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Original citation & hyperlink:
Eyre, E, Cox, V, Birch, S & Duncan, MJ 2016, 'An integrated curriculum approach to increasing habitual physical activity in deprived South Asian children' European Journal of Sport Science, vol 16, no. 3, pp. 381-390.
https://dx.doi.org/10.1080/17461391.2015.1062565

DOI 10.1080/17461391.2015.1062565
ISSN 1746-1391
ESSN 1536-7290

Publisher: Taylor & Francis

This is an Accepted Manuscript of an article published by Taylor & Francis in European Journal of Sport Science on 2016, available online: http://www.tandfonline.com/ 10.1080/17461391.2015.1062565

An integrated curriculum approach to increasing habitual physical activity in deprived South Asian children

Eyre ELJ[1], Cox, VM[1], Birch SL[1], Duncan MJ[1]

Manuscript type: Original research

Abstract: 243
Original Research: 3665

Submission Date: 08/01/2015

[1] Department of Applied Science and Health, Coventry University, James Starley Building, Priory Street, Coventry, CV1 5FB.

Address for correspondence:

Emma Eyre

Department of Applied Science and Health

Coventry University

Priory Street

Coventry

CV1 5FB

Email: Emma.eyre@coventry.ac.uk

ABSTRACT

Integrating physical activity (PA) within a school curriculum is a promising approach for increasing PA in children. To date, no research has examined its effectiveness in increasing the low levels of PA witnessed in deprived South Asian (SA) children. The study aims to ascertain whether an integrated school based curriculum and pedometer intervention could increase PA in children from deprived SA backgrounds. Following ethical approval and informed consent, 134 deprived SA children (63 boys, 71 girls, control (n=40, mean age=11.12 years, *SD*=0.32 years) and intervention (n=94, mean age=9.48 years, *SD*=0.62 years)) from a primary school in England, UK completed a 6-week integrated PA intervention based on virtually walking from their school (middle of the country) to the coast and back (March–July 2013). Habitual PA was determined at baseline and post 6-weeks intervention for both groups, and determined weekly during the intervention in the experimental group. The results indicated that average daily steps were significantly higher at post 6-weeks compared to baseline for the intervention group (intervention mean change = 8694, *SD*=7428 steps/day vs. control mean change = -1121, *SD*=5592 steps/day, 95% CI of difference, 6726 to 7428 steps/day, *P*=0.001, *d* = 1.76). In addition, significant decreases in BF% and waist circumference were observed in the intervention group post 6-weeks (mean change for BF% = -4.5%, mean change for WC = -1.7cm, *P*=0.001). School based integrated curriculum and pedometer interventions provide a feasible and effective mechanism for increasing habitual PA in primary school children from deprived SA backgrounds.

Keywords: Intervention, Fatness, Adiposity, Obesity, Education, Pedometer

INTRODUCTION

The proportion of obesity and obesity related non-communicable diseases such as cardiovascular and metabolic disease are increased in South Asians (SA) living in the UK (Mckeigue, Shah & Marmot, 1991). The onset of increased risk of cardiovascular and metabolic disease is witnessed in SA children, relating to obesity (Whincup et al., 2002) and tracking into adulthood (Raitakari et al. 2003). The aetiology is multifactorial, comprising of lifestyle factors (i.e. physical inactivity, nutrition and demographic) (Eyre, Duncan, Smith & Matyka, 2013a; Fischbacher, Hunt & Alexander, 2004) and genetic predispositions (Yajnik et al. 2002). Lifestyle choices can attenuate the increased risk and, unlike genetic factors, can be changed.

