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Inattention and hyperactivity in children at risk of obesity: a community cross-sectional study

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ABSTRACT

Objective: There is a link between the symptoms of hyperactivity/inattention and overweight in children. Less is known about the factors which might influence this relationship, such as physical and sedentary activity levels or exercise self-efficacy. The aim of this study is to examine the associations between the symptoms of hyperactivity/inattention and risk factors for adult obesity in a sample of children with barriers to exercise.

Design: Children aged 9–11 years were recruited from 24 primary schools that participated in the Steps to Active Kids (STAK) physical activity intervention study. Study inclusion criteria were low exercise self-efficacy, teacher-rated overweight or asthma. Children with high levels of physical activity were excluded. Measures included parent and teacher-rated behavioural and emotional well-being using the Strengths and Difficulties Questionnaire, physical and sedentary activity levels, BMI (body mass index) and exercise self-efficacy.

Results: Of 424 participating children, 62% were girls and 39% were classified as overweight or obese. As compared with population norms, boys in this at-risk sample were more likely to receive an abnormal teacher-rated hyperactivity/inattention score (OR 1.48, 95% CI 1.01 to 2.17). Children with teacher-rated abnormal hyperactivity/inattention scores reported higher levels of sedentary activity (OR 1.13, 95% CI 1.02 to 1.17), but not physically active activity. The pattern of findings was similar for children with hyperactivity/inattention problems as rated by both parent and teacher (pervasive hyperactivity and impairment).

Conclusions: Although BMI was not directly related to hyperactivity/inattention, children with risk factors for adult obesity have more hyperactivity/inattention problems. In particular, hyperactivity/inattention is associated with higher levels of sedentary activity. Higher rates of pervasive hyperactivity and impairment were apparent in this at-risk group.

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INTRODUCTION

There is longitudinal evidence that poor physical fitness and inactivity in childhood increases the risk of obesity in adulthood.[1–3]

ARTICLE SUMMARY

Article focus
- Increased sedentary activity and decreased physical activity levels are known risk factors for the development of obesity.
- There is a relationship between hyperactivity/ inattention and obesity in childhood. This relationship may be underpinned by associated difficulties with coordination or self-regulation.
- This study assessed whether children with risk factors for adult obesity, including current overweight and low levels of physical activity, were also likely to score above cut-off for inattention and hyperactivity.

Key messages
- Sedentary children with risk factors for obesity have an increased risk of hyperactivity/ inattention.
- Interventions to promote physical activity in sedentary or overweight children need to accommodate potential difficulties with inattention and hyperactivity.

Strengths and limitations of this study
- The study used a well-validated measure of inattention and hyperactivity with multiple informants (teacher and parent).
- This study used normative data to establish increased risk of attention deficit hyperactivity disorder symptoms rather than a contemporary comparison group of physically active children.

Research in Western countries has highlighted that childhood health problems associated with being overweight and physically inactive are known risk factors for predicting overweight and associated health problems in adulthood.[4 5] Early intervention for children with barriers to exercise such as low exercise self-efficacy (confidence about participation in exercise) or chronic health conditions, for example, asthma, is therefore important to aim to reduce the risk of obesity later in life. There is some evidence that children with chronic conditions have higher rates of obesity and lower physical activity levels.[6] The

neurodevelopmental disorder, attention deficit hyperactivity disorder (ADHD), is one of the most common childhood disorders with a world-wide prevalence rate of around 3–5% and long-term adverse consequences.[7] Sub-threshold high levels of hyperactivity/inattention, particularly when pervasive across settings, are also a risk factor for later problems.[8] Although symptoms of hyperactivity/inattention might be expected to reduce the risk of obesity due to the increased metabolism of calories through increased customary activity levels, growing evidence suggests an association between weight problems and symptoms of ADHD, possibly due to difficulties with self-regulation.[9 10]

