J. Racial and Ethnic Health Disparities (2015) 2:358–364
DOI 10.1007/s40615-014-0081-8

Teacher and Friend Social Support: Association with Body Weight in African-American Adolescent Females

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Received: 4 November 2014 / Revised: 12 December 2014 / Accepted: 19 December 2014 / Published online: 17 January 2015

Abstract The purpose of this study was to examine the direct and indirect ecological influences of teacher and friend social support on body weight and diet behaviors in African-American adolescent females. Using a quantitative, cross-sectional research design, a convenience sample of 182 urban African-American adolescent females (12–17 years old) completed a 39-item questionnaire. The questionnaire assessed perceived teacher social support, friend social support, nutrition self-efficacy, and diet behaviors (with internal reliability values of scale items: alpha=0.74, 0.81, 0.77, and 0.69 respectively). Anthropometric assessments were conducted to measure height and weight to compute BMI. Majority of the participants were in middle or early high school (65 %) and were overweight or obese (57.7 %). Both teacher social support and friend social support demonstrated a positive, indirect influence on child weight status through nutrition self-efficacy and diet behaviors following two different and specific paths of influence. Diet behaviors, in turn, demonstrated a positive, direct effect on child weight status. In the structural model, teacher social support had the greatest effect on diet behaviors, demonstrating a direct, positive influence on diet behaviors (B=0.421, p<0.05), but its direct effect on nutrition self-efficacy was not significant. Friend social support demonstrated a positive, direct effect on nutrition self-efficacy (B=0.227, p<0.05), but its direct effect on diet behaviors was not statistically significant. The study's findings call for actively addressing the childhood obesity epidemic in the school environment by implementing health behavior change strategies at various social and ecological environmental levels.

Keywords Body weight · School Health · Social Support · Obesity · Adolescent Females · African-American

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Introduction

Childhood overweight and obesity have acquired the proportions of a global epidemic. In the USA, the prevalence of childhood obesity has doubled in the past three decades. Almost one in five US children and adolescents are obese [1]. Childhood overweight and obesity create a synergistic chain reaction of adverse physical, psychological, and economic consequences, resulting in shortened life span, decreased overall quality of life, and increased health-care cost [2, 3]. In addition to the growing prevalence of childhood overweight and obesity in the USA, significant racial and ethnic disparities continue to exist, with African-American adolescent females having the highest rates of obesity compared to adolescents of other racial/ethnic backgrounds [1–4]. Although evidence exists regarding the significant increases in the prevalence of overweight and obesity among African-

American females and adolescents, the search to identify specific causal mechanisms continues.

Research studies continue to shed light on factors associated with the childhood overweight and obesity epidemic, with specific attention to ecological influences such as individual, social, and environmental influences [5]. Examining the influences of ecological factors on child weight may hold the answer to impede the exponential increases in childhood overweight and obesity prevalence rates. For example, Story et al. posit that the food and eating environments have a greater influence on the increasing obesity epidemic than individual factors [6]. Story's model is rooted within McLeroy's ecological perspective, which delineated multiple levels of influence on health behavior [7]. The model specifically examines individual and social-environmental factors to elucidate associative paths of influence [6, 7].

Individual level factors examine diet behaviors and nutrition self-efficacy, while the social-environmental factors examine social support and influence. Diet behaviors provide information on energy intake while perceived self-efficacy refers to a self-report of the youth's internal level of confidence as it relates to eating healthy and overcoming barriers to eating healthy [8, 9]. In contrast, social support examines the influence of others in the surrounding environment on an individual's behaviors (e.g., teacher support, peer influence, and parental involvement). Previous studies report direct associative relationships with different types of social support and diet behaviors [9–12]. As adolescents spend a considerable amount of their waking time in schools, peers and teachers have considerable influence on youth behavior. However, the influence of friends and teachers is not well explored in relation to body weight and dietary choices. Teacher and friend social support refers to a self-report of assistance received from either teachers or friends that aid the youth in engaging in healthy eating behaviors [10–12].

