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The Effect of Active Video Gaming on Children’s Physical Activity, Behavior Preferences and Body Composition

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Liverpool John Moores University

Active video game interventions typically provide children a single game that may become unappealing. A peripheral device (jOG) encourages step-powered gaming on multiple games. This trial evaluated the effect of jOG on children’s objectively measured PA, body fat and self-reported behaviors. 42 of 58 eligible children (8–10 y) randomly assigned to an intervention (jOG) or control (CON) completed the trial. Intervention children received two jOG devices for home use. Analyses of covariance compared the intervention effect at 6 and 12 weeks from baseline. No differences were found between groups for counts per minute (CPM; primary outcome) at 6 and 12 weeks (p > .05). Active video gaming increased (adjusted change 0.95 (95% CI 0.25, 1.65) h·d⁻¹, p<.01) and sedentary video gaming decreased (-0.34 (-1.24, 0.56) h·d⁻¹, p > .05) at 6 weeks relative to CON. No body fat changes were observed between groups. Targeted changes in video game use did not positively affect PA. Larger trials are needed to verify the impact of active video games on children’s PA and health.

Sedentary time in youth is negatively associated with metabolic health (7), and youth spending more than 2 hr·d⁻¹ in sedentary screen-based behaviors are at greater risk for overweight (16). Children play sedentary video games for 30–45 min·d⁻¹ (21), and this prevalence is highest in lower socioeconomic status (SES) groups (9). Financial constraints and parental concerns of outdoor safety may contribute to fewer sport, play and PA opportunities outside the home (9). Active video games that incorporate movement into video gaming (12,18) may be an innovative method for encouraging PA and discouraging sedentary behavior in children from deprived areas.

Research into active video game use in the home and its affect on PA and sedentary time is limited. In 9–12 year olds, a dance simulation game was insufficiently motivating to maintain regular use in the home over 12 weeks (3). Similarly in 9–18 year olds, home use of a dance game decreased over 6 months (19). Participants...
suggested dance games were insufficiently immersive, fun, or graded in terms of difficulty to maintain motivation for long-term use (3,19). In ten 10–14 year olds provided an EyeToy and dance mat for home use, no significant increase in objective and subjectively measured total, moderate and vigorous PA was found compared with ten controls at 12 weeks (25). This was despite an increase in active video gaming, decrease in total video gaming, and, significant decrease in sedentary video gaming in intervention children relative to controls (25). Similarly, no significant change was found compared with controls in objectively measured sedentary time or PA at 10 weeks in forty 7–8 year olds provided with a dance game for home use, despite lower self-reported sedentary screen time and mean use of the game for 60 min-wk$^{-1}$ (20). While these studies may be insufficiently powered to detect changes in PA, they suggest active video games may not increase PA or reduce sedentary time in the long-term.

Participants in previous interventions were typically provided a single game for use on a specific console, and like any sedentary video game, over familiarization may contribute to decreased motivation for sustained use (23). An alternative approach may be to reengineer PA into video games young people own and play. A peripheral device enabling this is jOG (New Concept Gaming Ltd, Liverpool, UK). jOG encourages step-powered video gaming of light-to-moderate intensity (unpublished data from our group) and is compatible with PlayStation (PS) 2, PS3 (Sony Co, Tokyo, Japan) and Nintendo Wii (Nintendo Co Ltd, Minami-ku Kyoto, Japan) consoles. Use of jOG in the home and its impact on PA is unknown. This randomized controlled trial (RCT) evaluated the effects of jOG on the PA (counts per minute; CPM) of 8–10 year old children from low SES groups. A secondary aim was to assess the effects on subcomponents of habitual PA, behavior preferences and body fat.

**Methods**

**Participants and Settings**

Pupils in years (grades) 4 and 5 (8–10 y) from three primary schools in low SES areas in North West England were invited to participate. The study received institutional ethics approval. Parents/guardians and children gave written informed consent and assent respectively. Parents/guardians completed medical questionnaires on behalf of their child. Children completed a video gaming survey. Children were eligible if they were free from the presence of chronic disease and metabolic disorders, owned a PS2 or PS3 video game console and self-reported playing these for ≥ 2 hr-wk$^{-1}$.

