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 diet for 1-wk and 1,500 kcal diet for 3 wks (p<0.05 CHO:PRO). Subjects then ingested 2,000 kcals for 2 wks (45-50 CHO:PRO) and repeated this diet while participating in the Curves 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 VAT issue (VAT) was determined at 0 & 16 wks. MANOVA revealed a significant time effect (p<0.001) and group x time effect (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 -5.6±6 kg, p=0.63), and VAT mass (W -98±468, C -240±454 g, p=0.26). Subjects in the C group experienced greater gains in FFM (W -3.3±5.9, C +1±2±4 kg, p=0.02) 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), 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)

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.

Results
- MANOVA revealed a significant time effect (p<0.001) and group x time effect (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 -5.6±6 kg, p=0.90), 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 kg, p=0.02) and lost more body fat (W -1.1±8, C -4.5±5.5 %, p=0.07).

Conclusion & 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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Abstract

54 sedentary women (34±8 yrs, 35±6 kg/m2) were randomized to participate in the Curves® program or Weight Watchers® weight loss programs for 16-wks. Participants in the Curves® program followed a 1,200 kcal diet for 1-wk and 1,500 kcal diet for 3 wks (30:45 CHO:PRO). Subjects then ingested 2,000 kcals for 2 wks (45:30 CHO:PRO) and repeated this diet while participating in the Zumba program. MANOVA revealed a significant time (p<0.001) and group x time (p=0.004) effect. Both groups had similar changes in body composition with Android (A) and Gynoid (G) measurements were analyzed at 0 and 16 wks. A-FFM (W: -419±760, C: -624±700 g, p=0.31), G-FFM (W: 839±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-FFM (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 Android and Gynoid body composition. Supported by Curves International Inc. (Waco, TX).

Methods and Procedures

Participation in the Curves® program, or a similar program including both structured diet and 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.

Results

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.

Conclusions and Practical Applications

Results indicate that different types of diets can differentially affect changes in Android and Gynoid body composition. Findings suggest participation in the Curves® program, in comparison to Weight Watchers®, results in more favorable changes in body composition.

Figures

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

Statistical Analysis

Subjects

54 sedentary women (34±8 yrs, 35±6 kg/m2) were randomized to participate in the Curves® or Weight Watchers® programs for 16-wks. Participants in the Curves® program followed a 1,200 kcal diet for 1-wk and 1,500 kcal diet for 3 wks (30:45 CHO:PRO). Subjects then ingested 2,000 kcals for 2 wks (45:30 CHO:PRO) and repeated this diet while participating in the Zumba program. MANOVA revealed a significant time (p<0.001) and group x time (p=0.004) effect. Both groups had similar changes in body composition with Android (A) and Gynoid (G) measurements were analyzed at 0 and 16 wks. A-FFM (W: -419±760, C: -624±700 g, p=0.31), G-FFM (W: 839±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-FFM (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).

Experimental Design

Subjects

54 sedentary women (34±8 yrs, 35±6 kg/m2)
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 followed the Weight Watchers® Points Plus program, which consisted of: following food plans based on a points system, and attending weekly meetings for weight loss and presentations regarding exercise recommendations, tracking methods, and weight reduction strategies.

Subjects were randomized to 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 weight loss and presentations regarding exercise recommendations, tracking methods, and weight reduction strategies.

Exercise was encouraged but not mandatory.

Acknowledgements and Funding

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Rationale

According to the CDC, approximately one-third of adult Americans are obese (~34%), and the estimated annual medical cost associated with obesity is about $174 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.

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 indicate that different types of diets can differentially affect changes in Android and Gynoid body composition.

Conclusions and Practical Applications

Results indicate that different types of diets can differentially affect changes in Android and Gynoid body composition. Findings suggest participation in the Curves® program, in comparison to Weight Watchers®, results in more favorable changes in body composition.

Participants 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.
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 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±1.7; JC -1.8±2.3; NS -1.4±2.5; CC -3.5±3.3; JC -1.8±2.7 kg, p=0.001), less loss in FFM in CC (C -0.2±2.3; JC -0.3±2.7; WW -2.2±2.7; JC -3.5±3.3 kg, p<0.001), 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 mass (r=0.22).

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.

V02 max was determined with treadmill test by Bruce protocol at 0 & 12 wks. 1RM of upper and lower body strength and muscular endurance (18RM) 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.

Results

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

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

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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 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±1.7; JC -1.8±2.3; NS -1.4±2.5; CC -3.5±3.3; JC -1.8±2.7 kg, p=0.001), less loss in FFM in CC (C -0.2±2.3; JC -0.3±2.7; WW -2.2±2.7; JC -3.5±3.3 kg, p<0.001), 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 mass (r=0.22).

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.

V02 max was determined with treadmill test by Bruce protocol at 0 & 12 wks. 1RM of upper and lower body strength and muscular endurance (18RM) 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.

