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Pain is Associated with Physical Activity and Health-Related Quality of Life in Overweight and Obese Children

Crystal S. Lim, **Sarah J. Mayer-Brown**, **Lisa M. Clifford**, and **David M. Janicke**
Department of Clinical & Health Psychology University of Florida, Gainesville, FL

Abstract

This study examined associations between pain, physical activity, physical fitness, and health-related quality of life (HRQOL) in overweight and obese children. Participants were 270 overweight and obese children 8–12 years of age and their parents. Children were separated into No Pain Frequency, Low Pain Frequency, and High Pain Frequency groups. Children in the Low Pain Frequency group spent less time in moderately intense physical activities compared to the No Pain Frequency group. Children in the High Pain Frequency group reported significantly lower HRQOL in most domains of functioning compared to children in the No Pain and Low Pain Frequency groups. Pain in overweight and obese children may negatively impact physical activity and HRQOL and should be assessed and treated in research and clinical work.

Rates of overweight and obesity in children are alarming, with about one-third of children currently considered overweight or obese (Ogden, Carroll, Kit, & Flegal, 2012). The associated short- and long-term consequences impact all domains of health (Daniels, 2006; Pearce, Boergers, & Prinstein, 2002; Zeller, Roehrig, Modi, Daniels, & Inge, 2006) and rising healthcare costs (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008) make obesity a significant public health concern. In addition to the more common comorbidities of increased weight status including type 2 diabetes and cardiovascular disease, studies have also found higher rates of chronic pain conditions in overweight and obese adults (Hitt, McMillen, Thornton-Neaves, Koch, & Cosby, 2007; Tukker, Visscher, & Picavet, 2009; Wright et al., 2010), functional disability (Okifuji, Donaldson, Barck, & Fine, 2010) and lower levels of physical activity (van den Berg-Emons, Schasfoort, de Vos, Bussmann, & Stam, 2007). However, little research has examined the effects of pain on physical functioning in overweight and obese children.

Physical activity plays an important role in weight management treatment ; however children who experience physical discomfort or pain are less likely to engage in physical activity (Kirk, Scott, & Daniels, 2005). The limited research investigating the association between pain and weight status in children is largely derived from studies of children with chronic pain presenting in clinical settings. Compared to normative samples, there are higher rates of patients who are overweight and obese in pediatric chronic pain clinics (Wilson, Samuelson, & Palermo, 2010). Relative to healthy weight children, overweight and obese

Name and Address for Correspondence: Crystal S. Lim, Ph.D. Research Assistant Professor Department of Clinical & Health Psychology P.O. Box 100165 Gainesville, FL 32610-0165 cms528@phhp.ufl.edu.

children are more likely to experience orthopedic complications, such as musculoskeletal pain (Taylor et al., 2006) and recurrent abdominal pain (Malaty et al., 2007). Similarly, children and adolescents with a higher percentage of body fat demonstrate lower physical fitness (Kelly et al., 2011; Willig et al., 2011) and decreased mobility compared to their healthy weight counterparts (Taylor et al., 2006). To our knowledge, the only study that assessed the relationships between pain, physical activity, and weight in children found that higher body mass index (BMI) was associated with lower levels of vigorous activity among older children, but not in younger children (Wilson et al., 2010). However, interpretations of these findings are limited by the relatively small number of younger children who were overweight or obese (e.g., $n = 6$, or 22% of sample) included in the study.

Research has also found associations between weight status, pain, and children's health related quality of life (HRQOL). HRQOL is a multidimensional patient-centered construct that indicates physical, emotional, and social functioning (Panepinto, O'Mahar, DeBaun, Loberiza, & Scott, 2005). Internationally, researchers have found that overweight and obese children have significantly lower HRQOL across multiple domains of functioning compared to healthy weight children (Hughes, Farewell, Harris, & Reilly, 2007; Ottova, Erhart, Rajmil, Dettenborn-Betz, & Ravens-Sieberer, 2012; Schwimmer, Burwinkle, & Varni, 2003; Zeller & Modi, 2006). HRQOL impairments have also been found among children and adolescents with chronic pain (Gold, Mahrer, Yee, & Palermo, 2009). Evidence suggests that relative to youth with chronic pain only and youth with obesity only, youth with co-occurring obesity and chronic pain experience significantly greater impairments in HRQOL (Hainsworth, Davies, Khan, & Weisman, 2009). The likelihood of impairment in overall HRQOL and physical functioning may be three to six times greater, respectively, among youth with both pain and obesity compared to youth with obesity alone (Hainsworth et al., 2009). While the available literature has focused on impairments associated with weight status and chronic pain, research suggests that self-reported, non-clinical pain may also have detrimental effects on physical functioning and HRQOL.