Several studies have demonstrated this relationship within clinically obese or clinically diagnosed ADHD samples[11 12] and in population-based studies.[13 14] However, the findings are inconsistent possibly because of cross-sectional designs, methodological and sample characteristic differences.[15–17] Some children with ADHD may have low self-esteem and social functioning problems as well as possible coordination difficulties.[18 19] These problems may influence self-confidence and participation in physical activity, referred to as exercise self-efficacy and could therefore become risk factors for the development of later obesity. Despite this, many studies which investigate the relationship between weight and hyperactivity/inattention problems do not explore factors that might influence this relationship such as physical or sedentary activity levels and exercise self-efficacy. To date, no research has looked at both weight and symptoms of hyperactivity/inattention in children with barriers to exercise and who are at risk for adult obesity. Studies including sedentary or physical activity measures have either not looked at hyperactivity/inattention or have used non-standardised measures to assess activity levels and child behaviour.[20–22] Some studies report gender differences in the relationship between behaviour, including hyperactivity/inattention, and weight; however, these studies have involved samples of younger children.[23–25] It is important to establish whether hyperactive/inattentive children are over-represented in at-risk groups since they may be less likely to be targeted for activity interventions as many of these target physical health outcomes.[26]

The aims of this study are to explore rates of inattention and hyperactivity in a sample of children with barriers to physical activity and to explore which risk factors for adult obesity are associated with symptoms of hyperactivity/inattention. We hypothesised that children with risk factors for adult obesity (current overweight or barriers to physical activity) will have high rates of difficulties with hyperactivity and inattention.

METHODS
Participants
This study uses screening baseline data from a cluster randomised controlled trial collected April 2010–November 2011, the Steps to Active Kids (STAK) study.[27] STAK is assessing the impact of a targeted physical activity intervention in children aged 9–11 years with risk factors for adult obesity.[27] Twenty-four schools agreed to participate and an opt-out procedure was used to screen children in years 5 and 6 of primary school (see figure 1). Parents received a letter with information about the screening process and study. Of the 2479 children who were screened, 1065 met the eligibility criteria and were invited to take part prior to randomisation.[27] Children with high levels of customary physical activity were excluded as the STAK intervention is specifically designed to meet the needs of children with low levels of exercise self-efficacy.
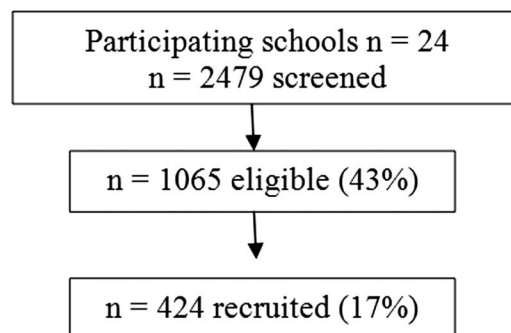
Measures
Screening
For each child, their class teacher completed screening questions to identify those with risk factors for adult obesity. Children reported whether they had a diagnosis of asthma, participated in team sports and had an active hobby and how often they participated in the activity. They completed the nine-item predilection subscale of the Children's Self-Perceptions of Adequacy in and Predilection for Physical Activity (CSAPPA) to assess willingness to engage in physical activity with a cut-off of 27 or below indicating low-exercise self-efficacy.[28] Teachers rated the child's build using the Child Body Image Scale, which represents centile bands according to the 1990 growth charts.[29 30] Teachers also answered whether children found physical education (PE) difficult due to asthma, overweight, coordination problems or lack of fitness as well as whether the child was sporty.

Inclusion criteria for the main STAK study comprised of one or more of the following: child-rated asthma, child-rated low exercise self-efficacy, teacher-rated build at above 85th centile and teacher-rated concern about participation in PE. If the children participated regularly in an active hobby or a team sport and were rated as 'sporty' by their teacher, they were excluded.

Baseline study measures
Child symptoms of hyperactivity/inattention were assessed using both the teacher-rated and parent-rated

Figure 1 Screening of participants and recruitment flow.

Strengths and Difficulties Questionnaire (SDQ).[31] The SDQ is a widely used measure to assess emotional and behaviour difficulties in children aged 4–16 years. The questionnaire contains five subscales (prosocial, emotional, conduct, peer problems and hyperactivity/inattention) and provides a total score incorporating the latter four subscales. Subscale scores range from 0 to 10 with the total score ranging from 0 to 40. There is also an impact score, which indicates the level of child distress and associated social impairment. There are abnormal cut-off scores for both totals and subscales, with a score of 7 or above indicating hyperactivity/inattention problems which has been found to have 74–75% sensitivity at predicting a Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) diagnosis of ADHD.[32] In addition, 'probable ADHD' reflects those children rated as having both parent-rated and teacher-rated scores of 6 or above for hyperactivity/inattention (pervasive hyperactivity) and impact scores of 1 or above (impairment).[31][33] Although children with pervasive hyperactivity and impairment may not all meet criteria for a clinical diagnosis, this algorithm reflects the use of multiple informants to determine that symptoms and impact are pervasive across settings, thus compares well with a diagnostic interview.[34] The SDQ has high validity and reliability and has been shown to discriminate between children who have received a clinical diagnosis of ADHD and those who have not.[35]

