



# Extra-familial social factors and obesity in the Hispanic Community Children's Health Study/Study of Latino Youth

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**Abstract** Hispanic/Latino youth are disproportionately affected by obesity. However, how social factors outside of the family relate to Hispanic/Latino youth obesity is not well understood. We examined associations of extra-familial social factors with overweight/obesity prevalence,

and their variation by sex and age, in 1444 Study of Latino Youth participants [48.6% female; 43.4% children (8–11 years); 56.6% adolescents (12–16 years)], who were offspring of the Hispanic Community Health Study/Study of Latinos participants. Youth self-reported general social support from friends, dietary-, and physical activity (PA)-specific support from peers, and awareness/internalization of thinness ideals. Overweight/obesity was defined as body mass index  $\geq$  85th percentile. Logistic regression models assessed effects of social factors and their interactions with age-group and sex, adjusting for potential confounders. Social support from friends interacted with both age and sex in relation to overweight/obesity. Female children who reported lesser (*OR* 0.60; 95% CI [0.39, 0.91]) and female adolescents who reported greater (*OR* 1.35; 95% CI [1.06, 1.74]) social support from friends had higher odds of overweight/obesity. Among males, greater awareness/internalization of thinness ideals related to higher odds of overweight/obesity (*OR* 2.30; 95% CI [1.59, 3.31]). Awareness/internalization of thinness ideals was not associated with overweight/obesity among females. Dietary and PA-specific peer support did not relate to overweight/obesity. Social support from friends and awareness/internalization of thinness ideals were significantly related to odds of overweight/obesity in Hispanic/Latino youth; associations varied by age and sex, and persisted after control for intra-familial factors (overall family support/function; diet and activity specific support).

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## Introduction

The prevalence of obesity during childhood and adolescence has markedly increased over the past three decades, with disproportionate impact in racial/ethnic minorities, including Hispanic/Latino youth (e.g., Isasi et al., 2016). According to the 2013–2014 National Health and Nutrition Examination Survey (NHANES), the prevalence of obesity is higher among Hispanic/Latino youth ages 2–5 (15.6%), 6–11 years (25%), and ages 12–19 (22.8%) compared to their non-Hispanic white counterparts (5.2%, 13.6%, and 19.6%, respectively) (Ogden et al., 2016). Furthermore, youth obesity has been associated with a variety of negative health outcomes, including increased risk of diabetes, cardiovascular disease, and premature mortality in adulthood (Global Burden of Disease 2015 Obesity Collaborators, 2017). Understanding the factors that contribute to obesity in Hispanic/Latino youth is an urgent public health goal.

Ecological models, such as those informed by social cognitive theory (SCT), suggest that youth obesity reflects the interplay of internal personal factors and external environmental influences (Bandura, 1989; Baranowski et al., 2002). Despite the general acceptance of SCT (Ohri-Vachaspati et al., 2015) and the acknowledgement of the larger social determinants of obesity, most quantitative research on youth obesity has focused on the home and family context (e.g., Halliday et al., 2014). While these “intra-familial” factors relate in important ways to Hispanic/Latino youth obesity (e.g., Halliday et al., 2014; Kilanowski, 2016), social factors outside the family context are less well understood. However, emerging evidence has shown that “extra-familial” social factors such as social support from peers and media exposure can influence children’s weight (e.g., Voelker et al., 2015). Additionally, these factors may increase in salience as children transition into adolescence and their time spent away from home increases (Rubin et al., 1998; Sabatelli & Mazor, 1985).

For adolescents, peer groups provide an important social context that informs socially acceptable ranges of weight and body size (Stokes et al., 2016) and influences perceptions of weight (Grogan, 2016). Furthermore, peers may contribute to obesity risk by influencing physical activity and dietary behaviors. For example, peer social support (e.g., encouragement and praise) is associated with fruit and vegetable consumption across diverse samples (Chung et al., 2017). Conversely, studies of Hispanic/Latino samples suggest that peer support for unhealthy food choices (e.g., fast food) may promote poor dietary choices (Kilanowski, 2016). Peer support for physical activity (e.g., modeling and verbal encouragement) has been linked to

higher levels of physical activity among Hispanic/Latino youth (Bishop et al., 2018).

During adolescence, peer support, body satisfaction, and weight status also appear to be closely interrelated. Higher peer support in adolescents and young adults relates to lower body mass index (BMI), disordered eating (Sahoo et al., 2015), and higher body satisfaction (Voelker et al., 2015; Webb & Zimmer-Gembeck, 2014). In addition to obese youth reporting significantly lower levels of total perceived social support compared to their normal weight peers (e.g., Wu et al., 2014), obese youth seem to experience differences in the relative importance of various social support sources (i.e., from teachers, parents, classmates, close friends). For example, obese youth may report higher levels of close friend support, but lower support from classmates, relative to their non-obese counterparts, and increases in perceived support from teachers over time (a pattern opposite to that in normal weight youth) (Wu et al., 2014).

The perception and significance of peer support may differ across sexes. In studies of diverse youth samples, females consistently report higher levels of peer support than males (Rawlins, 2017). Hispanic/Latino adolescent males, on the other hand, receive greater familial support (Raffaelli et al., 2013) and physical activity-specific parental support (Allen et al., 2016), compared to females. Additionally, for females, social influences on body dissatisfaction may be closely linked to social networks (Caccavale et al., 2012) and may have a more robust association with BMI than among males (Voelker et al., 2015).