Little has been done to understand the psychosocial and ecological correlates of childhood obesity specifically taking into account racial and ethnic differences. Also, current literature voids related to indirect associations between social and individual level ecological factors and obesity in racial/ethnic minority youth provide a fertile area of exploration. Thus, the purpose of this study was to examine the direct and indirect ecological influences on child weight status in urban, African-American adolescent females by testing a hypothesized model to examine associative paths of influence between child weight status, diet behaviors, nutrition self-efficacy, and teacher and friend social support. Specifically, we pursued the following two research questions: (1) Does teacher social support have an influence on child weight through nutrition self-efficacy and diet behaviors? (2) Does friend social support have an influence on child weight through nutrition self-efficacy and diet behaviors?

Methods

Study Design and Participants

The study used a quantitative, non-experimental, multivariate cross-sectional research design. A survey called "Youth Diet and Behaviors Questionnaire (YDBQ)" was used to examine the influences of ecological factors on child weight in African-American adolescent females. A convenience sample of 214 African-American adolescent females was used for the study. Participants were recruited from school and community-based sites. Trained student research assistants facilitated a multiphase data collection process, which involved questionnaire administration and anthropometric data collection. Anthropometric data collection involved recording the height and weight data from each participant. The study received full approval by the University of Florida Institutional Review Board (IRB) and the Duval County Public School's (DCPS) Office of Research, Assessment, and Evaluation.

Instruments, Measures, and Variables

The YDBQ is a 39-item questionnaire that combines previously validated diet behavior, nutrition self-efficacy, and nutrition social support scales [13, 14]. The questionnaire's associated answer sheet included a section to collect anthropometric data; specifically height, weight, age, BMI, and BMI percentile. Child weight status was measured using the CDC BMI-for-age growth charts for girls to obtain a percentile ranking [15]. BMI-for-age percentiles were calculated using height, weight, and age data to identify child weight classification. Diet behavior, nutrition self-efficacy, and teacher and friend social support were examined as independent variables, while child weight status served as the dependent variable.

The first nine questionnaire items assessed *diet behaviors* using a healthy-item nutrition behavior scale wherein participants were asked about the type and number of times specific foods were eaten the previous day. Participants were asked to select the answer that best describes how many times they ate a specified food on the previous day, with responses ranging from none to three or more times. The next 15 questionnaire items assessed *nutrition self-efficacy*. The 15-item scale asks participants questions on their ability to select and eat different types of food, using a three-point Likert scale from 1 (not sure) to 3 (very sure). The final 10 questionnaire items assessed *social support* by dividing the 10 items into two subscales for teacher and friend social support. Each subscale contained five-item scales that ask participants what they believe teachers and friends wanted them to eat, using a three-point Likert scale from 1 (never or almost never) to 3 (always or almost always) on each respective subscale. The survey's readability and content validity was confirmed by a panel of experts (n=15 cooperative extension nutrition professionals,

survey research, and school health experts located throughout the USA).

Data Analysis

Structural equation modeling (SEM) was used to model the complex relationships among the variables of interest. Sample size was driven by the SEM analyses, which uses a ratio of the number of participants to the number of model parameters to be estimated. The sample size for this study was based upon the study's initial model, which consisted of a total of nine parameters and applied a 20:1 ratio, and called for a minimum number of 180 participants. The final study sample size (n= 182) slightly exceeded the required minimum sample size [16].

Mplus5.2® was used to generate measurement and structural models for SEM to examine associative paths of influence between the independent and dependent variables [17]. The analyses proceeded through two model development phases: (1) measurement and (2) structural models. The first analyses consisted of measurement model development to control for the observed error variance. The scale reliability analysis guided measurement model development to form latent variables for use in the final structural model. A scale reliability analysis was conducted to assess the internal consistency reliability of the study's sample data and measures (diet behaviors, nutrition self-efficacy, and the social supports subscales), with acceptable values at and above 0.70 [18]. Path analyses were used to form measurement models for diet behaviors and nutrition self-efficacy using their respective scale items as indicator manifest variables and were subsequently used in the structural model as latent variables. The maximum likelihood (ML) estimation method was used to estimate model parameters as close as possible to the study data for both measurement models [19].

