Three-Year Follow-Up of an Early Childhood Intervention: What About Physical Activity and Weight Status?

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Background: Fundamental movement skills are a correlate of physical activity and weight status. Children who participated in a preschool intervention had greater movement skill proficiency and improved anthropometric measures (waist circumference and BMI z scores) post intervention. Three years later, intervention girls had retained their object control skill advantage. The study purpose was to assess whether at 3-year follow up a) intervention children were more physically active than controls and b) the intervention effect on anthropometrics was still present. Methods: Children were assessed at ages 4, 5, and 8 years for anthropometric measures and locomotor and object control proficiency (Test of Gross Motor Development-2). At age 8, children were also assessed for moderate to vigorous physical activity (MVPA) (using accelerometry). Several general linear models were run, the first with MVPA as the outcome, intervention/control, anthropometrics, object control and locomotor scores as predictors, and age and sex as covariates. The second and third models were similar, except baseline to follow-up anthropometric differences were the outcome. Results: Overall follow-up rate was 29% (163/560), with 111 children having complete data. There were no intervention control differences in either MVPA or anthropometrics. Conclusion: Increased skill competence did not translate to increased physical activity.

Keywords: preschool, intervention, object control, locomotor

In 2011–12, approximately one-quarter of Australian children aged 5 to 17 years were overweight or obese.1 Fundamental movement skill competence (ie, the ability to run, kick, and jump) is a correlate of physical activity2–4 and weight status.2,4,5 Recent reviews demonstrate movement skill interventions are successful in increasing children’s movement skill ability.6,7 An example is the Tooty Fruity Vegie in Preschools (TFV) program, a 10-month Australian obesity prevention intervention with a movement skill focus, which found intervention children at posttest improved their movement skills and anthropometric outcomes relative to control children.8 The TFV program included both physical activity and healthy eating strategies aimed at preschool staff, parents and children. Detailed methods papers covering the intervention strategies, intervention intensity and evaluation methods and instruments have been published elsewhere.9,10

However it is unclear what the long term impact is of increasing children’s movement skill competence. In TFV, intervention girls had higher object control skill competence (commonly ball skills) than control girls at 3-year follow up.11 If movement skill competence translates to subsequent physical activity,2 then there is a strong case for interventions to improve movement skill competency in typically developing children. Thus, one purpose of this study was to assess at 3-year follow up whether TFV intervention children were more physically active (moderate to vigorous—MVPA) than control children. The second purpose was to assess whether the intervention effect on anthropometrics was still present.

Methods

In 2006–07, children from 18 intervention and 13 control preschools participated in TFV, details published elsewhere.9 TFV children were assessed at ages 4 (pre), 5 (post), and 8 years (follow-up) for anthropometric measures and locomotor and object control proficiency (Test of Gross Motor Development-2, TGMD-2).11 At age 8, children were also assessed for physical activity level (using accelerometry). In short, 29.1% (163/560) of the original TFV children were followed up in 2010–11 using the same measurement protocols for height, weight, waist and movement skills as the original study.9 Waist circumference is an established measure in children12–14 and was taken at the level of the natural waist, between the ribs and iliac crest and over the naval at the end of a normal expiration. After excluding children with missing data, less than 3 days of accelerometry data or children who may have received TFV the following year (TFV had a wait list control design11), there were 111 children in the analyses reported in this paper. Ethics approval was gained from the former North Coast Area Health Service (HREC 487N), the former NSW Department of Education and Training (2010011), Deakin University (2010–154), and the local Catholic Education Office (PT: jw E.2.8.4). Written informed consent was obtained from parents/guardians.

BMI was calculated and weight status was determined using Cole et al’s cut-off points.15 Calculated variables were created for the differences between baseline and follow-up waist circumference and BMI (‘T1-T3 waist’ and ‘T1-T3 BMI’ respectively). Children were fitted with an ActiGraph Model GT1M accelerometer to be worn on the right hip, from waking for the entire day over a 7-day period, removed only for sleeping and aquatic activities. Data were collected in 15-second epochs. A day of data were considered valid if it had a minimum of 8 hours wear time, with no more than 10-minute interruption period/s. Trost indicated accelerometer data from 2 to 3 days will reliably (≥ 0.70) estimate children’s MVPA.16

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Most children (84.7%, n = 94) had > 3 days of monitor data. Time in MVPA was determined for each day individually, and across the entire wear period, using age specific cut-points. Children’s movement skills were assessed in the field using live observation with the TGMD-2 according to standard instructions. Each attempt was scored with each component receiving a ‘1’ if correctly executed or a ‘0’ if not. The components for the 2 trials are then summed for each skill and then scores for the 6 locomotor and 6 object control skills are summed for composite locomotor and object control scores respectively. Children’s object control and locomotor scores were adjusted to accommodate the age range of children who were tested. Interrater reliability results for the locomotor raw subtotal were ICC = 0.73 (CI 0.49–0.87), and for the object control raw subtotal, ICC = 0.81 (CI 0.63–0.91).

To answer our first question, a general linear model was fitted with time spent in MVPA as the outcome variable. Predictor variables were: sex, age, object control, and locomotor scores, T1-T3 waist and intervention/control. This model was repeated with T1-T3 BMI instead of T1-T3 waist. To answer our second question, 2 general linear models were fitted with T1-T3 waist and T1-T3 BMI as outcome variables. Predictor variables were: sex, age, object control and locomotor scores, time spent in MVPA, and intervention/control.