**Intervention Design**

The RCT was conducted for 12 weeks (January-April 2009). Following baseline measures, eligible children were randomly assigned at the individual level to an intervention (jOG) or control (CON) group. Randomisation, stratified by gender, was achieved by drawing folded sheets of paper, each marked with a participant’s code, from a hat. Allocation alternated between groups (1st, 3rd, 5th child into jOG group). Participants and researchers were not blinded to the experimental group. Intervention participants were given two jOG devices for home-use and familiarized
with it during a school-based session. jOG packaging contained instructions for use. Two devices were given to discourage sedentary play during multiplayer gaming. jOG links a hip-worn pedometer to a standard console controller and encourages gamers to step on the spot to use directional controls to generate onscreen character movement in games (http://www.newconceptgaming.com/products/ps2-compatible-jog/). For every step the pedometer records, 1-s of onscreen movement is obtained. For continuous gaming, sustained stepping is required. jOG includes an option to disable the device, allowing games to be played seated while jOG is connected to the console. Though children were not told this, the jOG instruction manual contained this information. Participants and their parents were encouraged to play their PS video games in a step-powered manner with jOG, rather than seated with or without jOG connected to the console. Though discouraged, participants could unplug jOG and play games seated. Participants kept the devices after the trial. The CON group were asked to continue playing their video games as normal and received two jOG devices upon trial completion.

**Instruments and Procedures**

At baseline (0 weeks), midtest (6 weeks) and postintervention (12 weeks) participants attended university laboratories for a series of measures. Habitual PA was also measured at these specified time points.

**Behavior Preference Survey.** Participants self-reported how much time they spent in minutes in the following behaviors from waking until lunch, lunch until dinner, and dinner until bedtime: sedentary (seated) video gaming, active video gaming (other than jOG step-powered gaming at 6 and 12 weeks), TV viewing, computer/internet use for pleasure, working on a computer, reading for pleasure and doing homework. Questions were asked for a typical school and weekend day, allowing calculation of a weighted weekly estimate (h∙d⁻¹). This approach is reliable and demonstrates appropriate predictive validity in youth (16). At 6 and 12 weeks children similarly reported time spent playing video games in only a step-powered manner with jOG. This contributed to the active video gaming variable. Total video gaming time (sedentary, active) and time spent in productive (working on the computer, reading, doing homework) and leisure (total video gaming, TV, computer/internet use) behaviors was calculated. Productive behaviors have been defined to increase knowledge that helps pupils improve their education and awareness, while leisure behaviors lack these gains (10).

**Habitual Physical Activity Assessment and Data Analysis.** PA was measured for 7 days every 5 s by an accelerometer (ActiGraph GT1M, ActiGraph Ltd, Pensacola, FL, USA) worn on the right hip. ActiGraph is valid and reliable for use in child studies (5). At each time point participants were given the same monitor. Data were downloaded using manufacturer software (v.3.2.2, ActiGraph Ltd, Pensacola, FL, USA) and checked for compliance by a data reduction program (Mahuffe, MRC, Cambridge, UK). Sustained bouts of 20 min of 0 counts indicated monitor removal (2). Missing counts were removed from the calculation of daily wear time. To be retained for analyses participants had to provide ≥9 hr of wear time for ≥3 days at 0, 6 and 12 weeks. These criteria have shown acceptable reliability in similar aged children (22). Data were analyzed using individually calibrated activity count thresholds determined from a treadmill (H P Cosmos, Traunstein, Germany)
protocol performed during each laboratory visit. Participants wore an ActiGraph
(5-s epochs, right hip) and following treadmill familiarization, walked at 4 km∙h⁻¹
for 3 min, rested for 30 s, then jogged at 8 km∙h⁻¹ for 3 min. Speeds of 4 km∙h⁻¹
and 8 km∙h⁻¹ were selected as they differentiated between walking and jogging in
children this age (13). In previous studies in youth, activity counts from 4 km∙h⁻¹
treadmill walking have been used to analyze PA data (1), and such an individual
calibration approach has provided a valid indication of free-living PA (6).

