

## **Sports Activity, Nutritional Intake on Intelligence and Academic Achievements among Boys: Review**

**Kulbir Singh Rana and AnuradhaLehri**

### **Abstract**

**Aim:** The aim of this systemic review is to search all relevant data available for this purpose. The review further identifies the available literature on the impact of individual variables like Sports participation, physical fitness, physical education, nutrition status, psychological parameters, cognition, and social factors on intelligence and academic achievements. For each variable a comprehensive list of relevant journal articles were collected using a range of sources, including peer reviewed journal articles and reports. Key search terms included “Sports participation and academic performance”, “impact of physical activity and sport on intelligence and academic achievement”, “health benefits of sports and physical activity”, “competitive school sport and health” and “impact of nutritional status on intelligence and academic achievements”.**Method:** Approximately 45,461 journal articles were located. The first 150 articles of each search were observed. From these, 196 were deemed relevant to review for this research, and 28 were used in the review. **Results:** various researchers reported the individual effects of nutrition, physical fitness, sports participation on academic achievements and intelligence. **Conclusion:** Our results suggested that the combination of nutrition, sports participation, and physical fitness will improve academics scores, personality, intelligence level and cognition of students.

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### **Introduction**

Engagement in sports competition is known to contribute to the developmental outcomes for a healthy lifestyle, where children learn about physical, social and cognitive skills (Choi et al, 2014). Broadly, engagement in physical activity is also recognized to contribute a range of positive outcomes, specifically; physical and mental health, social wellbeing, cognitive and academic performance (Bailey et al, 2013). It is recognized that physical education (PE) in schools is an ideal vehicle to promote physical activity due to its availability to all young people. Despite these recognized benefits, it remains a concern that within schools “the increasing pressures to improve academic scores often lead to additional instructional time for academic subjects at the cost of time for being physically active” (Singh et al, 2012). In this regard, Trudeau and Shepard (2008) stated that if we want to improve the academic achievement, physical fitness and health of our young people, we should not be limiting the time allocated to PE and school sport. The time allocated to physical education in the majority of

western schools has declined over the last decade, with a consequent increase in time allocation for other academic subjects (Hillman et al., 2008). One area of recent current interest has been whether or not participation in sport and other forms of physical activity can enhance cognitive function, including memory and concentration. Large, all-encompassing reviews examining this relationship between physical activity and learning behavior have suggested that school children may indeed derive cognitive benefits from participation in physical activity including sport (Mahar et al., 2006). Finally it has been argued that the potential psychological and social benefits of physical education, physical activity and sport may indirectly academic performance by enhancing mental health, improving feelings of connectedness with school and by enhancing positive social behaviors (Trudeau and Shephard, 2008). The purpose of this review is to examine the impact of physical education and sport on academic achievement and on those wider social outcomes which might impact on academic achievement and other aspects of school performance. The review includes academic peer-reviewed journal articles and other sources of information such as published reports. This review draws upon evidence that explores the impact of competitive school sport on young people. However, due to the limited research available on these competition specific outcomes, the findings presented focus on the role physical activity, PE and school sport play on the holistic development of the child. Particular attention has been paid to the academic, diet and health and wellbeing outcomes for young people.

#### **Method**

The literature was explored for 04 variables;

1. Sports Participation
2. Nutritional intake
3. Intelligence
4. Academic achievement

For each variable a comprehensive list of relevant journal articles were collected using a range of sources, including peer reviewed journal articles and reports. Key search terms included "Sports participation and academic performance", "impact of physical activity and sport on intelligence and academic achievement", "health benefits of sports and physical activity", "competitive school sport and health" and "impact of nutritional status on intelligence and academic achievements". Approximately 45,461 journal articles were located. The first 150 articles of each search were observed. From these, 196 were deemed relevant to review for this research, and 28 were used in the review. Further searches through other sources were also carried out to locate primary research articles within the literature. These have been recorded within the reference list. Literature searches were primarily focused on the impacts of competitive school sport, sport activity and physical education where possible, but also included physical activity. These terms were commonly used synonymously. References are made to additional authors and their studies throughout the review. Where detail of their studies is not provided, this can be viewed by accessing the original research using the full reference provided in the reference list.