Pain episodes and somatic complaints are common in children (Fearon, McGrath, & Achat, 1996) and research has linked non-clinical pain (i.e., not formally diagnosed with a pain condition) to decreased functioning. For instance, in a study of school children, approximately half reported experiencing at least one pain symptom frequently and less than 4% reported constant pain (Vervoort, Goubert, Eccleston, Bijttebier, & Crombez, 2006). Findings suggest that pain, even at non-clinical levels, may have important implications for physical activity and functioning. This may be particularly salient for overweight and obese children, who despite the absence of chronic pain, may experience pain symptoms that go undetected by parents or health care providers, but have the potential to negatively impact engagement in physical activity and HRQOL. For example, these children may experience more discomfort when engaging in physical activity, potentially making the activity less reinforcing, ultimately leading to less engagement in physical activity and greater impairments in HRQOL. In addition, engagement in physical activity has been linked to improved general mental health and social and emotional well-being in children (Ahn & Fedewa, 2011; Lubans, Plotnikoff, & Lubans, 2012). Inactivity in overweight and obese children may lead to a negative cycle of decreased mood, excess weight, and increased pain

(Shultz, Anner, & Hills, 2009). Overweight and obese children who engage in low amounts of physical activity are more likely to remain overweight and obese (Taylor et al., 2006; Wittmeier, Mollard, & Kriellaars, 2008). Physical fitness, or the ability to perform specific physical activities, has also been linked to psychological functioning and weight status in children. Previous research has linked increases in physical fitness to improvements in psychological functioning (Kelly et al., 2011) and healthier weight status (e.g., lower BMI z-scores) (Bout-Tabaku, Briggs, & Schmitt, 2013). However, it is unclear how the frequency of pain may impact physical activity and physical fitness in overweight and obese children. Further investigation into the relationships between pain, physical activity and physical fitness, HRQOL, and weight in children with non-clinical pain is needed to tailor interventions to address barriers to physical activity and improve HRQOL.

Building on previous research, the purpose of the current study is to compare physical activity, physical fitness, and HRQOL in overweight and obese children who report varying frequencies of pain. It was hypothesized that obese children reporting low and high pain frequency, on average, would engage in significantly less physical activity, as well as have significantly lower physical fitness and HRQOL compared to overweight and obese children not reporting pain.

Methods

Participants and Procedures

Participants were 270 children, 8–12 years of age (M = 10.36 years, SD = 1.38), with a BMI > 85th percentile for age and gender and residing in a rural county in the Southeastern United States with their participating parent(s) or legal guardian(s).

Data for this study was from secondary analysis of a larger study, the Extension Family Lifestyle Intervention Project (E-FLIP for Kids), which examined the effectiveness of 12-month family-based weight management interventions for children with overweight and obesity. Parent and child dyads were recruited from rural communities using diverse methods, including direct mailings, brochure distributions through public schools and pediatrician offices, and community presentations (Janicke et al., 2011). Inclusionary criteria consisted of children being between 8 and 12 years of age with a BMI at or above the 85th percentile for age and gender. In addition, children and parents had to live together in a rural county and parents (or legal guardians) had to be 75 years or younger. Exclusion criteria were a child or parent being diagnosed with a chronic medical condition that limited dietary intake and physical activity, participation in another weight control program, or uncontrolled high blood pressure in the child. Families completed an initial phone screening followed by an in-person screening to determine eligibility and to complete informed consent procedures. Eligible parent and child dyads completed pre-treatment weight, height, HRQOL, and physical functioning assessments prior to randomization to one of three treatment arms (see (Janicke et al., 2011) for more details). Data for this project comes from the pre-treatment measures completed by children and parents prior to beginning a family-based weight management intervention. This study was approved by the governing Institutional Review Board.

Measures

Pain—The presence or absence of pain was assessed using the item "I hurt or ache" from the Pediatric Quality of Life Inventory (PedsQL) (Varni, Seid, & Kurtin, 2001), which assesses HRQOL during a one month period. Pain is primarily understood to be a subjective experience, thus this item was selected because it provides a broad assessment of non-clinical pain from the child's perspective. Previous reviews have concluded that children can reliably report pain (Cohen et al., 2008; Stinson, Kavanagh, Yamada, Gill, & Stevens, 2006) and utilizing one item to assess pain in children has been done in other pediatric pain research (Malaty et al., 2007; Wilson et al., 2010). In addition, previous pediatric pain studies have also categorized children into pain frequency groups based on their response to one pain frequency item (Haraldstad, Sorum, Eide, Natvig, & Helseth, 2011). Given that the PedsQL is commonly used in pediatric clinical settings to screen for problems associated with child functioning, utilizing the "hurt or ache" item for a broad assessment of non-clinical pain symptoms (e.g., not diagnosed with a chronic pain condition) may provide clinicians working in busy clinical settings a feasible means of briefly assessing pain symptoms that could interfere with child functioning. Children in this study were dichotomized into three groups based on their response to the item regarding the frequency of "hurt or ache" in the past one month. The three groups consisted of No Pain Frequency, Low Pain Frequency, and High Pain Frequency. The No Pain Frequency group was compromised of children who reported "Never" in response to the item. Those in the Low Pain Frequency group indicated "Sometimes" and "Almost Never" on the item and children in the High Pain Frequency group answered "Often" and "Almost Always".

Physical activity—Children's physical activity was examined using the Block Kids Physical Activity Screener (Drahovzal, Bennett, Campagne, Vallis, & Block, 2003), which assesses the frequency and duration of time spent in various physical and sedentary activities over the past one week. Children completed the measure with parent assistance as needed. Minutes per day spent in moderate and vigorous physical activities were used in the current study. The measure has demonstrated adequate psychometric properties when compared to objective measures of physical activity (Drahovzal et al., 2003).

