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previous evidence indicates potential shared mechanisms and neural substrates associated with motor and language development, this work has not explored these interrelationships within the early stages of development and has instead primarily focused on individuals older than one year. Therefore, the purpose of this study is to examine the influence of fine and gross motor competence at 3 months on the competency of receptive and expressive language at 6 months. A sample of 12 infants (8 female) born at full-term were assessed at 3 months old (3.45 +/- 0.25 months) and 6 months old (6.41 +/- 0.32 months) for this study. All competency measures were assessed using the Bayley Scales of Infant Development – 3rd ed. Utilizing a linear regression model, findings for this study indicate that an infant's fine motor competence at 3 months old did not influence either measure of language competency at 6 months ($F(1,10) <= 0.271$, $p >= 0.614$, $R^2 <= 0.026$). However, gross motor competence at 3 months old did significantly predict the infant's expressive language competency at 6 months ($F(1,10) = 22.744$, $p = 0.001$, $R^2 = 0.695$), with receptive language competency showing a statistical trend ($F(1,10) = 4.312$, $p = 0.065$, $R^2 = 0.301$). Taken together, these results suggest that a focus on gross motor development during early infancy may have a cascading effect on future language development; and conversely that any disruptions in the development of this system may be associated with delays in language development during this sensitive period. Funding source: Support for our research was provided by a U.S. Office of Special Education Program Training Grant through the U.S. Department of Education, and research funding from the School of Kinesiology at the University of Michigan both awarded to D. Ulrich.

The Association between Multidimensional Balance and the Locomotor Subscale of the TGMD-3 in Youth with Visual Impairments

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Youth with visual impairments (YVI) are a population prone to health- and motor-related disparities. Balance performance could be acting as a functional constraint on these outcomes. However, traditional balance assessments have lacked dimensionality and most studies investigating balance in YVI have been indefinite and/or lacked empirical rigor. Therefore, the purpose of this study was to examine the association between the Brief-Balance Evaluation Systems Test (BB) and the locomotor subscale of the Test of Gross Motor Development-3 (LOC-3) in YVI.A convenience sample of YVI ($N = 96$, $M_{age} = 12.98$, $SD = 2.28$) were recruited to participate in this study. Participants were digitally recorded completing the BB and the LOC-3. Zero-order Spearman correlations (rho) were used to assess the strength and direction of the monotonic relationship between composite and item scores. Further, a second-order partial rho (confounders = comorbidity, vision level) was performed between total scores. Quantile regression was used to parsimoniously predict LOC-3 total score from individual BB items. Mean scores for the BB were 15.71 ($SD = 3.27$) and 26.23 ($SD = 8.36$) for the LOC-3. The zero-order rho between BB and LOC-3 was .60 ($p < .001$, 95% CI = .46-.72) while the second-order rho was .42 ($p < .001$, 95% CI = .24-.57, $SE = 0.08$). Zero-order rhos between individual BB and LOC-3 items ranged from -.09 to .55. Using quantile regression, a model utilizing the BB timed up and go (beta = 7.00), hip/trunk lateral strength (beta = 3.00), and functional reach forward (beta = 2.00) was selected ($F = 7.49$, $p < .001$, Nagelkerke pseudo-$R^2 = .37$). This is the first study to investigate multidimensional balance abilities in YVI. Unlike past investigations in balance in YVI (and other populations), these results strongly support the existence of an association relationship between balance and locomotor performance. 'Biomechanical' and 'stability in gait' balance mechanisms/constraints may be systems of interest moving forward concerning locomotor performance in YVI.

Is there a Relationship Between Time Spent in Constrained Positions and Infant Development at 3 Months?

