

## Abstracts

# Nutrition/Bone Health/Obesity

### **Influence of Loading on Bone in Independently Ambulatory Children with Myelomeningocele**

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**Background** Children with myelomeningocele (MM) often have functional deficits leading to insufficient loading, decreased bone accrual and increased fracture risk. This study assessed bone deficits and their relationship to loading.

**Methods** Thirty-five independently ambulatory children with MM and 19 controls ages 6–13 years were examined. Subjects underwent gait analysis to obtain 3D lower extremity kinematics and kinetics during walking. Children with MM also had average steps/day recorded by an activity monitor. Bone was measured using computed tomography of the tibias at 13% (proximal metaphysis), 50% (diaphysis), and 90% (distal metaphysis) of tibia length.

**Results** The groups had similar age (mean 10.0, SD 2.4 years), sex (59% male), and anthropometric measures, but children with MM had lower cancellous bone density in both proximal (117 vs. 165 mg/cm<sup>3</sup>,  $p < 0.0001$ ) and distal (117 vs. 159 mg/cm<sup>3</sup>,  $p < 0.001$ ) metaphyses, plus smaller diaphyseal bone area ( $p = 0.004$ ) and thickness ( $p = 0.002$ ). They had higher knee extensor and ankle dorsiflexor moments but lower knee flexor, hip flexor, ankle plantarflexor, and knee adductor moments ( $p \leq 0.03$ ).

For the children with MM, higher cancellous density was associated with higher magnitude knee flexor ( $p \leq 0.003$ ), hip extensor ( $p \leq 0.01$ ), and ankle plantarflexor moments ( $p = 0.007$ ). Cross-sectional area of the distal metaphysis was associated with higher knee extensor and ankle plantarflexor moments ( $p \leq 0.05$ ). In the diaphysis, bone area was positively related to knee flexor moments ( $p = 0.001$ ). There was no relationship

between steps/day, demographics and bone properties at any site.

**Conclusions** Independently ambulatory children with MM have bone deficits in the tibial metaphyses and diaphysis which likely contribute to increased fracture risk. To build bone, rehabilitation programs for these more functional children should focus on activities that produce high loads rather than more repetitions.

### **The Implication of Total Energy Expenditure on Nutritional Guidance in Children with Special Needs**

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**Background** Children with special needs (SN) have a higher risk of obesity when compared to their typically developing peers. Two specific diagnoses include Spina Bifida (SB) (physical disability) and Down syndrome (DS) (intellectual disability). While the etiology of obesity risk is multifactorial, it is proposed that these children have a lower (although not quantified) basal metabolic rate that directly impacts their daily recommended nutritional intake. The purpose of this study was to evaluate Total Energy Expenditure (TEE) in children with SB, DS and a healthy comparison (HC) group and its' impact on the child's nutritional needs.

**Methods** A descriptive correlational study that included a convenience sample of 36 children (4–18 years-of-age) with either SB, DS or a HC group stratified by age, disability, and mobility status (SB ambulatory vs. SB wheelchair user). Measures: TEE and fat free mass were measured by the gold standard doubly labeled water assessment over 14 days. Analysis: Descriptive and regression analyses.

**Results** Children with SN had significantly lower TEE, averaging 500–800 calories less per day when compared to the HC group. Children with SB who were ambulatory and children with DS had similar levels of TEE. Children with SB who primarily used a wheelchair for mobility had the lowest TEE. The main predictor of TEE for each sample was the individual's fat free mass (SB-ambulatory  $R^2 = 0.94$ ; SB-wheelchair users  $R^2 = 0.83$ ; DS  $R^2 = 0.91$ ; HC  $R^2 = 0.82$ ).

**Conclusions** Participants with SN had a significantly lower TEE when compared to the HC group. This discrepancy can easily lead to overfeeding of the child with SN which contributes to the increased prevalence of obesity in these high-risk populations. Providers have the ability to educate families and provide appropriate guidance that can minimize overfeeding, encourage physical activity, and promote a healthy weight in children with SN.

### Quantitative Analysis of Lower Extremity Adipose Tissue Distribution in Children with

#### Myelomeningocele

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**Background** Children with myelomeningocele (MM) tend to be more overweight/obese compared to youth without MM. Intramuscular fat has been associated with insulin resistance, while effects of subcutaneous fat seem to be less negative. This study quantified lower leg adipose, muscle and bone volume in children with MM.

**Methods** Eighty-eight children with MM and 113 without MM underwent computed tomography scans of both tibias. Tissue volumes were computed along the entire tibia length. Subcutaneous and muscle-associated adipose were classified relative to the crural fascia. Tissue volumes were compared among groups using linear regression.

**Results** There were no significant differences in subcutaneous adipose among groups (control:  $2110 \pm 823 \text{ cm}^3$ , sacral:  $2030 \pm 931$ , low lumbar:  $1509 \pm 673$ , midlumbar:  $2138 \pm 931$ , high lumbar/thoracic:  $2421 \pm 645$ ;  $p \geq 0.14$ ). Muscle-associated adipose volume increased (control:  $84 \pm 70 \text{ cm}^3$ , sacral:  $307 \pm 288$ , low lumbar:  $534 \pm 311$ , midlumbar:  $897 \pm 513$ ,

high lumbar/thoracic:  $861 \pm 382$ ) and muscle volume decreased (control:  $3210 \pm 889 \text{ cm}^3$ , sacral:  $2212 \pm 988$ , low lumbar:  $910 \pm 565$ , midlumbar  $908 \pm 577$ , high lumbar/thoracic:  $558 \pm 273$ ) with increasing level of involvement ( $p < 0.05$ ). Bone volume also tended to decrease with higher neurosegmental levels (control:  $807 \pm 233 \text{ cm}^3$ , sacral:  $698 \pm 274$ , low lumbar:  $483 \pm 195$ , midlumbar:  $544 \pm 207$ , high lumbar/thoracic:  $293 \pm 99$ ).