Beyond the influence exerted by peer groups, media also provides youth with information on acceptable body weight and sex-specific body image ideals. U.S. media consistently stigmatizes obesity (Puhl et al., 2013), promoting body ideals of thinness for females (Perloff, 2014) and lean muscularity for males (Schaefer et al., 2017). Awareness and internalization of thinness ideals resulting from media exposure are associated with body dissatisfaction (Voelker et al., 2015) and frequent weight-control practices (Rodgers & Melioli, 2016) among overweight youth. Importantly, longitudinal studies find that weight control practices, such as dieting, leave adolescents vulnerable to further weight gain (Siahpush et al., 2015) by lowering metabolic rate and/or triggering overeating (Dulloo & Montani, 2015). There is also emerging evidence that Hispanic/Latino youth may perceive and internalize media-portrayed body ideals differently than their non-Hispanic white counterparts, viewing thinness as an “Anglo”-specific ideal (Romo et al., 2016). Despite these findings, how awareness and internationalization of media-portrayed body appearance ideals relate to BMI and how

these associations may differ by sex and age in Hispanic/Latino youth remains unclear.

Although obesity disproportionately affects Hispanic/Latino youth as a group, the social factors that shape overweight/obesity may vary according to within-group differences. For example, it is important to understand how social factors may impact obesity in males compared to females or younger versus older youth. Therefore, the current study examined associations of extra-familial social factors, i.e., general social support from friends, dietary and physical activity (PA)-specific support from peers, and awareness/internalization of thinness ideals, with prevalence of overweight and obesity, and the degree to which these associations varied by sex and age in a multi-site study of Hispanic/Latino youth. Additionally, to determine the extent to which these influences were relevant beyond intra-familial factors, we explored these associations while accounting for overall family functioning/support and dietary and PA-specific support from family.

Due to evidence that exposure to thin body ideals in the media may serve to highlight the discrepancy between current weight status and socially prescribed body ideals, we hypothesized that youth who endorsed greater awareness/internalization of thinness ideals would be more likely to be overweight or obese than those with lesser awareness/internalization of these ideals. We further hypothesized that youth who endorsed lower social support from friends, and lower peer social support for healthy diet and PA behaviors would be more likely to be overweight or obese than those with higher scores. Due to the centrality of thinness (vs. muscularity) in female-specific body ideals (Perloff, 2014), we predicted that the relationship between overweight and obesity and extra-familial social factors would be more pronounced in females than males. We predicted that associations of extra-familial social factors with overweight and obesity would vary by age-group, and would be more pronounced among adolescents (12–16 years) compared to children (8–11 years). Lastly, we hypothesized that associations would be robust to control for intra-familial factors.

## Methods

### Participants

The Hispanic Community Health Study/Study of Latinos (HCHS/SOL) is a population-based cohort study of chronic disease prevalence, incidence, and risk and protective factors in 16,415 adults (ages 18–74 years). Participants were recruited using a two-stage probability sampling design from four U.S. cities (Chicago, IL; Miami, FL; Bronx, NY; and San Diego, CA) between 2008 and 2011.

A detailed description of the sampling approach and methods have been reported elsewhere (Lavange et al., 2010; Sorlie et al., 2010). SOL Youth recruited 1466 youth and their primary caregivers from all four HCHS/SOL study sites between 2012 and 2014. The study identified 1777 eligible youth between 8 and 16 years of age who were invited to participate. Youth were eligible if they lived with a HCHS/SOL participant, had no known serious health problems, and were not pregnant or had recently given birth. Eighty-two percent ( $N = 1466$ ) of eligible youth enrolled along with their primary caregivers ( $N = 1020$ ). Further details about the aims and methodology of SOL Youth have been published elsewhere (Ayala et al., 2014; Isasi et al., 2014). The current study excluded children with missing BMI data or predictor values, yielding a final analytic sample of  $N = 1444$ .

### Procedures

After obtaining written informed consent from caregivers and assent from youth, trained bilingual staff performed clinical examinations and administered questionnaires in participants' preferred language, using standardized protocols. Caregivers provided demographic information and youth completed measures of general social support from friends, dietary and PA-specific support from peers, and awareness/internalization of thinness ideals. All aspects of the research were conducted with approval from the institutional review boards of each of the institutions involved in the study.

#### *Extra-familial social factors*

*General social support from friends* was assessed with the friend-specific subscale of the 12-item Multidimensional Scale of Perceived Social Support (Zimet et al., 1988, 1990). This measure has been found to be internally consistent and its factor structure supported in Hispanic/Latino youth samples (Edwards et al., 2004).

The friend specific-subscale is comprised of the following items: “My friends really try to help me,” “I can count on my friends when things go wrong,” “I have friends with whom I can share my joys and sorrows,” and “I can talk about my problems with my friends.” In accordance with previous studies of Hispanic/Latino families (Orth et al., 2014) and children (Taylor et al., 2015), the scale was modified for ease of administration to use a 4-point versus the original 7-point Likert-type scale, ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Item responses were averaged to create a summary score with higher scores indicating greater support from friends.

Internal consistency reliability was acceptable in this sample ( $\alpha_{\text{English}} = .77$  and  $\alpha_{\text{Spanish}} = .71$ ).