Lu Qu, Larken Marra, Carissa Wengrovius, Dale Ulrich, University of Michigan

The American Academy of Pediatrics recommends that infants spend minimal time in restrictive positions/devices (i.e. swings) to mitigate the possibility of motor development delay. There is no thorough exploration of a relationship between time spent in a particular position and early infant development. We aim to determine if a relationship exists between the time spent in a constrained position and the attainment of motor, cognitive and language development at 3 months of age. A sample of 18 full-term infants (9 female) was assessed at 3 months (M:3.5,SD:.26) using the Bayley Scales of Infant Development–3rd ed. Three days of physical activity (~10 h/day) were recorded using ActiGraph GT3X-BT placed on the infant's wrist (W) and ankle (A). Parental logs were used to track the type of device/position (e.g. car seat, floor) and time within each device/position. A correlation analysis was used to determine this relationship. Significant negative relationships were found between the percentage of time in constrained positions and the raw score of the Expressive Communication subtest (A: $r(18)$=-.57, p<.01), (W: $r(18)$=.57, p<.01); and the raw score of the Fine Motor subtest (A: $r(18)$=-.70, p<.001), (W: $r(18)$ =-.70, p<.001). Meanwhile, the percentage of time in less constrained positions was negatively correlated with the composite score of the Motor subtest (A: $r(18)$=-.60, p<.01), (W: $r(18)$=-.59, p<.05). These results show that increased time in constrained positions is significantly associated with less developed fine motor and expressive language skills at 3 months. Additionally, positioning which allows for some limb movement is still associated with decreased overall motor development. These findings suggest that the relationship between constrained or limited positioning and the effects on infant development are emerging as early as 3 months. Therefore, future research in this area should investigate the implications of prolonged constrained positioning on infant development and parent training. Funding source: U.S. Department of Education Training Grant.

Motor Competence Assessment (MCA): Portuguese Normative Values.

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Motor competence (MC) relationship with the development of healthy life styles is well known. Nonetheless, there is no established instrument able to measure this "new" construct along the life span, and the ones usually cited in the literature were mostly built for the diagnosis of children in risk for motor impairment, lack objectivity or fidelity in the assessment protocol, or do not assess the three components of MC: locomotor, stability, and manipulative. Because of this, researchers have difficulty on comparing their results, and to understand the real effect of MC development on the human development. The MCA (Motor Competence Assessment) has been recently presented in an attempt to solve these problems but its normative values have not yet been established. This study presents the MCA Portuguese normative data from 3 to 23 years of age. Data used in the study belongs to a larger project that aims to collect data on motor competence,

physical activity, physical fitness, somatic fitness, cognitive performance, and academic achievement in Portugal. This sample data was collected in Viana do Castelo, Lisboa, and Melgaço. A total of 2087 students (1102 boys) of all education levels, from Preschool to University, with no motor or cognitive impairment were tested in the MCA. The MCA is composed by two tests for each MC component (Stability: lateral jumps + shifting platforms; Locomotor: standing long jump + 10 m shuttle run; and manipulative: throwing ball + kicking ball). All tests are quantitative (product-oriented) motor tests without a marked developmental (age) ceiling effect, and of feasible execution. Results were inspected for the normality of distribution according to age and sex. Smoothed percentile curves were created using the LMS Chart Light Version 2.54 software. The best model for each test and sex was used according to the goodness of fit values produced. The final norms showed a good fit to the developmental expectations of the instrument, allowing to differentiate and to classify performances along the all span studied, 3 to 23 years of age.

The Relation Between Fine Motor Skills and Executive Functions in 2-Year-Old Children

Lucas Rooney, Laura Claxton, Purdue University

Numerous studies point to a link between fine motor skills and executive functioning (EF) in 3- to 6-year-olds (e.g., Oberer et al., 2017; MacDonald et al., 2016); however, it is unclear if this relation exists at younger ages. For example, Gottwald et al. (2016) found that 18-month-old's fine motor skills and EF were not related; whereas, Wu et al. (2017) found that fine motor skills at 2-years predicted EF at 3-years. Therefore, the current project aimed to further explore EF and fine motor skills in typically developing 2-year-olds. Thirty-seven 2-year-olds (m=30.91mo; 14 girls; range=25-35mo) participated. Participants completed the Minnesota Executive Function Scale (MEFS) and the Fine Motor portion (FMQ) of the Peabody Developmental Motor Scale Version-2. The MEFS, a comprehensive measure of EF, assesses cognitive flexibility, inhibition, and working memory. The FMQ has two subtests: Grasping (whole-hand and finger grasping) and Visual Motor Integration (VMI; eye-hand coordination). To control for verbal IQ, parents identified the number of words children could produce using age appropriate versions of the MacArthur-Bates Communicative Development Inventories. MEFS and FMQ were positively correlated (r=0.62, p=0.00) even when controlling for age (in mos) and verbal IQ (r=0.57, p=0.01). For the fine motor subtests, MEFS positively correlated with VMI (r=0.52, p=0.00) and Grasping (r=0.40, p=0.03). But, when controlling for age and verbal IQ only VMI remained positively correlated with MEFS (VMI: r=0.54, p=0.01; Grasping: r=0.25, p=0.26). Regression analyses controlling for age and verbal IQ showed that VMI significantly predicted MEFS performance (adj r^2=0.31; β=0.54; p=0.00), but not Grasping (adj r^2=0.11; β=0.31; p=0.22). These findings demonstrate a link between EF and visual-motor integration in 2-year-olds. Future research should continue to assess which aspects of fine motor skills are linked to EF at these younger ages.

