Published in final edited form as:

J Acad Nutr Diet. 2012 May ; 112(5): 718–724. doi:10.1016/j.jand.2012.02.004.

Factors Associated with Weight Resilience in Obesogenic Environments in Female African-American Adolescents

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Abstract

This study used a descriptive, cross-sectional analysis to examine a social ecological model of obesity among African-American female adolescents residing in obesogenic environments. The goal was to identify factors that promote weight resilience, defined as maintaining a healthy body weight despite living in an environment that encourages inactivity and undermines healthy weight behaviors. During 2005 to 2008, weight-resilient ($n=32$) and obese ($n=35$) African-American female adolescents (12 to 17 years) living in Detroit, MI, and their caregivers completed measures of individual, family, and extrafamilial weight-resilience factors. Variables related to weight resilience in bivariate analyses were subjected to multivariate analysis using logistic regression to test the hypothesis that these factors independently predicted adolescent membership into the weight-resilient or obese group. As hypothesized, the odds of an adolescent being weight resilient were predicted by lower caregiver body mass index (calculated as kg/m^2) (odds ratio [OR]=0.790; 95% confidence interval [CI]: 0.642 to 0.973), lower caregiver distress (OR=0.796; 95% CI: 0.635 to 0.998), higher caregiver monitoring and supervision of exercise (OR=5.746; 95% CI: 1.435 to 23.004), more frequent full-service grocery store shopping (OR=5.147; 95% CI: 1.137 to 23.298), and more peer support for eating (OR=0.656; 95% CI: 0.445 to 0.969). Contrary to prediction, lower eating self-efficacy (OR=0.597; 95% CI: 0.369 to 0.965) also predicted weight resilience. The model correctly classified 92.5% of all cases. Findings suggest that increasing psychosocial weight-resilience factors across multiple systems might be an important intervention strategy for obese African-American female adolescents residing in obesogenic environments.

Keywords

Obesity; Adolescence; Minority; Weight resilience

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

Obesity in adolescence is linked to short-term (1) and severe long-term health complications (2,3). Despite recent national focus on obesity prevention and treatment (4), obesity prevalence rates among African-American females are as high as 27.7%, suggesting novel approaches are necessary to address this problem. One such novel approach is examining the relationship of the obesogenic environment on adolescent obesity using the framework of resilience.

The obesogenic environment is characterized by readily available, energy-dense foods and beverages combined with environmental factors that encourage inactivity and undermine healthy weight behaviors (5). The risk of living in an obesogenic environment is disproportionately greater among socially disadvantaged and/or minority populations (6,7). However, a large percentage of individuals who reside in obesogenic environments maintain a healthy body weight, or are weight resilient. Resilience is a dynamic process of achieving a positive adaptation (eg, maintaining a healthy body weight) despite exposure to considerable threat or severe adversity (eg, living in an obesogenic environment) (8).

The resilience approach, first developed by Garmezy (9) to understand the risk for development of serious mental health problems, provides a strength-based framework for understanding how some children succeed in risky contexts. The resilience framework has informed prevention interventions and social policies targeting vulnerable children and families (10). Resilience researchers identify the following major protective categories: individual's attributes, family qualities, and supportive extrafamilial systems (11). These protective factors mirror Davison and Birch's social ecological framework of pediatric obesity (12). Individual factors shown to be weight protective in female adolescents include eating and activity behaviors (12) and psychosocial factors such as self-efficacy for eating (13) and physical activity (14). Parent weight status is the strongest known family-level predictor of youth weight status (15). Parenting behaviors, such as monitoring youth eating and activity behaviors and supporting a healthy lifestyle, also directly influence youth weight-related practices and weight status (15). Depression is strongly related to weight status in adults (16) and parental depression is a childhood obesity risk factor (17,18). At the extrafamilial level, adolescents' dietary intake and physical activity are associated with those of their peers, as well as with environmental factors such as availability of healthy food and neighborhood resources for activity (19,20).

This study examines obesity among African-American female adolescents using a social ecological, resilience framework. The objective of this study was to compare weight-resilient African-American female adolescents and obese African-American female adolescents living in the same obesogenic environment to identify potentially modifiable individual, family, and extrafamilial factors promoting weight resilience. It was hypothesized that weight-resilient African-American female adolescents would report higher levels of individual, family, and extrafamilial protective factors than obese African-American female adolescents residing in similar neighborhoods and of similar socioeconomic background.

METHODS

This study used a descriptive, cross-sectional analysis design with two convenience samples of African-American youth residing in Detroit, MI. The primary outcome of the study was membership in the weight-resilient or obese group.