Height was measured using a stadiometer and weight was recorded where each child removed any extra clothing (eg, sweater) and footwear for both measurements which were each recorded once. Waist circumference was recorded using a tape equidistant between the iliac crest and the base of the rib cage; the children were asked to breathe as normal. Body mass index (BMI) centiles were calculated in weight/height² using the British 1990 growth reference chart for children adjusting for age and gender.[36] Participants with a centile of 91–96 were classified as overweight and those with a centile of 97 or above as obese.[36] Children were asked whether they had a diagnosis of asthma.

Exercise self-efficacy was assessed using the CSAPPA Scale.[28] This measure has been developed and validated for use in 8 to 16-year-old children and adolescents to examine self-report attitudes towards physical activity participation. The three subscales measure adequacy (self-confidence), predilection (preference for) and enjoyment of physical activity, with higher scores indicating higher exercise self-efficacy. It has been found to moderately relate to performance on aerobic fitness as well as self-reported physical activity participation.[37][38]

Self-report sedentary and physical activity levels were measured using a UK modified version of the Physical Activity Questionnaire (PAQ).[39] The modified version has been used in previous studies and contains 59 items including physical activity (eg, running) and sedentary activity (eg, television viewing).[6] Children rate their participation in each activity (none, a little and a lot) in three time periods within the previous 24 h (before school today, after school yesterday and during school yesterday). Higher physical activity scores indicate higher levels of participation in physical activity, while higher sedentary activity scores indicate higher levels of participation in sedentary activity.

Statistical analysis

Data were analysed using SPSS V.17.0. Teacher ratings of child behaviour were compared with the UK normative data[40] (boys, n=4073 and girls, n=4135; aged 5–15 years) to calculate the ORs separately for boys and girls. Non-parametric analyses were conducted as appropriate. Participant characteristics were assessed for gender differences using Mann-Whitney U tests. Scores from the teacher-rated hyperactivity/inattention subscale were treated as categorical as we were specifically interested in children with high (high hyperactivity/inattention group) and low (low hyperactivity/inattention group) scores in relation to risk factors for adult obesity. Comparisons between children with teacher-rated abnormal hyperactivity/inattention scores (score of 7 or above) and those with low scores on risk factors for adult obesity (BMI centile, physical and sedentary activity levels and exercise self-efficacy) were made using Mann-Whitney U tests. Associations between abnormal teacher-rated hyperactivity/inattention scores and risk factors for adult obesity were assessed using logistic regression analyses for the whole sample. Adjustments were made for the possible influence of gender (categorial) plus other teacher-rated SDQ subscales (conduct, peer problems, prosocial and emotional), BMI centile, physical activity levels, sedentary activity levels and exercise self-efficacy (all continuous). Comparisons between those rated with and without pervasive hyperactivity and impairment (6+ cut-off scores for both parent-rated and teacher-rated hyperactivity/inattention and impact of 1+ for both parent and teacher) were assessed using Mann-Whitney U tests separately by gender due to differences in this subsample.

Ethical approval

Approval for this study was received from the University of Nottingham Medical School Ethics Committee.

RESULTS

After screening, the parental consent for participation was received for 424 (40%) children who met the eligibility criteria. Based on screening data, participants and non-participants did not differ in relation to gender, exercise self-efficacy or teacher-rated overweight. Among the participating sample, 62% were girls and 13% self-reported asthma (table 1). Thirty-nine per cent were classified as overweight or obese.[36] Information on child behaviour was received for 371 (87.5%) children through the teacher-rated SDQ. Both parent and teacher-rated SDQ information was received for 270

Table 1 Participants' demographic information

	Boys (n=161) Median (IQR)	Girls (n=263) Median (IQR)	U p Value
Age (years)	10 (9–10)	10 (9–10)	0.60
Weight (kg)	38.1 (32–48)	38.6 (32–48)	0.90
Height (cm)	142 (137–147)	142 (136–146)	0.85
Waist (cm)	70 (63–81)	68 (61–77)	0.08
Body Mass Index centile	88 (48–98)	79 (44–96)	0.05
Active score (PAQ)	57 (50–67)	59 (52–66)	0.51
Sedentary score (PAQ)	25 (22–29)	25 (22–29)	0.88
CSAPPA total	53 (46–60)	50 (43–57)	0.04
SDQ teacher total score (out of 40)	10 (6–17)	5 (2–11)	<0.001**
SDQ teacher hyperactivity/inattention subscale (out of 10, ≥7 abnormal cut-off)	4 (2–7)	2 (0–4)	<0.001**

**p<0.001.
CSAPPA, Children's Self-Perceptions of Adequacy and Predilection for Physical Activity Scale; IQR, interquartile range; PAQ, Physical Activity Questionnaire; SDQ, Strengths and Difficulties Questionnaire; U, Mann-Whitney U test.