#### **Impact of physical education, physical activity and sport on academic achievement and cognitive functions**

The large majority of university-based, internationally published research in this field has found a positive association between children's physical activity participation and academic achievement. A two year physical activity intervention led to significant improvements in children's mathematics scores (Hollar et al., 2010). Children can spend less time in academic learning and more time being physically active during the school day without affecting academic success or progress. Greater vigorous physical activity out of school resulted in higher

test scores (Coe et al., 2006). Body mass index, diet and physical activity explained up to 24% of the variance in academic achievement after controlling for gender, parental education, family structure and absenteeism (Sigfusdottir et al., 2006). This is a thorough review and highlights the strengths and limitations of the studies cited. One of the limitations of many of the studies is the failure to control substantial influencing variables such as socioeconomic status, which is the strongest predictor of academic achievement (Williams, 2003). It is thought that socioeconomic status is a leading influence of academic achievement due to the increasing opportunities and environments provided for learning with higher levels of socioeconomic status. However, one recent North American study on public school children has shown that the relationship between fitness and academic achievement remained significant after controlling for both socioeconomic status and race/ethnicity (Chomitz et al., 2009). Furthermore, as cited in the review by Martin et al. (2010) the relationship between physical activity and academic achievement was still evident after parental education had been controlled (Sigfusdottir et al., 2006). A further problem with the majority of the literature concerning physical education, physical activity and sport in school and academic performance is the use of cross-sectional designs. It cannot therefore be suggested that any observed relationships between physical education, physical activity, sport and academic achievement are causally related. Therefore, the remainder of this section has a focus on longitudinal intervention studies, several of which have been well-controlled. Several key longitudinal studies have used physical education as an intervention, whilst monitoring its impact on academic achievement. The Vanves study in France (Fourestier, 1996) and project SPARK in California (Sallis et al., 1999) all reported no decline in youth academic performance as a result of an additional 60 minutes per day (on average) allocated to physical education. Despite this, a promising 2-year follow-up on the SHAPE project found that intervention schools had in fact developed an advantage in arithmetic and reading scores over control schools (Shephard, 1997) as summarized in the Martin (2010) review. Collectively, these studies suggest no decline, or an improvement in academic achievement with additional physical education, even when this replaced academic subject lesson time. A threshold amount of physical activity may be necessary to acquire learning benefits (Davis et al., 2007). Participation in vigorous physical activity may enhance learning. (Coe et al., 2006).

#### **Impact of nutritional status physical activity and sport on academic achievement and cognitive functions**

Jago et al (2004) conducted a study on the relationship between physical activity and diet and found some association between the variables, but the results varied in accordance with gender. The study utilized activity monitors and dietary recalls to record the food intake and mean time of moderate to vigorous activity completed by 210 8-10 year old African-American girls. Whilst they found that increased physical activity was related to lower fat intake and lower BMI, it was also associated with higher carbohydrate intake. A considerable limitation of the research on this topic involved the issue of self-reporting dietary intake, whether this is through food frequency questionnaires or food diaries. Due to the nature of the topic, participants may under-report or over-report consumption of certain foods, thus potentially affecting the accuracy, reliability and validity of the findings and conclusions (Visscher et al, 2013). Meyer et al (2000) suggested that a healthy diet is essential for the overall health of children during their vital years of growth and development. Following the onset of the obesity epidemic, the significance of a healthy diet has also been connected to a reduced risk of obesity. Several researchers have begun observing the connection between sports participation and diet in young people. Ottevaere et al (2011) and Tomlin et al (2013) conducted studies surrounding this association and have concluded that adolescents who participate in sport have a healthier diet than their non-sporting peers. Tomlin et al (2013) observed the dietary patterns of 1421 Canadian 10-11 year olds and