Participants

Obese African-American female adolescents (body mass index [BMI; calculated as kg/m^2] >95th percentile) were recruited from an adolescent medicine clinic located in a major urban children's hospital between October 2005 to November 2006. The initial contact with the family was made by a clinician in the clinic, who then referred families to the research team for a home-based weight-loss trial using multisystemic therapy (21). The baseline data, collected before intervention initiation, are examined in the present study for this group. A comparison sample of weight-resilient African-American female adolescents (BMI <75th percentile) was recruited from the same adolescent medicine clinic using the same protocol from May 2007 to March 2008. All participants met the following inclusion criteria: female; self-identified African-American; between 12 years, 0 months and 17 years, 11 months; living in the city of Detroit; and residing with a primary caregiver willing to participate in the study. Adolescents were excluded for serious mental health problems (such as psychosis), pregnancy, a chronic medical illness requiring ongoing specialty care, medications causing weight changes, and current participation in an organized weight-management program. Research protocols were approved by the Wayne State University Human Investigation Committee. Primary caregivers, the biological parent or legal guardian, provided informed consent and adolescents provided assent to participate. Families received \$50 for their participation. Lack of participation was primarily related to time constraints or disinterest in weight-loss treatment.

Measures

Individual Measures—To measure food intake, a registered dietitian administered a single-day Multiple Pass 24-Hour Food Recall (22) to adolescents eliciting information for the day before the date of data collection. Energy, macronutrients, and food-group servings were evaluated using the Food Processor Nutrient Analysis Program (version 10, 2008, ESHA, Salem, OR). Adolescents also completed the Fat and Fiber-Related Diet Behavior Questionnaire, a validated (23) 33-item self-report measure used in African-American adults (24). Adolescents rated the extent to which they engaged in dietary behaviors that reduced fat and increased fiber intake. This questionnaire used a 4-point scale (1=always, 4=never) with higher scores indicating high-fat, low-fiber intake in the past month. The Seven Day Physical Activity Recall (PAR) (25) was used to collect typical physical, sedentary, and sleep-activity patterns and has been validated with adolescents (26). Summary scores were calculated by totaling the number of minutes spent in physical (categorized by intensity level, ie, light, moderate, or vigorous), sedentary, and sleep activity.

Self-efficacy for food and activity choices was measured with the Eating Habits and Exercise Confidence Survey. This measure has been validated (27) and used with African-American adolescent samples (28). Eating habits were assessed with 20 items (including

sticking to healthier eating patterns and reducing calories) and exercise confidence with 12 items (including sticking to and making time for exercise). Participants rated each item using a 5-point scale from “I know I cannot” to “I know I can” with higher scores indicating higher self-efficacy.

Family Measures—Caregivers completed The Brief Symptom Inventory 18 (29), an abbreviated measure of psychological distress validated in people older than 18 years of age (30) and used with African-American adults (31). Higher scores on the Global Symptom Index indicate greater distress. Adolescents reported how often their family members engaged in supportive or nonsupportive behavior for healthy eating and exercise during the past 3 months on a 5-point Likert Scale ranging from “none” to “very often” using the Social Support for Eating Habits and Exercise Scale. This measure has been validated (32) and used with adolescents (33). The following subscale scores were used: family encouragement, participation, and discouragement and rewards. Adolescents and caregivers completed the Parental Monitoring of Weight Behaviors Scale, an investigator-developed instrument modeled after the validated Parental Monitoring of Diabetes Care Scale (34), which has been used in African-American adolescents and caregivers (35). Caregiver monitoring and supervision of adolescent eating (four items adolescent, five caregiver) and activity (two items adolescent, three caregiver) behavior was assessed using a 5-point Likert scale, where higher summary scores indicate increased caregiver monitoring and supervision.

Extrafamilial Measures—Adolescents reported how often their friends engaged in supportive or nonsupportive behavior for healthy eating and exercise during the past 3 months on a 5-point Likert Scale ranging from “none” to “very often” using the Social Support for Eating Habits and Exercise Scale (32). Two subscale scores, friend encouragement and participation, were used. Adolescents and caregivers completed an adapted version of the validated Chronic Illness Resources Survey (36) to assess use of community resources in weight management. This measure has been used in minority females (37). Adaptations for the present study included minor wording changes, for example, substituting “obesity” for “chronic illness,” and the addition of single items to assess the availability of neighborhood full-service grocery stores and convenience stores. Respondents used a 4-point scale ranging from “not at all” to “a great deal” to assess their use of extrafamilial neighborhood (six items) and community (six items) resources in management of weight and health during the past 3 months.