For both SA children and adults in the UK, physical activity (PA) levels are lower compared to white adults and children (Eyre et al. 2013a; Fishbacher et al. 2004). From objectively measured PA, between 35-54% SA children adhere to the guidelines of 60 minutes of daily moderate-to-vigorous PA for health benefits, in comparison to age matched white children (70-73%; Eyre et al. 2013a; Owen et al. 2009). This is important because physically active children are more likely to be active adults (Huotari, Nupponen, Mikkelsson, Laakso, & Kujala, 2011). Additionally, physical inactivity in adults explains >20% of the excess cardiovascular mortality in SA's even after adjustment for potential confounding variables (Williams, Stamatakis, Chandola & Hamer, 2011). Deprivation is also associated with increased chronic disease (Mackenbach et al. 2008) and inactivity (Duncan, Birch & Woodfield, 2002). In the UK, SA (i.e. Pakistani or Bangladeshi) are most likely to live in deprived neighbourhoods (Jayaweera, Hockley, Redshaw, & Quigley, 2007).

The Birmingham Healthy Eating and Active lifestyle for Children Study (BEACHeS) was the first to consider the determinants of PA behaviour in deprived SA children, identifying child, family, culture, school, local environment and macro environment as key factors (Pallan, Perry & Adab, 2012). Eyre, Duncan, Birch, & Cox's (2013b) qualitative study in children highlighted that school teachers were key role models, and the primary motivator for PA in SA children. Several studies have cited the school environment as one where programs aimed at preventing disease, increasing PA and reducing fatness, are most effective (Lubans, Morgan & Tudor-Locke, 2009; Oliver, Schofield & McEvoy, 2006; Riley, Lubans, Holmes, & Morgan, 2014).

Most recently, school based interventions have incorporated PA within specific curriculum activities (e.g. maths) (Duncan et al. 2012; Oliver et al. 2006; Riley et al. 2014). Integrating PA throughout the curriculum seems a promising approach, which enables the promotion of PA throughout the school day at the same time as enhancing cross-curricular educational opportunities (Duncan et al. 2012; Oliver et al. 2006). In SA communities, education is prioritised over PA (Eyre et al. 2013b). Therefore, as children spend a large proportion of their day in school, a school based intervention seemed a viable mechanism to maximise PA behaviours in SA children. Prior work suggests that the use of pedometers in interventions provides an effective open-loop feedback mechanism which is both motivational and educational, resulting in increased PA (Duncan et al. 2012; Oliver et al. 2006). The most effective pedometer based interventions to increase children's PA use an integrated curriculum model (Lubans et al. 2009). Subsequent data has supported this assertion (Duncan et al. 2012) showing that children were more active during and after curriculum integration. Despite this, studies employing the integrated curriculum model are limited in terms of the range of variables they have examined, with few considering the impact on other health measures (e.g. fatness). They were further restricted by the absence of a control group and using a short time frame with limited post intervention follow-up. Additionally, to the author's knowledge no studies have looked at the impact of an integrated curriculum approach in deprived SA children. The impact of this approach could be important but it is not yet known whether an integrated curriculum would be feasible in groups where other priorities (e.g. religion) take precedent over PA. Thus, this study seeks to build on prior work by establishing whether an integrated school based curriculum and pedometer intervention is feasible and whether it can increase PA post 6-weeks in deprived SA children against a matched control group.

METHOD

Participants

Following ethical approval, parental consent and child assent, 134 deprived SA (Indian, Pakistani and Bangladeshi) children (40 control, 94 intervention, 63 boys, 71 girls) from a primary school in Coventry, UK participated in a quasi-experimental design. Ethnicity classification was based on the 2001 Census classification (Office of National Statistics, 2006). The school 4th school within the most deprived ward (index of multiple deprivation score = 5.57) of Coventry (Coventry City Council, 2010; ID2010) was recruited via cluster sampling at ward and school level. The control group was from Year 6 (mean age 11.12 years, *SD*= 0.32 years) and the intervention group included children from Years 4 and 5 (mean age 9.48, SD= 0.62 years). The use of a control group from a different school year was necessary to enable comparison of the intervention in children from the same school environment. It also enabled greater fidelity of the results by ensuring that there was no implicit cross over effect of the integrated curriculum intervention from intervention to control group. Both groups were not significantly different at baseline for pedometer steps/day or body fat (BF%, $P<0.05$) therefore, age was controlled for in subsequent statistical analysis.