Comparison of Indirect Calorimetry- and Accelerometry-Based Energy Expenditure in a Low Socioeconomic Preschool Movement Skill Intervention

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To examine the differences in energy expenditure (EE) during a fundamental movement skill intervention as measured by indirect calorimetry and accelerometry. Children ages 3-5 years old (N = 76; *Mage* = 46.91 ± 8.94 months), from a Head Start program located in an urban city in the southeastern United States, participated in 4 thirty-minute movement lessons per week that included an array of gross motor tasks divided into locomotor (e.g., run, jump, leap) and object control skills (e.g., throw, catch, kick) over a 12 week period. Accelerometers (ActiGraph GT3X+; Freedson 1998; hip) were used to measure physical activity (PA) during the intervention. For the purposes of this study, children (N = 4; M_{age} = 44.3 ± 3.67 months) wore a COSMED K4b2 portable gas analyzer during 8 independent intervention sessions. Dependent t-tests and Pearson's correlations were used to examine METS estimated by accelerometry and METS derived from indirect calorimetry. Average EE evaluated by indirect calorimetry exceeded thresholds for moderate PA in children (*MMETS* = 4.4 ±1.5) while EE predicted by accelerometry was approaching thresholds for vigorous PA (*MMETS* = 6.2 ±1.9). Dependent t-tests indicated statistically significant differences (p < .05) between accelerometry-based MET estimations and indirect calorimetry. Correlations were not significant between indirect calorimetry and accelerometry in 6 of the 8 sessions evaluated. Results indicate a lack of agreement between accelerometers and indirect calorimetry during a fundamental movement skill intervention demonstrating the need for improved measurement techniques during physical activity interventions. Current measurement practices underestimate the metabolic value of repetitively practiced discrete skills. Given the predictive validity of discrete skills regarding future PA participation, interventions need to target these skills. Thus, future intervention strategies should evaluate both EE and skill learning to maximize positive developmental trajectories for health.

Physical Fitness and Gross-Motor Skills Among one and Multiple Sports Participants

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This study investigated how participating into one or several organized sports relates to children's physical functional capacity. Participants were 781 (boys=378, girls=403) fifth grade children (age=11.3, *SD*=0.3) who were involved in organized sport. Students participated in a series of physical performance tests (5) and gross-motor tests (3) under the surveillance of research group. Physical performance tests included tests of 20 meters shuttle run, curl-up, push-up, standing five-jumps, and combined throwing and catching. Gross-motor tests included sideways jumping, moving sideways and walking backwards tests. Total fitness score and motor quotient score were calculated. One-way analysis of covariance and t-test were used to compare group differences in physical performance variables. Participation to several sports was associated with better fitness and gross motor total score results among boys. Earlier start age was associated with higher scores in gross motor test among boys and girls and in fitness scores among boys. Late start age with one sport was associated with lower scores among boys especially in jump test, push-up and motor quotient. Among girls', late one sport participants had lower scores in push-up and moving sideways. Results from this study showed that among boys participating to several sports and early involvement in organized sports were related to higher performance in fitness and gross-motor tests at the age of 11. Among girls, association was found only with early involvement in sports and motor coordination tests.

Exploring Caregiver Perspectives of Social and Motor Skills in Children with Autism Spectrum Disorder and the Impact on Participation

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