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## Research Article

# Weight Loss Programs fail in obese children with Blount's and SCFE

## Abstract

**Introduction:** Slipped capital femoral epiphysis (SCFE) and Blount's disease in children are associated with obesity. The purpose of this study is to evaluate the effectiveness of pediatric weight management programs in achieving weight loss in overweight children with SCFE and Blount's disease.

**Methods:** A retrospective review of medical records was performed on children treated surgically for SCFE and Blount's Disease between 2008 and 2013 by the senior author (WH). All patients in the study were overweight or obese.

**Results:** Sixteen females and 17 males with a mean age of 12.7 years were identified. All patients were offered a referral for weight loss management. 17 (52%) patients accepted the offer for a weight loss consultation and 12 (36%) actually attended the pediatric weight loss center. Patients who attended the pediatric weight loss center experienced a larger increase in BMI during follow-up compared to patients who did not attend the weight loss center.

**Conclusions:** Adolescents with SCFE or Blount's disease showed poor compliance in attending a weight management center. Furthermore, patients who attended the weight loss clinic failed to decrease their BMI.

## Introduction

The association between obesity and Slipped Capital Femoral Epiphysis (SCFE) and Blount's disease in children is well established in the literature [1-3]. Approximately two-thirds of patients with Blount's disease are obese and up to 80% of patients with SCFE are overweight or obese [1,4]. Increased stress placed on the tibia and femur of overweight and obese children predisposes them to the development of deformity. In these patients, excess weight overcomes the tensile strength of bone and cartilage leading to undergrowth of the medial aspect of the proximal tibial metaphysis in Blount's disease. Similarly, excess weight places increased stress on the cartilaginous growth plate of the hip leading to SCFE [4,5]. Obese children are also prone to develop additional musculoskeletal conditions, including flat feet, fractures, fracture complications, and complications following spinal surgery for scoliosis [6-13].

Recent studies have shown that obese children with Blount's and SCFE are at risk for disease progression [1-3,14]. Nasreddine and Kocher et al., suggested that a supervised weight loss program for patients being managed for unilateral SCFE may minimize progression to bilateral involvement [15]. Stimulated by Nasreddine's conclusions, we designed a study to

examine the effectiveness of a supervised weight loss program for patients with SCFE and Blount's disease. The aim of this study was to evaluate the effectiveness of a pediatric weight management program in achieving weight loss in overweight and obese children with SCFE and Blount's disease.

## Methods

This study was approved by the hospital's Institutional Review Board. The senior author's database was used to identify patients with a diagnosis of Blount's disease or SCFE who had undergone surgery related to this diagnosis between 2008 and 2013. Patients were excluded if they were older than 18 years of age at the time of their initial surgery or if they were of normal weight. The medical records of identified patients were reviewed retrospectively and demographic and clinical information was collected for each patient (Table 1).

The CDC BMI Percentile Calculator for Child and Teen was used to calculate child BMI percentile-for-age scores. Patients with a BMI percentile-for-age less than the 85<sup>th</sup> percentile were considered of healthy weight, between the 85<sup>th</sup> and 95<sup>th</sup> percentile-for-age were overweight, greater than the 95<sup>th</sup> percentile-for-age were considered obese, and patients with a BMI greater than the 99<sup>th</sup> percentile-for-age were considered severely obese [16,17].

The weight loss methods utilized by our hospital's pediatric weight loss center entailed a multidisciplinary approach centered on diet modification and exercise. The children were treated by registered dietitians, exercise physiologists, and pediatricians with expertise in obesity management. Each patient underwent a comprehensive medical evaluation and was provided with an individualized meal plan that centered on decreasing meal portion size and sugary drink consumption. A balanced and nutritious diet was designed for each patient participating in the program. Additionally, each patient had a consult with an exercise physiologist to increase their physical activity while decreasing lifestyle activities that promote a sedentary lifestyle. The exercise program included at least 60 minutes of physical activity daily, aerobic exercises, and limiting television and computer use to less than two hours daily. All patients had an initial assessment and were followed up on a quarterly basis. Psychological assessments of the patients, and assessment of parenting skills, were not performed routinely. No patient had a medical problem prohibiting them from attending the weight loss clinic. Due to the outpatient nature of the obesity management program, compliance with the recommendations of the weight loss clinic could not be accurately measured.