For each speed, the mean of the middle 2 min of data were calculated as the
individual’s count threshold (13). At each monitoring period, individual thresholds
and a sedentary threshold of 100 CPM (28) established the time spent per valid
day sedentary, between sedentary and 3.99 km∙h⁻¹ (PA₄₄), 4 km∙h⁻¹ and 7.99 km∙h⁻¹
(PA₄₋₇.₉₉) and ≥ 8 km∙h⁻¹ (PA₉₉) for each participant. Individual thresholds were
applied at each time point, as leg length and stature, factors influencing counts
generated during locomotion (15), increased in both groups from week 0–12 (p < .05),
as did sitting stature in the jOG group at week 6 (p < .05, one-way repeated-
measures ANOVA).

Steps, CPM, total PA (TPA: > 100 CPM) and time spent ≥ 4 km∙h⁻¹ (PA₄₄)
were also determined for each valid day. The volume of each PA component per
day was calculated (total volume from valid days/number of valid days). Data were
then adjusted for wear time (volume/mean wear time of valid days) to account for
significant differences in sedentary time and PA₄₄ at baseline between participants
providing ≥ 13.0 hr∙d⁻¹, and, 10.0–10.9 hr∙d⁻¹ and 11.0–11.9 hr∙d⁻¹ of valid mean
wear times. Thus, PA data were presented as min∙h⁻¹ or steps∙h⁻¹ of wear time.

**Anthropometry and Maturation Assessment.** Stature and sitting stature
were measured to the nearest 0.1 cm using a Leicester Height Measure (Seca
Ltd, Birmingham, UK) and body mass to the nearest 0.1 kg using a calibrated
mechanical flat Seca scale (Seca Ltd, Birmingham, UK) with participants wearing
light clothing and without shoes (17). Body mass index (BMI) was calculated as
mass divided by stature (kg∙m⁻²). Maturity status was estimated by calculating
years from attainment of peak height velocity (PHV; 24). Stature, sitting stature,
leg length, mass, chronological age and their interactions were used in gender-
specific equations to predict each participant’s maturation offset (y to PHV; 24).

**Body Fat Assessment.** Subtotal and trunk body fat % were assessed by dual-
energy x-ray absorptiometry (DXA, Hologic QDR series Discovery A, Bedford,
MA, USA). DXA assessment of body composition has been validated against
hydrodensitometry (30) and is a gold standard for assessing fat mass in youth (11).
Participants were scanned in the supine position while wearing a t-shirt and shorts.
The scanner was calibrated daily. The coefficient of variation (mean baseline, mid
and post measures) for repeated measurements of subtotal body fat was 0.48% and
for trunk body fat 1.17%.

**Statistical Analysis**

Dependent on data normality by group, independent *t* tests or Mann-Whitney tests
assessed baseline group comparability for age, maturation offset, number of inactive/
active video game consoles in the home and typical video gaming setting. Analysis
of covariance (ANCOVA) compared the intervention effect at 6 and 12 weeks from
baseline on the primary outcome CPM and all secondary outcome variables. The
intervention group (jOG vs CON) was the independent variable and the variable change score (mid or post minus baseline) the dependent variable. Covariates in all analyses were the baseline value for the variable to control for any imbalances at baseline (29) and gender as the stratification factor. Change in maturity offset (post minus baseline) was included as a covariate in ANCOVA for trunk and subtotal body fat %, PA<4, PA4–7.99, PA≥4, steps and CPM at 12 weeks. This was included as significant correlations ($p < .05$; Spearman’s) were observed between change in maturity offset and these dependent variables. Adjusted change scores and 95% confidence intervals (CI) for the difference in change between groups are presented unless stated otherwise. To account for missing PA data a per protocol analyses (PPA) was conducted. For the primary outcome, the PPA was compared with intention-to-treat (ITT) analysis, as a sensitivity analysis. To treat missing data, the monotone imputation technique and ten imputation sets were used. Imputation was based on all 58 randomized participants. Statistical analyses were performed using SPSS v.17.0 and statistical significance was set at $p \leq .05$.