found that those involved in organized sporting activity consume more calories, fat, fiber, fruit, non-flavored milk and vegetables than those who do not participate in sport or physical activity. While the above studies have found associations between the variables, there are research papers available which indicate that there is no relationship between sport and diet. Vissers et al (2013) found no obvious association between diet and physical activity and Academic and Health. McNaughton et al (2008) could not find a consistent relationship between physical activity and the dietary patterns of 764 Australian 12-18 year olds. Nonetheless, the results of the research papers on this topic appear to be mixed and articulate different information. The results of the studies surrounding this topic are mixed, the dietary consumption of young athletes are deemed to be lacking in carbohydrates, energy and numerous micronutrients, particularly calcium, iron, folate and zinc, yet intake of fat is in excess (Beals, 2002). Similarly, Tomlin et al (2013) noted that less than 50% of the children in the sporting and non-sporting groups of this study met the recommended guidelines in regards to fruit and vegetables, and the sport group ingested more fat than that which is recommended. A considerable limitation of the research on this topic involved the issue of self-reporting dietary intake, whether this is through food frequency questionnaires or food diaries. Due to the nature of the topic, participants may under-report or over-report consumption of certain foods, thus potentially affecting the accuracy, reliability and validity of the findings and conclusions (Vissers et al, 2013).

**Impact of physical activity and sports on attendance, classroom behavior, psychological and social benefits that may impact intelligence and academic achievement**

Large cross-sectional studies have shown a positive relationship between participation in sports programs and school attendance and between physical fitness and school attendance (Stead et al 2010). Welk et al (2010) also suggested that health-related fitness is positively associated with school attendance. However, this increased attendance is insignificant if the students do not focus, think and behave appropriately, and work productively whilst they are at school. The other performance indicators relate to these broad topics, which it could be argued, are more difficult to measure. Moreover, Stead et al (2010) recognized that Physical Education, physical activity and sport have been shown to positively impact the extent to which young people feel connected to their school, the aspirations of young people and the positive social behaviors which exist within their school. These outcomes of sporting participation on academic performance can be seen as the result of non-sporting skills and habits which sport can teach individuals. These cognitive changes coupled with improvements in attitude, aspirations, attendance, effort and on-task behavior facilitate increased productivity in lessons, therefore improving the likelihood of achieving better academic grades (Pfeifer & Corneille, 2010). In this way, the evidence from the journal articles reviewed suggests that the impact of sporting participation upon academic performance is significantly positive due to the extensive range of outcomes. A review by Choi et al (2014) addresses this gap in the literature, recognizing the wide range of positive outcomes that exposure to sports competition can have on children early in life (behavioral, physical and psychosocial). Most notably, through competition children are provided with excellent opportunities to build their skills, develop their social adjustment; integration and emotional growth. Competition is also thought to contribute to children's ability to work with others in the achievement of shared goals. When it comes to long-term success, competition helps children be better prepared for the challenges they will face in the future, whilst helping them to learn effective emotional and psychological skills and strategies to deal with winning and losing, as well as success and failure.

## **Conclusion**

Our review suggested that the combination of nutrition, sports participation, and physical fitness will improve academics scores, personality, intelligence level and cognition of students.

## **References**

- Bailey R. Physical Education and Sport in Schools: A Review of Benefits and Outcomes. *Journal of School Health* 2006; 76:397-401.
- Beals KA: Eating behaviors, nutritional status, and menstrual function in elite female adolescent volleyball players. *J Am Diet Assoc.* 2002 Sep; 102(9):1293-6.
- Choi, H.S., Johnson, B., & Kim, Y.K. (2014). Children's Development through Sports Competition: Derivative, Adjustive, Generative, and Maladaptive Approaches. *Quest*, 66 (2), 191-202.
- Chomitz VR, Slining MM, McGowan RJ, Mitchell SE, Dawson GF, Hacker KA. Is there a relationship between physical fitness and academic achievement? *Percept Mot Skills.* 1999; 89:245-248. Positive results from public school children in the northeastern United States. *J Sch Health.* 2009 Jan; 79:30-7.
- Coe DP, Pivarnik JM, Womack CJ, Reeves MJ, Malina RM. Effect of physical education and activity levels on academic achievement in children. *Medicine and Science in Sports and Exercise* 2006; 38:1515-1519.
- Davis CL, Tomporowski PD, Boyle CA, et al. Effects of aerobic exercise on overweight children's cognitive functioning: A randomized controlled trial. *Research Quarterly for Exercise and Sport* 2007; 78:510.
- Dona L Tomlin, Shannon K Clarke, Meghan Day, Heather A McKay and Patti-Jean Nayl (2013). Sports drink consumption and diet of children involved in organized sport. *Journal of the International Society of Sports Nutrition.*
- Fourestier, M. Sport ET education [Sport and education]. *La Santi de l'Homme* 1996 142: 10-14. In: Shephard RJ. Curricular physical activity and academic performance. *Pediatric Exercise Science* 1997; 9:113-126.
- Hillman CH, Erickson KI, Kramer AF. Be smart, exercise your heart: exercise effects on brain and cognition. *Nat Rev Neurosci.* 2008 Jan; 9:58-65.
- Hollar D, Messiah SE, Lopez-Mitnik G, Hollar TL, Almon M, Agatston AS. Effect of a two-year obesity prevention intervention on percentile changes in body mass index and academic performance in low-income elementary school children. *American Journal of Public Health* 2010; 100:646.
- Mahar MT, Murphy SK, Rowe DA, Golden J, Shields AT, Raedeke TD. Effects of a Classroom-Based Program on Physical Activity and On-Task Behavior. *Med. Sci. Sports Exerc.* 2006; 38:2086-2094.
- Martin, K. Brain boost: Sport and physical activity enhance children's learning. *School of Population Health, The University of Western Australia.* May 2010.
- Meyer et al. A Review of Literature: The impact of competitive school sport on students' academic performance within school as well as other factors such as improved diet, health and wellbeing. *TOP Foundation*, June 2014.
- Ottevaere C; HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study Group. Relationship between self-reported dietary intake and physical activity levels among adolescents: the HELENA study. *Int J Behav Nutr Phys Act.* 2011 Feb 6;8:8. doi: 10.1186/1479-5868-8-8.