*Awareness/internalization of thinness ideals* was assessed using a study-specific version of the 14-item Socio-cultural Attitudes Towards Appearance Questionnaire (SATAQ; Heinberg et al., 1995). This measure was developed to capture an individual's awareness (i.e., familiarity and acknowledgement) and internalization (i.e., acceptance and adoption) of media-portrayed societal ideals of appearance with a particular focus on thin body ideals. This measure has been used in studies of diverse samples including those of Hispanic/Latino college students (Franko et al., 2012) and Hispanic/Latino children and adolescents (Ayala et al., 2007). Items include, "People on TV project the type of appearance I desire," "Photographs of thin people make me wish I were thin," and "I often read magazines and compare my appearance to the models." We used an abbreviated 7-item version (Ayala et al., 2007) that was modified such that all questions were phrased positively (Ayala et al., 2007). Responses were on a 5-point Likert-type scale ranging from 1 (*completely disagree*) to 5 (*completely agree*). Item scores were averaged with higher scores indicating greater awareness and internalization of societal ideals of thinness. Internal consistency was high in this sample ( $\alpha_{\text{English}} = .81$  and  $\alpha_{\text{Spanish}} = .83$ ).

*Dietary and PA-specific support from peers* was assessed via an 8-item study-specific measure derived from previously published instruments assessing the frequency of peer encouragement and support for healthy diet (Hagler et al., 2005) and PA (Norman et al., 2005) experienced in a typical week. This scale includes three items pertaining to fruit and vegetable consumption and five pertaining to PA. Original scale items pertaining to dietary fat (4 items) and sedentary activity (3 items) were omitted. Sample items include, "A friend [ate] fruit and vegetables with you" and "[Your friends] encouraged you to do sports or physical activity." Response options were on a 5-point Likert-type scale ranging from 1 (*never*) to 5 (*everyday*). Scores were averaged, with higher scores indicating higher levels of support. Internal consistency reliability for the scale was acceptable in this sample ( $\alpha_{\text{English}} = .65$  and  $\alpha_{\text{Spanish}} = .73$ ).

### Overweight/obesity

Child height (cm) was measured with a wall stadiometer (SECA 222, Germany) and weight (kg) was obtained with a digital scale (Tanita Body Composition Analyzer, TBF 300, Japan). Weight categories were defined using age- and sex-specific percentiles (Kuczmarski et al., 2002; Skinner et al., 2015), as underweight/normal weight (BMI < 85th percentile), overweight (BMI 85th to < 95th percentile),

and obese (BMI  $\geq$  95th percentile) groups (Skinner et al., 2015). For analyses, the overweight and obese categories were combined and compared to the underweight/normal weight group.

### Covariates

Demographic covariates included nativity (born on U.S. mainland or elsewhere), Hispanic/Latino background (Mexican, Dominican, Cuban, Puerto Rican, Central or South American or other Hispanic/Latino), language of interview (Spanish or English), field center (Bronx NY, Chicago, IL, Miami FL, San Diego CA), yearly household income (income of less than \$30,000 vs. greater or equal to \$30,000), and highest level of caregiver educational attainment (less than a high school degree/GED vs. high school degree/GED or greater). As a proxy for developmental stage, youth were divided and compared across age-group; children were defined as ages 8–11, and adolescents as ages 12–16, as per Centers for Disease Control recommendations (CDC, 2016).

### Analytic plan

Descriptive statistics, including frequencies, means, and standard deviations were calculated using complex survey procedures in IBM SPSS Statistics 24.0 (IBM, Inc., Armonk, NY). MPlus 7.0 (Muthén & Muthén, 2006) maximum likelihood robust (MLR) estimation procedure was used to estimate model parameters in remaining multivariable analyses. MLR is a full-information maximum likelihood approach to missing data in which model parameters and standard errors are estimated using all observed data, resulting in unbiased parameter estimates and standard errors under various missing data conditions (Enders, 2010). All models adjusted for potential confounders and accounted for sample weights and design effects (strata and clustering).

To examine whether the association of social factors with overweight/obesity varied by sex and age, three three-way multiplicative interaction terms of sex, age-group, and each of the social factors (social support from friends, awareness/internalization of thinness ideals, peer dietary and PA-specific support), and seven age and sex by social factor two-way interaction terms were constructed. Social variables were z-scored prior to analysis to facilitate interpretation of coefficients. Variables were entered into logistic regression models in a hierarchical manner. In the first analytic step, logistic regression models tested the main effects of age, sex, and the three social variables. The second step of analysis simultaneously tested two- and three-way interactions within the total sample. Significant

interactions were examined in stratified analyses as appropriate. As a final step, supplementary analyses were conducted to determine the extent to which the effects of extra-familial factors were above and beyond similar intra-familial factors. Models were repeated with additional control for: (1) overall family functioning/support as captured by the General Family Functioning subscale of the McMaster Family Assessment Device (Byles et al., 1988), an assessment of family well-being and support that is similar in content to the social support from friends scale, and; (2) dietary and PA-specific support from family assessed via a study specific measure derived from previously published instruments (Hagler et al., 2005; Norman et al., 2005), and parallel to those contained in the dietary and PA-specific support from peers scale.

## Results

### Demographic characteristics

Descriptive statistics for all study variables are presented in Table 1. The mean age in the study sample was 12.08 ( $SE = .08$ ) years, 43.4% were 8–11 years old, and 48.6% were female. The majority (78.4%) was born in the U.S. mainland, and individuals with Mexican heritage were the largest Hispanic/Latino ancestry group (49.0%). Most of the youth preferred to complete their interview in English (79.5%). Seventy percent of caregivers reported a yearly household income below \$30,000, and 38.7% had less than a high school education or GED. Nearly half of youth (47.1%) were overweight or obese ( $BMI \geq 85$ th percentile).

