

Children in organized hockey: How much physical activity do they really get?

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ABSTRACT

International Journal of Exercise Science 8(2): 184-191, 2015. For optimal physical and mental health and child growth, development and maturation, the Canadian physical activity guidelines recommend children participate in minimally 60 minutes of moderate intense physical activity each day. It is often believed that children's participation in sport provides sufficient physical activity to meet these recommendations. The purpose of this study was to measure the amount and intensity of physical activity obtained by children participating in a regularly scheduled ice hockey practice and game. Actigraph GT3X triaxial accelerometers (motion detectors) were used to determine the intensity and amount of physical activity obtained by 9- and 10-year old children (16 boys; 1 girl) during an ice hockey practice and game. Downloaded accelerometer counts were converted to minutes of moderate, hard, or very-hard physical activity. On average, participants spent 30.2 ± 10.8 min or 43.1% of their 70-min ice hockey practice and 22.3 ± 6.3 min or 28.2% of their 80-min ice hockey game in moderate or more intense physical activity. Children's participation in one session of organized ice hockey, whether a practice or a game, did not meet the minimal daily physical activity recommendation for children. Thus parents, teachers, coaches, and physical activity practitioners must create, support, and encourage additional opportunities for children to engage in physical activity of sufficient intensity for optimal growth and development and to ensure physical and mental health and well-being.

KEY WORDS: Accelerometry, physical activity guidelines, health, sport

INTRODUCTION

Engaging in physical activity on a regular basis is a simple yet effective approach to preventing the inactivity-related health deficits for all people, regardless of age, gender, or ethnicity. In order to help Canadians achieve optimal health benefits from their participation in regular physical activity, the Canadian Society for Exercise Physiology worked with the Public Health Agency of Canada and ParticipACTION to

develop the Canadian Physical Activity Guidelines for various age groups (15). Accordingly, it is recommended that children (5-11 years of age) and youth (12-17 years of age) should participate in at least 60 minutes of moderate or more intense physical activity each day. It should be noted that this amount of physical activity need not be attained all at once, but can be obtained throughout the day from active play, participation in sport, physical education, active transportation, and

planned exercise (15). Research that has objectively measured physical activity indicates that only 5% of Canadian children meet these guidelines (1). As such, parents, educators, coaches, and all those engaged in promoting physical activity to children have their work cut out for them.

Sport is often promoted as an avenue for children to meet the physical activity recommendations. It should be highlighted that although children may be engaged in their sport practice or game for one hour, it does not mean that they actually obtain 60 minutes of moderate or more intense physical activity (11). In fact, some research shows that children obtained only approximately one third (~20 minutes) of the recommended physical activity from a one-hour organized sport session with, the other two thirds of the time spent either in a light or sedentary intensity (6,11,16). It is not surprising that each minute of children's participation in sport whether a game or practice is not at a moderate or greater intensity. As children learn the skills to participate in sport there is often time spent engaged in less intense behaviors, such as listening to their coach or waiting for their turn to practice the drills (11). The type of sport played may relate to the amount and intensity of physical activity obtained as it is hypothesized that each sport has different physiological demands. For example in one hour, children playing soccer obtained approximately 18 ± 2 min minutes of moderate or more intense physical activity while only 14 ± 2 min were noted from participation in basketball and 11 ± 1 min in flag football (16). Further, varying coaching styles, playing time, and positioning may also have a role in the amount and type of

intensity of physical activity that children obtain (16).

Approximately 51% of children in Canada are regularly involved in organized sport (14). Further, about 25% of children participate in ice hockey, making it the second most practiced sport in Canada after soccer (13). As such it was considered important to better understand the contribution of children's participation in hockey in meeting the physical activity recommendations. Thus, the purpose of this study was to measure the amount and intensity of physical activity achieved by children during an organized ice hockey practice and game.

METHODS

Participants

A convenience sample of 9- and 10-year old children participating on an Atom AA hockey team were invited to participate in this study. Written informed consent was obtained from all 17 participants' parents/guardians, while informed assent was obtained from the participants. Data were collected from 14 children at their hockey practice, and from all 17 children at their hockey game. The two goalies' data were not included in the data analyses given the lower level of intensity of physical activity expected for that particular position. Prior to data collection, research ethics approval was obtained from the St. Francis Xavier University Research Ethics Board.

