Richard B.
Kreider, PhD

Baylor University

## Curves Women's Health \& Fitness Initiative



Identify ways to optimize the health and well-being of women through various diet, exercise, and/or nutritional interventions

## Curves Women's Health \& Fitness Initiative



- Completed Studies
-Curves I
-Curves II
-Curves Extension (ongoing)
-Curves Biomechanics
-Curves Exercise Intensity
-Curves Metabolism
-Curves Calcium
-Curves Osteoarthritis
-Curves Seniors
-C-Fit for Kids


## Research Update



- Curves Combined
- Curves Extension
- Curves Special Populations
- Seniors

- Metabolic Syndrome
- Medically-Managed
- C-Kids II (High Risk)
- Curves Smart
- Ongoing/Planned Studies


## Curves Study Design




Control, EX Only, HCHO, MHP, VHP, HCD Diets

- At 0, 2, 10, 10.4, \& 14 W:
- Dietary Records (4-d)
- Psychometric Tests

Curves I

- Body Composition/Bone Density (DEXA)
- Total Body Water (BIA)
- Fasting Blood Samples (12h)
- Resting Energy Expenditure (REE)
- At 0, 10, \& 14 wks:
- Maximal Stress Test
- 1RM Bench Press
- $80 \%$ of 1 RM on Bench Press
- 1RM Leg Press
- $80 \%$ of $1 R M$ on Leg Press
- Hip \& waist measurement
- Resting HR \& BP
- Side effects were monitored by ar Curves RN on a weekly basis
Curves Calcium Curves OA


## Curves Combined



FASEB J. 2007 21:lb 225


More evidence that VHP diet promotes greater weight loss!



## Curves Combined


$78 \mathrm{kcal} / \mathrm{d}$
$548 \mathrm{kcal} / \mathrm{wk}$
0.67 lbs/mo
8.1 lbs/year!
$\mathrm{n}=424$
$p=0.001$
Resting Energy Expenditure


FASEB J. 2007 21:lb 226

## Curves Combined ( $n=467$ )

| Variable | Impact of Curves |
| :---: | :---: |
| Body Fat | $\downarrow(1.5-2 \%)$ |
| Waist \& Hip | $\downarrow$ (1-4\%) |
| Resting HR | $\downarrow(2.6 \%)$ |
| Resting SBP | $\downarrow(3.0 \%)$ |
| Resting DBP | $\downarrow$ (3.5\%) |
| 1 RM Bench Press | $\uparrow(5.1 \%)$ |
| 1 RM Leg Press | $\uparrow(13 \%)$ |
| BP Endurance | $\uparrow(21 \%)$ |
| LP Endurance | $\uparrow(36 \%)$ |
| Statistically significant time effects (p<0.05). | FASEB J. 2007 21:lb 227 \& 229 |

## Curves Combined

| Variable | Impact of Curves |
| :--- | :---: |
| Maximal Aerobic Capacity (n=467) | $\uparrow$ (8\%) |
| Total Cholesterol (n=335) | $\downarrow(3-6 \%)$ |
| Triglycerides (n=335) | $\downarrow(2-7 \%)$ |
| Glucose (n=335) | $\downarrow(1-3 \%)$ |
| Leptin (n=216) | $\downarrow$ (17-21\%) |
| Fasting Insulin (n=216) | $\downarrow(2-13 \%)$ |
| Insulin Sensitivity ( $n=216)$ | $\uparrow$ (9-23\%) |

## Curves Combined ( $n=287$ )

| Variable | Impact of Curves |
| :--- | :---: |
| Physical Functioning | $\uparrow(24-29 \%)$ |
| Social Functioning | $\uparrow$ (11\%) |
| Vitality | $\uparrow(23-26 \%)$ |
| Mental Health | $\uparrow(7-8 \%)$ |
| Appearance Evaluation | $\uparrow(19 \%)$ |
| Body Area Satisfaction | $\uparrow(14-15 \%)$ |
| Overweight Preoccupation | $\downarrow(36-18 \%)$ |
| Self-Classified Weight | Curie |