Effects observed from ANCOVA were additionally evaluated for clinical importance through prespecification of a minimum clinically important difference (MCID). This approach makes inferences based on meaningful magnitudes and has been advised by researchers (14). MCID was determined through a distribution-based method as a Cohen’s $d$ (standardized difference between change scores between groups) of 0.2 between-subjects SDs (4). However, the SD of pooled baseline data were used to negate the possibility of individual differences from the intervention influencing 6 and 12 week SD. The adjusted change score for a given variable was interpreted as beneficial or detrimental if it exceeded the MCID in the appropriate direction.

**Results**

Informed consent was received from 69 of 295 children invited to participate. One child was withdrawn (by parent) before randomisation and ten were ineligible. Thus, 58 children were randomized. Due to incomplete PA data for 16 children, complete data sets were available for 22 (13 m, 9 f; 76%) of the 29 (19 m, 10 f), and 20 (15 m, 5 f; 69%) of the 29 (20 m, 9 f) participants in the jOG and CON groups, respectively. Thirteen of these 42 children did not provide ≥1 valid weekend day of PA data at each time point (31%: 10 jOG, 3 CON). The remaining 29 participants (69%; 12 jOG, 17 CON) provided ≥1 valid weekend day and ≥3 weekdays at each time point. At baseline jOG and CON groups, respectively, were comparable ($p > .05$) in age (mean (SD) 9.2 (0.5) vs 9.2 (0.5) y), maturation offset (-3.2 (0.9) vs -3.1 (0.8) y to PHV), number of inactive (5.8 (2.2) vs 6.6 (2.4)) and active (1.2 (0.9) vs 1.5 (0.8)) video game consoles in the home, and typical setting of gaming (home: 100% vs 96%).

**Habitual Physical Activity**

Similar to the PPA (Table 1), ITT analyses found no significant difference between groups for CPM at 6 (ITT $p = .17$) and 12 weeks (ITT $p = .38$). There were no other statistically significant intervention effects on PA variables. At 6 and 12 weeks, the adjusted change score between groups relative to CON for PA4–7.99, PA≥4, steps and CPM satisfied MCID criterion for detriment.
<table>
<thead>
<tr>
<th></th>
<th>Baseline (0 weeks)</th>
<th>Midtest (6 weeks)</th>
<th>Postintervention (12 weeks)</th>
<th>Adjusted change 0–6 (95% CI) **</th>
<th>Adjusted change 0–12 (95% CI) **</th>
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<tbody>
<tr>
<td></td>
<td>jOG</td>
<td>CON</td>
<td>jOG</td>
<td>CON</td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>39.3 (3.9)</td>
<td>38.9 (3.2)</td>
<td>39.6 (3.5)</td>
<td>38.5 (3.5)</td>
<td>0.7 (-0.7–2.1)</td>
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<td></td>
<td></td>
<td></td>
<td>38.5 (2.7)</td>
<td></td>
<td>0.4 (-1.1–1.9)</td>
</tr>
<tr>
<td>PA&lt;4</td>
<td>13.6 (2.9)</td>
<td>14.0 (2.8)</td>
<td>13.5 (3.4)</td>
<td>13.5 (3.3)</td>
<td>0.3 (-1.0–1.6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>13.8 (3.0)</td>
<td></td>
<td>0.2 (-1.3–1.7)</td>
</tr>
<tr>
<td>PA4–7.99</td>
<td>6.3 (2.5)</td>
<td>6.1 (3.2)</td>
<td>6.1 (2.3)</td>
<td>6.8 (2.8)</td>
<td>-0.9 (-2.1–0.3)</td>
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<td></td>
<td></td>
<td></td>
<td>7.1 (2.7)</td>
<td></td>
<td>-0.8 (-2.3–0.7)</td>
</tr>
<tr>
<td>PA&gt;4</td>
<td>0.8 (0.6)</td>
<td>1.0 (1.1)</td>
<td>0.8 (0.6)</td>
<td>0.9 (0.8)</td>
<td>-0.0 (-0.3–0.3)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1.2 (0.8)</td>
<td></td>
<td>0.1 (-0.3–0.6)</td>
</tr>
<tr>
<td>PA=8</td>
<td>7.1 (2.4)</td>
<td>7.0 (3.4)</td>
<td>7.0 (2.3)</td>
<td>7.7 (3.0)</td>
<td>-0.9 (-2.2–0.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7.9 (3.1)</td>
<td></td>
<td>-0.6 (-2.2–1.0)</td>
</tr>
<tr>
<td>TPA</td>
<td>20.7 (3.9)</td>
<td>21.1 (3.2)</td>
<td>20.4 (3.5)</td>
<td>21.5 (2.8)</td>
<td>-0.7 (-2.2–0.7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>21.5 (3.5)</td>
<td></td>
<td>-0.4 (-1.9–1.1)</td>
</tr>
<tr>
<td>Steps (steps h⁻¹)</td>
<td>805.6 (191.7)</td>
<td>768.4 (160.1)</td>
<td>790.3 (177.7)</td>
<td>841.6 (195.6)</td>
<td>-58.1 (-159.1–42.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(193.8)</td>
<td>(178.5)</td>
<td>-85.5 (-183.2–12.3)</td>
</tr>
<tr>
<td>CPM</td>
<td>556.5 (151.2)</td>
<td>562.2 (148.1)</td>
<td>526.4 (114.7)</td>
<td>592.7 (145.9)</td>
<td>-57.6 (-123.5–8.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(205.3)</td>
<td>(242.2)</td>
<td>-50.4 (-186.1–85.3)</td>
</tr>
</tbody>
</table>