### Associations of extra-familial social factors and overweight/obesity

Results of logistic regression models are shown in Table 2. As evidenced by Chi square tests, after accounting for covariates, all models (i.e., main effects, two and three-way interaction terms, and stratified analysis models) accounted for a significant amount of variance in weight status compared to the null model ( $p < 0.001$ ). After accounting for demographic covariates (3.9% of model fit, Nagelkerke pseudo  $R^2$ ), inclusion of extra-familial social factors main effects and interaction terms improved model fit by 3.6% and 2.5%, respectively. There was a significant interaction of social support from friends with age and sex (three-way interaction) in relation to overweight/obesity ( $p = 0.01$ ). Age and sex stratified analyses showed that in female children, a one standard deviation increase in social support from friends was associated with 40% lower odds of overweight/obesity ( $OR 0.60$ ; 95% CI [0.39, 0.91]). Among

female adolescents, a one standard deviation increase in social support from friends was associated with a 35% higher odds of overweight/obesity ( $OR 1.35$ ; 95% CI [1.06, 1.74]). In contrast, there was no significant association between social support and odds of overweight/obesity among male children ( $OR 0.99$ ; 95% [0.71, 1.38]) or adolescents ( $OR 0.97$ ; 95% [0.69, 1.36]). Figure 1 depicts the social support from friends by sex interaction effect.

Tests of main effects revealed a significant positive association of awareness/internalization of thinness ideals with odds of overweight/obesity ( $OR 1.51$ ; 95% CI [1.29, 1.76];  $p < 0.001$ ). However, this relationship varied significantly by sex ( $OR 1.83$ ; 95% CI [1.16, 2.89];  $p = 0.01$ ). As depicted in Fig. 2, in males, a one standard deviation higher awareness/internalization of thinness ideals score was associated with more than a doubling in odds of overweight/obesity: ( $OR 2.30$ ; 95% CI [1.59, 3.31]). For females, a higher awareness/internalization of thinness ideals score was also associated with increased odds of overweight/obesity; however, this relationship was not statistically significant ( $OR 1.20$ , 95% CI [0.90, 1.60]).

There were no other significant main or interaction effects of social variables with overweight/obesity. Dietary and PA-specific support from peers was not significantly associated with odds of overweight/obesity in any analysis.

### Supplementary analyses controlling for intra-familial factors

The associations between extra-familial factors and odds of obesity remained consistent (in patterns of significance and magnitudes of effects) in models controlling for intra-familial factors. Specifically, for females, social support from friends remained significantly associated with odds of obesity among children ( $OR 0.59$ ; 95% [0.36, 0.95]) and adolescents ( $OR 1.34$ ; 95% [1.04, 1.74]), and was not significantly associated with odds of obesity among male children ( $OR 0.97$ ; 95% [0.68, 1.40]) or adolescents ( $OR 0.95$ ; 95% [0.66, 1.36]). The interaction of awareness/internalization of thinness ideals and sex was attenuated after controlling for intra-familial factors, but remained significant ( $p < 0.05$ ). Among males the association between awareness/internalization of thinness ideals and odds of obesity was modestly attenuated, but remained significant ( $OR 2.01$ ; 95% [1.34, 2.90]); the association was unchanged among females ( $OR 1.20$ ; 95% [0.87, 1.64]).

After accounting for covariates (3.9% of model fit, Nagelkerke pseudo  $R^2$ ), and intra-familial factors (main effects, 1.9%; interaction effects, 2.7%), extra-familial main effects and interaction terms improved model fit by an additional 3.6% and 2.5%, respectively. Chi-squared test indicated that the full model accounted for a significant