The second analyses consisted of developing the structural model to test the latent and manifest variables' associative paths of influence on child weight status. The model specifications included the latent variables created for diet behaviors and nutrition self-efficacy and the manifest variables of teacher and friend social support. Four paths of influence were hypothesized and tested to answer the study's research questions. Direct path effects were estimated using the maximum likelihood (ML) estimation method, whereas total indirect effects were calculated as the sum of the path coefficients between specific independent variables and intermediate variables and the intermediate variables and the outcome variable [20].

Path coefficients were assessed for statistical significance at $p<0.05$. Modifications were made based on the model modification index (M.I.) and expected parameter change index (E.P.C.). Five goodness-of-fit indices were examined to assess the fit between the measurement models and the study data: the chi-square statistic, comparative fit index (CFI), Tucker-Lewis fit index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) [16, 21, 22].

Results

Sample Characteristics

Out of the 214 participants who consented, 182 took part in the study; 31 were not available and one participant refused at data collection. All participants were African-American female adolescents, ages 12 to 17 years old, with a median age of 14 years. The highest participation was among 12-year-olds, comprising slightly under one third (30.8 %) of the of participant population. More than half (65 %) of the participants were in middle or early high school (ninth grade). Majority of the participants had an unhealthy weight status based on BMI-for-age. More than half of the study participants (57.7 %) were classified as either overweight or obese, with more than a third (33 %) classified as obese (Table 1).

Scale Reliability Analysis

Cronbach α values were estimated for study subscales to ensure acceptable internal reliability. The analysis found acceptable α values for diet behaviors (α=0.69), self-efficacy measure (α=0.77), teacher social support (α=0.74), and friend social support (α=0.81) subscale measures.

Table 1 Age, study setting, and weight status of study participants

Characteristic	Number	Percent
Age		
12	55	30.2
13	31	17.0
14	32	17.6
15	19	10.4
16	17	9.3
17	28	15.4
Study setting		
Community-based	42	23.1
School-based	140	76.9
Weight status		
Underweight	0	0
Healthy weight	77	42.3
Overweight	45	24.7
Obese	60	33.0

Underweight=less than the fifth percentile; healthy weight=fifth percentile, less than 85th percentile; overweight=85th–95th percentile; obese=95th percentile or greater

Measurement Models

Diet Behaviors

The results of the diet behaviors measurement model yielded a non-significant chi-square statistic (χ^2=28.511, p<0.197) and desirable fit indices (CFI=0.932, TLI=0.894, RMSEA=0.036, and SRMR=0.047). Path coefficients (β) and fit statistics for the diet behaviors measurement model also yielded desirable values. Nearly all path coefficients were statistically significant at p<0.05, with items on fruit juice and fruit (β=0.499, p<0.05), vegetables (β=0.440, p<0.05), and (fruit β=0.406, p<0.05) serving as the strongest measures of diet behaviors.

Nutrition Self-Efficacy

The results of the nutrition self-efficacy measurement model yielded a significant chi-square statistic (χ^2=137.494; p<0.0006). However, the fit indices were acceptable (CFI=0.867, TLI=0.841, RMSEA=0.056, and SRMR=0.061). Path coefficients (β) and fit statistics for the nutrition self-efficacy measurement model yielded acceptable values. All path coefficients for the scale items were statistically significant (p<0.05). The strongest measure of nutrition self-efficacy were scale items vegetables at dinner (β=0.547, p<0.05) and selecting a grilled chicken sandwich vs. hamburger (β=0.545, p<0.05). Fit statistics' for the final measurement and structural models are listed in Table 2.

Structural Model

Fit indices for the structural model suggest a marginal data fit. Fit statistics were less than desirable, as evidenced by a statistically significant chi-square (χ^2=406.494; p<0.0002). However, fit indices were acceptable (CFI=0.831, TLI=0.810, RMSEA=0.041, and SRMR=0.067). Although the fit of the structural model was not ideal, it was maintained as the structural model for the analysis as the model provided the best fit possible with the data.