* Baseline, midtest and postintervention values are unadjusted mean (SD).

** Change scores and 95% CIs are the differences between groups (relative to CON) after adjustment by ANCOVA for the baseline value and gender. ANCOVA for PA<4, PA4–7.99, PA>4, steps and CPM at 12 weeks are also adjusted for change in maturation offset (post minus baseline).

PA, physical activity; TPA, total physical activity (PA<4, PA>4), CPM, counts per minute.
Behavior Preferences

Step-powered video gaming was significantly greater at week 6 than 12 in the jOG group (Table 2). A significant increase in active video gaming at 6 weeks was observed in the jOG group relative to CON. No other statistically significant intervention effects on behavior variables were found. For active video gaming at 6 and 12 weeks, the adjusted change score between groups satisfied MCID criteria for benefit (0.14 hr∙d⁻¹ increase). The adjusted change score at 6 weeks between groups for inactive video gaming satisfied criteria for detriment (0.25 hr∙d⁻¹ increase), as did the change score for leisure behaviors at 6 weeks (0.60 hr∙d⁻¹ increase). The adjusted change score for TV viewing between groups at 12 weeks satisfied criteria for benefit (0.37 hr∙d⁻¹ decrease).

Anthropometrics and Body Fat

Compared with CON, the jOG group had a statistically significant increase in stature at 6 weeks (Table 3). No other significant or clinically relevant changes were found.

Discussion

This RCT examined the short-term effects of a peripheral active video gaming device (jOG) on the PA, behavior preferences and body fat of 8–10 year old children. No significant difference in CPM was observed at 6 or 12 weeks between intervention and control groups. However, a nonsignificant but detrimental change in CPM, steps, \( \text{PA}_{4-7.99} \) and \( \text{PA}_{\geq 4} \) at 6 and 12 weeks was observed relative to controls. At 6 weeks, sedentary video gaming decreased and active video gaming significantly increased in the jOG group relative to controls, with the increase in active gaming largely due to jOG use. Overall time spent playing video games also increased. At 12 weeks an increase in total video gaming was similarly observed relative to controls, due to an increase in sedentary and active video gaming. Thus, these findings may suggest an increase in total video gaming is detrimental to PA, regardless of whether the main contributor is active, or active and sedentary gaming. It is acknowledged that sample size calculations were not conducted prospectively for the trial. Thus, the trial may have been insufficiently powered to detect significant effect sizes for PA variables practically different between groups based on MCID analyses.

