 Q4	.208*	.219*	.671**	-.671**	.015	-.155	-.105	.034	.093	.056	.049	.583**
Carbohydrate Intol Questionnaire T1 Q5	.301**	.324**	.692**	-.692**	.010	-.056	.058	.033	.321**	.151	.140	.485**
Carbohydrate Intol Questionnaire T1 Q6	.249**	.377**	.618**	-.618**	-.022	-.177	-.033	-.007	.118	.045	.005	.537**
Carbohydrate Intol Questionnaire T1 Q7	.381**	.243*	.608**	-.608**	.122	.015	.108	.030	.306**	.154	-.013	.487**
Carbohydrate Intol Questionnaire T1 Q8	.298**	.422**	.649**	-.649**	-.058	-.103	-.157	.080	.234*	.060	-.067	.596**
Carbohydrate Intol Questionnaire T1 Q9	.310**	.223*	.669**	-.669**	.050	-.113	-.043	-.011	.211*	.192*	.176	.499**
Carbohydrate Intol Questionnaire T1 Q10	.263**	.192*	.566**	-.566**	.086	-.046	.111	.094	.242*	.101	-.085	.395**
Carbohydrate Intol Questionnaire T1 Q11	.244*	.329**	.569**	-.569**	.204*	-.020	-.018	.020	.272**	.201*	.212*	.531**
Carbohydrate Intol Questionnaire T1 Q12	.298**	.320**	.576**	-.576**	-.050	-.208*	-.135	-.063	.160	.073	-.058	.426**
Carbohydrate Intol Questionnaire T1 Q13	.226*	.252**	.570**	-.570**	-.055	.053	.178	.053	.100	-.086	.055	.493**
Carbohydrate Intol Questionnaire T1 Q14	.149	.316**	.552**	-.552**	-.037	-.024	.076	.171	.253**	.087	.232*	.568**
Carbohydrate Intol Questionnaire T1 Q15	.227*	.336**	.469**	-.469**	-.025	.063	.086	.042	.670**	.217*	.079	.318**
Carbohydrate Intol Questionnaire T1 Q16	.175	.192*	.445**	-.445**	.038	.003	.000	.039	.200*	.145	.068	.439**
Carbohydrate Intol Questionnaire T1 Q17	.284**	.265**	.495**	-.495**	.150	-.157	-.108	.025	.129	.008	.143	.398**
Carbohydrate Intol QuestionnaireT1 Q18	.450**	.294**	.673**	-.673**	-.018	-.138	-.026	.007	.258**	.015	.183	.613**
Carbohydrate Intol Questionnaire T1 Q19	1	.233*	.522**	-.522**	-.015	-.031	.000	-.086	.265**	.154	.097	.417**
Carbohydrate Intol Questionnaire T1 Q20	.233*	1	.556**	-.556**	.039	-.129	.035	-.035	.203*	-.054	.043	.466**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Texas A&M University: Exercise & Sport Nutrition Laboratory
Trial: Validation of Carbohydrate Intolerance Questionnaire (CIQ)

Carbohydrate Intolerance Questionnaire

Name: ______________________ Age: _____ Ethnicity: __________

The Institute for Nutritional Science has devised a sample of questions to determine if you are carbohydrate intolerant or calorie sensitive. Please complete the following three tests to help us better determine your best method of dieting.

Test I: Symptoms of Carbohydrate Intolerance - Have you ever experienced any of the following symptoms?

1. _____Insomnia	11. _____Lack of sex drive
2. _____Irritability	12. _____Fatigue and Exhaustion
3. _____Headaches	13. _____Overemotional crying spells
4. _____Depression	14. _____Leg cramps and blurred vision
5. _____Nervousness	15. _____Cravings for starch and sugar rich foods
6. _____Muscle pains	16. _____Digestive disturbances with no apparent cause
7. _____Forgetfulness	17. _____Rapid pulse, especially after eating certain foods
8. _____Mental confusion	18. _____Shortness of breath, sighing and excessive yawning
9. _____Needless worrying	19. _____Drowsiness, especially after meals or in mid afternoon
10. _____Antisocial behavior	20. _____Faintness, dizziness, cold sweats, shakiness, weak spells

_____Total # of "yes" answers. _____Total # of "no" answers.

Test II: Carbohydrate Intolerance – Respond to the following statements with either a yes or no.

1. _____You are more than 25 pounds overweight.
2. _____You have had a tendency to be overweight all of your life.
3. _____You have been overweight since you were very young.
4. _____You have a poor appetite and often skip meals.
5. _____You have food cravings that temporarily go away when starch or sugary foods are eaten.
6. _____There are foods that you feel you absolutely could not do without.
7. _____Your waistline is bigger than your hips.
8. _____Most or all of the symptoms associated with carbohydrate intolerance apply to you (Test I).

_____Total # of "yes" answers. _____Total # of "no" answers.

Test III: Calorie Sensitivity – Respond to the following statements with either a yes or no.

1. _____You had a normal body weight when younger but slowly gained weight after age 30.
2. _____You are presently overweight but by less than 25 pounds.
3. _____You have a normal appetite – get hungry at meal times.
4. _____You have few, if any, food cravings.
5. _____You have maintained the same basic eating habits all of your life.
6. _____You eat three meals per day.
7. _____You have gained a certain amount of extra body weight but seem to have tapered off (not continued to steadily gain more and more weight).
8. _____You have few or none of the symptoms associated with poor carbohydrate metabolism (Test I).

_____Total # of "yes" answers. _____Total # of "no" answers.

IRB NUMBER: IRB2013-0401F
IRB APPROVAL DATE: 06/10/2013
IRB EXPIRATION DATE: 06/01/2014

HEALTH & KINESIOLOGY
TEXAS A&M UNIVERSITY

EDUCATION & HUMAN DEVELOPMENT
TEXAS A&M UNIVERSITY

ASSESSMENT OF FACTORS RELATED TO CARBOHYDRATE INTOLERANCE I: OGTT GLUCOSE AUC

K Levers, E Galvan, A Coletta, R Dalton, YP Jung, A O'Connor, C Goodenough, S Simbo, C Seesselberg, B Bonin, M Koozehchian, B Sanchez, N Barringer, C Rasmussen, M Greenwood, R Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX 77843-4243

Abstract

The OGTT is a gold standard in assessing carbohydrate intolerance (CI) and insulin resistance. However, the test is costly. This study examined whether a CI could predict response to an OGTT. 108 women (31.6±13 yr, 34.7±7% body fat, 25.3±4 kg/m2) donated fasting blood samples, completed a CI inventory, had body composition and health measures determined, and underwent a 75 g OGTT in which glucose samples and perceptions of CI symptoms were obtained at 0, 30, 60, 90, and 120 minutes. Pearson product correlations were performed to determine which factors correlated with OGTT glucose AUC. Results revealed significant correlations (p<0.05) in GAUC (264±46 mg/hr/dL) to G120 AUC (r=0.60), glucose AUMC (r=0.97), Cmax (r=0.91), fasting insulin (r=0.26), HOMA (r=0.30), height (r=-0.28), resting HR (r=0.19), BMC (r=-0.36), BMD (r=-0.32), FFM (r=-0.28), being overweight since very young (r=0.27), and slowly gaining weight after age 30. These findings indicate that OGTT GAUC is positively correlated with G120, insulin, and HOMA. Further, shorter women who gained weight as they got older with a higher resting HR and lower FFM, BMC, and BMD were more related to GAUC during a OGTT.

Supported by Curves International Inc. (Waco, TX)

Rationale

Physical inactivity and poor nutritional health have led to a worldwide epidemic of obesity. According to the CDC and NIH, the pattern of American obesity continues to rise as 78.4 million adults (35%) are were classified as obese (BMI ≥ 30 kg/m2) in 2013, which is nearly double the number of obese adults in 2003 (40 million). High blood glucose levels and physical inactivity have proven to be major contributors in the development of type 2 diabetes. Adult diabetes prevalence has also increased to 25.8 million (7 million undiagnosed) with an estimated 79 million adults having prediabetes. This alarming rise of obesity and type 2 diabetes calls for identification of health and demographic factors that demonstrate a correlation to HOMA and insulin resistance. Preliminary assessment indicated that components of the carbohydrate intolerance questionnaire (CIQ) weakly correlated with fasting HOMA levels, however there has not been an association made between CIQ answers and the results of an oral glucose tolerance test (OGTT) as the current gold standard for determining insulin resistance in the field.

PURPOSE: To determine which CIQ items correlated to OGTT and HOMA markers of insulin resistance because carbohydrate restricted diets are recommended for the carbohydrate intolerant population to aid in healthy weight management or weight loss.

Experimental Design

Subjects

- 108 women (31.6±13 yr, 34.7±7% body fat, 25.3±4 kg/m^2) with a 8-10-hr fasting blood glucose level < 100 mg/dL were recruited for this study.
- Subjects were informed of experimental procedures and signed a consent statement in adherence with the human subject guidelines of Texas A&M University.
- A standard medical exam and review of subject medical history was performed by a research RN for clearance to participate in study.

Testing Protocol

- Subjects donated fasting blood samples, completed a CIQ (carbohydrate intolerance questionnaire), had body composition analyzed, health measures determined, and underwent an OGTT with a standardized 75g carbohydrate beverage in which blood glucose samples and perceptions of CI symptoms were obtained at 0, 30, 60, 90, and 120 minutes.

Methods and Procedures

- Subjects were recruited to participate in this study through flyers, newspaper ads, and radio advertisements.
- Body mass and height, body composition via DEXA scan, anthropometric measurements, resting blood pressure and HR were obtained during the baseline testing session prior to administration of the 2-hr OGTT.
- Blood glucose levels were determined from fasting serum samples and standard finger stick procedures using a portable blood glucose monitor during the OGTT.
- Fasting serum insulin levels were determined using commercially available immuno-absorbent (ELISA) kits in conjunction with a ultraviolet microplate reader.
- All measurements throughout the study were obtained by lab personnel.
- Self-reported 4-day dietary records were recorded 1-wk prior to baseline testing.