**Table 1** Sample characteristics for youth participants: SOL Youth ( $N = 1444$ )

Characteristic	$n^a$	Sample %	Weighted % [95% CI] <sup>b</sup>
Sex ( $N = 1444$ )			
Female	727	50.3	48.6 [45.4–51.9]
Male	717	49.7	51.4 [48.1–54.6]
Age ( $N = 1444$ )			
Children, ages 8–11 years	660	45.7	43.4 [40.2–46.5]
Adolescents, ages 12–16 years	784	54.3	56.6 [53.5–59.8]
Language of interview ( $N = 1440$ )			
Spanish	282	19.5	20.5 [16.9–24.6]
English	1158	80.2	79.5 [75.4–83.1]
Hispanic/Latino Heritage ( $N = 1367$ )			
Central American	110	7.6	6.3 [4.9–8.1]
Cuban	100	6.9	5.5 [4.1–7.4]
Dominican	162	11.2	13.0 [10.4–16.2]
Mexican	643	44.5	49.0 [44.2–53.8]
Puerto Rican	128	8.9	10.1 [7.8–12.9]
South American	66	4.6	4.2 [2.9–5.8]
More than one/other	158	10.9	11.9 [9.5–14.8]
Nativity/immigration status ( $N = 1432$ )			
Not born in the U.S. mainland	319	22.1	21.6 [18.6–24.9]
Born in the U.S. mainland	1113	77.1	78.4 [75.1–81.4]
Study site ( $N = 1444$ )			
Bronx, NY	416	28.8	35.8 [31.6–40.2]
Chicago, IL	366	25.3	16.2 [13.5–19.3]
Miami, FL	256	17.7	13.3 [10.8–16.4]
San Diego, CA	406	28.1	34.7 [29.8–39.9]
Caregiver education <sup>c</sup> ( $N = 1440$ )			
< High school/GED	556	38.5	38.7 [34.6–43.0]
High school/GED only	410	28.4	29.2 [25.2–33.5]
> High school/GED	474	32.8	32.2 [28.2–36.4]
Household yearly income ( $N = 1417$ )			
< \$30,000	1014	70.2	70.6 [66.0–74.9]
≥ \$30,000	403	27.9	29.4 [25.1–34.0]
BMI Categories ( $N = 1444$ )			
Underweight/normal weight ( $\leq$ 84th percentile)	734	50.8	52.9 [49.2–56.5]
Overweight (85–94th percentile)	301	20.8	20.2 [17.6–23.1]
Obese ( $\geq$ 95th percentile)	409	28.3	26.9 [24.0–30.1]
Extra-familial social factors			
	$n$	Unweighted $M$ ( $SD$ )	Weighted $M$ ( $SE$ ) <sup>c</sup>
Social attitudes towards weight (Possible range 1–5)	1444	2.5 (0.97)	2.5 (0.03)
Social support from friends (Possible range 1–4)	1444	3.17 (0.58)	3.17 (0.02)
Dietary and physical activity support (Possible range 1–5)	1444	3.09 (0.70)	3.08 (0.02)

*GED* General Education Development Test, *BMI* Body Mass Index, *CI* confidence interval, *M* Mean, *SD* Standard Deviation, *SE* Standard Error

<sup>a</sup>Total sample sizes vary slightly due to missing data

<sup>b</sup>Weighted data used sampling weights from SOL Youth to account for differential selection probabilities and non-response

<sup>c</sup>Highest level of education completed by caregiver

**Table 2** Results of logistic regression analyses of overweight/obesity prevalence on extra-familial social factors, with and without inclusion of interaction terms (*N* = 1444)

	Primary models		Models controlling for intra-familial factors	
	OR [95% CI]	<i>P</i> value	OR [95% CI]	<i>P</i> value
<b>Model 1: main effects only</b>				
Age <sup>a</sup>	0.86 [0.66, 1.12]	0.25	0.86 [0.68, 1.14]	0.33
Sex <sup>b</sup>	1.34 [0.98, 1.82]	0.06	1.34 [1.00, 1.86]	0.05
Awareness/internalization of thinness ideals	1.51 [1.29, 1.76]	<0.001	1.51 [1.29, 1.77]	<0.001
Social support from friends	0.97 [0.83, 1.13]	0.69	0.94 [0.80, 1.10]	0.46
Dietary and physical activity support from peers	1.03 [0.90, 1.19]	0.65	0.92 [0.78, 1.09]	0.32
<b>Model 2: interaction effects</b>				
Sex X Age	0.99 [0.54, 1.83]	0.97	0.95 [0.51, 1.78]	0.88
Awareness/internalization of thinness ideals X Age	1.17 [0.80, 1.72]	0.43	1.23 [0.83, 1.81]	0.30
Social support from friends X Age	2.22 [1.38, 3.58]	0.001	2.26 [1.38, 3.70]	0.001
Dietary and physical activity support X Age	0.96 [0.62, 1.47]	0.84	0.97 [0.62, 1.50]	0.88
Awareness/internalization of thinness ideals X Sex	1.83 [1.16, 2.89]	0.01	1.86 [1.16, 2.99]	0.01
Social support from friends X Sex	1.60 [0.95, 2.69]	0.08	1.58 [0.92, 2.72]	0.10
Dietary and physical activity support X Sex	1.00 [0.64, 1.57]	0.99	1.97 [0.61, 1.55]	0.90
Awareness/internalization of thinness ideals X Age X Sex	0.63 [0.34, 1.16]	0.14	0.59 [0.32, 1.09]	0.09
Social support from friends X Age X Sex	0.44 [0.23, 0.84]	0.01	0.44 [0.22, 0.85]	0.01
Dietary and physical activity support X Age X Sex	1.35 [0.74, 2.47]	0.33	1.33 [0.72, 2.47]	0.37