Statistical Analysis—Data were analyzed using the Predictive Analytics Software Statistics (version 18.0, 2010, PASW Statistics, Chicago, IL). Point biserial correlations (r_{pb} , the correlation coefficient used when one variable is dichotomous, eg, membership to weight-resilient or obese group, and the other is continuous, eg, BMI) were used to test the hypothesis that weight-resilient African-American female adolescents were more likely to report individual, family, and extrafamilial factors supportive of a healthy weight status than obese African-American female adolescents. A criterion of $P>0.05$ was used to identify the individual, family, and extrafamilial factors variables related to weight status. These variables were then subjected to multivariate analysis using logistic regression to test the

hypothesis that they independently predicted adolescent weight status. Before multivariate analysis, data were evaluated to ensure that the assumptions of logistic regression analysis (ie, multicollinearity, outliers) were met. One participant was missing the Seven Day PAR data, which represented 1.5% of the data for three of the predictor variables (PAR–Total, PAR–Sedentary, and PAR–Sleep). These data were estimated using the maximum likelihood estimation algorithm in the Missing Values Analysis module for PASW Statistics. Results with and without the missing data estimates were compared and found not to be different; thus, the analyses presented are those with the missing data estimated.

RESULTS

Group Differences in Individual, Family, and Extrafamilial Factors

There were no demographic differences between the weight-resilient and obese groups ($P>0.10$), including family income and caregiver education. Means, standard deviations, and point biserial correlations with group membership (where membership in the weight-resilient group was coded as 0 and membership in the obese group was coded as 1) are presented in Table 1. Two individual resilience protective factors were significantly related to membership in the weight-resilient group: higher fiber intake, $r_{pb}(65)=-0.281$; $P<0.05$, and higher fruit and vegetable intake, $r_{pb}(65)=0.242$; $P<0.05$. One individual factor, higher eating self-efficacy, $r_{pb}(65)=-0.284$; $P<0.05$, was related to membership in the obese group. Three family factors, lower parental BMI, $r_{pb}(65)=-0.491$; $P<0.001$, lower scores on the Global Symptom Index, $r_{pb}(65)=-0.328$; $P<0.01$, and greater knowledge of the adolescent's exercise as reported by adolescents, $r_{pb}(65)=0.297$; $P<0.05$, were related to membership in the weight-resilient group. Conversely, greater parental rewards and lower punishment for exercise, $r_{pb}(65)=-0.261$; $P<0.05$, was related to obese group membership. Two extrafamilial factors, higher levels of friend support for eating, $r_{pb}(65)=-0.375$; $P<0.01$, and a greater likelihood of shopping in a full-service grocery store (adolescent-report), $r_{pb}(65)=0.343$; $P<0.05$, were associated with weight-resilience membership.

Logistic Regression Analysis

Logistic regression using a single-step entry was conducted to determine which of the individual, family, and extrafamilial factors identified during the bivariate analyses were independently predictive of weight-resilience group membership. Results, presented in Table 2, indicated that the overall model was statistically reliable in distinguishing weight-resilient adolescents from obese adolescents ($-2 \text{ Log Likelihood}=26.01$; Nagelkerk $R^2=0.841$; Hosmer and Lemeshow Goodness-of-Fit (8)=4.31; $P=0.828$; $\chi^2(9)=66.73$; $P<0.001$). The model correctly classified 92.5% of all cases, 91.4% of the obese cases, and 93.8% of the weight-resilient cases. Wald statistics indicated that five of the seven factors associated with membership in the weight-resilient group in the bivariate analyses significantly predicted weight resilience in the multivariate analysis. The odds of an adolescent being weight resilient were predicted by lower caregiver BMI (OR=0.790; 95% CI: 0.642 to 0.973), lower caregiver distress (OR=0.796; 95% CI: 0.635 to 0.998), higher adolescent-reported caregiver monitoring and supervision of exercise (OR=5.746; 95% CI: 1.435 to 23.004), higher adolescent-reported shopping in a full-service grocery store (OR=5.147; 95% CI: 1.137 to 23.298), and more supportive peer behavior around eating

(OR=0.656; 95% CI: 0.445 to 0.969). In contrast, one of two factors associated with obese group membership in the bivariate analyses remained significant in the multivariate analyses. Higher eating self-efficacy (OR=0.597; 95% CI: 0.369 to 0.965) was a predictor of obese group membership. Post-hoc effect-size calculations (Cohen's $d=M_1-M_2/s_{pooled}$) were generated for each significant predictor. All were within the moderate to strong range, $d=0.577$ to 1.207).