Statistical Analysis

- Correlations between participant answers to the CIQ and AUC responses to the OGTT in addition to other dependent measures were analyzed via Pearson product correlation using IBM SPSS for Windows version 22.0 software (Chicago, IL).

Results

- Results revealed significant correlations (p<0.05) in GAUC (264±46 mg/hr/dL) to G120 AUC (r=0.60), glucose AUMC (r=0.97), Cmax (r=0.91), fasting insulin (r=0.26), HOMA (r=0.30), height (r=-0.28), resting HR (r=0.19), BMC (r=-0.36), BMD (r=-0.32), FFM (r=-0.28), being overweight since very young (r=0.27), and slowly gaining weight after age 30.

Conclusions

- These findings indicate that OGTT glucose area under the curve (GAUC) is positively correlated with blood glucose levels at the end of a 2hr OGTT (G120) in addition to insulin and HOMA responses. Further, shorter women who gained weight as they got older with a higher resting HR and lower free-fat mass (FFM), bone mineral content (BMC), and bone mineral density (BMD) were more related to GAUC during a OGTT.

Practical Application

- Based on the results of this validation study, it seems that there is a correlation between specific CIQ answers, body composition measures, and the glucose area under the curve (GAUC) resulting from an OGTT in determining insulin resistance. The CIQ may be used to assess carbohydrate intolerance and to prescribe a carbohydrate restricted diet in conjunction with an active lifestyle.

Acknowledgements and Funding

Supported by Curves International Inc., Waco, TX
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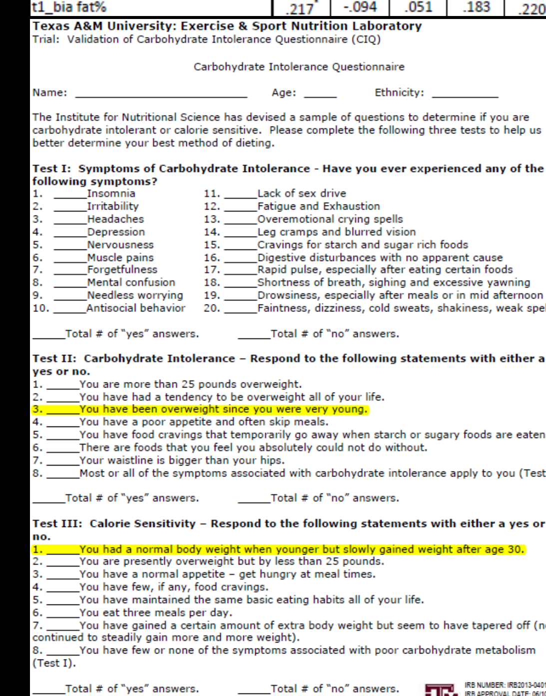
Dependent Variable Correlation Matrix

	OGTT Glucose AVG 0min	OGTT Glucose AVG 30min	OGTT Glucose AVG 60min	OGTT Glucose AVG 90min	OGTT Glucose AVG 120min	Cumulative Obs AUC (mg*hr/dL)	AUC (mg*hr/dL)	Cumulative Obs AUMC (mg*hr^2/dL)	AUMC (mg*hr^2/dL)	Cmax (mg/L)	Insulin Mean (uIU/mL)	t1 G/I Ratio	t1 HOMA	Age
OGTTglucoseAVG 0min	1	.429**	.339**	.250**	.248**	.429**	.073	.353**	.159	.415**	.176	.082	.276**	.303**
OGTTglucoseAVG 30min	.429**	1	.640**	.479**	.164	.781**	.059	.627**	-.081	.916**	.174	-.015	.197*	-.062
OGTTglucoseAVG 60min	.339**	.640**	1	.792**	.474**	.929**	.116	.905**	-.061	.823**	.180	-.047	.212*	.055
OGTTglucoseAVG 90min	.250**	.479**	.792**	1	.691**	.885**	.106	.949**	.052	.672**	.260**	-.078	.297**	.112
OGTTglucoseAVG 120min	.248**	.164	.474**	.691**	1	.598**	.134	.732**	.240*	.340**	.338**	-.137	.374**	.055
Cumulative Obs AUC (mg*hr/dL)	.429**	.781**	.929**	.885**	.598**	1	.119	.972**	.003	.905**	.262**	-.063	.302**	.054
AUC (mg*hr/dL)	.073	.059	.116	.106	.134	.119	1	.128	.201*	.062	.012	-.046	.024	.051
Cumulative Obs AUMC (mg*hr2/dL)	.353**	.627**	.905**	.949**	.732**	.972**	.128	1	.047	.803**	.283**	-.085	.322**	.071
AUMC (mg*hr2/dL)	.159	-.081	-.061	.052	.240*	.003	.201*	.047	1	-.095	.117	-.021	.136	.075
Cmax (mg/L)	.415**	.916**	.823**	.672**	.340**	.905**	.062	.803**	-.095	1	.207*	-.021	.240*	-.035
Insulin_Mean (uIU/mL)	.176	.174	.180	.260**	.338**	.262**	.012	.283**	.117	.207*	1	-.528**	.990**	.000
t1_GIRatio	.082	-.015	-.047	-.078	-.137	-.063	-.046	-.085	-.021	-.021	-.528**	1	-.493**	.108
t1_HOMA	.276**	.197*	.212*	.297**	.374**	.302**	.024	.322**	.136	.240*	.990**	-.493**	1	.045
Age	.303**	-.062	.055	.112	.055	.054	.051	.071	.075	-.035	.000	.108	.045	1
FAM_ht (cm)	-.244*	-.243*	-.167	-.258**	-.332**	-.283**	-.123	-.289**	-.017	-.218*	-.253**	.007	-.269**	-.023
t1_wt (kg)	-.054	-.243*	-.114	-.028	-.039	-.144	-.178	-.100	.039	-.160	.038	-.050	.041	.281**
t1_RHR	.084	.111	.133	.200*	.291**	.194*	.071	.221*	.001	.098	.115	-.032	.120	-.018
t1_SBP	.008	.036	.020	.072	.029	.047	-.035	.051	.066	.046	.115	-.098	.118	.188
t1_DBP	.070	.021	.062	.170	.189	.112	.001	.144	.139	.028	.153	-.129	.159	.238*
t1_waist (in)	.163	-.027	.094	.219*	.182	.126	-.136	.167	.095	.055	.231*	-.135	.258**	.461**
t1_hip (in)	.013	-.213*	-.140	-.046	-.016	-.144	-.173	-.106	.055	-.169	.059	-.022	.076	.330**
t1_BMI	.081	-.138	-.027	.121	.151	.003	-.128	.058	.052	-.055	.197*	-.066	.212*	.332**
t1_bmc (kg)	-.308**	-.362**	-.230*	-.275**	-.335**	-.357**	-.184	-.337**	-.030	-.317**	-.194*	.037	-.216*	-.006
t1_bmd (g/cm2)	-.293**	-.352**	-.210*	-.244*	-.233*	-.322**	-.116	-.291**	-.025	-.309**	-.242*	.100	-.269**	.035
t1_ffm (kg)	-.165	-.248**	-.165	-.234*	-.391**	-.282**	-.230*	-.293**	.049	-.244*	-.106	.074	-.111	-.017
t1_fm (kg)	.086	-.145	-.057	.051	.124	-.036	-.091	.010	.015	-.081	.166	-.117	.177	.359**
t1_bodyfat%	.183	-.034	.021	.130	.236*	.076	-.008	.116	.005	-.004	.264**	-.168	.279**	.386**
CIQ T1 Q1	.202*	.018	.039	.026	.167	.059	-.065	.068	.015	.020	.001	.124	.032	.286**
CIQ T1 Q2	-.006	.036	-.105	-.086	-.130	-.072	-.046	-.099	.017	-.044	.022	.110	.021	-.057
CIQ T1 Q3	-.057	.008	-.187	-.192*	-.180	-.155	-.091	-.190*	-.037	-.104	-.095	-.013	-.109	-.089
CIQ T1 Q4	.129	.174	.056	.037	.019	.101	-.041	.068	.074	.108	.191*	-.020	.175	.081
CIQ T2 Q1	.109	-.037	.053	.224*	.246*	.115	-.045	.169	.141	.054	.157	-.020	.178	.425**
CIQ T2 Q2	-.112	-.279**	-.168	-.084	.033	-.188	-.176	-.131	.052	-.238*	-.044	.086	-.034	.167
CIQ T2 Q3	-.089	-.280**	-.236*	-.220*	-.045	-.266**	-.230*	-.231*	.095	-.259**	-.170	.102	-.169	.087
CIQ T2 Q4	.164	.095	.010	.001	.005	.044	-.119	.020	-.036	.105	.120	.223*	.135	.128
CIQ T3 Q1	.253**	.072	.195*	.234*	.150	.202*	.059	.216*	-.021	.095	.056	-.034	.095	.635**
t1_bia fat%	.217*	-.094	.051	.183	.220*	.082	-.040	.135	.053	-.015	.202*	-.048	.231*	.641**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).



Texas A&M University: Exercise & Sport Nutrition Laboratory
Trial: Validation of Carbohydrate Intolerance Questionnaire (CIQ)

Carbohydrate Intolerance Questionnaire

Name: ______________________ Age: _____ Ethnicity: __________

The Institute for Nutritional Science has devised a sample of questions to determine if you are carbohydrate intolerant or calorie sensitive. Please complete the following three tests to help us better determine your best method of dieting.

Test I: Symptoms of Carbohydrate Intolerance - Have you ever experienced any of the following symptoms?