Table 2 Fit indices for final measurement and structural models

Model	χ^2	*df*	CFI	TLI	RMSEA	SRMR
Measurement						
Diet behaviors	28.511	23	0.932	0.894	0.036	0.047
Nutrition self-efficacy	137.494	88	0.867	0.841	0.056	0.061
Structural	406.936	312	0.831	0.810	0.041	0.067

χ^2 chi-square statistics, *df* degrees of freedom, *CFI* comparative fit index, *TLI* Tucker-Lewis fit index, *RMSEA* root mean square error of approximation, *SRMR* standardized root mean square residual

Statistically significant correlations between manifest indicator variables of latent variables and model manifest variables were observed (Table 3). Correlations ranged from −0.005 to 0.510. Many of the correlations were statistically significant at p<0.05. BMI marginally correlated with several of the diet behaviors items, with the highest correlations demonstrated with milk (r=0.214, p<0.01), cereals (r=0.156, p<0.01), fruit (r=0.212, p<0.01) and fruit juice (r=0.203, p<0.01), and teacher social support (r=0.162, p<0.05).

The structural model suggests that teacher social support had the greatest effect on diet behaviors, demonstrating a direct, positive influence on diet behaviors (β=0.421, p<0.05), However, its direct effect on nutrition self-efficacy was not statistically significant (Fig. 1). Friend social support demonstrated a positive, direct effect on nutrition self-efficacy (β=

Table 3 Correlations matrix for the latent and manifest variables (structural model)

	BMI	TSS	FSS
Diet behaviors			
Cheese	0.026	0.126*	0.052
Milk	0.214**	0.166**	0.150**
Cottage cheese/yogurt	0.084	0.188*	0.132*
Rice/pasta	0.040	0.138*	0.171**
Processed grains	−0.072	0.192**	0.082
Cereals	0.156**	0.145**	0.137*
Vegetables	0.021	0.119*	0.164**
Fruit	0.212**	0.216**	0.032
Fruit juice	0.203**	0.272**	0.203**
Nutrition self-efficacy			
Whole grain/low sugar cereal	0.096	0.151**	0.096
Fruit as a snack	−0.037	−0.026	0.012
Baked potato	0.050	0.134*	0.028
Popcorn no butter	0.028	0.095	0.081
Grilled chicken vs. hamburger	0.013	0.030	0.048
Fruit vs. candy	−0.023	0.062	0.138*
Grilled vs. fried fish	0.033	−0.033	0.111*
Whole vs. white bread	0.089	0.181**	0.103
Water vs. fruit drink	0.035	0.012	0.052
Milk vs. soda	0.070	0.193**	0.204**
Scoops of ice cream	0.006	0.198**	0.203**
Daily breakfast	−0.051	0.141*	0.243**
Vegetables at dinner	−0.074	−0.025	0.144
Order salad at restaurant	−0.003	0.005	0.151**
Ask for whole grain bread	−0.025	0.002	0.080
BMI	–	0.162*	0.042
TSS	0.162*	–	0.510**
FSS	0.042	0.510**	–