Children also completed the Progressive Aerobic Cardiovascular Endurance Run (PACER) (Leger & Lambert, 1982; Leger, Mercier, Gadoury, & Lambert, 1988), which was adapted from the 20 meter shuttle run test and used to assess physical fitness. To complete the PACER test, children run 20 meter laps for as long as possible, or until they fail to complete two consecutive laps within a specified time denoted by beeping sounds emitted from a CD. For the initial stage of the task, children are required to complete each 20 meter lap within approximately 9 seconds. After the first minute, the speed increases 1.0 mph and then by 0.5 mph for each subsequent minute. Total number of laps completed was used as the measure of physical fitness in analyses.

Health-related quality of life—Children and parents completed the PedsQL (Varni et al., 2001), a 23-item scale that measures physical, emotional, social, and school dimensions of HRQOL. Participants rated how much of a problem each item had been over the last month using a 5-point Likert scale ranging from *Never* to *Almost Always*. The measure has

excellent internal consistency, clinical validity, and factor-analytic support for subscales (Varni et al., 2001). The Total, Physical, Emotional, Social, and School scales were examined in main analyses. Of note, scores on the child-report of the PedsQL Total and Physical scales were calculated with the pain item ("I hurt or ache") removed. In this sample, the Chronbach's alpha for the Total and Physical scales without the pain item included were 0.86 and 0.69, respectively.

Anthropometric measurements—Measures of child height (to the nearest 0.1 cm) and weight (to the nearest 0.1 kg) were obtained by trained research personnel using a Harpendon stadiometer for height and a certified digital scale for weight. Children were dressed in light clothing and did not wear shoes for measurements. Child body mass index (BMI) z-score was calculated using age- and gender-specific norms published by the Center for Disease Control and Prevention (Kuczmarski et al., 2000).

Demographic information—Parents completed a demographics questionnaire that included family background information, such as parent/child age, parent/child gender, race, marital status, education, occupation, and family income.

Data Analysis Plan

Analyses were performed using SPSS 20 software. First, descriptive statistics were conducted on sociodemographic data, BMI z-score, pain frequency, all HRQOL scales, and measures of physical fitness and physical activity for the sample. Second, chi-square and bivariate correlational analyses were conducted to assess for covariates and to examine relationships between the main study variables (e.g., pain group, time in moderate physical activities, time in vigorous physical activities, physical fitness, and Total, Physical, Emotional, Social, and School scales of the PedsQL) and demographic variables (e.g., gender, race/ethnicity, weight status). Planned primary analyses consisted of analyses of variance (ANOVAs) and analyses of covariance (ANCOVAs) if covariates were implicated to compare children in the No Pain Frequency, Low Pain Frequency, and High Pain Frequency groups on the variables of interest. Post hoc tests were used to examine significant group differences, specifically Bonferroni to correct for multiple comparisons.

Results

There were slightly more female (54.4%) child participants in this study. Most were identified by parents as Caucasian (68.1%), with smaller proportions identified as African American (13.3%), Biracial (11.9%), Asian or Native Hawaiian (0.8%), and American Indian (0.7%). Fourteen parents (5.2%) did not report their child's race. In terms of ethnicity, 11.9% of children were identified as Hispanic or Latino. Participating parents were mostly mothers (87.0%), with fathers (7.8%), grandparents (4.1%), and other legal guardians (1.1%) making up a smaller percentage. Average child BMI z-score was 2.19 (*SD* = 0.37), with 28.9% of children classified as overweight and 71.1% classified as obese. Mean parent age was 40.04 years (*SD* = 6.8) and most were currently married (65.9%), with smaller numbers being divorced/separated (16.7%), never married (10.7%), cohabitating

(3.3%), and widowed (3.3%). Most parents (81.5%) earned at least a high school degree. Median yearly family income fell in the $40,000 – $59,999 range.

Information about the frequency of responses on the pain item from the PedsQL are presented in Table 1. The descriptive statistics for the main study variables for the entire sample are reported in Table 2. Examination of the physical activity and physical fitness data revealed significant positive skewness (greater than 1.5); therefore square root transformations were applied to normalize these variables before main analyses were conducted. The means and standard deviations presented in Table 2 for the physical activity and physical fitness data were prior to square root transformations to allow for easier interpretation of the data (e.g., minutes of physical activity per day). No other main study variables demonstrated significant skewness. In this sample of children, 39.6% (n = 107) denied experiencing pain during the previous one month (reported "Never"), which comprised the No Pain Frequency Group. Fifty-three percent (n = 143) endorsed experiencing pain "Sometimes" and "Almost Never " (Low Pain Frequency Group), whereas 7.4% (n = 20) reported "*Often*" and "*Almost Always*" pain (High Pain Frequency Group). There were no significant child gender or racial/ethnic differences or differences based on parent demographic factors (e.g., marital status, education) found on the main study variables. Chi-square analyses revealed no significant differences between the pain groups on weight status classification. Intercorrelations between main study variables are presented in Table 3. Child report of pain was significantly positively associated with minutes of moderate physical activity, as well as Total, Emotional, Social, and School HRQOL. Of note, on the "I hurt or ache" PedsQL item, "Never" is scored higher, indicating that children who report less pain engage in more moderately intense physical activities and report better HRQOL.