1. _____Insomnia
2. _____Irritability
3. _____Headaches
4. _____Depression
5. _____Nervousness
6. _____Muscle pains
7. _____Forgetfulness
8. _____Mental confusion
9. _____Needless worrying
10. _____Antisocial behavior
11. _____Lack of sex drive
12. _____Fatigue and Exhaustion
13. _____Overemotional crying spells
14. _____Leg cramps and blurred vision
15. _____Cravings for starch and sugar rich foods
16. _____Digestive disturbances with no apparent cause
17. _____Rapid pulse, especially after eating certain foods
18. _____Shortness of breath, sighing and excessive yawning
19. _____Drowsiness, especially after meals or in mid afternoon
20. _____Faintness, dizziness, cold sweats, shakiness, weak spells

_____Total # of "yes" answers. _____Total # of "no" answers.

Test II: Carbohydrate Intolerance – Respond to the following statements with either a yes or no.

1. _____You are more than 25 pounds overweight.
2. _____You have had a tendency to be overweight all of your life.
3. _____You have been overweight since you were very young.
4. _____You have a poor appetite and often skip meals.
5. _____You have food cravings that temporarily go away when starch or sugary foods are eaten.
6. _____There are foods that you feel you absolutely could not do without.
7. _____Your waistline is bigger than your hips.
8. _____Most or all of the symptoms associated with carbohydrate intolerance apply to you (Test I).

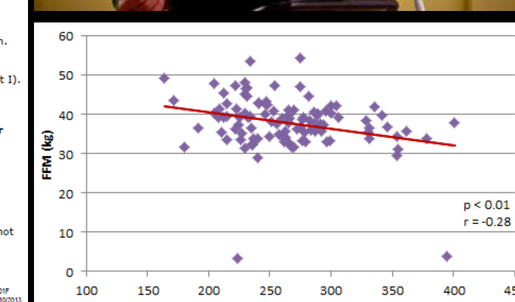
_____Total # of "yes" answers. _____Total # of "no" answers.

Test III: Calorie Sensitivity – Respond to the following statements with either a yes or no.

1. _____You had a normal body weight when younger but slowly gained weight after age 30.
2. _____You are presently overweight but by less than 25 pounds.
3. _____You have a normal appetite – get hungry at meal times.
4. _____You have few, if any, food cravings.
5. _____You have maintained the same basic eating habits all of your life.
6. _____You eat three meals per day.
7. _____You have gained a certain amount of extra body weight but seem to have tapered off (not continued to steadily gain more and more weight).
8. _____You have few or none of the symptoms associated with poor carbohydrate metabolism (Test I).

_____Total # of "yes" answers. _____Total # of "no" answers.

IRB NUMBER: IRB2013-0401F
IRB APPROVAL DATE: 06/10/2013
IRB EXPIRATION DATE: 06/01/2014



ANALYSIS OF THE VALIDITY OF A CARBOHYDRATE INTOLERANCE QUESTIONNAIRE II

C Goodenough, K Levers, E Galvan, A Coletta, R Dalton, YP Jung, A O'Connor, S Simbo, C Seesselberg, B Bonin, M Koozehchian, B Sanchez, N Barringer, C Rasmussen, M Greenwood, R Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX 77843-4243

Abstract

108 women donated fasting blood samples, completed a carbohydrate intolerance questionnaire (CI), had body composition and health measures determined, and underwent a 75g, 2-h OGTT. Having food cravings relieved with CHO ingestion correlated with irritability (r=0.24), nervousness (r=0.32), forgetfulness (r=0.31), mental confusion (r=0.23), worrying (r=0.21), antisocial behavior (r=0.24), lack of sex drive (r=0.27), leg cramps/blurred vision (r=0.25), cravings for sweets (r=0.67), digestive disturbances (r=0.20), yawning (r=0.26), drowsiness (r=0.27), and dizziness/shakiness (r=0.20). Must have foods correlated with worrying (r=0.19), lack of sex drive (r=0.20), and food cravings (r=0.22). Having a waistline larger than hips correlated with age (r=0.23), waist circumference (r=0.28), lack of sex drive (r=0.21), and leg cramps/blurred vision (r=0.23). Gaining weight after age 30 correlated with glucose AUMC (r=0.22), age (r=0.64), DBP (r=0.24), waist circumference (r=0.37), BMI (r=0.21), fat mass (r=0.25), body fat % (r=0.36), insomnia (r=0.21), lack of sex drive (r=0.32), being more than 25 lbs overweight (r=0.20), and being overweight since youth (r=0.26).

Supported by Curves International Inc. (Waco, TX)

Rationale

Termed a worldwide epidemic, obesity is connected to physical inactivity and poor nutritional health. Classified as a (BMI ≥ 30 kg/m2) in 2013, the CDC and NIH have identified an increasing pattern of American adult obesity of 78.4 million adults (35%), nearly double the number of obese adults in 2003 (40 million). This epidemic has been further linked to clinical conditions, specifically high blood glucose levels and physical inactivity, that are proven major contributors in the development of type 2 diabetes. Type 2 diabetes prevalence in adults has also increased to 25.8 million (7 million undiagnosed) with an estimated 79 million diagnosed prediabetic. This alarming rise of obesity and type 2 diabetes calls for identification of health and demographic factors, such as self-perceived dietary intolerances and body weight parameters, that demonstrate a correlation to HOMA and insulin resistance. Preliminary assessment indicated that components of the carbohydrate intolerance questionnaire (CIQ) weakly correlated with fasting HOMA levels, however there has not been an association made between CIQ answers and the results of an oral glucose tolerance test (OGTT) as the current gold standard for determining insulin resistance in the field.

PURPOSE: To determine which CIQ items correlated to OGTT and HOMA markers of insulin resistance because carbohydrate restricted diets are recommended for the carbohydrate intolerant population to aid in healthy weight management or weight loss.

Experimental Design

Subjects

- 108 women (31.6±13 yr, 34.7±7% body fat, 25.3±4 kg/m^2) with a 8-10-hr fasting blood glucose level < 100 mg/dL were recruited for this study.
- Subjects were informed of experimental procedures and signed a consent statement in adherence with the human subject guidelines of Texas A&M University.
- A standard medical exam and review of subject medical history was performed by a research RN for clearance to participate in study.

Testing Protocol

- Subjects donated fasting blood samples, completed a CI (carbohydrate intolerance) inventory, had body composition analyzed, health measures determined, and underwent an OGTT with a standardized 75g carbohydrate beverage in which blood glucose samples and perceptions of CI symptoms were obtained at 0, 30, 60, 90, and 120 minutes.

Methods and Procedures

- Subjects were recruited to participate in this study through flyers, newspaper ads, and radio advertisements.
- Body mass and height, body composition via DEXA scan, anthropometric measurements, resting blood pressure and HR were obtained during the baseline testing session prior to administration of the 2-hr OGTT.
- Blood glucose levels were determined from fasting serum samples and standard finger stick procedures using a portable blood glucose monitor during the OGTT.
- Fasting serum insulin levels were determined using commercially available immune-absorbent (ELISA) kits in conjunction with a ultraviolet microplate reader.
- All measurements throughout the study were obtained by lab personnel.
- Self-reported 4-day dietary records were recorded 1-wk prior to baseline testing.

Statistical Analysis

- Correlations between participant answers to the CIQ and AUC responses to the OGTT in addition to other dependent measures were analyzed via Pearson product correlation using IBM SPSS for Windows version 22.0 software (Chicago, IL).

Results

- Results revealed correlation of CHO ingestion with irritability (r=0.24), nervousness (r=0.32), forgetfulness (r=0.31), mental confusion (r=0.23), worrying (r=0.21), antisocial behavior (r=0.24), lack of sex drive (r=0.27), leg cramps/blurred vision (r=0.25), cravings for sweets (r=0.67), digestive disturbances (r=0.20), yawning (r=0.26), drowsiness (r=0.27), and dizziness/shakiness (r=0.20). Must have foods correlated with worrying (r=0.19), lack of sex drive (r=0.20), and food cravings (r=0.22). Having a waistline larger than hips correlated with age (r=0.23), waist circumference (r=0.28), lack of sex drive (r=0.21), and leg cramps/blurred vision (r=0.23). Gaining weight after age 30 correlated with glucose AUMC (r=0.22), age (r=0.64), DBP (r=0.24), waist circumference (r=0.37), BMI (r=0.21), fat mass (r=0.25), body fat % (r=0.36), insomnia (r=0.21), lack of sex drive (r=0.32), being more than 25 lbs overweight (r=0.20), and being overweight since youth (r=0.26).

Conclusions

- These findings indicate that food cravings relieved with CHO ingestion or foods self-identified as "must haves", are positively correlated with factors associated with quality of life and general well-being. Correlations of these factors were found to be associated with temperament and general disposition and social behaviors. Additionally, relieved CHO cravings have a positive correlation to negative physical manifestation such as decreased energy level and poor well-being. Furthermore, larger waist to hip measurements were also positively correlated with similar physical manifestations, and increased with age. Finally, women who gained weight as they got older, with an excess of 25lbs, higher resting DBP, waist circumference, BMI, fat mass and body fat % are found to have been overweight since youth, in addition to having a significantly higher glucose AUMC.

Practical Application

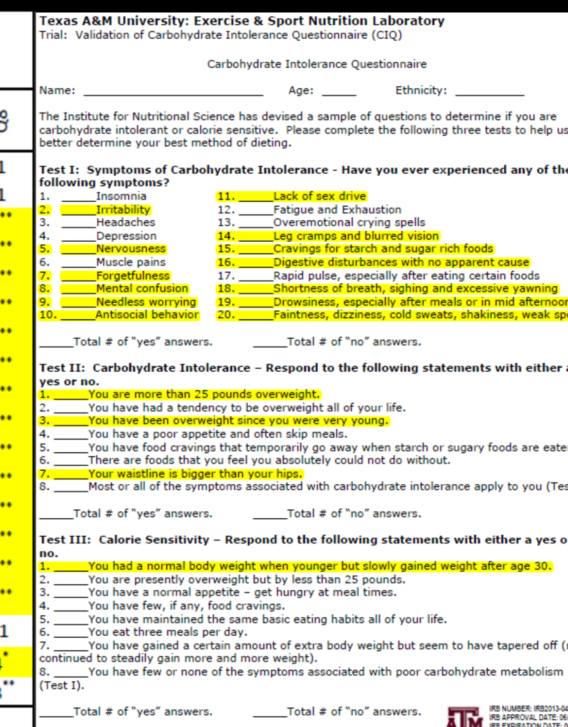
- Based on the results of this validation study, it appears that there is a correlation between specific Carbohydrate Intolerance Questionnaire (CIQ) answers, body composition, and the glucose area under the first moment curve (GAUMC) resulting from an OGTT in determining insulin resistance. Furthermore, such a questionnaire enables health care practitioners associate changes in temperament, general well-being and digestive manifestations that individuals may experience from CHO ingestion, aspects that often go assessed from general OGTT applications. The CIQ may be used to assess carbohydrate intolerance and the relationship of such dietary component on an individual's quality of life. Thus, question answers may be used prescribe a carbohydrate restricted diet in conjunction with an active lifestyle to establish overall well-being .