The mean values of each patient's BMI preoperatively and at latest follow-up were compared using the paired t-test. The effect of variables such as sex, ethnicity, laterality, progression to bilateral SCFE, and weight loss clinic attendance on the change in BMI between the preoperative visit and most recent follow-up was compared using the unpaired t-test. Statistical significance was defined as  $p < 0.05$ .

## Results

During the study period, 43 patients aged 18 or younger underwent surgical treatment for either SCFE or Blount's disease. Four patients were excluded for inadequate medical records and six patients were excluded because they had a BMI <85<sup>th</sup> percentile-for-age. Therefore, the final analysis consisted of 33 patients--16 females and 17 males-- with an average age of 12.7 years (range, 3.6 to 18.0 years). Nineteen (58%) patients had a family history of diabetes. We did not collect data on the weight of the parents or any family members. Subject demographic details are noted (Table 1).

Patient details regarding BMI, weight, and BMI percentile-for-age at the initial visit and most recent follow-up were assessed (Table 2). Patient average initial weight was 80.4 kg (range, 42.5-144.1 kg) and final weight was 95.4 kg (range, 43.8-153.7 kg). Preoperatively, 6 (18%) patients were overweight, 13 (39%) were obese, and 14 (43%) were severely obese. At an average follow-up of 24 months, the mean patient BMI increased from 32.4 kg/cm<sup>2</sup> to 34.8 kg/cm<sup>2</sup> ( $p=0.001$ ). Compared with their preoperative BMI, 25 (76%) children had an increase in their BMI at the latest follow-up. Only one subject who presented with unilateral SCFE progressed to bilateral SCFE during the course of the study.

**Table 1:** Demographic information of patient's with SCFE and Blount's disease.

	SCFE, n (%)	Blount's, n (%)	Total, n (%)
No. Patients	22 (67)	11 (33)	33
<b>Side affected</b>			
Right	8 (36)	3 (27)	11 (33)
Left	11 (50)	5 (46)	16 (49)
Bilateral	3 (14)	3 (27)	6 (18)
<b>Sex</b>			
Male	12 (55)	5 (45)	17 (52)
Female	10 (45)	6 (55)	16 (48)
<b>Race</b>			
Black	2 (9)	4 (36)	6 (18)
Other	20 (91)	7 (64)	27 (82)
Mean age (y) at initial surgery	12.2	13.7	12.7

**Table 2:** Body mass index (BMI) and weight (in kg) of patient's with SCFE and Blount's disease at initial visit and most recent follow-up.

	SCFE	Blount's	Total
<b>Body Mass Index</b>			
Initial	29.3 (27.0-31.6)	38.5 (34.9-42.2)	32.4 (29.5-35.2)
Latest Follow-up	31.7 (28.8-34.7)	41.0 (37.4-44.7)	34.8 (31.7-38.0)
<b>Weight</b>			
Initial	73.1 (65.1-81.2)	94.9 (80.5-109.3)	80.4 (70.9-89.9)
Latest Follow-up	89.9 (77.9-101.8)	106.4 (91.9-120.9)	95.4 (84.3-106.5)
<b>BMI % for Age</b>			
Initial	96.3 (94.4-98.2)	98.3 (97.2-99.5)	97.0 (95.5-98.4)
Latest Follow-up	95.3 (92.5-98.0)	98.5 (97.5-99.5)	96.3 (94.3-98.4)
Length of Follow-up (mo)	25.5 (18.6-32.4)	23.4 (14.2-32.6)	24.2 (19.1-30.5)

Data presented as mean and (95% confidence interval)

