

Factors Related to Single Leg Hopping Task Performance in Youth: Keys to an Objective Assessment of Physical Literacy

Nicole J. Chimera¹, Shawn M. Beaudette¹, Umar Yousufy¹, Nathan D. Hall¹

¹Department of Kinesiology, Brock University, St. Catharines, Canada

Email: nchimera@brocku.ca

Summary

Physical literacy (PL) is an important contributor to lifelong physical activity but is often assessed with subjective movement screens. This study determined the relationship between age, sex, history of physical activity, and PL self-assessment on hop length (HL) and hop asymmetry (HA) during a PL hopping task assessed through markerless motion capture. Biological sex and age were predictors of HL, while physical activity level may be related to HA.

Introduction

PL is a multidimensional construct that assesses competence, confidence, motivation, and feelings a person has during movement [1]. In children, higher PL correlates with higher physical activity, less sedentary behaviour, improved cardiorespiratory fitness, reduced screen time and weight status, and male sex [2,3]. Typically, PL is assessed using movement screens such as the Physical Literacy Assessment for Youth (PLAY). The PLAY-basic tool uses 5 skills (throw, kick, hop, run, backwards walk) to assess PL and includes assessment of symmetrical movements in throwing, single-leg hopping, and kicking. However, the subjective nature of the PLAY-basic may limit interpretation. Motion capture can quantify movement performance, which may provide more objective assessment of PLAY-basic data. Therefore, the purpose of this study was to determine the relationship of age, sex, history of physical activity (PAQ-C), and PL self-assessment (PLAY-self) with HL and HA assessed through markerless motion capture of PLAY-basic hop task.

Methods

Children (6-12 years) were assessed with the PLAY-basic tool. In this secondary analysis of data, an open-source pose estimation tool (FreeMoCap.org) was used to reconstruct 2-dimensional (2D) full body markerless kinematics from the PLAY-basic hop task (performed on preferred and non-preferred limb) recorded on a single HD camera (Fs = 25 Hz, Sony Handycam HDR CX405). A custom MATLAB[®] script (MathWorks, 2024) used the heel marker from the 2D coordinates to identify three similar hops for each limb in participants (Figure 1). HL (based on pixels) was determined from the preferred limb; HA was calculated as absolute difference between limbs. Age, sex, PAQ-C, PLAY-self were predictor variables; HL and HA were criterion variables. All predictors were simultaneously entered into the regression

analysis; those with $p < 0.25$ were retained for final regression to determine relationships with HL and HA (IBM SPSS v.29).

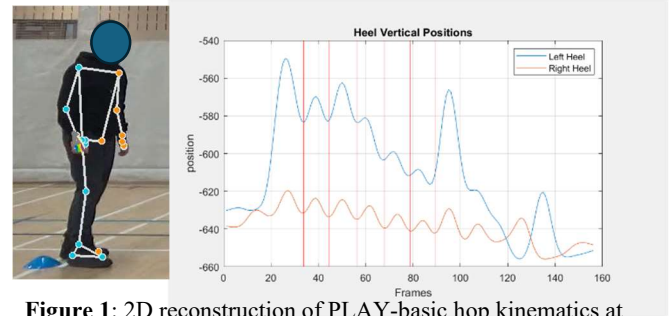


Figure 1: 2D reconstruction of PLAY-basic hop kinematics at initiation of hop (left); with heel vertical positions plotted (right).

Results and Discussion

Mean and standard deviation (SD) for all variables were computed from forty-seven children ($n=27$ female; $n=20$ male) (Table 1). PLAY-basic hop data were processed and analyzed with age and sex identified as significant predictors of the variance in preferred limb HL ($R^2 = .323$; $p < .001$; unstandardized $\beta = 60.87$ [sex], 8.84 [age]). Physical activity level was the only predictor of HA, although the final regression equation resulted in a non-significant inverse relationship between physical activity level and HA ($R^2 = .058$; $p = .104$; unstandardized $\beta = -10.31$).

Conclusions

Older age and male sex were related to longer hop length explaining 32% of the variance during a kinematic analysis of the PLAY-basic hop task. Children with higher levels of physical activity may demonstrate less HA although further investigation is warranted.

Acknowledgments

This research was funded, in part, by SSHRC PEG awarded to NJC and NH (892-2022-2033) and NSERC DG awarded to SMB (RGPIN-2020-05195). The authors wish to thank the YMCA of Niagara Kid Fit Program for their partnership.

References

- [1] Tremblay M et al. (2018). *BMC Public Health* **18**:1034.
- [2] Nezondet C et al. (2023). *Children (Basel)*, **10**: 712.
- [3] Saunders TJ et al. (2018). *BMC Public Health*. **18**.1037.

Table 1: Mean \pm standard deviation (SD) for predictor and criterion variables in male and female children.

	Age (years)	PLAYSelf	PAQ-C	HL (pixels)	HA (pixels)
Male	8.25 \pm 1.74	73.59 \pm 7.63	3.10 \pm 0.90	201.05 \pm 60.33	37.56 \pm 34.38
Female	7.85 \pm 1.41	67.97 \pm 12.39	2.77 \pm 0.68	136.67 \pm 47.12	32.02 \pm 31.73