As no covariates were identified from preliminary analyses, ANOVAs were used to examine differences between the No Pain Frequency, Low Pain Frequency, and High Pain Frequency groups. Results are presented in Table 2. Significant group differences were found for time spent in moderate physical activity (F (2,264) = 4.45, p = .013), with children in the Low Pain Frequency group reporting less time engaged in moderate physical activities compared to the No Pain Frequency group (Bonferroni adjusted p = 0.01). No differences were found in moderate physical activity between the High Pain Frequency and No Pain Frequency groups. In addition, no significant group differences were found in time of vigorous physical activity and laps completed in the 20 meter fitness test. Significant group differences were found on the following child-report HRQOL scales: Total (F (2, 266) = 20.02, p < .001), Physical (F (2, 267) = 17.29, p < .001), Emotional (F (2, 267) = 30.53, p < .001), and Social (F (2, 267) = 6.20, p = .002) scales of the PedsQL, with children in the No Pain Frequency group reporting higher total, physical, emotional, and social HRQOL compared to children in the Low Pain Frequency (all Bonferroni adjusted ps < .05 (ranged from .000 to .038)) and High Pain Frequency (all Bonferroni adjusted ps < .05 (ranged from .000 to .006)) groups. No group differences were found on the School dimension of child HRQOL. When parent report of child HRQOL was examined the only significant group difference was on the School HRQOL scale (F (2, 267) = 4.61, p = .011), with parents of children in the High Pain

Frequency group reporting lower school HRQOL than the No Pain Frequency (Bonferroni adjusted $p = .021$) and Low Pain Frequency (Bonferroni adjusted $p = .008$) groups.

Discussion

The purpose of this study was to examine whether pain was associated with physical activity, physical fitness, and HRQOL in overweight and obese children. Results from this study demonstrated that almost two-thirds of treatment seeking children with overweight and obesity reported experiencing some frequency of pain in the past month, with most experiencing low pain frequency. Our hypothesis that there would be differences in physical activity between overweight and obese children reporting non-clinical low and high pain frequency and those not reporting pain was partially supported. Children in the Low Pain Frequency group reported significantly less engagement in moderate intensity physical activity per day compared to children in the No Frequency Pain group; however, they also engaged in less physical activity than children in the High Pain Frequency group. In addition, the pain groups did not differ in minutes per day spent engaged in vigorous physical activity. The lack of differences in vigorous physical activity could be due to the homogeneity of our sample in terms of weight status and the difficulties overweight and obese children may experience, regardless of pain or discomfort, when engaging in vigorous physical activity, such as negative social interactions, sweating more profusely, difficulties keeping up with peers, and body image uneasiness while being active. Our findings are consistent with outcomes reported by Wilson and colleagues (2010) who did not find an association between pain, weight status, and physical activity in their study of children and adolescents with chronic pain. However, our finding of group differences in moderate intensity activity diverges from Wilson et al. and may reflect differences in participant characteristics and measurement methods. For example, the larger proportion of youth in Wilson et al. were adolescents and healthy or underweight (62%) compared to children in the current sample who were 8 to 12 years of age and overweight and obese. Additionally, in the current study, children reported on levels of physical activity in the past week, whereas children in Wilson et al. reported on pain-related limitations in physical activity over a longer period of time. Another potential reason for our inconsistent findings (e.g., children in the Low Pain Frequency group engaged in less physical activity than children in the High Pain Frequency group) could be the small number of children in the High Pain Frequency group. These findings highlight the need for additional research to better understand how child age, stage of development, and different methods of measurement influence relations between pain, weight, and physical activity in overweight and obese children.

In contrast to our hypotheses, group differences were not indicated for level of child physical fitness. The lack of differences between the pain groups may be a reflection of the method of measuring physical fitness used in the current study. More specifically, laps completed during the PACER task may be a better representation of the combination of child motivation and physical capabilities (Leger & Lambert, 1982). The effects of non-clinical pain on physical functioning may be more transient and more strongly influenced by motivation, which is subjective and may be better captured in self-report measures of physical activity. Alternatively, the inability to detect group differences may also be a reflection of the generally low levels of physical fitness observed among the children in the

current study. On average, children were only able to complete 8 laps during the PACER test which was below the minimum required of 10 laps to calculate VO_2max in children (Institute, 2011; Leger & Lambert, 1982; Leger et al., 1988), the more advanced measure of physical fitness permitted by the PACER task.

According to child report of pain and HRQOL, overweight and obese children reporting frequent pain also reported significantly lower total, physical, emotional, and social dimensions of HRQOL. In addition, the PedsQL scores of children in the High Pain Frequency group, based on both child and parent report on most scales, are below suggested cut-offs (Varni, Burwinkle, Seid, & Skarr, 2003), indicating these children may be at risk for clinically significant impairments in HRQOL. This finding of pain frequency group differences are consistent with our hypothesis and with results reported by Haraldstad and colleagues (Haraldstad, Christophersen, Eide, Nativg, & Helseth, 2011), who found that pain was a significant predictor of HRQOL (across all domains of functioning) in a large sample of children ranging in weight status. While the lack of differences between the pain frequency groups on school HRQOL is in contrast to previous research involving children with chronic pain (Gorodzinsky, Hainsworth, & Weisman, 2011) and large samples of school-age children (Haraldstad, Christophersen, et al., 2011), our outcomes are similar to previous research that has demonstrated lower HRQOL across all domains with the exception of school functioning among overweight and obese children and adolescents with chronic pain (Hainsworth et al., 2009). Hainsworth and colleagues suggest that the interrelationships between pain and obesity may be different across domains of HRQOL. Perhaps for school HRQOL, weight status has a larger impact on functioning than pain. For example, overweight and obese children are at risk for peer victimization (Pearce et al., 2002), which could impact perceptions of functioning in the school environment, irrespective of pain frequency. Interestingly though was the finding that parent report of child HRQOL significantly differed by groups on only the school dimension of HRQOL. One explanation for the lack of group differences in parent report of HRQOL could be that parents relay on their children's external or observable functioning when completing ratings (Eiser & Morse, 2001). Given that pain is an internal, subjective experience it may not impact parent ratings of HRQOL as much as it may influence child ratings of HRQOL. In addition, poor agreement has been found between child and parent report of HRQOL in overweight and obese samples (Zeller & Modi, 2006), which may account for the inconsistent findings when child and parent report of HRQOL was examined in this study. Clearly more research is needed to further identify the interrelationships of weight status and pain on various dimensions of HRQOL, as well as methods of assessing HRQOL, in overweight and obese children.