Procedures

Height, mass, body mass index (BMI) waist circumference (WC) and BF% were obtained from all children at baseline and 6-weeks after the intervention had finished (post 6-weeks). All measures were obtained bare foot and in light indoor clothing.

Anthropometric measures

Stature was measured using a stadiometer (Leicester portable height measure, UK) to the nearest 1mm. Body mass was measured to the nearest 0.1kg using weighing scales (Tanita inc. Tokyo Japan). BMI-for-age and sex was assessed as kg/m^2 based on British reference curves 1990 for children and young people (Cole, Freeman & Preece, 1995; Cole & Pan, 1999). Leg-to-leg bioelectrical impedance analysis (BIA) was used to determine BF%. The stature and age of the child were input into the BIA (Tanita inc. Tokyo Japan, BF350). The children were instructed to stand still with one foot on each of the impedance sections on the scales from which BF% was determined.

Curriculum integration

The full schematic for the intervention design can be found in Table 1. The intervention group undertook a 6-week, school-based pedometer intervention using an integrated curriculum model (Duncan et al. 2012; Oliver et al. 2006). There were two stages to this intervention; the first stage was designed to increase PA through increasing opportunities to be active throughout the school day by using a pedometer challenge which was linked to the curriculum. To increase adherence to the pedometer challenge, each child was taught to skip (15 minute lesson) and provided with a personal skipping rope. This was included to encourage free play at school and outside of school. Additionally, afterschool activity sessions were held with a shorter duration (45 minutes), once a week, for 4 weeks, allowing the children time to attend mosque and the activity sessions. Secondly, an environment was created to promote that exercise was beneficial. The curriculum was modified, topics in Science (i.e. 'keeping healthy' (Year 5) and 'journeys' (Year 4)), were developed and delivered to varied education/ability needs. Therefore, science was used as the main subject and provided cross curriculum links to other subjects (Table 1). A themed health week was held, where all subject lessons related to the theme (Table 1). At the end of this intervention (week 6), the curriculum reverted back to its regular provision.

The pedometer challenge

Pedometers were used to provide open loop feedback, providing motivation to increase PA steps. The pedometer challenge required the children to walk virtually from school (middle of the country) to the coast (total miles 252 (756,000 steps), 42 miles per week). The children were challenged to achieve total daily steps of 18,000, inclusive of bonus steps. These were based on the Tudor-Locke et al. (2004) conversion of 15,000 steps/day as representative of healthy weight and meeting PA guidelines. Children who walked to or from school, or attended afterschool activity sessions were given 3000 bonus steps, which were not included in the final analysis. A conversion rate of 3000 steps to 1 mile was used based from pilot work on children's stride length. Each child was provided with a global position-derived satellite map of their route, which was broken down into weekly challenges to meet the 6-week target. Every Monday, total weekly steps were calculated and feedback was provided.

Quantitative data collection

All children wore one unsealed hip mounted piezo-electric pedometer (New Lifestyles, NL2000, Montana, USA) at baseline and post 6-weeks. Steps were obtained on a weekly basis for a total of 6-weeks during the intervention, for the intervention group only. All activity monitoring was obtained for 7 days on each measurement period and removed only for water based activities. The New Lifestyles pedometer was employed as it shows high reliability and validity in assessing ambulatory PA in children from different weight status groups (Crouter, Schnieder, & Bassett, 2005). The children, under teacher's supervision, recorded their steps at 9am and 3pm on weekdays and self-reported their steps under the supervision of parents at 9am on weekend days. Children recorded non-wear time; pedometers removed for >1 hour were treated as missing data, consistent with previous pedometer research (McNamara, Hudson, Taylor, 2010).