BMI body mass index, *TSS* teacher social support, *FSS* friend social support

*p<0.10; **p<0.05

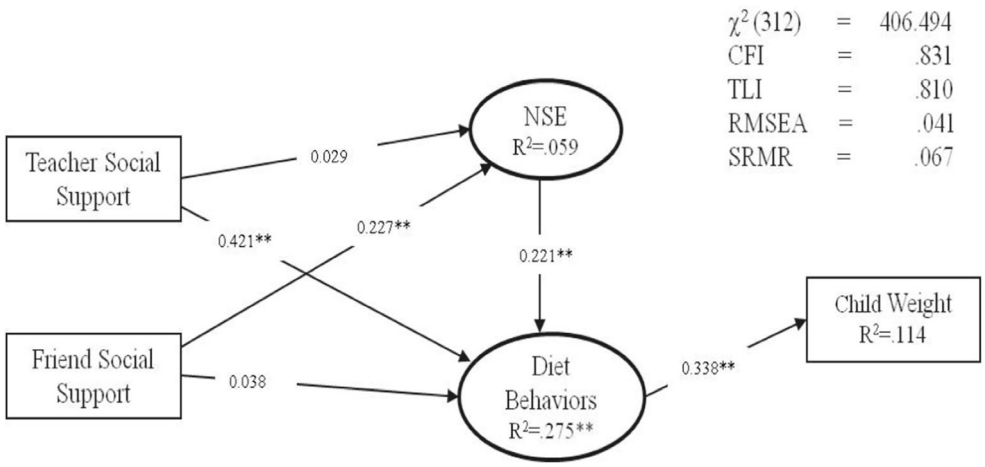

Fig. 1 Standardized path coefficients for the final structural model

0.227, $p<0.05$), but its direct effect on diet behaviors was not statistically significant. Nutrition self-efficacy demonstrated a direct, positive effect on diet behaviors ($\beta=0.221$, $p<0.05$), with 6 % of its variance explained by friend social support. Diet behaviors demonstrated a positive, direct effect on child weight ($\beta=0.338$, $p<0.05$), with 28 % of its variance explained by nutrition self-efficacy and teacher social support and accounting for 11 % of the variance in child weight status.

The results of the path analysis indicate that both teacher social support and friend social support demonstrate positive, indirect influence on child weight status through nutrition self-efficacy and diet behaviors following two different and specific paths of influence. Diet behaviors, in turn, demonstrate a positive, direct effect on child weight status. Friend social support demonstrated a positive, total indirect effect ($\beta=0.016$; $p<0.05$) on child weight through nutrition self-efficacy ($\beta=0.227$; $p<0.05$) and diet behaviors ($\beta=0.221$; $p<0.05$). Teacher social support also demonstrated a positive, indirect effect on child weight status, but through diet behaviors only ($\beta=0.142$; $p<0.05$). Diet behaviors demonstrated a positive, direct effect on child weight status ($\beta=0.338$; $p<0.05$).

Discussion

This study examined ecological influences on weight status in African-American adolescent females, specifically peer and teacher social support. Friend social support directly influences the nutrition self-efficacy of African-American adolescent females. Nutrition self-efficacy, in turn, directly influences diet behaviors, and diet behaviors directly influence weight status. This finding suggests indirect associative influences between friend social support and child weight status through nutrition self-efficacy and diet behaviors, respectively. The direct influence of friend social support on nutrition self-efficacy indicates significant peer influence in a social network. Adolescent peers tend to spend extensive amounts of time together engaged in recreation and socialization activities that often involve eating [9, 23].

Teacher social support demonstrated a positive, indirect effect on child weight status through diet behaviors only. Diet behaviors demonstrated a positive, direct effect on weight status. This finding suggests an indirect associative influence between teacher social support and child weight status through diet behaviors. As children spend a significant portion of the day in school, teachers are afforded a unique opportunity to help influence diet behaviors in a variety of methods like modeling, policy implementation, and formal curriculum [3, 24]. Unfortunately, current laws and policies in the USA do not readily provide many opportunities to influence children's health behaviors during the school day as evidenced by a reduction in mandatory health and physical education requirements and funding [24, 25]. Further research is needed in this area to determine how specific types of teacher social support can indirectly support diet behaviors and child weight with hopes to influence state health and physical education standards and associated funding.

The literature offers some support for our findings, with previous studies reporting direct associative relationships with different types of social support, nutrition self-efficacy, and diet behaviors. Granner and colleagues found self-efficacy to have the highest association with diet behaviors and further suggested that diet behaviors among African-American adolescents is predicted more by social influences than availability [10]. This partially supports findings of the current study, in regard to a relationship between adolescent self-efficacy and their diet behaviors. The differences between previous studies and this investigation may be attributed to gender and race differences, as the current study specifically examined African-American adolescent females. Findings from Granner and associates support our results only in the context of African-American adolescents, making no distinction among gender [10].

Stanton and colleagues found race-specific associations between diet behaviors and social support subscales with African-American adolescents reporting higher perceived friend social support related to diet behaviors [11]. Similar findings were also found by Cutler and associates confirming a positive association between peer social support and fruit, vegetable, and starchy food diet behaviors [12]. In another study from Australia, de La Haye et al. reported significant peer influence on adolescents' sweet food and fast food consumption [26]. Similarly, in a recent study from Minnesota by Bruening et al., significant associations were found between adolescents and their friends with regard to sugar-sweetened beverage/diet soda intake and fast food restaurant visits [27]. These studies provide substantial support for our investigation. Our findings differ from studies by Finnerty et al. and Coppinger et al. that reported significant association between peer influence and physical activity, but no association between peer influence and dietary behaviors [28, 29]. However, the studies by Finnerty et al. and Coppinger et al. were conducted in the UK and make no mention of examining gender and race differences [28, 29]. Our study is unique because it specifically examined African-American adolescent female population and peer and teacher influence on specific diet components and self-efficacy.