Dependent Variable Correlation Matrix

CARBOHYDRATE INTOLERANCE QUESTIONNAIRE Correlation Matrix

	CIQ T2 Q5	CIQT2 Q6	CIQ T2 Q7	CIQT2 Q8
Age	.125	.077	.226*	.101
t1_waist (in)	.098	.044	.280**	.111
CIQ T1 Q1	.086	.111	.010	.368**
CIQ T1 Q2	.235*	.106	-.031	.403**
CIQ T1 Q5	.321**	.151	.140	.485**
CIQ T1 Q7	.306**	.154	-.013	.487**
CIQ T1 Q8	.234*	.060	-.067	.596**
CIQ T1 Q9	.211*	.192*	.176	.499**
CIQ T1 Q10	.242*	.101	-.085	.395**
CIQ T1 Q11	.272**	.201*	.212*	.531**
CIQ T1 Q14	.253**	.087	.232*	.568**
CIQ T1 Q15	.670**	.217*	.079	.318**
CIQ T1 Q16	.200*	.145	.068	.439**
CIQ T1 Q18	.258**	.015	.183	.613**
CIQ T1 Q19	.265**	.154	.097	.417**
CIQ T1 Q20	.203*	-.054	.043	.466**
CIQ T2 Q1	.135	.073	.244*	-.031
CIQ T2 Q7	.118	.198*	1	.194*
CIQ T3 Q1	-.247**	-.181	-.123	-.593**

*Significant at 0.01 level **Significant at 0.05 level


Texas A&M University: Exercise & Sport Nutrition Laboratory
Trial: Validation of Carbohydrate Intolerance Questionnaire (CIQ)

Carbohydrate Intolerance Questionnaire

Name: ______________ Age: _____ Ethnicity: __________

The Institute for Nutritional Science has devised a sample of questions to determine if you are carbohydrate intolerant or calorie sensitive. Please complete the following three tests to help us better determine your best method of dieting.

Test I: Symptoms of Carbohydrate Intolerance - Have you ever experienced any of the following symptoms?

1. _____Insomnia
2. _____Irritability
3. _____Headaches
4. _____Depression
5. _____Nervousness
6. _____Muscle pains
7. _____Forgetfulness
8. _____Mental confusion
9. _____Needless worrying
10. _____Antisocial behavior
11. _____Lack of sex drive
12. _____Fatigue and Exhaustion
13. _____Overemotional crying spells
14. _____Leg cramps and blurred vision
15. _____Cravings for starch and sugar rich foods
16. _____Digestive disturbances with no apparent cause
17. _____Rapid pulse, especially after eating certain foods
18. _____Shortness of breath, sighing and excessive yawning
19. _____Drowsiness, especially after meals or in mid afternoon
20. _____Faintness, dizziness, cold sweats, shakiness, weak spells

_____Total # of "yes" answers. _____Total # of "no" answers.

Test II: Carbohydrate Intolerance – Respond to the following statements with either a yes or no.

1. _____You are more than 25 pounds overweight.
2. _____You have had a tendency to be overweight all of your life.
3. _____You have been overweight since you were very young.
4. _____You have a poor appetite and often skip meals.
5. _____You have food cravings that temporarily go away when starch or sugary foods are eaten.
6. _____There are foods that you feel you absolutely could not do without.
7. _____Your waistline is bigger than your hips.
8. _____Most or all of the symptoms associated with carbohydrate intolerance apply to you (Test I).

_____Total # of "yes" answers. _____Total # of "no" answers.

Test III: Calorie Sensitivity – Respond to the following statements with either a yes or no.

1. _____You had a normal body weight when younger but slowly gained weight after age 30.
2. _____You are presently overweight but by less than 25 pounds.
3. _____You have a normal appetite – get hungry at meal times.
4. _____You have few, if any, food cravings.
5. _____You have maintained the same basic eating habits all of your life.
6. _____You eat three meals per day.
7. _____You have gained a certain amount of extra body weight but seem to have tapered off (not continued to steadily gain more and more weight).
8. _____You have few or none of the symptoms associated with poor carbohydrate metabolism (Test I).

_____Total # of "yes" answers. _____Total # of "no" answers.

IRB NUMBER: IRB2013-0401F
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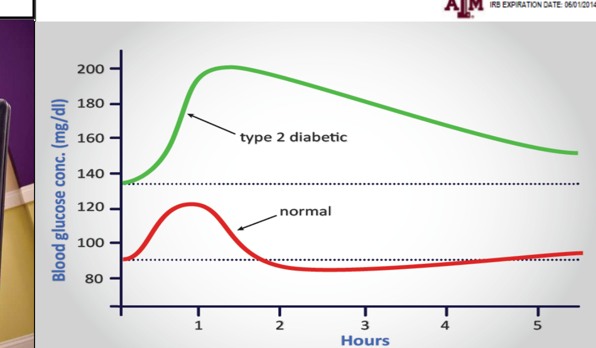
IRB EXPIRATION DATE: 06/01/2014



Acknowledgements and Funding

Supported by Curves International Inc., Waco, TX
www.ExerciseAndSportNutritionLab.com

ASSESSMENT OF FACTORS RELATED TO CARBOHYDRATE INTOLERANCE II: OGTT GLUCOSE AT 120 MINUTES

E Galvan, K Levers, A Coletta, R Dalton, YP Jung, A O'Connor, C Goodenough, S Simbo, C Seesselberg, B Bonin, M Koozehchian, B Sanchez, N Barringer, C Rasmussen, M Greenwood, R Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX 77843-4243

Abstract

This study examined whether responses to a carbohydrate intolerance questionnaire (CIQ) could predict response to an oral glucose tolerance test (OGTT). 108 women (31.6±13 yrs, 34.7±7% body fat, 25.3±4 kg/m2) donated fasting blood samples, completed a CIQ, had body composition and health measures determined, and underwent a 75g, 2-hr OGTT. Pearson product correlations were performed to determine which factors correlated with OGTT glucose at 120 minutes (G_{120}). Results revealed significant correlations ($p<0.05$) in G_{120} (112±25 mg/dl) to glucose AUC (r=0.60), glucose AUMC (r=0.73), C_{max} (r=0.34), fasting insulin (r=0.34), HOMA (r=0.37), height (r=-0.33), resting HR (r=0.29), BMC (r=-0.34), BMD (r=-0.23), FFM (r=-0.39), DEXA body fat (0.24), BIA body fat (r=0.22), and perceptions of being more than 25 lbs overweight (r=0.25). These findings indicate that OGTT G_{120} is positively correlated to OGTT glucose AUC, fasting insulin, and HOMA. Further, that shorter women who perceive themselves as more than 25 lbs overweight with a higher body fat and resting HR with lower FFM, BMC, and BMD were more related to G_{120} during a OGTT.

Supported by Curves International Inc. (Waco, TX)

Rationale

Physical inactivity and poor nutritional health have led to a worldwide epidemic of obesity. Obesity in the US continues to rise as 78.4 million adults (35%) are were classified as obese (BMI ≥ 30 kg/m2) in 2013. High blood glucose concentrations and physical inactivity are major contributors in the development of type 2 diabetes. Diabetes is the leading cause of blindness, kidney failure, and nontraumatic lower-limb amputations among adults in the US. Furthermore, it is a major cause of stroke and heart disease. This rise of obesity and type 2 diabetes calls for identification of health and demographic factors that demonstrate a correlation to HOMA and insulin resistance. Preliminary assessment indicated that components of the carbohydrate intolerance questionnaire (CIQ) weakly correlated with fasting HOMA levels, however there has not been an association made between CIQ answers and the results of an oral glucose tolerance test (OGTT) as the current gold standard for determining insulin resistance in the field.

PURPOSE: To determine which CIQ items correlated to OGTT at 120 minutes and HOMA markers of insulin resistance because carbohydrate restricted diets are recommended for the carbohydrate intolerant population to aid in healthy weight management or weight loss.

Experimental Design

Subjects

- 108 women (31.6±13 yr, 34.7±7% body fat, 25.3±4 kg/m^2) with an 8-10-hr fasting blood glucose concentration < 100 mg/dL were recruited for this study.
- Subjects were informed of experimental procedures and signed a consent statement in adherence with the human subject guidelines of Texas A&M University.
- A standard medical exam and review of subject medical history was performed by a research RN for clearance to participate in study.

Testing Protocol

- Subjects donated fasting blood samples, completed a CIQ (carbohydrate intolerance questionnaire), had body composition analyzed, health measures determined, and underwent an OGTT with a standardized 75g carbohydrate beverage in which blood glucose samples and perceptions of carbohydrate intolerance symptoms were obtained at 0, 30, 60, 90, and 120 minutes.