Quantitative Data analysis

Study information was delivered to 135 children via video and written forms, 134 consented (99%). Three of these children moved school by the end of the testing period. A further 29 participants were absent on baseline (control n=7, intervention n=5) or post 6-weeks testing days (control n=3, intervention n=14), and were excluded from analysis. A strict inclusion criterion was applied to the remaining data.

Daily step counts <1000 steps/day were excluded as incomplete data, consistent with research (Rowe et al. 2004). Following this, children who failed to provide 4 complete days and <10 hours of PA data (Trost, Pate, Freedson, Sallis, & Taylor, 2000) at all measurement time points were excluded (intervention n= 16) in order to account for day to day variations in activity patterns. Thus, a total of 49 children were excluded (control=5 boys, 5 girls, intervention=21 girls, 18 boys), leaving a final sample of 85 children with a compliance rate of 63%, which is consistent with other studies (46-99%; Clemes & Biddle, 2013). Mean pedometer steps for week, weekend, school (9am-3pm) and afterschool (3pm-9am) were calculated for baseline, intervention and post 6-weeks.

Statistical analysis

An Independent t-test was used to examine whether PA was significantly different between the control and intervention group at baseline. A 2 (control vs. intervention) by 2 (pre and post- PA/ BMI/WC/BF%) by 2 (gender) Repeated Measures Analysis of Covariance (repeated ANCOVA) assessed PA and BF% changes. In the present study BMI Z-score was used as a covariate in the analysis as it has been associated with PA in children, independent of the other variables assessed in this study. The use of ANCOVA also enables any differences in PA, pre to post intervention and between groups to be analysed, controlling for any impact of weight status whilst at the same time enabling the association between the dependant variable and the covariate to be determined. Eight factor analyses examined week by week differences in PA during the intervention. The statistical package for social sciences (SPSS version 20) was used for all analyses, and the alpha level was set at $P<0.05$. Effect sizes were calculated using Cohen's *d* and 95% confidence intervals (CI) were calculated.

RESULTS

Baseline characteristics

Anthropometric data for the children indicated a mean BMI of 19.00, *SD*= 7.42kg/m^2, 24.7% of which were classified as overweight/obese (Cole et al. 2000). At baseline there were no significant PA or BF% differences between the control and intervention group (*P* >0.05).

Intervention results

The results evidence a significant increase in PA (daily, weekday, school and afterschool) from baseline to post 6-weeks, for the intervention group compared to the control group (*P*=0.00) (Table 2). The control group's PA decreased for daily PA, weekday, school and afterschool PA but weekend PA increased (Table 2). An increase in the proportion of children meeting the pedometer cut-offs for health was also observed (11.7% vs. 44.7%). The response to the intervention was similar for boys and girls (*P* = 0.77, 95% CI of difference for boys, 7459 to 16497 steps/day and 95% CI of difference for girls, 5124 to 10099 steps/day). Subsequent analysis was conducted whereby age and maturation were added independently as covariates. The results remained the same and are thus not reported further. The week by week variations in PA are plotted in Figure 1.

****** FIGURE 1 HERE *********

The findings evidenced no change in BMI Z-scores between control and intervention group from baseline to intervention (Table 2). However, the intervention group evidenced significantly lower WC and BF% scores post 6-weeks intervention compared to the control group (Table 2).

DISCUSSION

This study assessed the utility of an integrated curriculum pedometer intervention to enhance PA in deprived SA children living in Coventry, UK. The results provide evidence that an integrated approach is feasible and can increase habitual PA and decrease BF% for up to 6-weeks post intervention. To the author's knowledge this is the first study to date which compares the model to a control group and examines changes in measures of BF%/weight status alongside PA. These findings support previous studies showing that integrating PA into the curriculum with a pedometer based feedback loop is effective (Duncan et al. 2012; Oliver et al. 2006) in enhancing habitual PA behaviour in children.