DISCUSSION

This study was among the first to investigate a social ecological model of weight resilience (maintaining healthy weight in an obesogenic environment) in African-American females that included both energy and psychosocial factors. As expected, no demographic differences were found and the authors were able to explore factors associated with resilience in a demographically homogenous group at high risk for obesity. Weight status, in this sample, was influenced by factors at the individual, family, and extrafamilial levels.

Weight-resilient African-American female adolescents reported healthier individual energy factors. Specifically, lower-fat/higher-fiber and fruit and vegetable intake were associated with weight resilience, a finding consistent with other research associating an energy-dense, low-fiber, high-fat dietary pattern with increased weight fatness in childhood (38). However, these eating behaviors did not remain predictive of weight resilience in the multivariate model. In addition, no differences were found in the amount of physical activity reported by obese African-American female adolescents and weight-resilient African-American female adolescents. These findings suggest that energy balance alone does not explain weight resilience in African-American female youth living in an obesogenic environment and the psychosocial factors might be more relevant for distinguishing adolescents' risk for obesity.

Contrary to the hypothesis, higher self-efficacy for eating (ie, confidence in one's ability to eat in ways that control calories and fat) was linked to obesity. Previous research suggests that obese African-American female adolescents might be overconfident in their ability to eat in a healthy way. Nigg and colleagues (39) suggested that high confidence in the context of low motivation can be related to lower weight-management behaviors, as individuals overestimate their ability to change difficult behaviors. Consistent with this assertion, high self-efficacy for weight loss at treatment entry was detrimental for obese, low-income African-American women because of greater disappointment when participants were not immediately successful in losing weight (40). Understanding the interplay between self-efficacy and motivation toward behavior change can be an important consideration when designing treatment programs for the African-American female population and other high-risk groups.

As anticipated, several family factors were predictive of weight resilience. Weight-resilient African-American female adolescents were significantly more likely to have caregivers who maintained a healthier weight. Although genetics can partially explain this relationship (41,42), research has shown that overweight individuals are more likely to create obesogenic environments for themselves and their children (12). Caregivers of weight-resilient African-American female adolescents also reported fewer symptoms of psychological distress.

Depressed parents are not only more likely to be overweight themselves (16), but can also have more difficulty engaging in behaviors that support a healthy lifestyle with their children. Weight-resilient African-American female adolescents reported their caregivers provided more supervision and oversight of their physical activity. Such supervision likely leads to more accurate knowledge of youth's activity level, which, in turn, allows caregivers to promote activity when adolescents spend too much time in sedentary activities. Parental support for weight-loss behaviors in African-American adolescent females has been associated with weight loss (21,42,43). Together with the data from the present study, this research argues for promoting family support and involvement throughout adolescence, even as the adolescents make more independent decisions about eating and activity level.

Extrafamilial weight-resilience factors included both peer support for healthy behaviors and community resources related to healthy weight. Weight-resilient African-American female adolescents reported having friends with healthier eating (ie, less consumption of high-fat, high-calorie foods), which supports the importance of peers' eating habits (44,45). Community food resources were also shown to influence dietary patterns, a finding that is consistent with the broader obesity literature (46,47). Weight-resilient African-American female adolescents reported more frequently accessing full-service grocery stores, which generally provide better food availability than convenience stores (48). Given that both groups likely faced the same barriers to accessing full-service stores, understanding why the weight-resilient group sought out these stores might inform future research.

Several limitations warrant attention in future research. A single dietary recall might not accurately reflect intake, thus, future studies would benefit from 3-day nutrient intake and activity records or use of other more objective assessment methods, such as ecological momentary assessment and accelerometers. The measure of parental monitoring used in the present study was investigator developed, so psychometric testing with a representative sample of adolescents is warranted. There is a lack of validated measures for African-American adolescent weight behaviors; research is needed to develop new measures or assess the performance of existing measures with African-American adolescents. In addition, the inclusion of males in future studies would be important in determining whether the same factors are related to weight resilience for males. Finally, recruiting from the general population of obese adolescents (compared to those from an intervention trial) is necessary to confirm these findings.

CONCLUSIONS

The study of weight resilience in adolescents is a novel approach to identifying which social ecological factors should be promoted when developing obesity treatment for high-risk youth. Although energy behaviors initially differentiated weight-resilient from obese youth, psychosocial risk factors across individual, family, and extrafamilial systems were more predictive of weight status in multivariate analysis. Findings suggest that future obesity prevention research focusing on protective psychosocial factors can be as important as interventions addressing healthy eating and activity levels alone. Practical implications of this study reinforce the value of assessing psychosocial factors across multiple domains as well as involving family and peers in individualized obesity treatment. The framework of

weight resilience supports the expansion of the registered dietitian's role on the multidisciplinary obesity treatment team to include the assessment of psychosocial factors as well as nutrition.