Methods and Procedures

- Subjects were recruited to participate in this study through flyers, newspaper ads, and radio advertisements.
- Body mass and height, body composition via DEXA scan, anthropometric measurements, resting blood pressure and heart rate were obtained during the baseline testing session prior to administration of the 2-hr OGTT.
- Blood glucose concentrations were determined from fasting serum samples and standard finger stick procedures using a portable blood glucose monitor during the OGTT.
- Fasting serum insulin concentrations were determined using commercially available immuno-absorbent (ELISA) kits in conjunction with a ultraviolet microplate reader.
- All measurements throughout the study were obtained by lab personnel.
- Self-reported 4-day dietary records were recorded 1-wk prior to baseline testing.

Statistical Analysis

- Correlations between participant answers to the CIQ and OGTT glucose at 120 minutes in addition to other dependent measures were analyzed via Pearson product correlation using IBM SPSS for Windows version 22.0 software (Chicago, IL).

Results

- Results revealed significant correlations ($p<0.05$) in G_{120} (112±25 mg/dl) to glucose AUC (r=0.60), glucose AUMC (r=0.73), C_{max} (r=0.34), fasting insulin (r=0.34), HOMA (r=0.37), height (r=-0.33), resting HR (r=0.29), BMC (r=-0.34), BMD (r=-0.23), FFM (r=-0.39), DEXA body fat (0.24), BIA body fat (r=0.22), and perceptions of being more than 25 lbs overweight (r=0.25).

Conclusions

- These findings indicate that OGTT G_{120} is positively correlated to OGTT glucose AUC, fasting insulin, and HOMA. Further, that shorter women who perceive themselves as more than 25 lbs overweight with a higher body fat and resting HR with lower FFM, BMC, and BMD were more related to G_{120} during a OGTT.
- Based on the results of this validation study, it seems that there is a correlation between one CIQ answer, fasting insulin, HOMA, height, body composition measures, resting heart rate, and the glucose area under the curve (GAUC) resulting from an OGTT in determining insulin resistance.

Practical Application

- The CIQ may be used to assess carbohydrate intolerance and to prescribe a carbohydrate restricted diet in conjunction with an active lifestyle.

Acknowledgements and Funding

Supported by Curves International Inc., Waco, TX
www.ExerciseAndSportNutritionLab.com

Dependent Variable Correlation Matrix

	OGTT Glucose AVG 0min	OGTT Glucose AVG 30min	OGTT Glucose AVG 60min	OGTT Glucose AVG 90min	OGTT Glucose AVG 120min	Cumulative Obs AUC (mg*hr/dL)	AUC (mg*hr/dL)	Cumulative Obs AUMC (mg*hr²/dL)	AUMC (mg*hr²/dL)	Cmax (mg/L)	Insulin Mean (uIU/mL)	t1 G/I Ratio	t1 HOMA	Age
OGTTglucoseAVG 0min	1	.429**	.339**	.250**	.248**	.429**	.073	.353**	.159	.415**	.176	.082	.276**	.303**
OGTTglucoseAVG 30min	.429**	1	.640**	.479**	.164	.781**	.059	.627**	-.081	.916**	.174	-.015	.197*	-.062
OGTTglucoseAVG 60min	.339**	.640**	1	.792**	.474**	.929**	.116	.905**	-.061	.823**	.180	-.047	.212*	.055
OGTTglucoseAVG 90min	.250**	.479**	.792**	1	.691**	.885**	.106	.949**	.052	.672**	.260**	-.078	.297**	.112
OGTTglucoseAVG 120min	.248**	.164	.474**	.691**	1	.598**	.134	.732**	.240*	.340**	.338**	-.137	.374**	.055
Cumulative Obs AUC (mg*hr/dL)	.429**	.781**	.929**	.885**	.598**	1	.119	.972**	.003	.905**	.262**	-.063	.302**	.054
AUC (mg*hr/dL)	.073	.059	.116	.106	.134	.119	1	.128	.201*	.062	.012	-.046	.024	.051
Cumulative Obs AUMC (mg*hr2/dL)	.353**	.627**	.905**	.949**	.732**	.972**	.128	1	.047	.803**	.283**	-.085	.322**	.071
AUMC (mg*hr2/dL)	.159	-.081	-.061	.052	.240*	.003	.201*	.047	1	-.095	.117	-.021	.136	.075
Cmax (mg/L)	.415**	.916**	.823**	.672**	.340**	.905**	.062	.803**	-.095	1	.207*	-.021	.240*	-.035
Insulin_Mean (uIU/mL)	.176	.174	.180	.260**	.338**	.262**	.012	.283**	.117	.207*	1	-.528**	.990**	.000
t1_GIRatio	.082	-.015	-.047	-.078	-.137	-.063	-.046	-.085	-.021	-.021	-.528**	1	-.493**	.108
t1_HOMA	.276**	.197*	.212*	.297**	.374**	.302**	.024	.322**	.136	.240*	.990**	-.493**	1	.045
Age	.303**	-.062	.055	.112	.055	.054	.051	.071	.075	-.035	.000	.108	.045	1
FAM_ht (cm)	-.244*	-.243*	-.167	-.258**	-.332**	-.283**	-.123	-.289**	-.017	-.218*	-.253**	.007	-.269**	-.023
t1_wt (kg)	-.054	-.243*	-.114	-.028	-.039	-.144	-.178	-.100	.039	-.160	.038	-.050	.041	.281**
t1_RHR	.084	.111	.133	.200*	.291**	.194*	.071	.221*	.001	.098	.115	-.032	.120	-.018
t1_SBP	.008	.036	.020	.072	.029	.047	-.035	.051	.066	.046	.115	-.098	.118	.188
t1_DBP	.070	.021	.062	.170	.189	.112	.001	.144	.139	.028	.153	-.129	.159	.238*
t1_waist (in)	.163	-.027	.094	.219*	.182	.126	-.136	.167	.095	.055	.231*	-.135	.258**	.461**
t1_hip (in)	.013	-.213*	-.140	-.046	-.016	-.144	-.173	-.106	.055	-.169	.059	-.022	.076	.330**
t1_BMI	.081	-.138	-.027	.121	.151	.003	-.128	.058	.052	-.055	.197*	-.066	.212*	.332**
t1_bmc (kg)	-.308**	-.362**	-.230*	-.275**	-.335**	-.357**	-.184	-.337**	-.030	-.317**	-.194*	.037	-.216*	-.006
t1_bmd (g/cm2)	-.293**	-.352**	-.210*	-.244*	-.233*	-.322**	-.116	-.291**	-.025	-.309**	-.242*	.100	-.269**	.035
t1_ffm (kg)	-.165	-.248**	-.165	-.234*	-.391**	-.282**	-.230*	-.293**	.049	-.244*	-.106	.074	-.111	-.017
t1_fm (kg)	.086	-.145	-.057	.051	.124	-.036	-.091	.010	.015	-.081	.166	-.117	.177	.359**
t1_bodyfat%	.183	-.034	.021	.130	.236*	.076	-.008	.116	.005	-.004	.264**	-.168	.279**	.386**
CIQ T1 Q1	.202*	.018	.039	.026	.167	.059	-.065	.068	.015	.020	.001	.124	.032	.286**
CIQ T1 Q2	-.006	.036	-.105	-.086	-.130	-.072	-.046	-.099	.017	-.044	.022	.110	.021	-.057
CIQ T1 Q3	-.057	.008	-.187	-.192*	-.180	-.155	-.091	-.190*	-.037	-.104	-.095	-.013	-.109	-.089
CIQ T1 Q4	.129	.174	.056	.037	.019	.101	-.041	.068	.074	.108	.191*	-.020	.175	.081
CIQ T2 Q1	.109	-.037	.053	.224*	.246*	.115	-.045	.169	.141	.054	.157	-.020	.178	.425**
CIQ T2 Q2	-.112	-.279**	-.168	-.084	.033	-.188	-.176	-.131	.052	-.238*	-.044	.086	-.034	.167
CIQ T2 Q3	-.089	-.280**	-.236*	-.220*	-.045	-.266**	-.230*	-.231*	.095	-.259**	-.170	.102	-.169	.087
CIQ T2 Q4	.164	.095	.010	.001	.005	.044	-.119	.020	-.036	.105	.120	.223*	.135	.128
CIQ T3 Q1	.253**	.072	.195*	.234*	.150	.202*	.059	.216*	-.021	.095	.056	-.034	.095	.635**
t1_bia fat%	.217*	-.094	.051	.183	.220*	.082	-.040	.135	.053	-.015	.202*	-.048	.231*	.641**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Texas A&M University: Exercise & Sport Nutrition Laboratory
Trial: Validation of Carbohydrate Intolerance Questionnaire (CIQ)

Carbohydrate Intolerance Questionnaire

Name: ______________________ Age: _____ Ethnicity: __________

The Institute for Nutritional Science has devised a sample of questions to determine if you are carbohydrate intolerant or calorie sensitive. Please complete the following three tests to help us better determine your best method of dieting.

Test I: Symptoms of Carbohydrate Intolerance - Have you ever experienced any of the following symptoms?

1. ______Insomnia	11. ______Lack of sex drive
2. ______Irritability	12. ______Fatigue and Exhaustion
3. ______Headaches	13. ______Overemotional crying spells
4. ______Depression	14. ______Leg cramps and blurred vision
5. ______Nervousness	15. ______Cravings for starch and sugar rich foods
6. ______Muscle pains	16. ______Digestive disturbances with no apparent cause
7. ______Forgetfulness	17. ______Rapid pulse, especially after eating certain foods
8. ______Mental confusion	18. ______Shortness of breath, sighing and excessive yawning
9. ______Needless worrying	19. ______Drowsiness, especially after meals or in mid afternoon
10. ______Antisocial behavior	20. ______Faintness, dizziness, cold sweats, shakiness, weak spells

______Total # of "yes" answers. ______Total # of "no" answers.

Test II: Carbohydrate Intolerance – Respond to the following statements with either a yes or no.

1. ______You are more than 25 pounds overweight.
2. ______You have had a tendency to be overweight all of your life.
3. ______You have been overweight since you were very young.
4. ______You have a poor appetite and often skip meals.
5. ______You have food cravings that temporarily go away when starch or sugary foods are eaten.
6. ______There are foods that you feel you absolutely could not do without.
7. ______Your waistline is bigger than your hips.
8. ______Most or all of the symptoms associated with carbohydrate intolerance apply to you (Test I).