All thirty-three patients were offered a referral for weight loss management at the first or second postoperative visit. Twelve (36%) patients attended the pediatric weight loss center. Patients who attended the weight loss clinic had an initial BMI of 36.9 kg/cm<sup>2</sup> and a last follow-up BMI of 40.3 kg/cm<sup>2</sup> ( $p=0.003$ ). The remaining 21 patients who did not attend a weight loss clinic had an initial BMI of 29.7 kg/cm<sup>2</sup> and a last follow-up BMI of 31.7 kg/cm<sup>2</sup> ( $p=0.06$ ). Therefore, patients who attended the weight loss center experienced an average increase in BMI of 3.4 kg/cm<sup>2</sup>, a 10% increase, compared to an average increase of 2.0 kg/cm<sup>2</sup> ( $p=0.35$ ), a 7% increase, for those patients who did not attend the weight loss clinic.

Factors assessed for a possible relationship as to whether or not patients attended the weight loss clinic included patient gender, race, diagnosis and BMI (Table 3). Only patient BMI at the initial visit was significant. Patients accepting a referral for weight loss management had an average initial BMI of 36.7 kg/cm<sup>2</sup> compared to 27.8 kg/cm<sup>2</sup> ( $p=0.001$ ) for patients refusing a referral. Similarly, patients who attended the weight loss clinic had an average initial BMI of 36.9 kg/cm<sup>2</sup> compared to 29.7 kg/cm<sup>2</sup> ( $p=0.01$ ) for patients who did not. Other factors examined including patient gender, race, and diagnosis were not significant (Table 3).

**Table 3:** Effect of certain variables on the change in BMI during follow-up.

	Initial BMI	Latest Follow-up BMI	Change in BMI	p
<b>Diagnosis</b>				
SCFE (n=22)	29.3 (27.0-31.6)	31.7 (28.8-34.8)	2.5 (0.6-4.3)	0.99
Blount's (n=11)	38.5 (33.4-43.7)	41.0 (35.8-46.2)	2.5 (0.6-4.4)	
<b>Sex</b>				
Female (n=16)	30.1 (26.5-33.6)	33.4 (29.7-37.1)	3.3 (1.9-4.7)	0.26
Male (n=17)	34.6 (30.7-38.4)	36.2 (31.5-40.9)	1.7 (-0.57-4.0)	
<b>Ethnicity</b>				
Black (n=6)	38.6 (33.4-43.8)	37.5 (32.5-42.5)	-1.1 (-5.5-3.4)	0.01
Other (n=27)	31.0 (28.1-33.9)	34.2 (30.7-37.7)	3.3 (2.1-4.5)	
<b>Deformity Side</b>				
Unilateral (n=27)	32.1 (29.2-34.5)	34.4 (31.2-37.6)	2.3 (0.8-3.8)	0.62
Bilateral (n=6)	33.5 (25.3-41.7)	36.7 (28.0-45.4)	3.2 (0.05-6.4)	
<b>Weight Loss Referral Accepted</b>				
Yes (n=17)	36.7 (33.4-40.0)	40.1 (37.0-43.3)	3.5 (2.0-5.0)	0.14
No (n=16)	27.8 (24.6-31.0)	29.2 (25.7-32.7)	1.4 (-0.8-3.7)	
<b>Weight Loss Program Attended</b>				
Yes (n=12)	37.0 (32.6-41.3)	40.3 (36.1-44.6)	3.4 (1.7-5.1)	0.35
No (n=21)	29.7 (26.7-32.8)	31.7 (28.3-35.1)	2.0 (0.1-3.9)	

Data presented as mean and (95% confidence interval)  
Statistical significance defined as p<0.05

## Discussion

Childhood obesity is a global public health epidemic predisposing children to the development of significant medical morbidities involving nearly every organ-system, including several musculoskeletal conditions [6-13,18]. The direct costs of childhood obesity in the U.S. alone exceed \$14 billion dollars annually [19]. Additionally, studies have shown that approximately one-third school-age children in the U.S. are overweight or obese, and about half these children will become obese adults with the estimated annual cost of treating obesity-related illness in adults approaching an additional \$147 billion [20]. The link between obesity and the SCFE and Blount's disease has been previously published [1-3,6,21]. Our study similarly shows a strong association of SCFE and Blount's disease with an elevated BMI as 81% (35/43) of patients were overweight or obese, and 37% (16/43) of patients were severely obese-- (BMI percentile-for-age greater than the 99<sup>th</sup> percentile)-- at the time of the initial visit.