## Curves Combined

- Developing a very large data base
- Curves promotes weight loss and improves fitness and a wide variety of women (18-65)
- Weight loss achieved without loss of FFM or
 reduction in REE
- VHP diet most effective in promoting fat loss



## Curves Long-Term Study



- Rationale
- Most people lose weight on various diets but regain the weight within a year
- Methods
- All subjects completing Curves 14 wk studies are invited to participate in one-year extension
- Subjects asked to exercise 3 times a week and diet (2 days @ 1,200 kcals/day) only if they gain 3 lbs
- Testing @ 3, 6, 9, and 12 months


## Long-Term Results

Body Mass


Maintained majority of weight loss after 1 year!


## Long-Term Results




$$
\mathrm{n}=72
$$

Resting Heart Rate


## Long-Term Results

Waist Circumference


Hip Circumference


## Curves Extension

## Summary



- Women can maintain weight loss, fitness, and health gains by consistently training and intermittent dieting
- Weight loss continues for
 about 6 months and then begins to increase
- Additional 4-8 wk diet every 3-6 months may promote further weight loss and additional health gains


## What's New?



## Curves for Seniors

Rationale


- Lose muscle and gain fat as one ages (sarcopenia)
- Loss of muscle mass and strength increases risk to falls and fractures
- Resistance-exercise increases strength and muscle mass in elderly
- High protein diets spare loss of muscle mass during weight loss
- Hypothesized that elderly may benefit from following a high protein diet combined with resistance-training


## Curves for Seniors

- 53 Women:
$-65.7 \pm 5$ yrs $(60-75)$
$-63.4 \pm 2$ in
$-43.5 \pm 4$ \% BF
$-30.4 \pm 4 \mathrm{~kg} \cdot \mathrm{~m} 2 \mathrm{BMI}$
- Randomized into:

- Exercise Only
- Exercise + High CHO Diet (55\% C, 30\% F, 15\% P)
- Exercise + High Protein Diet (PI - 7\% C, 30\% F, 63\% P) (PII - 15\% C, 30\% F, 55\% P)


## Curves for Seniors

| 14 Weeks of Curves Training |  |  |
| :---: | :---: | :---: |
|  | Testing Intervals | $\downarrow$ |
| $\begin{gathered} 1 \mathrm{Wk} \\ 1,200 \mathrm{kcal} / \mathrm{d} \end{gathered}$ | $\begin{gathered} 9 \mathrm{Wk} \\ 1,600 \mathrm{kcal} / \mathrm{d} \end{gathered}$ | 4 Wk <br> 2,100 kcal/d |
| Exercise Only n=53 | HCHO or HP Diets <br> At $\mathbf{0}, \mathbf{1 0}, \& 14 \mathrm{~W}$ : <br> - Dietary Records (4-d) <br> - Psychometric Tests <br> - Body Composition/Bone Density (DEXA) <br> - Total Body Water (BIA) <br> - Hip \& waist measurement <br> - Resting HR \& BP <br> - Fasting Blood Samples (12h) <br> - Resting Energy Expenditure (REE) <br> - 6 Minute Walk Test <br> - Equitest Balance / Functional Testing | Intermittent <br> 2d @ 1,200 kcal/d <br> - At 0 \& 14 wks: <br> - Maximal Stress Test <br> - 1RM Bench Press <br> - $80 \%$ of 1RM on Bench Press <br> - 1RM Leg Press <br> - $80 \%$ of 1RM on Leg Press - Side effects were monitored by an RN on a weekly basis |

## Curves for Seniors



HP group lost more weight!
$\mathrm{n}=53 \quad$ Body Mass $\quad \mathrm{p}=\mathbf{0 . 0 0 1}$


## Curves for Seniors



HP group lost more fat!

$$
\mathbf{n}=53 \quad \text { Fat Mass } \quad \mathbf{p}=0.001
$$



Weeks

## Curves for Seniors



Weight Loss
with loss of FFM!