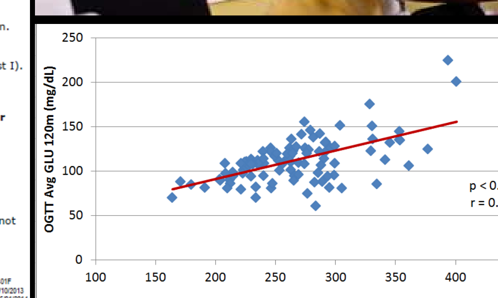
______Total # of "yes" answers. ______Total # of "no" answers.

Test III: Calorie Sensitivity – Respond to the following statements with either a yes or no.

1. ______You had a normal body weight when younger but slowly gained weight after age 30.
2. ______You are presently overweight but by less than 25 pounds.
3. ______You have a normal appetite – get hungry at meal times.
4. ______You have few, if any, food cravings.
5. ______You have maintained the same basic eating habits all of your life.
6. ______You eat three meals per day.
7. ______You have gained a certain amount of extra body weight but seem to have tapered off (not continued to steadily gain more and more weight).
8. ______You have few or none of the symptoms associated with poor carbohydrate metabolism (Test I).

______Total # of "yes" answers. ______Total # of "no" answers.

IRB NUMBER: IRB2013-0401F
IRB APPROVAL DATE: 06/10/2013
IRB EXPIRATION DATE: 06/01/2014



ANALYSIS OF THE VALIDITY OF A CARBOHYDRATE INTOLERANCE QUESTIONNAIRE III

M Koozehchian, K Levers, E Galvan, A Coletta, R Dalton, YP Jung, A O'Connor, C Goodenough, S Simbo, C Seesselberg, B Bonin, B Sanchez, N Barringer, C Rasmussen, M Greenwood, R Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX 77843-4243

Abstract

108 women donated fasting blood samples, completed a carbohydrate intolerance questionnaire (CI), had body composition and health measures determined, and underwent a 75g, 2-h OGTT. Being less than 25 lbs overweight correlated with age (r=0.19) and DBP (r=0.27). Getting hungry at meals correlated with BMI (r=0.23), antisocial behavior (r=0.37) and having a poor appetite/skipping meals (r=0.39). Having few food cravings correlated with waist circumference (r=-0.20), mental confusion (r=0.23), being 25 lbs overweight (r=-0.27), having temporary food cravings (r=-0.23), and must have foods (r=-0.30). Consistent eating habits correlated with RHR (r=-0.22), FFM (r=-0.19), being overweight throughout life (r=-0.20), and skipping meals (r=-0.20). Eating 3 times/d correlated with OGTT glucose AUC (r=-0.19), antisocial behavior (r=-0.19), being overemotional (r=-0.21), leg cramps/blurred vision (r=-0.27), drowsiness (r=-0.19), and skipping meals (r=-0.43). Maintaining weight gain correlated with waist (r=0.21) and hip (r=0.20) circumference, fat mass (r=0.21), body fat (r=0.22), headaches (r=0.20), mental confusion (r=0.28), leg cramps/blurred vision (r=0.28), and yawning (r=0.26).

Supported by Curves International Inc. (Waco, TX)

Rationale

The prevalence of overweight, poor nutritional health, and physical inactivity continues to increase in the US adult population. According to the CDC and NIH, the pattern of American obesity continues to rise as 78.4 million adults (35%) were classified as obese (BMI ≥ 30 kg/m2) in 2013, which is nearly double the number of obese adults in 2003 (40 million). High blood glucose levels and physical inactivity have proven to be major contributors in the development of type 2 diabetes. Adult diabetes prevalence has also increased to 25.8 million (7 million undiagnosed) with an estimated 79 million adults having prediabetes. This alarming rise of obesity and type 2 diabetes calls for identification of health and demographic factors that demonstrate a correlation to insulin resistance. Preliminary assessment indicated that there has not been an association made between CIQ answers and the results of an oral glucose tolerance test (OGTT) as the current gold standard for determining insulin resistance in the field.

PURPOSE: To determine which CIQ items correlated to OGTT and HOMA markers of insulin resistance because carbohydrate restricted diets are recommended for the carbohydrate intolerant population to aid in healthy weight management or weight loss.

Experimental Design

Subjects

- 108 women (31.6±13 yr, 34.7±7% body fat, 25.3±4 kg/m^2) with a 8-10-hr fasting blood glucose level < 100 mg/dL were recruited for this study.
- Subjects were informed of experimental procedures and signed a consent statement in adherence with the human subject guidelines of Texas A&M University.
- A standard medical exam and review of subject medical history was performed by a research RN for clearance to participate in study.

Testing Protocol

- Subjects donated fasting blood samples, completed a CIQ (carbohydrate intolerance questionnaire), had body composition analyzed, health measures determined, and underwent an OGTT with a standardized 75g carbohydrate beverage in which blood glucose samples and perceptions of CI symptoms were obtained at 0, 30, 60, 90, and 120 minutes.

Methods and Procedures

- Subjects were recruited to participate in this study through flyers, newspaper ads, and radio advertisements.
- Body mass and height, body composition via DEXA scan, anthropometric measurements, resting blood pressure and HR were obtained during the baseline testing session prior to administration of the 2-hr OGTT.
- Blood glucose levels were determined from fasting serum samples and standard finger stick procedures using a portable blood glucose monitor during the OGTT.
- Fasting serum insulin levels were determined using commercially available immuno-absorbent (ELISA) kits in conjunction with a ultraviolet microplate reader.
- All measurements throughout the study were obtained by lab personnel.
- Self-reported 4-day dietary records were recorded 1-wk prior to baseline testing.

Statistical Analysis

- Correlations between participant answers to the CIQ and AUC responses to the OGTT in addition to other dependent measures were analyzed via Pearson product correlation using IBM SPSS for Windows version 22.0 software (Chicago, IL).

Results

- Significant correlations (p<0.05) in GAUC (264±46 mg/hr/dL) to Being less than 25 lbs overweight correlated with age (r=0.19) and DBP (r=0.27). Getting hungry at meals correlated with BMI (r=0.23), antisocial behavior (r=0.37) and having a poor appetite/skipping meals (r=0.39). Having few food cravings correlated with waist circumference (r=-0.20), mental confusion (r=0.23), being 25 lbs overweight (r=-0.27), having temporary food cravings (r=-0.23), and must have foods (r=-0.30). Consistent eating habits correlated with RHR (r=-0.22), FFM (r=-0.19), being overweight throughout life (r=-0.20), and skipping meals (r=-0.20). Eating 3 times/d correlated with OGTT glucose AUC (r=-0.19), antisocial behavior (r=-0.19), being overemotional (r=-0.21), leg cramps/blurred vision (r=-0.27), drowsiness (r=-0.19), and skipping meals (r=-0.43). Maintaining weight gain correlated with waist (r=0.21) and hip (r=0.20) circumference, fat mass (r=0.21), body fat (r=0.22), headaches (r=0.20), mental confusion (r=0.28), leg cramps/blurred vision (r=0.28), and yawning (r=0.26).

Conclusions and Practical Applications

- The results of this study show that carbohydrate intolerance questionnaire correlate to OGTT and can be used as guides for determining insulin resistance. Significant correlations (p<0.01) between maintaining weight gain and waist and hip circumference and body fat %.
- Based on the results of this study, there is a correlation between specific CIQ answers, body composition measures, and the glucose area under curve resulting from an OGTT in determining insulin resistance. The CIQ may be used to assess carbohydrate intolerance and to prescribe a carbohydrate restricted diet in conjunction with an active lifestyle.

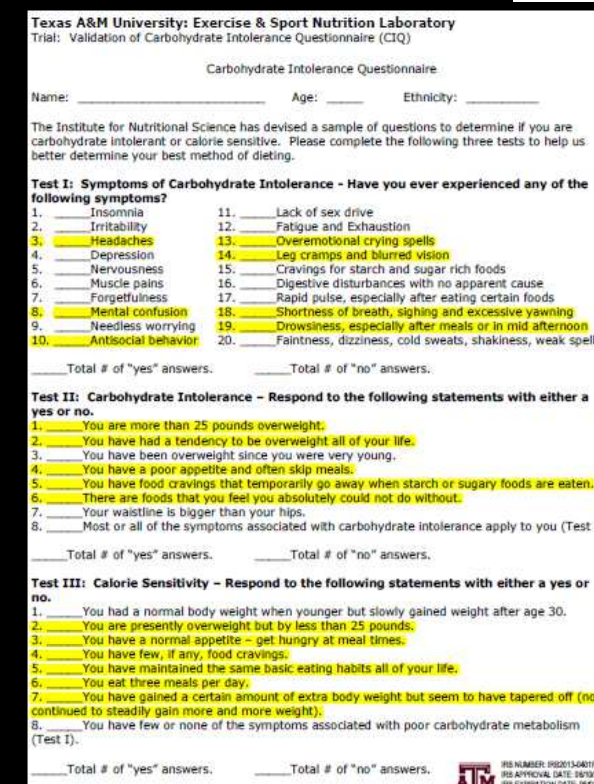
Acknowledgements and Funding

Supported by Curves International Inc., Waco, TX
www.ExerciseAndSportNutritionLab.com