(64%) children. There were no statistically significant differences between the children who did and did not have both parent-completed and teacher-completed SDQ information in relation to age, gender, activity levels, exercise self-efficacy and weight.

Comparisons on teacher-rated hyperactivity/inattention between study sample and normative data

Boys in the study were almost 1.5 times more likely (p<0.05) to have high hyperactivity/inattention scores compared with the normative sample (table 2). They were also more likely to have scores in the abnormal range across all SDQ domains compared with population norms. Table 2 also shows that both boys and girls were around twice as likely to have total SDQ scores in the abnormal range compared with population norms.

Comparisons between high and low teacher-rated hyperactivity/inattention and risk factors for adult obesity

For boys and girls combined, children with abnormal teacher-rated hyperactivity/inattention scores had higher levels of sedentary activity (median, Mdn=28) than children with low scores (Mdn=25, U=5939; p<0.001). No other differences in risk factors for obesity (BMI centile, exercise-self efficacy or physical activity) were found between those with high and low hyperactivity/inattention (table 2).

Teachers rated more boys with abnormal hyperactivity inattention scores (χ^2 (1)=19.77, p<0.001); therefore, analyses were also conducted separately by gender (table 3). Boys and girls with abnormal teacher-rated hyperactivity/inattention scores reported higher levels of sedentary activity (Mdn = 28, p=0.01 and 29; p<0.001, respectively). Girls with abnormal teacher-rated hyperactivity/inattention

Table 2 Teacher-rated SDQ total and subscale abnormal scores comparing the study sample with normative data

Teacher SDQ

SDQ total and subscales (abnormal cut-off)	Boys Norms n=4073	Study n=143	p Value	Girls Norms n=4135	Study n=228	p Value
Total problems (≥16, %)	13.7	26.6		5.6	10.5	
OR (95% CI)	2.16 (1.48 to 3.17)		<0.001	1.98 (1.27 to 3.08)		0.003
Hyperactivity/inattention (≥7, %)	19.1	25.9		6.4	8.8	
OR (95% CI)	1.48 (1.01 to 2.17)		0.045	1.40 (0.87 to 2.26)		0.162
Emotional problems (≥6, %)	4.9	9.1		4.5	7.9	
OR (95% CI)	1.94 (1.08 to 3.49)		0.023	1.82 (1.10 to 3.01)		0.020
Conduct problems (≥4, %)	11.5	22.4		5.1	8.3	
OR (95% CI)	2.22 (1.48 to 3.33)		<0.001	1.69 (1.04 to 2.76)		0.036
Peer problems (≥5, %)	8.6	17.5		5.6	7.9	
OR (95% CI)	2.25 (1.44 to 3.52)		<0.001	1.44 (0.88 to 2.38)		0.151
Prosocial (<4, %)	18.7	25.9		7.6	5.7	
OR (95% CI)	1.52 (1.03 to 2.22)		0.033	0.74 (0.42 to 1.30)		0.293

Italics type highlights ORs, which indicate increased risk in the study sample.
SDQ, Strengths and Difficulties Questionnaire.

Table 3 Comparisons between high and low teacher-rated SDQ hyperactivity/inattention scores

	Boys			Girls			Whole		
	High Median (IQR)	Low	U p Value	High Median (IQR)	Low	U p Value	High Median (IQR)	Low	U p Value
BMI centile	87 (47–98)	89 (47–99)	0.36	84 (55–99)	82 (43–96)	0.28	87 (51–98)	85 (45–97)	0.70
Active score (PAQ)	58 (49–68)	55 (49–65)	0.31	64 (58–67)	57 (51–65)	0.22	61 (52–67)	57 (50–65)	0.10
Sed score (PAQ)	28 (24–31)	24 (22–28)	0.01*	29 (27–35)	25 (22–28)	0.04*	28 (25–33)	25 (22–28)	<0.001**
CSAPPA total	52 (39–60)	54 (48–60)	0.26	55 (48–60)	50 (43–58)	<0.001**	53 (42–60)	52 (44–59)	0.81

*p<0.05.
**p<0.001.
BMI, Body Mass Index; CSAPPA, Children's Self-Perceptions of Adequacy in and Predilection for Physical Activity Scale; High, high hyperactivity/inattention score ≥7; IQR, interquartile range; Low, low hyperactivity/inattention score <7; PAQ, Physical Activity Questionnaire; SDQ, Strengths and Difficulties Questionnaire; Sed, sedentary activity; U, Mann-Whitney U test.