Limitations of this study are important to consider. First, our assessment of pain was based on child response to a single item from the PedsQL, which has not been validated in previous research. Other studies have also utilized one item to measure chronic pain in children (Malaty et al., 2007; Wilson et al., 2010) and current findings suggest that the "I hurt or ache" item may be helpful in identifying pain frequency that may impact physical activity and quality of life in overweight and obese children. However, this measure identified few children experiencing high pain frequency which likely impacted our findings. Future research is needed to test the validity and reliability of this approach as a

potential screener of non-clinical pain. In addition, our pain measure did not permit the assessment of other salient pain characteristics, such as the extent to which pain is chronic, acute, and recurrent or pain location, duration, and intensity. Second, the results of this study are correlational in nature and causal relations cannot be determined. It is likely that pain may limit overweight and obese children's physical activity but may also be that limited physical activity occurs first which then results in more pain. Third, participants in the current study were treatment seeking children living in rural areas who demonstrated a lack of variability in physical fitness. Levels of physical activity in children vary by level of urbanization (Davis, Bennett, Befort, & Nollen, 2011; Joens-Matre et al., 2008), though the extent of these differences are unclear. In addition, children in the current study were primarily of Caucasian descent and physical activity in children also varies by racial and ethnic background (Chuang, Sharma, Skala, & Evans, 2013; Newton et al., 2011). Together, these issues limit the generalizability of our results to other groups of children. In addition, children in the current study reported significant variability in time engaged in both moderate and vigorous physical activity. Though statistical transformations were used to account for this variability it calls into question whether self-report physical activity questionnaires are the most reliable and valid in children. Future research examining how pain may influence engagement in physical activity in overweight and obese children would benefit from utilizing objective measures of physical activity, such as accelerometers.

Despite limitations, findings from this study suggest that even at non-clinical levels, pain may serve as a barrier to physical activity and greater impairment in HRQOL among treatment-seeking children with overweight and obesity. This has important implications for the treatment of obesity, given that increasing physical activity is generally a core component of interventions for overweight and obese youth. Findings also suggest that the HRQOL "I hurt or ache" item may be an informative indicator of physically and psychosocially impairing pain symptoms among overweight and obese youth. Given the increased frequency with which the PedsQL is being utilized in pediatric clinical settings, this could help facilitate the assessment of pain among overweight and obese youth seen in busy clinical settings where non-clinical pain may be overlooked if it is not the presenting problem.

Taken together, these findings highlight the importance and utility of comprehensive pain assessments involving multiple methods of evaluation, especially measures to assess the presence and impact of non-clinical pain in overweight and obese youth, and physical functioning as a multidimensional construct represented by physical activity and physical fitness. This is an understudied area of pediatric health that warrants further research, including prospective studies to better understand the relationship between pain, obesity, and other associated risk factors, such as sleep quality, sleep duration, and pain-related cognitions, on child functioning. Research examining mechanisms of the obesity-pain relationship are also needed. For instance, pediatric obesity has been hypothesized to lead to changes in biochemical functioning, which increases the likelihood of musculoskeletal misalignment and musculoskeletal pain leading to decreased physical activity and HRQOL, ultimately resulting in additional weight gain (Shultz et al., 2009). However, these mechanisms are likely bidirectional and more research examining these pathways are needed. Longitudinal assessments of weight status, pain, physical activity, and HRQOL

would also enhance this body of research and are needed to examine the developmental nature of these constructs in overweight and obese children, such as whether there are progressive increases in pain intensity and frequency as children get older or as weight status increases.

Implications for Practice

The current study provides initial evidence of potentially detrimental effects of non-clinical pain frequency on physical activity and HRQOL among overweight and obese youth, which has important implications for the development and implementation of pediatric weight management interventions. Pain management strategies may be important to consider integrating into existing weight management programs to increase physical activity and improve HRQOL, especially if future research finds pain may detrimentally impact treatment outcomes. For example, activity pacing (Gill & Brown, 2009) focused on gradually increasing physical activity levels among overweight and obese children may lead to more sustainable changes in physical activity and improvements in overall functioning. Overall, the findings from this study demonstrate that non-clinical pain is important to consider in research and clinical work with overweight and obese children, especially when the focus is on increasing physical activity and improving every day functioning.