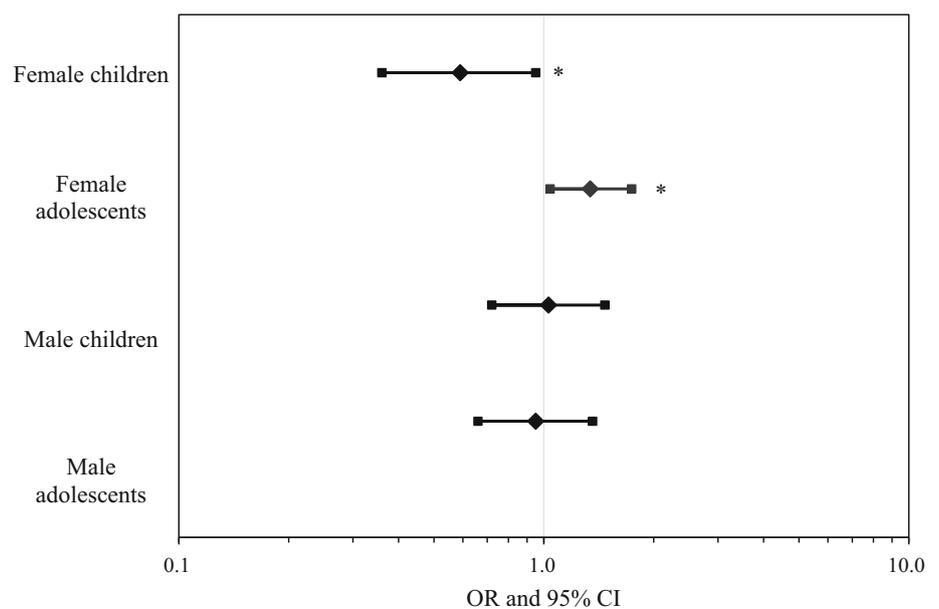
All models control for language of interview, youth Hispanic/Latino heritage group, youth place of birth (nativity), study site, caregiver education, and household income. Extra-familial social factor variables were z-scored prior to analysis. Logistic regression models tested variables in a hierarchical fashion. Model 1 only tested main effects. Model 2 simultaneously added the two- and three-way interaction terms of age-group and sex with social factors. In Model 1, the *OR* for age represents the odds ratio of overweight/obesity among adolescents compared to children and the *OR* for sex represents the odds ratio of overweight/obesity among males compared to females. The remainder of *OR*s in Model 1 represent the change in odds of overweight/obesity with every 1 standard deviation increase of the given social factor. In Model 2, two- and three-way interaction terms test whether or not differences in the overweight/obesity-social factors relationship is conditional on age-group and/or sex. Specifically, these interaction terms test whether *OR*s representing the overweight/obesity-social factors relationship differ between males/females, children/adolescents or age-group X sex subgroups

*OR* odds ratio; 95% CI = 95% confidence interval

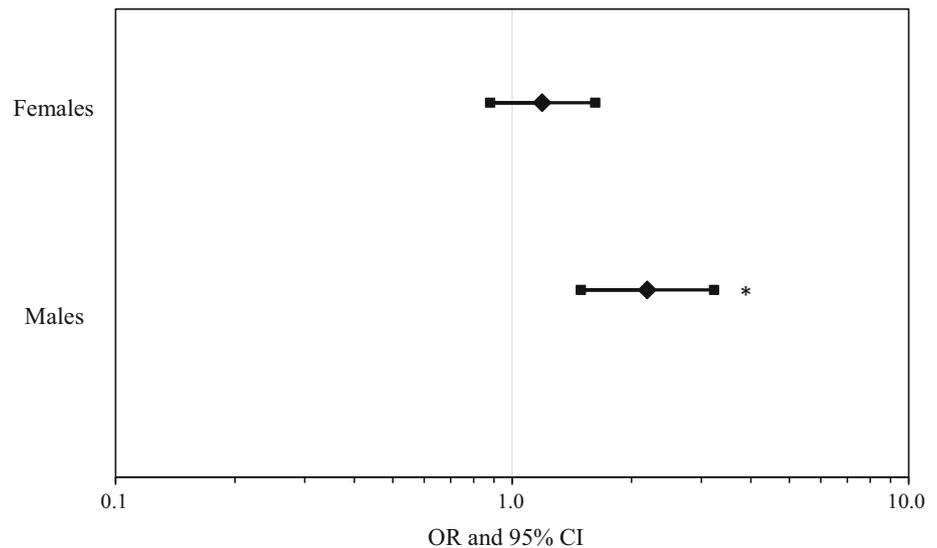
<sup>a</sup>Dummy coded with child age-group as reference group

<sup>b</sup>Dummy coded with female as reference group

**Fig. 1** The association of social support from friends with odds of overweight/obesity among Hispanic/Latino female and male children and adolescents. *Note OR* = odds ratio; 95% CI = 95% Confidence Interval. The odds ratios depicted represent the relative change in odds of overweight/obesity associated with one standard deviation increase of social support from friends from mean levels of social support from friends. Error bars represent the 95% confidence intervals. Odds ratios are displayed on a logarithmic scale. \**p* < 0.05



**Fig. 2** The association of awareness/internalization of thinness ideals with odds of overweight/obesity among female and male Hispanic/Latino youth. *Note* OR = odds ratio; 95% CI = 95% Confidence Interval. The odds ratios depicted represent the relative change in odds of overweight/obesity associated with one standard deviation increase of awareness/internalization of thinness ideals from mean levels of awareness/internalization of thinness ideals. Error bars represent the 95% Confidence Intervals. Odds ratios are displayed on a logarithmic scale. \* $p < 0.05$



amount of variance in weight status compared to the null model ( $p < 0.001$ ).

## Discussion

Consistent with hypotheses, extra-familial social factors related significantly to odds of overweight/obesity in Hispanic/Latino youth. These associations varied both by age and sex, persisted with controls for intra-familial factors (i.e., family functioning and familial support for healthy diet and physical activity), and were moderate in magnitude. Specifically, female children who reported lower social support from friends were more likely to be overweight or obese; however, among female adolescents, the converse was observed—adolescent females who reported *higher* social support from friends were more likely to be overweight or obese. Additionally, across the sample, higher awareness/internalization of thinness ideals related to a higher likelihood of overweight and obesity; however, this association was statistically significant in males but not females. No association was found between dietary and PA-specific peer support and overweight/obesity.