**Results**

At follow up, children were aged 8.16 years (SD = 0.67) and 8.36 years (SD = 0.69) for girls and boys respectively. A total of 55.0% (61/111) were intervention children. Mean time spent in daily MVPA was 93.0 minutes (SD = 26.6). The mean BMI was 15.9 (SD = 1.84). Around 10% of the sample were overweight or obese (overweight n = 9/111, 8.1%; obese 2/111, 1.8%).

The first model showed that intervention (β = -0.11; P = .913), object control skill (β = 0.36; P = .759), locomotor skill (β = 0.86; P = .549), and T1-T3 waist (β = -0.011; P = .906) were not significant predictors of MVPA. Significant predictors of children’s MVPA were sex (male: β = 0.288; P = .004) and age (β = -0.279; P = .040). Results were similar when T1-T3 BMI was the anthropometric predictor, but are not included here for brevity’s sake.

The second model indicated intervention (β = -0.35; P = .731), object control skill (β = -0.127; P = .365), MVPA (β = -0.006; P = .956) and age (β = -0.189; P = .171) were not significant predictors of T1-T3 waist. However, locomotor skills were significantly positively associated with T1-T3 waist (β = 0.331; P = .039). The third model indicated intervention (β = -0.313; P = .234), object control skill (β = -0.029; P = .801), locomotor skill (β = 0.102; P = .456), MVPA (β = -0.009; P = .064), age (β = 0.026; P = .279), and sex (β = -0.260; P = .370) were not significant predictors of T1-T3 BMI.

**Discussion**

This study found children who participated in a preschool obesity prevention intervention were no more physically active than control children 3 years after the intervention. In addition, intervention and control students’ waist and BMI changes did not differ at follow up. We were limited due to loss to follow-up and also because it was not possible to adjust for children’s previous physical activity levels as we did not assess children’s physical activity before and after the intervention. Because we found in a previous analysis that TFV intervention girls had retained their advantage at follow up in object control skills compared with control girls, it was thought this might have translated to increased MVPA at follow up. However, this was not the case. It could be plausible that the difference at follow up between intervention and control girls in their object control skill ability was not enough to be associated with increased MVPA, but object control skill was not even a significant predictor of MVPA in the model. Furthermore, locomotor skill was also not a predictor of MVPA in the model. This finding is quite surprising. There is a documented relationship between movement ability and physical activity in children. It could be suggested that the nature of children’s activity at age 8 may be more play based and therefore mastery of FMS may not be necessary for participation in MVPA. However a relationship between skill proficiency and MVPA has been found in this age group, and in younger children which somewhat refutes this. The authors postulate 2 more plausible reasons for the nonsignificant relationship. Firstly the sample was very physically active (the mean per day was 1.5 hours) which may have reduced the ability to find significant differences. Furthermore, there may have been a ceiling effect with the TGMD-2 by the time children reached the follow up assessment at the age of 8 years old. Similar reasons may also explain why there were no intervention/control anthropometric differences at follow up. Only around 10% of the sample was overweight or obese, and those followed up significantly more likely (P < .05) to have a smaller waist circumference and lower BMI than children not followed up, limiting the ability to find a relationship between being an intervention and control child and waist/BMI. Like in the physical activity model, neither locomotor nor object control skill were significant predictors of BMI differences, even though previous research shows an inverse association with locomotor skill ability and BMI. Since the sample was predominantly of normal weight range, the association between larger changes in waist circumference and locomotor skills may be related to differences in children’s rate of physical development.

It is perhaps not a surprise that there were no differences between intervention and control students. Many other factors (home, school and community), as well as the socioeconomic status of the children, would have influenced the physical activity behavior of both intervention and control children in the intervening period. No survey data were collected which may have informed the type and context of physical activity the children were engaged in and when they were engaged. Similarly many factors would have influenced the children’s movement skill. Each school would have had physical education but the quality and quantity varies enormously. No intervention studies with a comparable long term follow up in a preschool setting could be located which assessed physical activity. Children’s physical activity declines as children progress through childhood and adolescence, so any maintenance effect in physical activity as a result of childhood interventions is particularly important to document. A recent review of school based physical activity and movement skill interventions documented that such interventions can result in sustained outcomes, however only 13 studies assessed physical activity and 2 studies assessed FMS. Physical activity reviews in children and adolescents repeatedly suggest more follow up studies need to be conducted to assess long term intervention effect. Similarly, childhood obesity prevention interventions rarely assess long term outcomes. One preschool based study reported that intervention children had smaller increases in BMI compared with controls at 2-year follow up (interestingly without a post intervention effect on BMI).
Conclusions

Future research could investigate how much we need to increase movement skill competence in children to translate to increased physical activity. Instrumentation needs to be sensitive enough to detect potential differences and be suitable for the measurement of children across time. It is unclear what intervention factors contribute to a lasting change in preschool children’s weight status.

Acknowledgments

Funding was received from New South Wales Ministry of Health for this study. There is no conflict of interest for any of the authors. Data collection was supported by NSW Health Australia and Deakin University. LMB is supported by an NHMRC early career fellowship.

References