Physical Activity

Similar to Duncan et al. (2012), an increase in post intervention steps compared to baseline was found. However, this study extends beyond Duncan et al. (2012) by examining these effects one school term later (post 6-weeks) and making comparisons with a control group, confirming intervention effects. Noticeably, average daily steps were lower in the current study at baseline, and lower than accelerometer predicted cut points from previous studies (35-54%; Eyre et al. 2013a; Owen et al., 2009). Despite this, they are in agreement with the body of literature evidencing low PA in SA children (Eyre & Duncan, 2012a, Owen et al. 2009). It was apparent that with an appropriately targeted intervention, PA could be increased substantially resulting in nearly half of the children meeting the pedometer cut offs for health, post intervention. However, of concern, still half of the children failed to meet these targets.

Given these low baseline activity patterns, it might be argued that the increases in PA witnessed in this current study are a result of the increased opportunity to improve from baseline. Oliver et al. (2006) supports this notion as they found no differences in the PA when their total sample was analysed, but that children with low activity levels increased significantly. Although, both prior studies (Duncan et al. 2012; Oliver et al. 2006) used a similar integrated curriculum approach, the present study builds on this by providing simple PA equipment and opportunity for the children to achieve these daily targets (i.e. afterschool session, skipping introduction and equipment). This may have enhanced the success of the present intervention model. This study provides evidence that such changes can be observed for an extended period beyond 6-weeks although any longer term effects are not known.

This study also required the children to wear their pedometer over weekend days thus measuring the impact of the intervention on weekend activity; this was not employed in earlier studies and is a strength of this current research. There were no significant differences found for weekend activity post intervention. Thus, further approaches which have a direct impact on weekend PA may need incorporating in future work. However, increases in weekend PA from baseline in the control and intervention group were seen. Although speculative, some of the increases may relate to the reported increased engagement in outdoors environments and reduction in sedentary activities, obtained from qualitative interviews with the children (data not presented). Such results are supportive of prior research reporting that children, who spend more time outdoors, engage in more MVPA (McCurdy, Winterbottom, Mehta, & Roberts, 2010). Specific mechanisms to engage SA children outside of the school day are of particular importance, as the ethnic differences between white and SA children's daily PA are posited to be as a result of SA children being less active after school (Eyre et al. 2013a). The current study provides evidence of an intervention that can increase after school activity, potentially decreasing the ethnic gap in PA.

The control group's PA decreased on weekdays but increased on weekends, suggesting that the control group may have engaged in less weekday PA to compensate for their increased weekend PA (Ridgers et al. 2014). Yet, the intervention group's PA increased across all components of the day. During the intervention, the findings indicate some levelling off of PA at week 3 (Figure 1). This may be due to the proposed 'activity stat' whereby children have an individually set point for activity (Wilkin et al. 2006). It could be argued that when children reach this 'activity stat' it is then that they compensate for their increased activity at different times throughout the day or week, though this would require further exploration.

There is some debate about the most influential determinant for overall PA. Some argue that school is the main component (Ridgers, Timperio, Crawford & Salmon, 2011), others argue that afterschool activity account for the differences between overweight/obese vs. normal children and inactive vs. active children (Deforche, De Bourdeaudhuij, D'hondt & Cardon, 2009). The findings of our study show changes in PA across all components of the day. These findings are largely in agreement with Rowlands, Pilgrim & Eston (2008), who found that highly active children spend more time in PA before school, during class, lunch and after- school.

Body Fat

The current study also provides evidence that a short term PA intervention can result in favourable changes in weight status (WC and BF%). However, these differences were not seen when BMI Z-scores were used as a measure of weight status. This may be due to the low BMI for a given body fatness evident in SA's (Misra & Khurana, 2011). Duncan et al. (2012) also reported no change in weight status, potentially due to their reliance on BMI as their sole measure of weight status.