Acknowledgments

The authors would like to thank the adolescent medicine clinic staff at Children's Hospital of Michigan for their assistance in the recruitment process and the families for their participation. We gratefully acknowledge Karen Kolmodin MacDonnell, PhD, and Yulyu Yeh, MS, for their time and professionalism.

FUNDING/SUPPORT

This research project was funded by the American Diabetes Association and Blue Cross Blue Shield of Michigan.

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Table 1

Individual, family, and extrafamilial factors descriptive statistics and point-biserial correlations (*r*) with group membership in obese and weight-resilient African-American female adolescents (n=67)

	Mean	Standard deviation	<i>r</i>
Individual factors			
Fiber intake	32.36	5.09	−0.281 *
Fruit and vegetable intake	1.29	1.44	0.242 *
Eating confidence	15.19	2.98	−0.284 *
Total kilocalories	2,697	1,011	0.034
Total activity ^{ab}	6.33	4.14	−0.096
Sedentary activity ^{ab}	26.32	13.19	−0.081
Sleep ^{ab}	65.00	8.68	0.143
Family factors			
Caregiver BMI ^c	34.11	9.27	−0.491 ***
Caregiver distress symptoms	8.07	7.59	−0.328 **
Family encouragement for eating	16.36	4.34	−0.114
Family discouragement for eating	11.21	4.63	−0.115
Family participation in exercise	25.34	9.37	−0.074
Family rewards and punishment for exercise	10.18	2.74	−0.261 *
Number of support persons	3.33	2.12	−0.220 +
Caregiver knowledge of adolescent's eating A ^d	4.43	0.86	−0.065
Caregiver knowledge of adolescent's eating CG ^e	4.21	1.24	0.204 +
Caregiver knowledge of adolescent's exercise A	2.22	1.30	0.297 *
Caregiver knowledge of adolescent's exercise CG	4.82	0.57	0.195
Extrafamilial factors			
Friend encouragement for eating	10.25	5.75	−0.147
Friend discouragement for eating	8.91	4.91	−0.375 **
Friend participation in exercise	17.72	9.23	0.085
Neighborhood resources A	15.10	4.93	0.126
Neighborhood resources CG	13.01	3.77	−0.076
Community resources A	15.86	4.21	0.097
Community resources CG	14.44	4.91	−0.148
Grocery store A	4.13	0.85	0.343 **
Convenience store A	2.92	1.49	−0.154
Grocery store CG	4.33	0.97	0.231 +
Convenience store CG	4.09	1.20	−0.097

^a Hours/week.

^b n=66.

^c BMI=body mass index; calculated as kg/m².

^d A=adolescent report.

^e CG=caregiver report.

⁺ $P < 0.10$.

^{*} $P < 0.05$.

^{**} $P < 0.01$.

^{***} $P < 0.001$.

Table 2

Logistic regression model summary of the individual, family, and extrafamilial factors associated with weight resilience in African-American female adolescents (n=67)

Coefficient summary	B	Wald	df ^a	P value	Odds ratio	95% Confidence interval	Effect size (Cohen's d) ^b
Individual factors							
Fruit and vegetable intake	0.671	2.843	1	0.092	1.957	0.897–4.270	
Fiber intake	-0.157	1.597	1	0.206	0.855	0.670–1.090	
Eating confidence	-0.516	4.431	1	0.035	0.597	0.369–0.965	0.577
Family factors							
Caregiver BMI ^c	-0.235	4.913	1	0.027	0.790	0.642–0.973	1.207
Caregiver knowledge of adolescent exercise A ^d	1.748	6.103	1	0.013	5.746	1.435–23.004	0.616
Caregiver distress symptoms	-0.228	3.904	1	0.048	0.796	0.635–0.998	0.719
Family rewards and punishment for exercise	-0.607	3.490	1	0.062	0.545	0.288–1.030	
Extrafamilial factors							
Friend discouragement for unhealthy eating	-0.421	4.489	1	0.035	0.656	0.445–0.969	0.831
Full-service grocery store shopping A	1.638	4.523	1	0.033	5.147	1.137–23.298	0.727
Constant	24.468						

^a df=degrees of freedom.

^b Calculated for significant predictors.

^c BMI=body mass index; calculated as kg/m².

^d A=adolescent report.