Protocol

Physical activity was measured using the Actigraph GT3X triaxial accelerometers. These devices measure acceleration or movements in the vertical, anterioposterior,

and mediolateral anatomical axes, and are therefore effective devices to measure the variety of movements in sport (3). As is most commonly used, the movements were measured in 60-second epochs (3,11,16). Data were collected from participants wearing the accelerometer for the duration of a single practice (70 minutes) and game (80 minutes). Following standard protocol, the accelerometer was placed in a pouch, attached to a belt and placed over the participants' right hip, over their clothing and under their hockey equipment (7). The accelerometer data were downloaded as activity counts using the Actigraph software that accompanies the accelerometers. These activity counts were then used to classify each minute of the children's physical activity into one of the following intensities: sedentary (≤ 100), light (101-905), moderate (906-3520), hard (3521-6129), or very hard (≥ 6130) (5). A percent of the total time spent at each intensity of physical activity was calculated

for each participant for the ice hockey practice and game.

Statistical Analysis

Descriptive statistics, that is, means and standard deviations were calculated for the average time spent by the children in sedentary, light, moderate, hard and very hard physical activity for the ice hockey practice and game.

RESULTS

Although parental/guardian permission and participant assent were obtained from all 17 children (9-10 years of age; 16 boys, 1 girl) on the ice hockey team, data from only 13 and 15 children were analyzed for the ice hockey practice and game respectively. As previously noted, three children (boys) missed the practice and the data from the two goalies (boys) were not included in the final analyses. Total practice time was 70 minutes and total game time (including the

Table 1: Total minutes (mean \pm SD) and percentage of total time in sedentary, light, moderate, hard, and very hard intensity physical activity during a 70-minute ice hockey practice and an 80-minute hockey game

	Practice		Game	
	Total Time (min)	Percentage of Total Time (min)	Total Time (min)	Percentage of Total Time (min)
Sedentary	5.2 \pm 2.8	7.4%	23.7 \pm 10.6	29.7%
Light	35.1 \pm 9.1	50.1%	33.3 \pm 12.9	41.6%
Moderate	30.2 \pm 10.8	43.1%	21.9 \pm 6.3	27.4%
Hard	0	0	0.60*	0.75%
Very Hard	0	0	0	0

* only one individual had hard intensity physical activity, therefore no standard deviation was calculated.

warm-up) was 80 minutes.

The average and percentage of total time for the children for sedentary, light, moderate, hard, very hard intensity of physical activity for the ice hockey practice and game are presented in Table 1. On average, the children accumulated 30.2 ± 10.8 minutes of moderate or more intense physical activity during the 70-minute practice. All of the 30.2 minutes or 43.1% of the total practice time occurred at a moderate intensity. Compared to the practice, the average time spent in moderate or more intense physical activity was lower during the hockey game at 22.5 ± 6.9 minutes or 28.2% of the total game time. Almost all or 21.9 ± 6.3 minutes (27.4%) of the combined moderate or more intense physical activity was at a moderate intensity with only 0.6 minutes (0.75%) at a hard intensity.

DISCUSSION

The purpose of this study was to objectively measure the amount and intensity of physical activity obtained by children participating in a regularly scheduled ice hockey practice and game. The results indicated that 43.1% of the practice time and 28.2% of the game time were spent in moderate or more intense physical activity. These results show that neither the 70-minute hockey practice, nor the 80-minute hockey game provided sufficient physical activity to meet the minimal daily recommendations for children to obtain optimal physical and mental health benefits.

Participants in the current study obtained a slightly lower percentage of time in moderate or more intense physical activity

during their game (28.2%) compared to others in previously reported research (6, 11). More specifically, Sacheck et al. determined that 33% (16.9 min) of a 50-minute soccer game was spent in moderate or more intense physical activity (11). Similarly, Guagliano et al. found, on average, 30.6% (18 min) of a 60-minute game (of netball, basketball, and soccer) was spent in moderate or more intense physical activity (6).

Similar to the results reported by Guagliano et al., children in this study spent considerably more time in moderate or more intense physical activity during their practice than their game (43.1% vs. 28.2%) (6). The difference found between the practice and the game in the present study, however were considerably greater than that found by Guagliano et al. at 33.8% vs 30.6% (6). This finding may not be surprising as there is likely more variability between and within sports when it comes to practices compared to games in terms of the amount and intensity of physical activity obtained by the participants. This may be due in part to the coaches that regulate practices, and more specifically their individual coaching style. The ability to organize a practice in such a way that maximizes the amount of movement, minimizes less active time, and utilizes a large proportion of the playing surface are important considerations for a coach when planning for effective practices, and managing the factors that are under their control. Further it should be noted that the coaches' main objectives during a practice are not necessarily to maximize moderate or more intense physical activity but rather to focus on game strategies and the participants' skill development. Based on the visual observations made by the

researchers during the practice, it was noted that the coaches directed a session in which the children were actively moving the majority of the time. Little time was used to explain the drills and multiple groups completed the same drills at once using the majority of the ice surface. Children were encouraged to skate the drills at a high intensity, and the coaches skated along with them to encourage them to work hard. Thus, it can be said that the coaches of this particular ice hockey team ran an efficient practice - both for developing skills and providing moderate or more intense physical activity. It should be noted that there is the possibility of coaches' bias, since the coaches were not blinded to the data collection and purpose of this study. This limitation was noted in the research previously cited as well (6).