Limitations

The results of the study have to be viewed in light of potential limitations. The study used an adaptation of Story et al.'s ecological framework examining only two of the four environmental levels of influence on diet [6]. The structural model, although based on substantive theory and prior research, does not consider other factors of influence, such as physical and policy environmental factors. Study limitations include the use of food frequency questionnaires (FFQ) because of the inconsistent performance of this type of measure in validation studies and the tendency to introduce social desirability bias. Although cited in the literature as the most common tool used to assess diet behaviors, FFQ often yielded mixed findings in validation studies and offers a greater potential for social desirability bias, which could significantly obscure the measurement of the variable of interest [30]. However, the FFQ was used in the current study as it was a cost-effective method of data collection and imposed minimal burden on the respondent.

Implications

We found that teacher and friend social support influence childhood weight status in African-American adolescent females. These findings provide practice and research opportunities for strategies to increase nutrition self-efficacy among adolescents in an effort to improve diet behaviors and impact weight status. Practitioners should find ways to enhance positive role modeling and education by school teachers on healthy diet [31, 32]. This may involve periodic assessment of children's dietary behaviors, training teachers, and specific policy mandates to encourage healthy eating [9, 25]. Specifically, there should be support from administration and parents for teachers to implement health promotion programs when faced with the pressures of meeting state and national mandates tied to funding and employment. Schools can serve as critical venues for prevention and education regarding healthy diet and body weight management [3]. Arecent study of students, parents, and teachers reported that adolescents had preference for healthy foods, but faced significant barriers to eating healthy and also blamed situational factors. In the same study, parents reportedly blamed children and teachers blamed parents for unhealthy diet in children [24]. Such perceptions will hamper prevention efforts. Parents and school personnel can instead use a collaborative approach to directly influence adolescents' diet. In addition, they can also explore social networks of teenagers to identify areas of intervention and to indirectly influence dietary behaviors of children [5, 24, 31].

Keeping in view peer influence (friend social support) on children's diet and weight status, practitioners should employ strategies to educate children on healthy diet within the context of children's social networks. A social network approach is well within the social ecological model for childhood obesity prevention. Adolescent peer networks exist and operate within the broader social contexts that influence individual behavior, behavior change, and interpersonal relations that may act as mediators [26, 31]. This may require utilization of school-based programs and avenues to implement health interventions, communicate and educate children on healthy behaviors, and reinforce environmental change. Also, a cooperative approach that involves parents and peers may be effective in such situations [5, 31]. Opportunities should also be explored to develop youth interventions that capitalize on mobile technology and social networking. It has been suggested that such interventions could have a social "multiplier" effect where health impact could spread via social diffusion, just like the influence of peers on adolescents' diet [32].

Finally, special interventions may have to be designed keeping in view the unique characteristics of our study population (i.e., African-American and adolescent females). From adolescence to adulthood, African-American females face several challenges to eating healthy, engaging in adequate exercise, and maintaining health body weight. In all of these health behaviors, there is a greater potential role of modifying social support and implementing community-based interventions for African-American females across life span [10, 11, 33].

The findings of this study are also pertinent from the perspective of future research. The present study draws attention to the clear distinction among specific social relationships within the social-environmental context while understanding children's dietary behavior. The findings suggest that a solution to the increasing childhood obesity epidemic may be found through further delineation of social relationships within the context of social support. These highly specific social support systems may very well extend beyond common relationships, thus resulting in a potential area of future research.

Acknowledgments This work supported in part by the NIH/NCATS Clinical and Translational Science Award to the University of Florida UL1 TR000064.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

Conflict of Interest Authors Stanford, Khubchandani, Webb, Lee, Doldren, and Rathore declare that they have no conflict of interest.

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