Limitations

This study applies a model in children who have low PA patterns and are a hard to reach group (i.e. deprived ethnic). Similar to previous PA studies (Duncan et al. 2008; Owen et al. 2009) examining ethnicity, this study collapsed different ethnic groups (Indian, Pakistani, Bangladeshi) into one SA grouping. There may be variation in response to the current intervention within this SA grouping. However, in order to examine this possibility a far larger sample size, comprising adequate numbers of each SA sub group, would be required. This is challenging when using a whole school approach and as such was beyond the scope of the study.

The study included 6 classrooms (4 intervention, 2 control) from the same school environment to minimise cross over effects. Despite this, there is a possibility of nesting effects and clustering of activity/step counts due to the children being involved in the same curriculum provision, friendships and observation of active behaviours during break-times. However, given the sample size of the study and the fact that this study sought to provide an ecologically valid/real world intervention, it would be difficult to control for these. Since the control group's PA decreased during school time and increased out of school, it is likely that the effects of this were minimal and that changes observed were due to the intervention.

Using older children (Year 6) as a control group is problematic given the age-related decline in physical activity (Pate et al., 2002). However, the steepest decline has been witnessed in the transition from Year 6 to Year 7 (Duncan et al., 2008) and between young children and adolescent's (Sallis, 2000). Despite the control group's PA showing an overall decline, this was not statistically significant ($P = 0.42$). The effects of biological age on BF% and PA have also been reported (Sherar, Eslinger, Baxter-Jones, & Tremblay, 2007). This study obtained information on age at peak height velocity estimated using sitting height and leg length (Mirwald, Baxter-Jones, Bailey & Beunen, 2002), and re-analysed the data adjusting for maturation. The inclusion of maturation did not change the outcome of the findings and thus this data is not presented.

Due to the cross-over of the intervention on post intervention measures it was not feasible to obtain physical activity steps/day at the end of the intervention. Additionally, at Week-7, the school ran a second themed week of physical activity and thus this may have influenced PA measures for post if they had been collected. This lack of pre-post data in control group children make it more difficult to conclude that the behavioural impact and changes in weight status at post-6 weeks were solely related to the intervention components. We acknowledge this as a limitation and suggest future research using such an intervention approach seeks to address this issue.

Additionally, while it is acknowledged that seasonality affects PA, the inclusion of a control should arguably minimise the impact of seasonality. In the future it would be useful to ascertain whether the replication of this study in the winter season would augment the same findings, alongside longer follow up and obtaining information on the weather conditions at the measurement time.

CONCLUSION

This is the first study examining the utility of an integrated curriculum school based approach to increase PA and reduce BF% in deprived SA primary school children. This approach appears to be effective in increasing PA and reducing BF%. However, the sustainability of such an approach on health benefits post 6-weeks needs clarification, as does the impact of reduced PA and BF% on metabolic risk in adulthood health.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

COMPETING INTERESTS

No competing interests to declare.

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Figure 1 PA steps from baseline to post 6 weeks (n=55, July 2013)

Table 1: Intervention Schematic

Main physical activity task: Virtual walk (6-weeks)
Target : total miles 252 (756,000 steps), 42 miles per week (15,000 steps a day, (3000 bonus steps provided for walking to/from school or attending afterschool activity sessions).
Curriculum links: Maths (weekly steps, comparing less/more active days), geography (map tracking progress on route), PE (engaging in habitual PA)

MECHANISM FOR EDUCATION, PA AND HEALTH BEHAVIOUR CHANGE.