Dependent Variable Correlation Matrix

	CIQ T3 Q2	CIQ T3 Q3	CIQ T3 Q4	CIQ T3 Q5	CIQ T3 Q6	CIQ T3 Q7
Cumulative Observed AUC (mg*hr/dL)	.016	-.079	-.003	.116	-.191*	.052
Age	.191*	.036	-.010	.093	.006	.096
t1_RHR	-.053	.059	-.019	-.222*	-.078	.102
t1_DBP	.272**	-.080	-.002	-.002	-.082	.185
t1_waist (in)	.104	-.100	-.199*	-.151	-.133	.212*
t1_hip (in)	.173	-.092	-.159	-.161	-.069	.196*
t1_BMI	.146	-.225*	-.175	-.165	-.102	.182
t1_ffm (kg)	.016	-.133	-.152	-.193*	-.076	.022
t1_fm (kg)	.161	-.095	-.107	-.127	-.048	.206*
t1_bodyfat%	.181	-.053	-.063	-.074	-.062	.223*
CIQ T1 Q3	-.112	-.024	-.029	-.114	.007	.203*
CIQ T1 Q8	.080	-.054	.225*	.083	-.079	.280**
CIQ T1 Q10	.037	-.374**	-.063	-.021	-.192*	.133
CIQ T1 Q13	.156	-.171	-.034	-.034	-.210*	.148
CIQ T1 Q14	-.025	-.083	.071	-.057	-.272**	.279**
CIQ T1 Q18	.087	-.069	.010	-.108	-.092	.257**
CIQ T1 Q19	.128	-.099	.000	.040	-.192*	.108
CIQ T2 Q1	-.279**	-.161	-.271**	-.139	-.175	.028
CIQ T2 Q2	.351**	-.063	-.026	-.204*	-.055	.012
CIQ T2 Q4	-.043	-.387**	-.053	-.201*	-.423**	.052
CIQ T2 Q5	.002	-.092	-.234*	-.044	-.164	-.040
CIQ T2 Q6	-.030	-.110	-.298**	-.097	-.111	-.083

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).



Texas A&M University: Exercise & Sport Nutrition Laboratory
Trial: Validation of Carbohydrate Intolerance Questionnaire (CIQ)

Carbohydrate Intolerance Questionnaire

Name: ____________ Age: _____ Ethnicity: __________

The Institute for Nutritional Science has devised a sample of questions to determine if you are carbohydrate intolerant or calorie sensitive. Please complete the following three tests to help us better determine your best method of dieting.

Test I: Symptoms of Carbohydrate Intolerance - Have you ever experienced any of the following symptoms?

1. _____Insomnia
2. _____Irritability
3. _____Headaches
4. _____Depression
5. _____Nervousness
6. _____Muscle pains
7. _____Forgetfulness
8. _____Mental confusion
9. _____Needless worrying
10. _____Antisocial behavior
11. _____Lack of sex drive
12. _____Fatigue and Exhaustion
13. _____Overemotional crying spells
14. _____Leg cramps and blurred vision
15. _____Cravings for starch and sugar rich foods
16. _____Digestive disturbances with no apparent cause
17. _____Rapid pulse, especially after eating certain foods
18. _____Shortness of breath, sighing and excessive yawning
19. _____Drowsiness, especially after meals or in mid afternoon
20. _____Faintness, dizziness, cold sweats, shakiness, weak spells

_____Total # of "yes" answers. _____Total # of "no" answers.

Test II: Carbohydrate Intolerance – Respond to the following statements with either a yes or no.

1. _____You are more than 25 pounds overweight.
2. _____You have had a tendency to be overweight all of your life.
3. _____You have been overweight since you were very young.
4. _____You have a poor appetite and often skip meals.
5. _____You have food cravings that temporarily go away when starch or sugary foods are eaten.
6. _____There are foods that you feel you absolutely could not do without.
7. _____Your waistline is bigger than your hips.
8. _____Most or all of the symptoms associated with carbohydrate intolerance apply to you (Test I).

_____Total # of "yes" answers. _____Total # of "no" answers.

Test III: Calorie Sensitivity – Respond to the following statements with either a yes or no.

1. _____You had a normal body weight when younger but slowly gained weight after age 30.
2. _____You are presently overweight but by less than 25 pounds.
3. _____You have a normal appetite – get hungry at meal times.
4. _____You have few, if any, food cravings.
5. _____You have maintained the same basic eating habits all of your life.
6. _____You eat three meals per day.
7. _____You have gained a certain amount of extra body weight but seem to have tapered off (not continued to steadily gain more and more weight).
8. _____You have few or none of the symptoms associated with poor carbohydrate metabolism (Test I).

_____Total # of "yes" answers. _____Total # of "no" answers.

ASSESSMENT OF FACTORS RELATED TO CARBOHYDRATE INTOLERANCE III: FASTING HOMA

R Dalton, K Levers, E Galvan, A Coletta, YP Jung, A O'Connor, C Goodenough, S Simbo, C Seesselberg, B Bonin, M Koozehchian, B Sanchez, N Barringer, C Rasmussen, M Greenwood, R Kreider. Exercise & Sport Nutrition Lab, Texas A&M University, College Station, TX 77843-4243

Abstract

This study examined whether responses to a carbohydrate intolerance survey (CI) correlate to the homeostatic model assessment (HOMA). 108 women (31.6±13 yrs, 34.7±7% body fat, 25.3±4 kg/m2) donated fasting blood samples, completed a CI inventory, had body composition and health measures determined, and underwent a 75g, 2-hr OGTT. Pearson product correlations were performed to determine which factors correlated with HOMA. Results revealed significant correlations ($p<0.05$) in HOMA (1.51±1.1) to G120 (r=0.37), glucose AUC (r=0.30), glucose AUMC (r=0.32), Cmax (r=0.24), fasting insulin (r=0..99), G/I ratio (r=-0.49), height (r=-0.27), waist circumference (r=0.26), BMI (r=0.21), BMC (r=-0.21), BMD (r=-0.27), DEXA body fat (r=0.28), an BIA body fat (r=0.23) However, HOMA did not significantly correlate to any question on the CI or symptoms during the OGTT. Results indicate that HOMA is positively correlated to OGTT values, fasting insulin, the G/I ratio, waist circumference, BMI, and %BF and negatively correlated with height, BMC, and BMD, but not related to CI questionnaire of CI symptoms during an OGTT.

Acknowledgements and Funding

Supported by Curves International Inc. (Waco, TX)
www.ExerciseAndSportNutritionLab.com

Rationale

Inactivity and obesity are major risk factors for premature mortality. The risk for developing cardiovascular disease, cancer, and diabetes increase as inactivity and obesity rise. The United States Center for Disease Control and Prevention estimate more than 69% of Americans are overweight, over 35% are obese, less than 48% reach physical activity recommendations, and 25% of adults have no physical activity. Insulin resistance is associated with obesity, inactivity, and negative health. Approximately, 36% of diabetics have no physical activity and 84% are overweight. More effective methods of prevention, diagnosis, and treatment of obesity and insulin resistance could lead to lower rates of premature mortality.

PURPOSE: To determine if the results of the CI correlated to OGTT and HOMA markers of insulin resistance leading to a simple method of determining optimal diet and exercise strategies to aid in healthy weight management.

Experimental Design

Subjects

- 108 women (31.6±13 yr, 34.7±7% body fat, 25.3±4 kg/m^2) with a 8-10-hr fasting blood glucose level < 100 mg/dL were recruited for this study.
- Subjects were informed of experimental procedures and signed a consent statement in adherence with the human subject guidelines of Texas A&M University.
- A standard medical exam and review of subject medical history was performed by a research RN for clearance to participate in study.

Testing Protocol

- Subjects donated fasting blood samples, completed a CIQ (carbohydrate intolerance questionnaire), had body composition analyzed, health measures determined, and underwent an OGTT with a standardized 75g carbohydrate beverage in which blood glucose samples and perceptions of CI symptoms were obtained at 0, 30, 60, 90, and 120 minutes.

Methods and Procedures

- Subjects were recruited to participate in this study through flyers, newspaper ads, and radio advertisements.
- Body mass and height, body composition via DEXA scan, anthropometric measurements, resting blood pressure and HR were obtained during the baseline testing session prior to administration of the 2-hr OGTT.
- Blood glucose levels were determined from fasting serum samples and standard finger stick procedures using a portable blood glucose monitor during the OGTT.
- Fasting serum insulin levels were determined using commercially available immuno-absorbent (ELISA) kits in conjunction with a ultraviolet microplate reader.
- All measurements throughout the study were obtained by lab personnel.
- Self-reported 4-day dietary records were recorded 1-wk prior to baseline testing.

Statistical Analysis

- Correlations between participant answers to the CI and AUC responses to the OGTT in addition to other dependent measures were analyzed via Pearson product correlation using IBM SPSS for Windows version 22.0 software (Chicago, IL).

Results

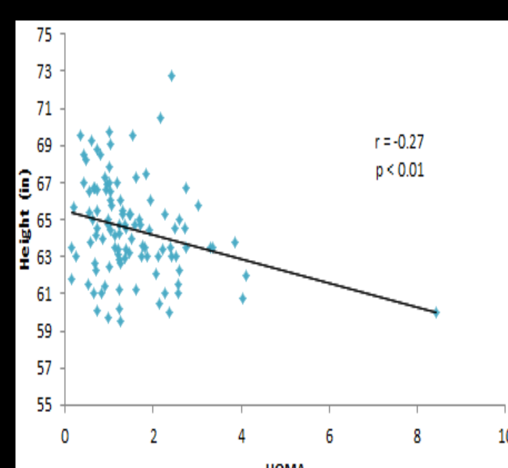
- Results revealed significant correlations ($p<0.05$) in HOMA (1.51±1.1) to G120 (r=0.37), glucose AUC (r=0.30), glucose AUMC (r=0.32), Cmax (r=0.24), fasting insulin (r=0..99), G/I ratio (r=-0.49), height (r=-0.27), waist circumference (r=0.26), BMI (r=0.21), BMC (r=-0.21), BMD (r=-0.27), DEXA body fat (r=0.28), an BIA body fat (r=0.23).