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References

Ahn S, Fedewa AL. A meta-analysis of the relationship between children's physical activity and mental health. Journal of Pediatric Psychology. 2011; 36(4):385–397. [PubMed: 21227908]

Bout-Tabaku S, Briggs MS, Schmitt LC. Lower extremity pain is associated with reduced function and psychosocial health in obese children. Clinical Orthopaedics and Related Research. 2013; 471(4): 1236–1244. [PubMed: 23065330]

Chuang RJ, Sharma S, Skala K, Evans A. Ethnic differences in the home environment and physical activity behaviors among low-income, minority preschoolers in Texas. American Journal of Health Promotion. 2013; 27(4):270–278. [PubMed: 23448417]

Cohen LL, Lemanek K, Blount RL, Dahlquist LM, Lim CS, Palermo TM, Weiss KE. Evidence-based assessment of pediatric pain. Journal of Pediatric Psychology. 2008; 33(9):939–955. [PubMed: 18024983]

Daniels SR. The consequences of childhood overweight and obesity. Future Child. 2006; 16(1):47–67. [PubMed: 16532658]

Davis AM, Bennett KJ, Befort C, Nollen N. Obesity and related health behaviors among urban and rural children in the United States: data from the National Health And Nutrition Examination Survey 2003–2004 and 2005–2006. Journal of Pediatric Psychology. 2011; 36(6):669–676. [PubMed: 21227910]

Drahovzal, DN.; Bennett, TM.; Campagne, PD.; Vallis, TM.; Block, TJ. Comparison of the Block Child Activity Screener with an objective measure of physical activity; Poster session at annual meeting of the International Society of Behavioral Nutrition and Physical Activity (ISBNPA); 2003.

Eiser C, Morse R. Can parents rate their child's health-related quality of life? Results of a systematic review. Quality of Life Research. 2001; 10(4):347–357. [PubMed: 11763247]

Fearon I, McGrath PJ, Achat H. 'Booboos': the study of everyday pain among young children. Pain. 1996; 68(1):55–62. [PubMed: 9251998]

Gill JR, Brown CA. A structured review of the evidence for pacing as a chronic pain intervention. European Journal of Pain. 2009; 13(2):214–216. [PubMed: 18448368]

Gold JI, Mahrer NE, Yee J, Palermo TM. Pain, fatigue, and health-related quality of life in children and adolescents with chronic pain. Clin J Pain. 2009; 25(5):407–412. [PubMed: 19454874]

Gorodzinsky AY, Hainsworth KR, Weisman SJ. School functioning and chronic pain: a review of methods and measures. Journal of Pediatric Psychology. 2011; 36(9):991–1002. [PubMed: 21745810]

Hainsworth KR, Davies WH, Khan KA, Weisman SJ. Co-occurring chronic pain and obesity in children and adolescents: the impact on health-related quality of life. Clinical Journal of Pain. 2009; 25(8):715–721. [PubMed: 19920723]

Haraldstad K, Christophersen KA, Eide H, Nativg GK, Helseth S. Predictors of health-related quality of life in a sample of children and adolescents: a school survey. Journal of Clinical Nursing. 2011; 20(21–22):3048–3056. [PubMed: 21320221]

Haraldstad K, Sorum R, Eide H, Natvig GK, Helseth S. Pain in children and adolescents: prevalence, impact on daily life, and parents' perception, a school survey. Scandinavian Journal of Caring Sciences. 2011; 25(1):27–36. [PubMed: 20409061]

Hitt HC, McMillen RC, Thornton-Neaves T, Koch K, Cosby AG. Comorbidity of obesity and pain in a general population: results from the Southern Pain Prevalence Study. Journal of Pain. 2007; 8(5): 430–436. [PubMed: 17337251]

Hughes AR, Farewell K, Harris D, Reilly JJ. Quality of life in a clinical sample of obese children. International Journal of Obesity. 2007; 31(1):39–44. [PubMed: 16733522]

Institute C. Healthy Fitness Zone Lookup Tables Retrieved. 2011 Jul 11.:2013.

Janicke DM, Lim CS, Perri MG, Bobroff LB, Mathews AE, Brumback BA, Silverstein JH. The Extension Family Lifestyle Intervention Project (E-FLIP for Kids): design and methods. Contemporary Clinical Trials. 2011; 32(1):50–58. [PubMed: 20708715]

Joens-Matre RR, Welk GJ, Calabro MA, Russell DW, Nicklay E, Hensley LD. Rural-urban differences in physical activity, physical fitness, and overweight prevalence of children. Journal of Rural Health. 2008; 24(1):49–54. [PubMed: 18257870]

Kelly NR, Mazzeo SE, Evans RK, Stern M, Thacker LF, Thornton LM, Laver JH. Physical activity, fitness and psychosocial functioning of obese adolescents. Mental Health and Physical Activity. 2011; 4:31–37.

Kirk S, Scott BJ, Daniels SR. Pediatric obesity epidemic: treatment options. Journal of the American Dietetic Association. 2005; 105(5 Suppl 1):S44–51. [PubMed: 15867895]

Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, Flegal KM, Guo SS, Wei R, Johnson CL. CDC growth charts: United States. Advance Data. 2000; (314):1–27. [PubMed: 11183293]

Leger LA, Lambert J. A maximal multistage 20-m shuttle run test to predict VO2 max. European Journal of Applied Physiology and Occupational Physiology. 1982; 49(1):1–12. [PubMed: 7201922]

Leger LA, Mercier D, Gadoury C, Lambert J. The multistage 20 metre shuttle run test for aerobic fitness. Journal of Sports Sciences. 1988; 6(2):93–101. [PubMed: 3184250]

Lubans DR, Plotnikoff RC, Lubans NJ. Review: A systematic review of the impact of physical activity programmes on social and emotional well-being in at-risk youth. Child and Adolescent Mental Health. 2012; 17(1):2–13.