The association between higher social support and lower overweight/obesity likelihood observed among female children is consistent with evidence that overweight and obese youth report less social engagement and lower perceived social support from peers than their normal and underweight peers (Caccavale et al., 2012; Voelker et al., 2015; Wu et al., 2014). Existing literature suggests that the relationship between levels of social engagement, social support, and weight status among youth is bidirectional and may operate through a variety of mechanisms. For example, overweight and obese children experience weight-based stigmatization from their peers, are perceived as less

attractive friends, and receive fewer invitations to engage in friendships (de la Haye et al., 2017). Overweight and obese youth are also more likely to experience peer rejection and aggression than their normal weight peers (Sahoo et al., 2015). Peer aggression and social marginalization experienced by overweight youth may decrease health-promoting behaviors, e.g., reducing participation in sports and other active pursuits, and increase problematic eating patterns (e.g., binge eating and dieting) (Sahoo et al., 2015; Harriger & Thompson, 2012), which, together, may cause further weight gain (Barkley et al., 2012; Salvy et al., 2012). Such findings suggest a reciprocal association of social engagement and support and weight status—a potentially obesogenic cycle, which may intensify over time.

Previous research suggests that the negative association between obesity and peer social support remains stable across different points of youth development (Wu et al., 2014). However, we found that among females, the directionality of the relationship between social support from friends and weight status differed in children and adolescents. One explanation may be that different sources of support may gain or lose importance across stages of development. For example, whereas children report peers, teachers, and family as major sources of social support, adolescents report that their friend groups represent the main and most influential source of social support (Sabatelli & Mazor, 1985). Furthermore, there is evidence that having overweight and obese friends normalizes higher body weight (Salvy et al., 2012; Voelker et al., 2015) and may promote further weight gain (Salvy et al., 2012) by modeling unhealthy eating patterns (Kilanowski, 2016) and lower levels of physical activity (Chung et al., 2017; Bishop et al., 2018). This pattern may be particularly strong among Hispanic/Latino females who may place

particular importance in social groups for sourcing information about acceptable body weight norms and who may be more accepting of heavier body types (Stokes et al., 2016; Grogan, 2016) compared to their non-Hispanic white counterparts. It is therefore possible that our finding of a negative association between social support and weight-status among younger overweight and obese females reflects the healthy-weight promoting effects of social support, whereas for overweight and obese adolescent females, higher levels of social support from friends may normalize or even encourage overweight/obesity, leading to a positive association between social support and weight-status in this group. Notably, because we did not examine developmental status, or have information about weight status of peer groups, these possible explanations remain to be examined and verified in future studies.

Interestingly, among males, social support from friends had no significant association with overweight/obesity in either children or adolescents. These findings may reflect the differential perception and significance placed upon peer support across sexes. Previous research suggests that, overall, females report higher levels of peer support than males (Rawlins, 2017). Additionally, compared to female youth, male youth may receive higher levels of parental support (Raffaelli et al., 2013) for longer into adolescence (Halliday et al., 2014). Male youth may therefore place less importance on peer groups than other sources of support, such as parental support, compared to their female counterparts. In addition, their weight status may simply be less strongly related to social support from friends than that of their female counterparts.

A significant main effect of awareness/internalization of thinness ideals showed that greater awareness/internalization was associated with a higher likelihood of overweight/obesity in Hispanic/Latino youth. However, this relationship varied significantly by sex and was only statistically significant in males. In exploratory sex-age stratified analyses, we found that adolescent girls with higher awareness/internalization of thinness ideals were at higher risk of overweight/obesity ( $OR$  1.38; 95% [CI 1.06, 1.80]), whereas the association was not significant in younger girls ( $OR$  1.24; 95% [CI 0.93, 1.65]). Because the three-way interaction was not statistically significant, these findings should be interpreted with caution. Nevertheless, they reinforce that the nature of the association of higher awareness/internalization of societal appearance ideals may depend both on phase of development and on sex.

Overall, these findings are consistent with evidence that internalization of body ideals represented in the media are significant predictors of body dissatisfaction and engagement in weight control practices (Rodgers & Melioli, 2016), which may put youth at risk of obesity in adolescence (Siahpush et al., 2015). Children and adolescents are

in frequent contact with media, including the Internet and social media (Lenhart et al., 2015), with African American/Black and Hispanic/Latino youth reporting more frequent Internet use than their non-Hispanic white peers (Lenhart et al., 2015). Through high levels of media exposure, overweight and obese youth may become aware of the mismatch between the ideal norms of thinness portrayed in the media and the reality of their actual body size (Couch et al., 2016), thus scoring higher on measures of awareness and internalization of societal appearance ideals than their normal weight peers. Furthermore, despite the evidence that Hispanic/Latino youth may not aspire to mainstream “Anglo” thinness ideals (Romo et al., 2016), weight-stigmatizing images and thin body ideals represented in the media may still drive body dissatisfaction and unhealthy weight-control practices among Hispanic/Latino youth (Mancilla-Díaz et al., 2012). As with associations of social support with overweight/obesity, the link between awareness of media-portrayed body ideals and weight status is, thus, likely to be bi-directional in nature. Weight control practices may be influenced by media exposure and overweight/obesity status may also drive higher awareness and internalization of societal ideals of appearance. These relationships remain to be clarified in future research.