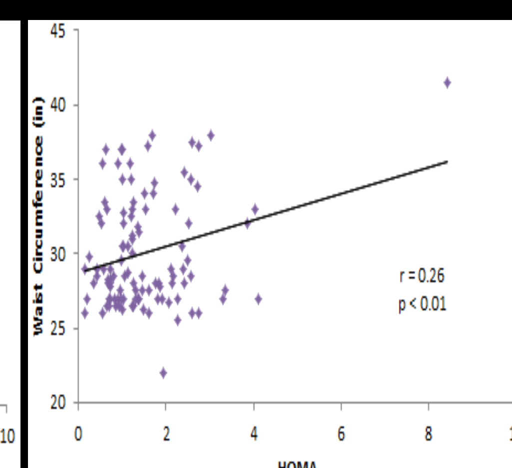
Conclusions

- These results support previous findings correlating HOMA to OGTT, height, waist circumference, BMI, BMC, BMD, and body fat %.
- The CI does not seem to be an accurate method of predicting insulin resistance.

Practical Application

- Individuals more at risk for developing insulin resistance, leading to other health problems, can be identified based on shorter stature and larger waist circumference by health care practitioners before more advanced methods are utilized.





Dependent Variable Correlation Matrix

	OGTT Glucose AVG 0min	OGTT Glucose AVG 30min	OGTT Glucose AVG 60min	OGTT Glucose AVG 90min	OGTT Glucose AVG 120min	Cumulative Obs AUC (mg*hr/dL)	AUC (mg*hr/dL)	Cumulative Obs AUMC	AUMC (mg*hr2/dL)	Cmax (mg/L)	Insulin Mean (uIU/mL)	t1 G/I Ratio	t1 HOMA	Age
OGTTglucoseAVG 0min	1	.429**	.339**	.250**	.248**	.429**	.073	.353**	.159	.415**	.176	.082	.276**	.303**
OGTTglucoseAVG 30min	.429**	1	.640**	.479**	.164	.781**	.059	.627**	-.081	.916**	.174	-.015	.197*	-.062
OGTTglucoseAVG 60min	.339**	.640**	1	.792**	.474**	.929**	.116	.905**	-.061	.823**	.180	-.047	.212*	.055
OGTTglucoseAVG 90min	.250**	.479**	.792**	1	.691**	.885**	.106	.949**	.052	.672**	.260**	-.078	.297**	.112
OGTTglucoseAVG 120min	.248**	.164	.474**	.691**	1	.598**	.134	.732**	.240*	.340**	.338**	-.137	.374**	.055
Cumulative Obs AUC (mg*hr/dL)	.429**	.781**	.929**	.885**	.598**	1	.119	.972**	.003	.905**	.262**	-.063	.302**	.054
AUC (mg*hr/dL)	.073	.059	.116	.106	.134	.119	1	.128	.201*	.062	.012	-.046	.024	.051
Cumulative Obs AUMC (mg*hr2/dL)	.353**	.627**	.905**	.949**	.732**	.972**	.128	1	.047	.803**	.283**	-.085	.322**	.071
AUMC (mg*hr2/dL)	.159	-.081	-.061	.052	.240*	.003	.201*	.047	1	-.095	.117	-.021	.136	.075
Cmax (mg/L)	.415**	.916**	.823**	.672**	.340**	.905**	.062	.803**	-.095	1	.207*	-.021	.240*	-.035
Insulin_Mean (uIU/mL)	.176	.174	.180	.260**	.338**	.262**	.012	.283**	.117	.207*	1	-.528**	.990**	.000
t1_GIRatio	.082	-.015	-.047	-.078	-.137	-.063	-.046	-.085	-.021	-.021	-.528**	1	-.493**	.108
t1_HOMA	.276**	.197*	.212*	.297**	.374**	.302**	.024	.322**	.136	.240*	.990**	-.493**	1	.045
Age	.303**	-.062	.055	.112	.055	.054	.051	.071	.075	-.035	.000	.108	.045	1
FAM_ht (cm)	-.244*	-.243*	-.167	-.258**	-.332**	-.283**	-.123	-.289**	-.017	-.218*	-.253**	.007	-.269**	-.023
t1_wt (kg)	-.054	-.243*	-.114	-.028	-.039	-.144	-.178	-.100	.039	-.160	.038	-.050	.041	.281**
t1_RHR	.084	.111	.133	.200*	.291**	.194*	.071	.221*	.001	.098	.115	-.032	.120	-.018
t1_SBP	.008	.036	.020	.072	.029	.047	-.035	.051	.066	.046	.115	-.098	.118	.188
t1_DBP	.070	.021	.062	.170	.189	.112	.001	.144	.139	.028	.153	-.129	.159	.238*
t1_waist (in)	.163	-.027	.094	.219*	.182	.126	-.136	.167	.095	.055	.231*	-.135	.258**	.461**
t1_hip (in)	.013	-.213*	-.140	-.046	-.016	-.144	-.173	-.106	.055	-.169	.059	-.022	.076	.330**
t1_BMI	.081	-.138	-.027	.121	.151	.003	-.128	.058	.052	-.055	.197*	-.066	.212*	.332**
t1_bmc (kg)	-.308**	-.362**	-.230*	-.275**	-.335**	-.357**	-.184	-.337**	-.030	-.317**	-.194*	.037	-.216*	-.006
t1_bmd (g/cm2)	-.293**	-.352**	-.210*	-.244*	-.233*	-.322**	-.116	-.291**	-.025	-.309**	-.242*	.100	-.269**	.035
t1_ffm (kg)	-.165	-.248**	-.165	-.234*	-.391**	-.282**	-.230*	-.293**	.049	-.244*	-.106	.074	-.111	-.017
t1_fm (kg)	.086	-.145	-.057	.051	.124	-.036	-.091	.010	.015	-.081	.166	-.117	.177	.359**
t1_bodyfat%	.183	-.034	.021	.130	.236*	.076	-.008	.116	.005	-.004	.264**	-.168	.279**	.386**
CIQ T1Q1	.202*	.018	.039	.026	.167	.059	-.065	.068	.015	.020	.001	.124	.032	.286**
CIQ T1Q2	-.006	.036	-.105	-.086	-.130	-.072	-.046	-.099	.017	-.044	.022	.110	.021	-.057
CIQ T1Q3	-.057	.008	-.187	-.192*	-.180	-.155	-.091	-.190*	-.037	-.104	-.095	-.013	-.109	-.089
CIQ T1Q4	.129	.174	.056	.037	.019	.101	-.041	.068	.074	.108	.191*	-.020	.175	.081
CIQ T2 Q1	.109	-.037	.053	.224*	.246*	.115	-.045	.169	.141	.054	.157	-.020	.178	.425**
CIQ T2 Q2	-.112	-.279**	-.168	-.084	.033	-.188	-.176	-.131	.052	-.238*	-.044	.086	-.034	.167
CIQ T2 Q3	-.089	-.280**	-.236*	-.220*	-.045	-.266**	-.230*	-.231*	.095	-.259**	-.170	.102	-.169	.087
CIQ T2 Q4	.164	.095	.010	.001	.005	.044	-.119	.020	-.036	.105	.120	.223*	.135	.128
CIQ T3 Q1	.253**	.072	.195*	.234*	.150	.202*	.059	.216*	-.021	.095	.056	-.034	.095	.635**
t1_bia fat%	.217*	-.094	.051	.183	.220*	.082	-.040	.135	.053	-.015	.202*	-.048	.231*	.641**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Texas A&M University: Exercise & Sport Nutrition Laboratory
Trial: Validation of Carbohydrate Intolerance Questionnaire (CIQ)

Carbohydrate Intolerance Questionnaire

Name: ____________________ Age: _____ Ethnicity: __________

The Institute for Nutritional Science has devised a sample of questions to determine if you are carbohydrate intolerant or calorie sensitive. Please complete the following three tests to help us better determine your best method of dieting.

Test I: Symptoms of Carbohydrate Intolerance - Have you ever experienced any of the following symptoms?

1. _____Insomnia
2. _____Irritability
3. _____Headaches
4. _____Depression
5. _____Nervousness
6. _____Muscle pains
7. _____Forgetfulness
8. _____Mental confusion
9. _____Needless worrying
10. _____Antisocial behavior
11. _____Lack of sex drive
12. _____Fatigue and Exhaustion
13. _____Overemotional crying spells
14. _____Leg cramps and blurred vision
15. _____Cravings for starch and sugar rich foods
16. _____Digestive disturbances with no apparent cause
17. _____Rapid pulse, especially after eating certain foods
18. _____Shortness of breath, sighing and excessive yawning
19. _____Drowsiness, especially after meals or in mid afternoon
20. _____Faintness, dizziness, cold sweats, shakiness, weak spells

_____Total # of "yes" answers. _____Total # of "no" answers.

Test II: Carbohydrate Intolerance – Respond to the following statements with either a yes or no.

1. _____You are more than 25 pounds overweight.
2. _____You have had a tendency to be overweight all of your life.
3. _____You have been overweight since you were very young.
4. _____You have a poor appetite and often skip meals.
5. _____You have food cravings that temporarily go away when starch or sugary foods are eaten.
6. _____There are foods that you feel you absolutely could not do without.
7. _____Your waistline is bigger than your hips.
8. _____Most or all of the symptoms associated with carbohydrate intolerance apply to you (Test I).

_____Total # of "yes" answers. _____Total # of "no" answers.

Test III: Calorie Sensitivity – Respond to the following statements with either a yes or no.

1. _____You had a normal body weight when younger but slowly gained weight after age 30.
2. _____You are presently overweight but by less than 25 pounds.
3. _____You have a normal appetite – get hungry at meal times.
4. _____You have few, if any, food cravings.
5. _____You have maintained the same basic eating habits all of your life.
6. _____You eat three meals per day.
7. _____You have gained a certain amount of extra body weight but seem to have tapered off (not continued to steadily gain more and more weight).
8. _____You have few or none of the symptoms associated with poor carbohydrate metabolism (Test I).

_____Total # of "yes" answers. _____Total # of "no" answers.

IRB NUMBER: IRB2013-0401F
IRB APPROVAL DATE: 06/10/2013
IRB EXPIRATION DATE: 06/01/2014