Malaty HM, Abudayyeh S, Fraley K, Graham DY, Gilger MA, Hollier DR. Recurrent abdominal pain in school children: effect of obesity and diet. Acta Paediatrica. 2007; 96(4):572–576. [PubMed: 17391473]

Newton RL, Han H, Sothern M, Martin CK, Webber LS, Williamson DA. Accelerometry measured ethnic differences in activity in rural adolescents. Journal of Physical Activity and Health. 2011; 8(2):287–295. [PubMed: 21415456]

Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. JAMA. 2012; 307(5):483–490. [PubMed: 22253364]

Okifuji A, Donaldson GW, Barck L, Fine PG. Relationship between fibromyalgia and obesity in pain, function, mood, and sleep. Journal of Pain. 2010; 11(12):1329–1337. [PubMed: 20542742]

Ottova V, Erhart M, Rajmil L, Dettenborn-Betz L, Ravens-Sieberer U. Overweight and its impact on the health-related quality of life in children and adolescents: results from the European KIDSCREEN survey. Quality of Life Research. 2012; 21(1):59–69. [PubMed: 21557001]

Panepinto JA, O'Mahar KM, DeBaun MR, Loberiza FR, Scott JP. Health-related quality of life in children with sickle cell disease: child and parent perception. British Journal of Haematology. 2005; 130(3):437–444. [PubMed: 16042695]

Pearce MJ, Boergers J, Prinstein MJ. Adolescent obesity, overt and relational peer victimization, and romantic relationships. Obesity Research. 2002; 10(5):386–393. [PubMed: 12006638]

Schwimmer JB, Burwinkle TM, Varni JW. Health-related quality of life of severely obese children and adolescents. JAMA. 2003; 289(14):1813–1819. [PubMed: 12684360]

Shultz SP, Anner J, Hills AP. Paediatric obesity, physical activity and the musculoskeletal system. Obesity Reviews. 2009; 10(5):576–582. [PubMed: 19460114]

Stinson JN, Kavanagh T, Yamada J, Gill N, Stevens B. Systematic review of the psychometric properties, interpretability and feasibility of self-report pain intensity measures for use in clinical trials in children and adolescents. Pain. 2006; 125(1–2):143–157. [PubMed: 16777328]

Taylor ED, Theim KR, Mirch MC, Ghorbani S, Tanofsky-Kraff M, Adler-Wailes DC, Yanovski JA. Orthopedic complications of overweight in children and adolescents. Pediatrics. 2006; 117(6): 2167–2174. [PubMed: 16740861]

Tukker A, Visscher TL, Picavet HS. Overweight and health problems of the lower extremities: osteoarthritis, pain and disability. Public Health Nutrition. 2009; 12(3):359–368. [PubMed: 18426630]

van den Berg-Emons RJ, Schasfoort FC, de Vos LA, Bussmann JB, Stam HJ. Impact of chronic pain on everyday physical activity. European Journal of Pain. 2007; 11(5):587–593. [PubMed: 17107818]

Varni JW, Burwinkle TM, Seid M, Skarr D. The PedsQL 4.0 as a pediatric population health measure: feasibility, reliability, and validity. Ambulatory Pediatrics. 2003; 3(6):329–341. [PubMed: 14616041]

Varni JW, Seid M, Kurtin PS. PedsQL 4.0: reliability and validity of the Pediatric Quality of Life Inventory version 4.0 generic core scales in healthy and patient populations. Medical Care. 2001; 39(8):800–812. [PubMed: 11468499]

Vervoort T, Goubert L, Eccleston C, Bijttebier P, Crombez G. Catastrophic thinking about pain is independently associated with pain severity, disability, and somatic complaints in school children and children with chronic pain. Journal of Pediatric Psychology. 2006; 31(7):674–683. [PubMed: 16093515]

Wang Y, Beydoun MA, Liang L, Caballero B, Kumanyika SK. Will all Americans become overweight or obese? estimating the progression and cost of the US obesity epidemic. Obesity. 2008; 16(10): 2323–2330. [PubMed: 18719634]

Willig AL, Hunter GR, Casazza K, Heimburger DC, Beasley TM, Fernandez JR. Body fat and racial genetic admixture are associated with aerobic fitness levels in a multiethnic pediatric population. Obesity. 2011; 19(11):2222–2227. [PubMed: 21546928]

Wilson AC, Samuelson B, Palermo TM. Obesity in children and adolescents with chronic pain: associations with pain and activity limitations. Clinical Journal of Pain. 2010; 26(8):705–711. [PubMed: 20664337]

Wittmeier KD, Mollard RC, Kriellaars DJ. Physical activity intensity and risk of overweight and adiposity in children. Obesity. 2008; 16(2):415–420. [PubMed: 18239653]

Wright LJ, Schur E, Noonan C, Ahumada S, Buchwald D, Afari N. Chronic pain, overweight, and obesity: findings from a community-based twin registry. Journal of Pain. 2010; 11(7):628–635. [PubMed: 20338816]

Zeller MH, Modi AC. Predictors of health-related quality of life in obese youth. Obesity. 2006; 14(1): 122–130. [PubMed: 16493130]

Zeller MH, Roehrig HR, Modi AC, Daniels SR, Inge TH. Health-related quality of life and depressive symptoms in adolescents with extreme obesity presenting for bariatric surgery. Pediatrics. 2006; 117(4):1155–1161. [PubMed: 16585310]

Table 1

Frequency of Responses on the PedsQL Pain Item for the Overall Sample and Pain Group Allocation (N = 270)

	I hurt of Ache Item	
Responses	***n***	**%**
Never	107	39.6
Almost Never	74	27.4
Sometimes	69	25.6
Often	12	4.4
Almost Always	8	3.0
Pain Frequency Groups	*n*	%
No Pain (Never Response)	107	39.6
Low Pain Frequency (Almost Never & Sometimes Responses)	143	53.0
High Pain Frequency (Often & Almost Always Responses)	20	7.4

Note. PedsQL = Pediatric Quality of Life Inventory.