Table 4 Characteristics of pervasive hyperactivity subsample

	No PH boys Median (IQR)	PH boys	U p Value	No PH girls Median (IQR)	PH girls	U p Value
Age (years)	10 (9–10)	9.5 (9–10)	0.45	10 (9–10)	10 (9–10)	0.62
Weight (kg)	40 (33–49)	35.08 (30–49)	0.18	39.65 (32–47)	38.2 (33–51)	0.93
Height (cm)	141.8 (138–147)	141.95 (135–147)	0.70	141.5 (136–146)	142 (138–147)	0.87
Waist (cm)	71.5 (63–82)	64 (61–79)	0.12	69 (62–76)	67 (61–80)	0.91
BMI centile	90 (59–99)	62 (34–98)	0.14	82 (48–97)	80 (68–96)	0.76
Active score (PAQ)	56 (49–65)	55 (47–67)	0.82	57 (51–64)	64 (47–68)	0.36
Sedentary score (PAQ)	24 (22–28)	26 (22–29)	0.45	24 (22–28)	29 (24–36)	0.06*
CSAPPA total	55 (48–63)	50 (39–57)	0.07	50 (43–57)	49 (35–57)	0.59

*p<0.05
BMI, Body Mass Index; CSAPPA, Children's Self-Perceptions of Adequacy in and Predilection for Physical Activity Scale; IQR, interquartile range; PAQ, Physical Activity Questionnaire; PH, pervasive hyperactivity score of ≥6 by parent and teacher on hyperactivity/inattention SDQ subscale and impact score of ≥1; SDQ, Strengths and Difficulties Questionnaire; U, Mann-Whitney U test.

scores also reported higher levels of physical activity (Mdn = 63.5, p=0.039). No other gender differences were found on the other risk factors for obesity (BMI centile and exercise self-efficacy) between high and low hyperactivity/inattention.

The logistic regression analyses confirmed that children with abnormal teacher-rated scores for hyperactivity/inattention were four times more likely to be boys (OR 4.10, 95% CI 2.14 to 7.76; p<0.001) and have an increased risk of participating in more sedentary activities (OR 1.13, 95% CI 1.05 to 1.21; p<0.001) than children with sub-threshold scores. Participation in sedentary activities remained significant (p=0.01) when adjusting for other SDQ subscales (emotion, peer problems, conduct and prosocial). Other factors such as exercise self-efficacy, age, BMI centile and physical activity levels were not associated with abnormal hyperactivity/inattention scores.

Pervasive hyperactivity and impairment in children with risk factors for obesity and barriers to exercise

Thirty-one (11.5%) children were classified with pervasive hyperactivity and impairment (64.5% boys; table 4). There was a significantly higher number of boys than girls classified (χ^2=9.68, p=0.002). In girls, the levels of sedentary activity differed between those with pervasive hyperactivity and those without. Girls with pervasive hyperactivity and impairment reported higher levels of sedentary activity participation (p=0.05). No other differences between the groups were found relating to physical activity levels and exercise self-efficacy.

DISCUSSION

This study found high rates of hyperactivity/inattention problems in boys in this sample of children with risk factors for physical inactivity and adult overweight. Children with high teacher-rated hyperactivity/inattention scores had higher reported levels of sedentary activity than those with low scores. This finding remained significant after adjusting for confounders. For girls, higher teacher-rated hyperactivity/inattention was also associated with higher reported physical activity levels. We found no evidence that weight was associated with hyperactivity/inattention in this selected at-risk sample.