- Pfeifer, C., & Cornelißen, T. (2010). The impact of participation in sports on educational attainment - New evidence from Germany. *Economics of Education Review*, 29, 94-103.
- Russell Jago et al. Relationship between Physical Activity and Diet among African-American Girls. *Obesity Volume 12, Issue S9, September 2004*, Pages 55S-63S.
- Sallis JF, McKenzie TL, Kolody B, Lewis M, Marshall S, Rosengard P. Effects of health-related physical education on academic achievement: Project SPARK. *Research Quarterly for Exercise and Sport* 1999; 70:127-134.
- Sandford R, Armour K, Bowyer S. It might be fashionable but does it „work“? Physical activity, behavior management and impact paper presented at the British Educational Research Association Annual Conference, Manchester University, September 2004.
- Sandford RA, Armour KM, Warmington PC. Re-engaging disaffected youth through physical activity programs. *British Educational Research Journal* 2006; 32:251-271.
- Sarah A. McNaughton, Kylie Ball, Gita D. Mishra, and David A. Crawford (2008). Dietary Patterns of Adolescents and Risk of Obesity and Hypertension. *Journal of Nutrition*. February 2008 vol. 138 no. 2, 364-370.
- Shephard RJ. Curricular physical activity and academic performance. *Pediatric Exercise Science* 1997; 9:113-126.
- Sigfusdottir ID, Kristjansson AL, Allegrante JP. Health behaviour and academic achievement in Icelandic school children. *Health Education Research*. June 9, 2006.
- Singh, A., Uijtdewilligen, L., Twisk, J.W., Van Mechelen, W., & Chinapaw, M.J. (2012) 'Physical activity and performance at school: a systematic review of the literature including a methodological quality assessment', *Archives of Pediatrics and Adolescent Med*, 166 (1). 49-55.
- Stead, R., & Neville, M. (2010). The impact of physical education and sport on education outcomes: a review of literature. Loughborough: Institute of Youth Sport.
- Trudeau F & Shephard RJ. Physical education, school physical activity, school sports and academic performance. *International Journal of Behavioral Nutrition and Physical Activity* 2008; 5:10.
- Vissers D, Hens W, Taeymans J, Baeyens J-P, Poortmans J, Van Gaal L (2013) The Effect of Exercise on Visceral Adipose Tissue in Overweight Adults: A Systematic Review and Meta-Analysis. *PLoS ONE* 8(2): e56415. <https://doi.org/10.1371/journal.pone.0056415>
- Welk G. *Cardiovascular Fitness and Body Mass Index are Associated with Academic Achievement in Schools*. Dallas, Texas: Cooper Institute. 2009.
- Williams JD. *Ten Hypotheses about Socioeconomic Gradients and Community Differences in Children's Developmental Outcomes*. Ottawa, Canada: Human Resources Development Canada; 2003.

Conflict of Interest: None Declared