In previous home-based active video game interventions a similar trend for increased active video gaming and reduced sedentary video gaming (25) or sedentary screen time (20) has been observed. Thus, provision of a peripheral device or active video game appears to encourage children to experiment with the device and devote time away from sedentary screen-based activities. However, no positive effect on PA or sedentary time was observed in any intervention. In the present trial there were no significant differences between groups at 6 weeks for TV use, reading, doing homework or working on a computer. However, relative to controls, a nonsignificant but detrimental increase in time spent in leisure behaviors (TV, total video gaming, computer/internet use) was found. Relative to controls, the intervention group had a decrease in TV viewing and increase in total video gaming, with the latter due to
<table>
<thead>
<tr>
<th>(h∙d⁻¹)</th>
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<td></td>
<td>jOG</td>
<td>CON</td>
<td>jOG</td>
<td>CON</td>
<td></td>
</tr>
<tr>
<td>Inactive video gaming</td>
<td>2.84 (1.05)</td>
<td>2.56 (1.47)</td>
<td>1.37 (1.39)</td>
<td>1.78 (1.56)</td>
<td>1.98 (1.43)</td>
</tr>
<tr>
<td>Step-powered jOG gaming</td>
<td>0.75 (0.71)</td>
<td>-</td>
<td>0.75 (0.71)</td>
<td>-</td>
<td>0.38 (0.55)†</td>
</tr>
<tr>
<td>Active video gaming</td>
<td>0.71 (0.75)</td>
<td>0.97 (0.59)</td>
<td>1.50 (1.53)</td>
<td>0.79 (0.69)</td>
<td>0.89 (1.16)</td>
</tr>
<tr>
<td>Total video gaming</td>
<td>3.57 (1.12)</td>
<td>3.51 (1.46)</td>
<td>2.94 (2.01)</td>
<td>2.56 (1.72)</td>
<td>2.86 (1.76)</td>
</tr>
<tr>
<td>TV viewing</td>
<td>2.58 (1.68)</td>
<td>2.85 (2.10)</td>
<td>2.18 (1.74)</td>
<td>2.41 (1.89)</td>
<td>1.44 (1.17)</td>
</tr>
<tr>
<td>Productive behaviors</td>
<td>1.21 (1.10)</td>
<td>1.81 (1.57)</td>
<td>0.61 (0.57)</td>
<td>0.81 (0.78)</td>
<td>0.65 (0.36)</td>
</tr>
<tr>
<td>Leisure behaviors</td>
<td>7.04 (2.70)</td>
<td>6.98 (3.34)</td>
<td>6.21 (3.21)</td>
<td>5.16 (3.11)</td>
<td>4.55 (2.21)</td>
</tr>
</tbody>
</table>

* Baseline, midtest and postintervention values are unadjusted mean (SD).

** Change scores and 95% CIs are the differences between groups (relative to CON) after adjustment by ANCOVA for the baseline value and gender.

† \( p = .01 \) (different from midtest).

‡ Significant \( (p < .01) \).

Productive behaviors (reading for pleasure, doing homework, working on a computer); Leisure behaviors (TV viewing, total video gaming, computer/internet use for pleasure).
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<td></td>
<td>jOG</td>
<td>CON</td>
<td>jOG</td>
<td>CON</td>
<td></td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>34.1 (10.0)</td>
<td>38.0 (10.6)</td>
<td>34.6 (10.2)</td>
<td>38.7 (10.6)</td>
<td>-0.2 (-0.9–0.5) 0.2 (-0.8–1.2)</td>
</tr>
<tr>
<td>Stature (m)</td>
<td>1.34 (0.06)†</td>
<td>1.38 (0.05)</td>
<td>1.35 (0.06)</td>
<td>1.39 (0.06)</td>
<td>0.005 (0.001–0.009) 0.003 (-0.002–0.009)</td>
</tr>
<tr>
<td>BMI (kg·m⁻²)</td>
<td>18.9 (4.5)</td>
<td>19.7 (4.3)</td>
<td>18.8 (4.5)</td>
<td>19.9 (4.3)</td>
<td>-0.2 (-0.6–0.2) 0.0 (-0.5–0.5)</td>
</tr>
<tr>
<td>Subtotal body fat (%)</td>
<td>26.7 (9.4)</td>
<td>27.2 (9.0)</td>
<td>26.7 (9.6)</td>
<td>27.4 (9.1)</td>
<td>-0.1 (-0.7–0.6) 0.6 (-0.4–1.5)</td>
</tr>
<tr>
<td>Trunk body fat (%)</td>
<td>20.7 (8.8)</td>
<td>21.9 (8.3)</td>
<td>20.8 (9.2)</td>
<td>21.8 (8.4)</td>
<td>0.5 (-0.6–1.6) 0.9 (-0.5–2.3)</td>
</tr>
</tbody>
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* Baseline, midtest and postintervention values are unadjusted mean (SD).