**Conclusions** Greater lower leg adipose tissue in children with MM is primarily attributable to higher volumes of muscle-associated adipose.

Because muscle-associated adipose is more strongly associated with negative health outcomes than subcutaneous adipose, children with MM may have an increased risk of adverse health effects. It may be possible to reduce muscle-associated adipose through diet and exercise interventions and be beneficial to tailor treatment protocols to consider the anatomic distribution of adipose tissue when treating children with MM.

### Parental Feeding Behaviors and Weight-Related Concerns in Children with Special Needs

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**Background** Parental feeding behaviors and concern about child weight are associated with obesity among typically-developing youth. Little is known about this relationship among parents of youth with special needs (specifically Spina Bifida [SB], Down syndrome [DS] and autism spectrum disorder [ASD]), despite these children being at higher risk for obesity. The purpose of this study was to explore the associations among parental feeding behaviors, parent weight concerns, demographics and child weight status in a sample of children diagnosed with SB, DS and a healthy comparison group.

**Methods** Cross sectional descriptive study design. Sample: Parents of 356 children with SB ( $n = 99$ ), DS ( $n = 110$ ) and ASD ( $n = 147$ ). Procedures: Parents of children with special needs completed an online survey. Measures: Demographics, Parent reported parent and child height and weight, and the Child Feeding Questionnaire. Summaries: Median and interquartile range (IQR). Tests: Mann-Whitney.

**Results** Parental monitoring and restriction were significantly related to the child's weight and intensified

when the parent was concerned about the child being overweight. Compared to the normal or underweight group, the overweight and obese group received a higher level of monitoring 4.0 (3.0, 5.0) vs 3.7 (2.3, 4.0) and restriction 4.0 (3.4, 4.4) vs. 3.4 (2.5, 4.0),  $p \leq 0.001$ . Child's diagnosis, family income, parent age and parent gender influenced select feeding behaviors.

**Conclusions** Obesity has significant health ramifications and negatively impacts an individual's ability to self-manage, which is crucial in individuals with special needs. These findings present an opportunity for the healthcare community to educate and promote healthy feeding practices in this vulnerable population.

### **Biopsychosocial Model of Care for Nutrition in Children with Spina Bifida**

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**Background** Children with Spina Bifida are at high risk for nutritional problems over the course of their development. Developmental delay, dysphagia, neurogenic bowel, behavioral aspects, and differences in mobility impact caloric needs, intake and expenditure with these parameters changing over time as the child grows.

These children also face considerable challenges to attaining optimal nutritional status related to variable chronology for reaching developmental milestones, adaption to their disability and psychosocial factors.

**Methods** A biopsychosocial model allows comprehensive nutritional assessment of the child in the context of medical issues, family and behavioral dynamics, and psychosocial stressors. It also engages an interdisciplinary team consisting of the Dietitian, Speech-Language Therapist, and Developmental Pediatrician to integrate findings into a comprehensive developmentally oriented care plan. In addition, the model establishes a foundation for providing accurate and insightful anticipatory guidance and recommendations across the developmental trajectory, with child and family education and shared decision-making comprising key components.

Case studies will be presented to demonstrate this model of care:

1. A toddler with Spina Bifida, dysphagia, language delay, and failure to thrive, whose father is incarcerated.

2. An adolescent with Spina Bifida who has depression, nonverbal learning disability, and obesity.

**Results** Utilizing a biospsychosocial model that engages relevant disciplines longitudinally, along with incorporating child/family education and shared decision-making, can optimize nutritional outcomes in children with Spina Bifida.

**Conclusions** Essential Features of Model:

1. Longitudinal Biopsychosocial Model.
2. Dietitian, Speech and Language Therapist, Developmental Pediatrician.
3. Child/Family Education and Shared-Decision Making.

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### **Consistency of Weight and Height Measurement in Clinics from the National Spina Bifida Patient Registry (NSBPR)**

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**Background** Accurately measuring height and weight or estimating body fat in children with Spina Bifida (SB) is complicated, which ultimately impacts the ability to prevent or treat obesity in this population. Weight and height serve to calculate body mass index (BMI) to indicate a child's weight status by age and gender. Currently, there is no policy or recommendation on how to properly measure height and/or estimate body fat in children with SB. We interviewed staff members of the NSBPR clinic sites to determine: (a) methods of height and weight measurements currently used for individuals with SB and (b) potential variations by clinic, mobility status and/or age group.

**Methods** This descriptive quality improvement project included two staff members from each of the 19 NS-

BPR clinic sites ( $n = 38$ ). For each clinic, the goal was to include a NSBPR principal investigator/co-investigator and a staff member who performs anthropometric measures for individuals with SB. Individual phone interviews based on a structured interview guide were conducted. Descriptive and thematic analysis were used.

**Results** Sites appear to be highly consistent in measuring height and weight for individuals able to walk, although there are inconsistencies in the inclusion of braces when measuring weight. Inconsistencies are

more pronounced in measuring individuals who use wheelchairs, often due to scoliosis, contractures, or limited mobility. The results will be fully discussed at the conference.

**Conclusions** Understanding the consistency of measurement of height and weight is fundamental to using these measures in analyses of the NSBPR data. Accurate measures will be even more important in the future in developing an algorithm to estimate fat mass in individuals with SB.