Our finding of higher rates of hyperactivity/inattention in boys in this at-risk sample concords with higher rates of ADHD in boys in the general population.[8] Furthermore, our rate of pervasive hyperactivity and impairment was markedly higher (11.5%) than that found in another school-based community study (3–4%) despite there being a larger proportion of girls in our sample.[41] We did not find an association between weight and symptoms of ADHD similar to previous studies using clinical and community-based samples.[42 43] Ebenegger et al[44] also used the hyperactivity/inattention SDQ subscale and found that although symptoms of ADHD were not related to BMI, children with

hyperactive/inattentive symptoms participated in increased physical activity and television viewing. We demonstrated that children with high teacher-rated hyperactivity/inattention scores reported higher sedentary activity levels. This finding is supported by previous research, which illustrated that sedentary activity such as television viewing and video game playing were related to attention problems.[45–47] Our findings suggest that although children with hyperactivity/inattention, in this selected sample, do not have lower levels of physical activity compared with those with symptoms of hyperactivity/inattention in the normal range, they do report more sedentary activity participation. This supports findings from a recent study of a large community sample of children aged 6–17 years which found that compared with children without ADHD, children with unmedicated ADHD were more likely to be rated as inactive.[22] Girls with unmedicated ADHD had higher levels of TV and computer use. This is particularly important given that children generally are spending increased time participating in sedentary activities and less time engaging in physical activity.[48] Furthermore, there is evidence that children in this age group with lower levels of fitness are associated with higher teacher-rated scores for hyperactivity/inattention.[25] Our finding of increased sedentary activity in the pervasive hyperactivity and impairment subsample supports the findings using only the teacher-rated SDQ as a measure of hyperactivity/inattention problems. This subscale only has five items assessing hyperactivity/inattention limiting the ability to analyse the different components of ADHD separately, but remains a useful screening tool. Furthermore, the mean exercise self-efficacy score for the pervasive hyperactivity and impairment group was markedly lower than the cut-off for concern considered to indicate low levels of confidence by the researchers who developed the measure.[28] Our findings lend support to the importance of identifying at-risk children for interventions.

We found that girls reported higher physical activity levels which is similar to that found in Baerg et al.[49] Baerg et al found that boys with ADHD and developmental coordination disorder, one of our teacher screening questions, had lower levels of physical activity, but girls had higher levels. It is not clear whether higher reported physical activity indicates higher energy expenditure, particularly as there were no differences in weight between those with high and low hyperactivity/inattention scores, with both groups having high rates of obesity in this sample of children selected for risk factors for adult obesity.[50] As this sample was selected as having low exercise self-efficacy and low participation in physical activity, further research is needed to compare those with high and low levels of exercise self-efficacy or high and low levels of physical activity participation to help clarify the findings.

This study was cross-sectional in nature and lacked a control group limiting the ability to identify the direction of the effect between activity levels and hyperactivity/

inattention or to explain the mechanisms underlying this relationship. Longitudinal studies are required to explore the development of activity levels, behavioural symptoms, risk factors for obesity over time and comparisons of those with high and low symptoms of hyperactivity/inattention or high and low physical activity levels. This would help establish how children rated with hyperactivity/inattention problems are represented in terms of high and low physical activity participation. Although the age range of our study sample was narrow, it reflects the current high levels of obesity reported in this age group and is an important age for targeted interventions before the transfer to secondary schools and adolescent development.[50] The use of a subjective measure of activity levels should be treated with caution due to possible report bias; further work could include objective measures such as accelerometers alongside self-report activity levels. Given that parent responses were less complete, our findings may have underestimated the prevalence of behaviour problems in this selected sample. Further research is required with larger samples of children rated as having pervasive hyperactivity and impairment, particularly when this study found higher rates of probable ADHD than previously reported in a community sample.

IMPLICATIONS

The concern that being overweight in childhood may lead to obesity in adult life has largely overlooked the role that other risk factors may play. Our findings add to previous research by highlighting that children with both barriers to physical activity and risk factors for obesity have increased difficulties with behaviour, particularly hyperactivity/inattention. This suggests that it is important to address the sedentary lifestyle that appears to be increasing in childhood. Although the findings have small effect sizes and cannot determine whether hyperactivity/inattention causes increased risk factors for obesity or vice versa, it is important to recognise the potential moderating influence of hyperactivity/inattention for interventions which aim to promote physical activity in children at risk of obesity and to accommodate for children with problems of hyperactivity/inattention. Additional research should attempt to further assess the influence of risk factors for adult obesity and barriers to physical activity alongside hyperactivity/inattention in childhood. Specifically, researchers should explore whether interventions to reduce risk factors for obesity could also reduce symptoms of hyperactivity/inattention, particularly as we found high levels that may indicate probable disorder.

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