In aggregate, our findings may reflect the differential importance and influence of various social factors across Hispanic/Latino youth sex groups and ages. Specifically, for females, it appears that friend groups may represent an important source of influence. This relationship may gain importance and become potentially problematic in adolescence—a time when the influence of close friends, who are likely to share similar weight status and obesogenic diet and activity patterns, peaks. In contrast, for males, larger social pressures coming from media may be more important than peer group influences. Notably, the interplay between peer support, media, and weight status, as well as how these relationships change across stages of development remains to be tested empirically in future longitudinal research.

There was no support for the hypothesized relationship between peer support for diet and PA and overweight/obesity in Hispanic/Latino youth. The lack of association remained consistent in exploratory models that excluded general social support from friends (data not shown). One possible explanation for these findings relates to the particulars of the social patterns of overweight and obese youth: overweight children and adolescents tend to have fewer friends and are alone more frequently than non-overweight youth (de la Haye et al., 2017; Harriger and Thompson 2012). Furthermore, overweight and obese youth tend to have friends of similar weight status (Bruning et al., 2015; Salvy et al., 2012) with whom they share dietary and PA patterns (Cheng et al., 2014; Vanderwater

et al., 2015). It is, therefore, possible that overweight and obese youth lack sufficient social contact with peers who would promote healthy diet and PA behaviors to demonstrate this association.

Our findings may be used to inform future obesity research among Hispanic/Latino youth. Specifically, our study suggests that the influence of close friends may be particularly important among overweight and obese female Hispanics/Latinas and warrants further examination. Additionally, considering the robustness of the observed association of awareness/internalization of thinness ideals and overweight and obesity in males, our findings suggest that a focus on the impact of media-portrayed body ideals and obesity may be a meaningful direction for future research in this population.

## Limitations

This study represents an important step in elucidating the relationships between extra-familial social factors and overweight/obesity in a large, well-characterized cohort of Hispanic/Latino youth comprising diverse heritage groups. However, this study also has various limitations that should be considered. SOL Youth data are cross-sectional and, thus, causality and temporality cannot be inferred. Moreover, there are several limitations associated with the present study's measures. To reduce participant burden, measures used to assess social factors in this study were modified and/or shortened from their original format. While modifications were largely supported by previous literature, robust evidence for the validity and reliability of abbreviated/modified measures is lacking. Additionally, with regards to the awareness/internalization of thinness ideals scale, the non-inclusion of muscularity items of the male-specific iteration of this scale (Smolak et al., 2001), as well as the lack of controls for factors that may be associated with how Hispanic/Latino youth perceive media-portrayed body ideals (e.g., acculturation), represent significant limitations.

Social support is a multifaceted construct that includes several subdomains or functions—e.g., emotional/affective, instrumental/tangible, informational, companionship/belonging—and that can be categorized as either received or perceived (Vaux, 1988). Support source (e.g., friends vs. teachers), support type (e.g., instrumental vs. belonging), and the amount of support perceived versus received may differentially impact youth weight-status (e.g., Wu et al., 2014). The social support measures included in the present study are considered “general” measures of support, with one capturing perceived social support from friends and family, and the other, received social support for healthy diet and exercise. While the

extant literature suggests that even such broad, un-differentiated measures of social support are associated with positive health outcomes (Zimet et al., 1988; Hagler et al., 2005; Norman et al., 2005), that lack of a nuanced assessment and exploration of social support type is a limitation of the present study.

Another important limitation of our study lies in how sex and age-group differences were explored. Specifically, broadly defined groups (e.g., dichotomized age-groups) are unlikely to capture the complexity of developmental or gender differences that may exist. For example, we lacked information regarding social networks and peer socialization patterns—factors that may be important in the associations of interest. Furthermore, we did not examine youth's dietary and physical activity patterns, or health behavior norms and attitudes. We encourage future research to reveal the possible mechanisms through which social support may relate to weight-status in Hispanic/Latino youth. Though our findings persisted after controlling for two intra-familial factors, additional family-related factors relevant to youth weight-status (e.g., general parenting practices and parenting surrounding eating and PA) were not examined in the present study. These factors should be further examined, particularly among younger children, for whom decisions regarding their diet and exercise routines are largely dictated by caregivers. While extra-familial social factors appear to be important correlates of obesity among Hispanic/Latino youth, these relationships represent only one layer of social determinants of obesity. How extra-familial social factors relate to additional intra-familial factors, as well as other environmental influences, such as neighborhood social and built environments, in their associations with youth overweight and obesity are important areas of future research.

## Conclusions

The findings from this study contribute to the literature on the relationship between social factors and overweight and obesity among Hispanic/Latino youth, highlighting possible shifts in importance of different extra-familial social factors across development and across sexes. Although longitudinal research is needed to confirm these findings and their directionality, this study represents an important step towards understanding contributors to obesity in Hispanic/Latino youth. Specifically, future research on the behavioral health trajectories among Hispanic/Latino youth may further explore the effects of media-portrayed thinness ideals and social support from friends and how these may differ across age and sex.

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### Compliance with ethical standards

**Conflict of interest** Julia I. Bravin, Angela P. Gutierrez, Jessica L. McCurley, Scott C. Roesch, Carmen R. Isasi, Alan M. Delamater, Krista M. Perreira, Linda Van Horn, Sheila F. Castañeda, Elizabeth R. Pulgaron, Gregory A. Talavera, Martha L. Daviglius, Maria Lopez-Class, Donglin Zeng, and Linda C. Gallo declare that they have no conflict of interest.

**Human and animal rights and informed consent** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent, or assent as appropriate, was obtained from all individual participants included in the study.

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