$\rightarrow-\mathrm{E}-\mathrm{HC} \quad \mathrm{HP}$

## Curves for Seniors



HP group lost more body fat!
 Curies

## Curves for Seniors

Resting Energy Expenditure


Resting Energy Expenditure


Curves for Seniors $(n=53)$

| Variable | Impact of Curves |
| :--- | :---: |
| Waist \& Hip | $\downarrow(2 \mathrm{~cm})$ |
| Resting HR | $\downarrow(2-3 \%)$ |
| Resting SBP | $\downarrow(4 \mathrm{mmHg}$ @ 10 wk$)$ |
| Resting DBP | $\downarrow(5 \mathrm{mmHg}$ @ 10 wk) |
| 1 RM Bench Press | $\uparrow(21 \%)$ |
| 1 RM Leg Press | $\uparrow(32 \%)$ |
| BP Endurance | $\uparrow(29 \%)$ |
| LP Endurance | $\uparrow(23 \%)$ |
| Maximal Oxygen Uptake | $\uparrow(12 \%)$ |
| 6 Minute Walk-Test | $\uparrow(6 \%)$ |

## Curves for Seniors

## Preliminary Findings



- Curves is an effective program for women age 60-75 yrs
- Weight loss achieved without loss of FFM
- HP diet is more effective in promoting fat loss
- Gains in strength, muscular endurance, and aerobic capacity were impressive


## Curves \& Metabolic Syndrome




## Clinical Identification of the Metabolic Syndrome*: NCEP-ATP III

*Diagnosis is established when $\geq 3$ of these risk factors are present

| Risk Factor | Defining Level |
| :---: | :---: |
| Abdominal obesity |  |
| (Waist circumference) |  |
| Men |  |
| Women |  |
| TG | $>102 \mathrm{~cm}(>40 \mathrm{in})$ |
| HDL-C | $>88 \mathrm{~cm}(>35 \mathrm{in})$ |
| Men |  |
| Women | $\geq 150 \mathrm{mg} / \mathrm{dL}$ |
| Blood pressure | $<40 \mathrm{mg} / \mathrm{dL}$ |
| Fasting glucose | $\geq 50 \mathrm{mg} / \mathrm{dL}$ |
| Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in |  |
| Adults. JAMA. 2001;285:2486-2497. |  |




## Curves Metabolic Syndrome

- 355 sedentary women
- 46 $\pm 11 \mathrm{yrs}$
$-163 \pm 7 \mathrm{~cm}$
- $92 \pm 16 \mathrm{~kg}$
- $45 \pm 4 \%$ body fat
- Assigned to:
- Control group (C)
- Exercise group (E)
- HCD group

- HC diet
- HP diet
- Participants followed the Curves diet and fitness program 3 days/wk.
- Participants were retrospectively divided into those with less than ( $\mathrm{n}=196$ ) or more than ( $\mathrm{n}=159$ ) 3 criteria for MS.


## Metabolic Syndrome Analysis

$\mathrm{n}=355, \mathrm{p}=0.046$
Fat Mass

$n=355, p=0.01$

## Systolic Blood Pressure



FASEB J. 2007 21:lb 235

## Curves Metabolic Syndrome



- 166 sedentary women ( $48 \pm 10$ yrs, $163 \pm 7 \mathrm{~cm} ; 96 \pm 17 \mathrm{~kg}$; $46 \pm 4 \%$ body fat) with MS were assigned to:
- Exercise group (E)
- High carbohydrate Diet (HC)
- High protein Diet (HP)
- Diets were $1,200 \mathrm{kcal} / \mathrm{d}$ for 1-2 wks and 1,600 kcal/d for 8-9 wks followed by a maintenance period (2,600 kcals/d).
- Subjects participated in the Curves fitness program 3days/wk.