** Change scores and 95% CIs are the differences between groups (relative to CON) after adjustment by ANCOVA for the baseline value and gender. ANCOVA for trunk and subtotal body fat % at 12 weeks are also adjusted for change in maturation offset (post minus baseline).

† p = .01 (different from CON).
‡ Significant (p = .02). 3 decimal places reported to improve interpretation of ANCOVA.

BMI, body mass index.
increased active gaming. Subsequent analysis indicated that computer/internet use for pleasure increased in the jOG group relative to controls by 0.3 (-0.4, 1.1) h∙d⁻¹ at 6 weeks. Thus, the nonsignificant difference in sedentary time may be due to intervention children allocating more time to this alternative sedentary pursuit. If active video games are to increase PA and reduce sedentary time, interventions may need to consider concurrently available sedentary behaviors young people enjoy.

Self-reported use of jOG at 12 weeks was half that at 6 weeks, indicating a novelty effect observed in previous trials (3,19,20). These studies noted that boredom with a dance game led to decreased use over time (3,19). In the current study, jOG was compatible with multiple video games children owned, which likely minimized the effect of over-familiarization with a single game. Gaming with jOG however requires continual stepping on the spot, with physical feedback from the working muscles inherent. Physical feedback such as using a joystick was found to act as a ‘reality check’ during gaming that distracted adolescents and adults from the game (32). This reminded the gamer of their surroundings (32) and prevented immersion into the game and sensations of time loss (33). Thus, step-powered gaming may have been distractive and felt like exercise over time, with physical sensations overriding enjoyment. It is also possible that children were unable to sustain the level of stepping required. These factors may have reduced the perceived value of using jOG, with sedentary gaming the more reinforcing alternative and preferred choice (8). The decrease in sedentary gaming at 6 weeks in the jOG group, and subsequent increase at 12 weeks when jOG use declined supports this. Achieving an optimal balance between physical input and immersion may be important if active video games are to be enjoyed and become the preferred choice over sedentary equivalents (8).

No significant effects on BMI and body fat were observed, with findings for BMI similar to those of Maloney et al. (20). In contrast, Ni Mhurchu et al. (25) reported reductions in waist circumference relative to controls at 12 weeks. However, the study was insufficiently powered to detect differences in anthropometrics (25), and like the present RCT failed to monitor energy intake across the trial. Energy intake during screen time contributes to obesity (27) and may have confounded body composition findings. Future screen-based trials should account for changes in energy intake.

This study had several limitations. The small samples were likely underpowered to detect changes in BMI or body fat. The 12-week trial provided an indication of short-term behavior change but not long-term sustainability. Only 29 of 42 participants providing valid PA data had ≥1 weekend day at each time point. However, no significant differences were found for PA variables at any time point between those providing 3 valid days (with no weekend day) and 4–7 valid days (data not shown), supporting the inclusion criteria of any 3 days. Factors that may have influenced treadmill activity counts across time points include technical issues with monitors or their positioning (15). These were protected against as best as possible by one researcher conducting and one monitor being used for, each protocol. The self-report survey may have been influenced by social demands and biases, and poor child recall of activity (31). The use of memory cards and console hard drives may provide objective data on video game use, which might be an opportunity for future research. Lastly, qualitative data on children’s perception of jOG may have indicated why the device was or was not used, and highlights an area for future research to consider.
Targeted changes in video game use following provision of an active video game peripheral device were not accompanied by increased PA or decreased sedentary time in children. Increased total video gaming, due to active or active and sedentary gaming, may be detrimental to PA in children. Preventing the allocation of time to other sedentary pursuits and providing PA opportunities away from the screen appear important if active video games are to benefit PA and health. The novelty effect observed for use of the peripheral device supports the call for new active video games that attract children and sustain their interest (26). Longer interventions in larger samples are needed to verify the effects of active video gaming on PA and health.

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References