Our results indicate that the pediatric weight loss program at our institution is ineffective in achieving weight loss in overweight and obese children with SCFE and Blount's disease. This failure is either due to the program being ineffective or the recommendation not being respected. However, due to the outpatient nature of the program compliance with the recommendations of the weight loss program could not be accurately measured. Despite attending a multidisciplinary clinic that included the expertise of physicians, dieticians, and exercise physiologists, children attending the weight loss management program not only failed to decrease their BMI, but instead showed an overall increase in BMI during the follow-

up period. In fact, only two patients (16%) who attended the weight loss clinic had a decrease in BMI at final follow-up. The failure to lose weight was not unique to this particular clinics program [22,23].

Weight loss clinics in general are unsuccessful for most children. Several studies have similarly reported limited effectiveness of interventions aimed at achieving weight loss in overweight children [24-27]. For example, a recent study by Reinehr et al., of 11,681 overweight children treated at 175 centers specialized in pediatric obesity care in Central Europe found a mean reduction of only -0.15 SDS-BMI over a period of 1.2 years. Reinehr therefore concluded that these centers fail to achieve clinically relevant weight loss in overweight pediatric patients [28]. A few trials have demonstrated efficacy of lifestyle interventions in overweight children under ideal circumstances [26,27,29], however, when studied under real-life conditions pediatric weight loss centers report poor results [24-26]. Studies showing poor results cite a lack of psychosocial support and parenting skills, poor motivation for lifestyle changes, and constraints to therapy compliance [26]. In our study only 71% of patients who accepted a weight loss evaluation actually attended the weight loss clinic, however we were not able to measure each patient's compliance with the weight loss recommendations among patients who attended the weight loss program. In addition, 48% of patients refused the initial offer for a weight loss evaluation, reflecting significant misperception by the parent and child that the patient's obesity was a significant health issue. A recent publication by Duncan et al. found that as high as 78% of parents perceived their obese child as just about the right weight, revealing a significant misperception of children's body weight by parent's [30]. According to our results, however, there appears to be a point at which patients or their parents are unable to deny their weight status, as the BMI of patients who accepted a referral and attended a weight loss program was significantly higher compared to those who did not.

Lifestyle modification through caloric restriction and enhanced exercise and physical activity remain key treatments for obesity in most children. Medications such as Orlistat and Sibutramine have been utilized but challenged due to serious adverse side effects such as gastrointestinal, cardiac, and neurological complications [22,31]. In the current study, no weight loss medication treatments were used.

Future avenues of research in pediatric weight loss include bariatric surgery. Bariatric surgery for adolescents as a treatment for obesity has risen steadily over the last several years; however many pediatricians are often reluctant to refer patients for surgery due to the perceived risk [33-35]. Reported complication rates for gastric bypass surgery are low and clinically significant BMI reductions have been shown [33,36-38].

Limitations of this study include its retrospective nature, small sample size, and potential selection bias of patients who attended the weight loss program. In addition, we were not able to measure patient compliance with the recommendations prescribed by professionals at the weight

loss center. Furthermore, due to our lack of long-term follow up we don't know the long-term orthopaedic consequences of these patients not losing weight. Other factors can influence the development of obesity in adolescents including the psychiatric state of the patients, alterations in eating habits, and psychosocial components, and these were not studied in this paper. The results of this preliminary study would be supported by a prospective study with comparison groups in the future.

## Conclusion

The current study demonstrates a near complete failure of one centers comprehensive pediatric weight loss clinic to reduce weight in obese children with SCFE and Blount's disease. Eighty-three percent of patients who attended the weight loss clinic demonstrated an increase in BMI at 2 years follow up. Without a comprehensive cultural change in the food industry and a behavioral change among children we foresee very little success in weight loss programs for obese children with SCFE and Blount's disease.

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