Table 2

Descriptive Statistics of the Sample and Pain Group Differences

	Overall Sample (*N* = 270)		No Pain Group (*n* = 107)		Low Pain Group (*n* = 143)		High Pain Group (*n* = 20)		F Statistic
Measures	***M***	***SD***	**M**	**SD**	***M***	***SD***	***M***	***SD***	
Physical Activity[a]									
Minutes in Moderate PAs	60.40	61.73	73.88	76.72	49.89	47.73	63.08	46.84	4.45*
Minutes in Vigorous PAs	21.92	31.15	25.61	37.52	19.15	25.72	21.89	28.31	.96
Physical Fitness (Laps)[b]	8.20	3.53	8.27	3.25	8.19	3.90	7.94	2.24	.07
PedsQL – Child Report									
Total[cd]	76.11	13.95	81.68	12.34	73.56	12.76	64.66	18.07	20.02***
Physical[c]	79.92	15.20	85.28	12.71	77.72	14.72	66.96	19.35	17.29***
Emotional	72.07	21.51	83.08	17.37	66.05	19.98	56.25	25.80	30.53***
Social	75.76	20.16	80.23	18.46	73.88	19.20	65.25	29.09	6.20**
School[d]	75.43	17.48	77.12	17.81	75.03	16.06	69.25	23.91	1.79
PedsQL – Parent Report									
Total	72.52	15.50	72.36	15.04	73.42	15.34	66.90	18.41	1.57
Physical	75.06	20.54	74.42	20.28	75.61	21.02	74.53	19.30	.11
Emotional	70.72	19.12	71.68	18.43	70.70	18.98	65.75	23.58	.81
Social	69.22	19.89	68.22	19.00	71.05	18.82	61.50	24.12	2.38
School	73.54	19.28	73.88	18.85	75.00	17.82	61.25	26.99	4.61*

Notes. PAs = Physical Activities, PedsQL = Pediatric Quality of Life Inventory, BMI = Body Mass Index. Children were categorized into the No Pain, Low Pain, and High Pain Groups based on their response to the "I hurt or ache" item on the PedsQL. Physical activity and physical fitness data were significantly skewed and square root transformations were conducted on the variables before primary analyses were conducted. However, for the ease of interpretation (e.g., minutes of physical activity and number of laps) the original data is presented in this table.

[a] Physical activity data is presented as minutes per day; *n* = 267 (No Pain *n* = 106, Low Pain *n* = 141, and High Pain *n* = 20).

[b] *n* = 240 (No Pain *n* = 98, Low Pain *n* = 124, High Pain *n* = 18).

[c] The "I hurt or ache" item was not included when calculating child-reported PedsQL Total or Physical Scales.

[d] *n* = 269 (No Pain *n* = 106, Low Pain *n* = 143, High Pain *n* = 20).

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Table 3

Intercorrelations between Pain Item and Main Study Variables

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1.	Hurt or Ache (C)	-													
2.	Minutes in Moderate PAs	.15*	-												
3.	Minutes in Vigorous PAs	.10	.58***	-											
4.	Physical Fitness (Laps)	.01	−.04	−.01	-										
5.	PedsQL Total (C)[a]	.41***	.06	.09	.20**	-									
6.	PedsQL Physical (C)[a]	.35***	.18**	.17**	.19**	.79***	-								
7.	PedsQL Emotional (C)	.47***	.01	.02	.12	.76***	.45***	-							
8.	PedsQL Social (C)	.26***	.02	.03	.22**	.85***	.57***	.56***	-						
9.	Ped sQL School (C)	.15*	−.02	.04	.07	.64***	.33***	.26***	.45***	-					
10.	PedsQL Total (P)	.08	.01	.05	.16*	.27***	.18**	.18**	.25***	.23***	-				
11.	PedsQL Physical (P)	.01	.08	.06	.14*	.11	.14*	.03	.12	.08	.85***	-			
12.	PedsQL Emotional (P)	.08	−.04	.04	.11	.26***	.15*	.25***	.22***	.19**	.73***	.45***	-		
13.	Ped sQ L Soc	.06	.01	.09	.16*	.30***	.22***	.22***	.31***	.14*	.81***	.57***	.53***	-	
14.	PedsQL School (P)	.14*	−.08	−.04	.08	.24***	.08	.14*	.19**	.37***	.71***	.42***	.42***	.48***	-

Notes. PAs = Physical Activities (data presented is minutes of PAs per day), PedsQL = Pediatric Quality of Life Inventory, (C) completed by child, (P) completed by parent.

[a]The "I hurt or ache" item was not included when calculating child-reported PedsQL Total or Physical Scales.

*$p < 0.05$.

**$p < 0.01$.

***$p < 0.001$.

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