Results

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

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

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


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 -335±540 g, p=0.01), A-BF (C -2.9±3.6; WW -0.4±3.7; JC -1.6±2.4; NS -0.6±1.9 %, p=0.001) with less loss in G-FMM (C -10±605; WW -823±658; JC -112±476; 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/day for 11 wks. Additionally the CC participants completed a 30-min resistance based circuit interspersed with calisthenic exercises or Zumba 4-days 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 CC 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 (Waltham, MA).

Statistics

Data were analyzed by MANOVA with repeated measures statistical analysis. Results are presented as means ± SD % change from baseline for each group after 4, 8, & 12 weeks.

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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Figures

German Fat Mass

Gynoid Free Fat Mass

Android Body Fat

Android Fat Mass

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.

CC experienced significant differences in the following:

• Android-Fat Mass (g) (p<0.001)
  - C: 8±421
  - CC: 479±462
  - WW: 19±610
  - JC: 275±406
  - NS: 237±546

• Android-Body Fat (%) (p<0.04)
  - C: -5.3±1.6
  - CC: -2.9±3.6
  - WW: -0.7±2.6
  - JC: -1.6±2.4
  - 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: 490±831

• 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: 32±540

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

* Significant difference between Curves and other study groups (p<0.05).
108 women donated fasting blood samples, completed a carbohydrate intolerance questionnaire (CIQ), had body composition and health measures determined, and underwent a 75g, 2-h OGTT. Pearson product correlations were performed to determine correlations to the following: Body mass index (BMI), waist circumference, hip circumference, body fat %, fasting serum insulin levels, insulin sensitivity index, fasting glucose, area under the curve (AUC) resulting from an OGTT in determining insulin resistance and health.

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 general population.

Objective: 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/m²) with a 8-10 hr fasting 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.

Conclusions and Practical Applications

- These findings indicate that carbohydrate intolerance questionnaires correlate to the body mass index (BMI), body fat %, insulin sensitivity index, and area under the curve (AUC) 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

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Analysis of the validity of a carbohydrate intolerance questionnaire

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Dependent Variable Correlation Matrix

- 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).

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 general population.

Objective: 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.

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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.

Conclusions and Practical Applications

- These findings indicate that carbohydrate intolerance questionnaires correlate to the body mass index (BMI), body fat %, insulin sensitivity index, and area under the curve (AUC) 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

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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)

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 1wk prior to baseline testing.

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 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

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**Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).
108 women donated fasting blood samples, completed a carbohydrate intolerance questionnaire (CIQ), had body composition and health measures determined, and underwent a 75-g 2-h OGTT. Having food cravings revealed with CHO ingestion correlated with irritability (r=0.24), nervousness (r=0.32), 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=0.20), dizziness/shakiness (r=0.20), and increased waist:hip ratio (r=0.23). 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=0.24), leg cramps/blurred vision (r=0.23), lack of sex drive (r=0.20), and leg cramps/blurred vision (r=0.23). Gaining weight after age 30 correlated with glucose AUC (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=0.35).

**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=0.20), 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=0.24), leg cramps/blurred vision (r=0.23), lack of sex drive (r=0.20), and being overweight since youth (r=0.26).

**Conclusions**

• These findings indicate that food cravings revealed 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 25 lbs, 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.

**Dependent Variable Correlation Matrix**

<table>
<thead>
<tr>
<th>Age</th>
<th>CIQ</th>
<th>BMI</th>
<th>Blood glucose AUMC</th>
<th>DBP</th>
<th>Waist circumference</th>
<th>Fasting HOMA levels</th>
<th>Fat mass</th>
<th>Body fat %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>0.27</td>
<td>0.25</td>
<td>0.30</td>
<td>0.21</td>
<td>0.24</td>
<td>0.21</td>
<td>0.25</td>
<td>0.37</td>
</tr>
</tbody>
</table>

**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).

**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 75 million diabetics. 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±7 kg/m2) 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 FIN 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.

**Abstract**

**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.

**Results**

• 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=0.24), leg cramps/blurred vision (r=0.23), lack of sex drive (r=0.20), and being overweight since youth (r=0.26).

**Conclusions**

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 (GALMUC) resulting from an OGTT in determining insulin resistance. Furthermore, such a questionnaire enables health care practitioners associate changes in temperature, general well-being and digestive manifestations that individuals may experience from CHO ingestion, aspects that often are missed 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.

**Practical Application**

**Acknowledgements and Funding**

Supported by Curves International Inc., Waco, TX

www.ExerciseAndSportNutritionLab.com
Abstract
This study examined whether responses to a carbohydrate intolerance questionnaire (CIQ) could predict responses to an oral glucose tolerance test (OGTT). 108 women (31.6±13 yr, 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 75-g, 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=0.40), fasting insulin (r=0.34), HOMA (r=0.37), height (r=0.33), resting HR (r=0.29), BMC (r=0.34), BMD (r=0.34), BMI (r=0.34), FFM (r=0.34), 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)