Curriculum delivery	**Quantity**	**Summary of tasks**	**Cross curriculum links**
PE (delivered by teachers)	1 hour per week, 6 weeks	Athletics Games Dance Gymnastics	Science: keeping healthy, the heart, lungs, movement Maths: pedometer steps and activity
Science: keeping healthy and journeys - delivered by teachers - delivered by research staff with teachers	 1 hour per week, 6 weeks 1 hour per week, 6 weeks	Healthy balanced diet Exercise and the body (heart, lungs) Journey of blood around the body Healthy and unhealthy drugs Smoking and the body	Literacy: create posters , menus, timetables for activity classes ICT: video on how heart works, create own promotional videos to encourage others to be active Art and design: design healthy drug, design health centre Maths: plot graph of changes of the heart before, during and after exercise. Compare boys and girls. PE: create games, activity sessions and lead them. Music: create song, or rap for healthy video.
Health week: Integrated health theme into every curriculum lesson over a whole week. - Delivered by teachers - Skipping lesson by research staff	 9-3.30, 5 days, 15 minutes per class	Create video summarises what they know on keeping healthy and advises others to keep healthy.	ICT, English, maths, science, PE
Activities to increase daily physical activity			
Afterschool activity sessions	45minutes, 1 per week, 4 weeks	**General plan** Warm up (5 mins) Plyometric and skill drill circuits (15 minutes) Playground games (15 minutes). Cool down (5 mins) Change time (5 mins) Each week had a specific focus for example: week 6 Olympic games focused on problem based learning to develop techniques such as ‘sprinting like Usain bolt’	PE

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Table 2: Descriptive variables from baseline to post 6 weeks intervention for control and intervention group.

	Control (n = 30; boys = 14, girls = 16)			Intervention (n = 55; boys = 26, girls =29)					
	Baseline	**Post 6 weeks**	**Mean change from Baseline to post 6 weeks**	**Baseline**	**Post 6 weeks**	**Mean change from Baseline to post 6 weeks**	***P* for group difference**	**95% CI of mean change between control and intervention**	**Effect size (*d*)**
PA (steps/day)									
Daily PA*	10479 ± 6665	9358 ± 4770	-1121 ± 5592	7845 ± 2942	16539 ± 4929	8694 ± 7428	0.001	6726, 12904	1.76
Week PA*	11543 ± 7825	7506 ± 3419	-4037 ± 7284	8609 ± 3429	17402 ± 10748	8793 ± 8881	0.001	9057, 16602	1.76
Weekend PA*	5270 ± 4615	16331 ± 12063	11061 ± 10045	3935 ± 3740	13273 ± 7613	9338 ± 4096	0.68	-4790, 1344	-0.17
School PA*	5923 ± 3259	5013 ± 3041	-910 ± 3256	4716 ± 4527	8903 ± 3059	4186 ± 2986	0.01	3704, 6488	1.57
Afterschool PA*	9027 ± 6498	6259 ± 3962	-2768 ± 6395	8397 ± 3189	10773 ± 7070	2376 ± 2339	0.01	3236, 7051	0.8
Body Fat									
BMI (kg/m^2)	20.18 ± 6.85	18.24 ± 4.62	-1.94 ± 0.93	17.77 ± 6.25	17.56 ± 4.23	-0.21 ± 0.88	0.11	1.38, 2.44	1.86
BMI Z-scores	0.47 ± 1.42	0.03 ± 1.50	-0.02 ± 0.49	0.33 ± 1.22	0.18 ± 1.37	-0.18 ± 0.39	0.16	-0.82, 0.08	0.33
WC (cm)	63.61 ± 11.34	63.40 ± 10.19	-0.21 ± 3.49	63.19 ± 13.94	61.46 ± 12.53	-1.73 ± 4.48	0.001	-3.40, 0.36	0.44
WC SDS	0.86 ± 1.57	0.75 ± 1.53	-0.11 ± 0.71	0.82 ± 1.44	0.03 ± 1.40	-0.79 ± 0.99	0.001	-1.21, -0.29	0.96
Body Fat (%)	21.72 ± 9.42	20.63 ± 9.31	-1.09 ± 2.77	22.35 ± 8.60	17.89 ± 8.53	-4.46 ± 4.77	0.01	-1.26, -0.34	1.22

Mean ±*SD*, * Adjust for baseline BMI Z-score

Abbreviations: BMI- body mass index**, CI –** confidence interval, **PA –** physical activity, **WC** – waist circumference