## Metabolic Syndrome Analysis


$n=166, p=0.02$

Waist Circumference



## Metabolic Syndrome Analysis

## $\mathrm{n}=166, \mathrm{p}=0.07$ <br> Cholesterol <br> 

$n=166, p=0.01$
Triglycerides


## Curves Metabolic Syndrome



- Curves program can help women with MS improve health status
- Subjects with MS may experience greater benefits from following a HP diet with exercise


# Curves for Medical Special Populations 

Rationale


- Many individuals have medically managed conditions in which exercise and weight loss may provide therapeutic benefit
- The purpose of this study was to determine the effects of the Curves fitness and weight loss program in individuals with various controlled medical conditions


## Curves for Medical Special Populations

- Women with medically diagnosed / treated conditions were recruited
- Cohort (n=113) consisted of:
- Obesity (83\%)
- Diabetes Mellitus (17\%)
- Hypertension (46\%)
- Hyperlipidemia (31\%)
- Thyroid Conditions (26\%)
- Other (19\%)

- Many had more than one condition



## Curves for Medical Special Populations



Control, EX Only, HCHO, MHP, VHP, or HCD Diets
( $n=113$ )

- At 0, 2, 10, 10.4, \& 14 W:
- Dietary Records (4-d)
- Psychometric Tests
$50 \pm 10$ yrs $95.3 \pm 21 \mathrm{~kg}$ $64 \pm 3$ in
- Body Composition/Bone Density (DEXA)
- Total Body Water (BIA)
- Hip \& waist measurement
- Resting HR \& BP
- Fasting Blood Samples (12h)
- Resting Energy Expenditure (REE)
- At 0, 10, \& 14 wks:
- Maximal Stress Test
- 1RM Bench Press
- $80 \%$ of 1 RM on Bench Press
- 1RM Leg Press
- $80 \%$ of 1 RM on Leg Press
- Side effects were monitored by RN on a weekly basis


## Curves for Medical Special Populations

Preliminary Analysis


Weight loss tended to be greater in diet groups

$$
\begin{array}{ll}
\mathrm{n}=109 & \text { Body Mass } \\
& \mathrm{T}=0.001 \\
\mathrm{I}=0.08
\end{array}
$$



## Curves for Medical Special Populations

Preliminary Analysis


Fat loss in all groups!


Curves for Medical Special Populations
Preliminary Analysis


Resting Energy Expenditure


## Curves for Medical Special Populations Preliminary Analysis

| Variable | Impact of Curves |
| :--- | :---: |
| Resting HR | $\downarrow$ (3-4\%) |
| Resting SBP \& DBP | $\downarrow(2-6 \mathrm{mmHg})$ |
| 1 RM Bench Press | $\uparrow(12 \%)$ |
| 1 RM Leg Press | $\uparrow(12 \%)$ |
| BP Endurance | $\uparrow(14 \%)$ |
| LP Endurance | $\uparrow(17 \%)$ |
| Maximal Aerobic Capacity | $\uparrow(6 \%)$ |
| Total Cholesterol | $\downarrow(5-10 \%)$ |
| Triglycerides | $\downarrow(6-9 \%)$ |
| Glucose | $\downarrow(4-7 \%)$ |

# Curves for Medical Special Populations Preliminary Findings 



- Curves appears to be safe and effective for women with medically managed conditions

- Preliminary results show weight loss as well as improved markers of health and.m fitness


## Curves C-Fit

- Curves C-Fit Study examined effects of incorporating Curves as part of PE in 3 middle schools ( $\mathrm{n}=510$ )
- Program found program improvements in fitness, however, a high percentage of students were identified as "at risk"

95th Percentile BMI



## C-Fit II for At Risk Kids

| Testing Intervals | Summer |
| :---: | :---: |

$1,000,1200,1400$, or $1600 \mathrm{kcal} / \mathrm{d}$ based on REE

3 month Follow-Up

## Standard PE only / No Diet ( $\mathrm{n}=\mathbf{2 5 \text { ) }}$

Exercise, Diet, and Behavioral Modification ( $\mathrm{n}=25$ )