Methods and Procedures

Rationale
Physical inactivity and poor nutritional health have led to a worldwide epidemic of obesity. Obesity in the US continues to rise to 78.4 million adults (35%) 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/m²) 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.
- 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 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=0.40), fasting AUC (r=0.40), insulin (r=0.34), HOMA (r=0.37), height (r=0.33), resting HR (r=0.29), BMI (r=0.34), BMD (r=0.34), BFF (r=0.34), FFM (r=0.34), 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

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Dependent Variable Correlation Matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>BMI</th>
<th>Body Fat</th>
<th>FFM</th>
<th>BMC</th>
<th>BMD</th>
<th>HR</th>
<th>Height</th>
<th>Glucose AUC</th>
<th>Fasting Insulin</th>
<th>HOMA</th>
<th>Resting HR</th>
<th>FFM</th>
<th>BMC</th>
<th>BMD</th>
<th>GAUC</th>
<th>Fasting Glucose</th>
<th>BIA Body Fat</th>
<th>Glucose AUC</th>
<th>HOMA</th>
<th>Glucose AUC</th>
<th>Height</th>
<th>Fasting Insulin</th>
</tr>
</thead>
</table>
| Dependent Variable Correlation Matrix

** Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).
Analyzing 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 Simco, C Seesselberg, B Bonin, S 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 (CIQ), 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=0.19), 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), having temporary food cravings (r=-0.23), and having a poor appetite/skipping meals (r=-0.43). Having few food cravings correlated with waist circumference (r=-0.20), mental confusion (r=0.23), 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=-0.27), hip (r=0.20), and BMI (r=-0.27), consumption of FFM (r=-0.22), body fat (r=-0.22), headaches (r=0.20), mental confusion (r=-0.58), leg cramps/blurred vision (r=-0.58), and yawning (r=-0.26).

Supported by Curves International Inc. (Waco, TX)

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 determined during the baseline testing session prior to administration of the 2-h 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=0.19), and skipping meals (r=0.20). Eating 3 times/d correlated with OGTT glucose AUC (r=-0.19), having temporary food cravings (r=-0.23), and having a poor appetite/skipping meals (r=-0.43). Having few food cravings correlated with waist circumference (r=-0.20), mental confusion (r=-0.58), leg cramps/blurred vision (r=-0.58), drowsiness (r=-0.19), and skipping meals (r=-0.43).

Conclusions

• The results of this study show that carbohydrate intolerance questionnaire correlates 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.

Dependent Variable Correlation Matrix

Cumulative Observed AUC (mg*hr/dL)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Age</th>
<th>BMI</th>
<th>Waist</th>
<th>Hip</th>
<th>Hip (%</th>
<th>FFM</th>
<th>Body Fat</th>
<th>Body Mass</th>
<th>DBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.19</td>
<td>0.27</td>
<td>0.20</td>
<td>0.19</td>
<td>-0.20</td>
<td>0.22</td>
<td>0.08</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>BMI</td>
<td>0.27</td>
<td>0.19</td>
<td>0.27</td>
<td>0.19</td>
<td>-0.20</td>
<td>0.22</td>
<td>0.08</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>Waist</td>
<td>0.20</td>
<td>0.20</td>
<td>0.27</td>
<td>0.20</td>
<td>-0.27</td>
<td>0.22</td>
<td>0.08</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>Hip</td>
<td>0.19</td>
<td>0.19</td>
<td>0.20</td>
<td>0.19</td>
<td>-0.20</td>
<td>0.22</td>
<td>0.08</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>Hip (%)</td>
<td>0.20</td>
<td>0.20</td>
<td>0.27</td>
<td>0.20</td>
<td>-0.27</td>
<td>0.22</td>
<td>0.08</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>FFM</td>
<td>0.27</td>
<td>0.19</td>
<td>0.27</td>
<td>0.27</td>
<td>-0.27</td>
<td>0.22</td>
<td>0.08</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>Body Fat</td>
<td>0.19</td>
<td>0.19</td>
<td>0.20</td>
<td>0.19</td>
<td>-0.20</td>
<td>0.22</td>
<td>0.08</td>
<td>0.20</td>
<td>0.19</td>
</tr>
</tbody>
</table>

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

Supported by Curves International Inc., Waco, TX

www.ExerciseAndSportNutritionLab.com
This study examined whether responses to a carbohydrate intolerance survey (CI) correlate to the homeostatic model assessment (HOMA). Subjects were recruited to participate in this study through flyers, newspaper ads, and radio advertisements. 108 women (31.6±13 yrs, 34.7±7% body fat, 25.3±4 kg/m²) donated fasting blood samples, completed a CI questionnaire of CI symptoms during an OGTT. Subjects were informed of experimental procedures and signed a consent statement in which blood glucose samples and perceptions of CI symptoms were obtained at 0, 30, 60, 90, and 120 minutes.

**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=0.39), 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.

**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.

**Experimental Design**

Subjects

- 108 women (31.6±13 yr, 34.7±7% body fat, 25.3±4 kg/m²) 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 immunoadsorbent (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. Self-reported 4-day dietary records were recorded 1-wk prior to baseline testing.
- 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=0.39), 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).
- **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).**