## At 0 and 10 weeks

Food Records (4-d)

- Height/weight
- Resting Energy Expenditure (REE)
- Body Composition/Bone Density (DEXA)
- Total Body Water (BIA)
- Hip \& waist measurement
- Resting HR \& BP
- Fasting Blood Samples (12h)
- Grip Strength
- Flexibility
- Push-up Endurance
- Curl-Up Endurance
- Walk/run test
- Pedometers
- Psychometric Tests
- Exit Interview

At 3 months

- Dietary Records (4-d)

Psychometric Tests
Heightweight



## C-Fit II for At-Risk Kids

| Intervention |  |
| :--- | :--- |
| Monday | Curves |
| Tuesday | Curves: |
| Wednesday | Aerobic Activity |
| Thursday | Curves. |
| Friday | Weight Check; Education; <br> Diet Assistance |

## C-Fit II for At-Risk Kids



- 43 Girls ( $6-8^{\text {th }}$ Grade)
- $12.7 \pm 1$ yrs (11-15)
- $61.7 \pm 3$ in
- $41.6 \pm 5$ \% BF
- $30.3 \pm 6 \mathrm{~kg} \cdot \mathrm{~m}^{2}$ BMI
- Randomized into:
- Control Group
- Regular PE
- No Diet Intervention
- Intervention Group
- Curves Fitness
- Diet ( 500 kcals below REE with 55\% C, 15\% P, 30\% F)
- Nutrition \& Fitness Education
- Behavioral Modification Techniques





## CurvesSmart



- Rationale
- The Curves Smart equipment provides feedback regarding maintenance of proper intensity during each repetition as well as provides a computerized progression as training adaptations occur.
- Theoretically, this should lead to greater training adaptations over time.


## CurvesSmart I



- 7 experience Curves trained women (min 6 wks)
- Familiarized to CurvesSmart
- Performed 1 RM testing
- On a separate day, subjects performed the CurvesSmart circuit with no visual feedback
- 3 days later, subjects repeated the CurvesSmart circuit with visual feedback
- Data collected on work output with and without feedback



## CurvesSmart I



## CurvesSmart II



- 86 sedentary women (as of 9/25/07)
- $38.4 \pm 8 \mathrm{yrs}$
$-163 \pm 8 \mathrm{~cm}$
$-93 \pm 20 \mathrm{~kg}$
- 43.6 $\pm 5 \%$ body fat
- Training Groups:
- Exercise with Feedback
- Exercise without Feedback
- Diet Groups:
- HC diet
- HP diet
- Participants followed the Curves weight loss and fitness program (3 days/wk).




## CurvesSmart II

Preliminary Findings
Fat Free Mass
Body Fat




## CurvesSmart - 7 Clubs



[^0]- Average energy expenditure from first 10 workouts from 1,031 clients at 7 different clubs:
$310 \pm 91$ kcals


## CurvesSmart - 7 Clubs



Caloric Expenditure

- CurvesSmart allows us to monitor results by:
- Member
- Club
- Region
- State
- Nation
- Will provide platform for the largest health and fitness outcome data base in the world!


## CurvesSmart

## Preliminary Findings

- Work output is $\sim 21 \%$ greater with visual feedback
- Some preliminary evidence of better fat loss and more impressive gains in strength
- No "upper end" to workout
- Personalized feedback, results, monitoring very well-received
- Provides platform to monitor health and fitness outcomes of women participating in Curves program world-wide


## Ongoing \& Planned Studies



- CurvesSmart (In progress)
- Curves "Fit" (In progress)
- Curves/General Mills (In progress)
- Curves "New Diet" with Calcium (In progress)
- Curves Web-Based Study (In progress)
- Curves Genetics (planned)



[^0]:    $n=1,031 ; 49.3 \pm 14 \mathrm{yrs} ; 174 \pm 40 \mathrm{lbs} ; 64.3 \pm 3 \mathrm{in}$