In contrast, the coaches have little influence on the amount and intensity of the children's physical activity during the hockey game apart from deciding who will play and who will sit on the bench. This is because the coaches cannot influence the actual game and how it happens other than to rotate the lines playing, suggest offensive and defensive plays, and other things related to the game. The coaches remain behind the bench with the game play at the discretion of the players on the ice, and the referees controlling the stoppage in play. Further, it should be noted that the lower percentage of time in moderate or more intense physical activity measured during the game is in part due to the fact that not all children are on the ice at the same time during the game, but rather play in shifts of five, not counting the goalie.

The majority of the sports for which physical activity intensity is available in

children (such as soccer, basketball, netball, and ice hockey) do not involve everyone in the games at the same time and require shift changes. As a result, children who play these sports usually do not have the opportunity to remain on the playing surface throughout the duration of the entire game, and therefore have less of an opportunity to engage in moderate or more intense physical activity. Practices for each of these sports generally include drills and scrimmages that involve most players at the same time and thus provide greater opportunities for more moderate or more intense physical activity.

Although the children in this study did not meet the minimal daily physical activity recommendations from their sport participation, there continues to be valid reasons for promoting sport participation in children (11,16). One reason is that children tend to spend less time engaged in sedentary behaviors on days when they participate in sport. It has also been shown that children who participate in organized sports accumulate higher overall levels of physical activity compared to non-participants (8). Further, children who participated in sport possess more self-confidence (4) and less body dissatisfaction compared to those who did (9). Interestingly, those participating in team sports reported better scores in the same body dissatisfaction category than those who played individual sports. Participating in sport also improves group cohesion, patience, and is an ideal place to develop new friendships (2). Involvement in sport is therefore a key contributor to the positive development of health and overall well-being for many children, even if they do not meet the physical activity

recommendations in a single practice or game.

A limitation of the current study may relate to the use of accelerometers. First, it may be that accelerometers do not reflect the actual intensity of physical activity that the children were engaged in during the ice hockey practice and game. Our observations of the children and their coaches on the ice lead us to believe that the children were highly engaged for their entire practice. This was not supported by the accelerometer data as there were surprisingly no recorded minutes of "hard" or "very-hard" intensity physical activity from any of the participants. The practice appeared to have many intense bouts of physical activity, such as when the coaches directed the players to skate quickly around the perimeter of the rink, complete a set of sprints, or when they chased the children when they were skating with the puck. This discrepancy may also be explained by the use of 60-second epochs. It is possible that the bursts of more vigorous intensity physical activity were less than 60-seconds and when averaged with less intense physical activity, did not equate to 'hard' or 'very hard' intensity physical activity. A shorter epoch may have more accurately recorded the varying intensity levels. Second, accelerometers may be more sensitive to ambulatory activities, such as walking and running, in comparison to non-ambulatory activities such as shooting, passing, or dribbling - and potentially are movement when ice skating. This is due to the fact that the accelerometer reads the movement from the area of the body where the device is placed as opposed to its individual parts (10). For example, the accelerometer would not account for the

pumping arm movement that hockey players tend to exhibit during sprints.

It should be noted that, to our knowledge, this is the first study that has collected objective physical activity data using accelerometers in a children's practice and game for ice hockey. There may be questions regarding accelerometer-collected data on the ice as it may be possible that the glide between skating strides is not well recorded. A study that examined the validity of using a Sensewear Armband, a device similar to an accelerometer, measured physical activity intensities for in-line skating (12). The wheels of the in-line skates allow for a gliding movement similar to that experienced by a person wearing ice-skates. When compared to indirect calorimetry, it was determined that the Sensewear Armband underestimated the amount and intensity of physical activity by as much as 24-56% (12).

Despite the limitations noted for using GT3X triaxial accelerometer, Romanzini, et al. found that overall, accelerometer count thresholds exhibit good to moderate validity in estimating the amount of moderate or more intense physical activity in children and adolescents (10). Further research needs to be conducted on the validity of using accelerometers to measure ice-skating, and more research should be conducted specifically on the amount and intensity of physical activity obtained during children's engagement with the sport of hockey. In addition, there is a need for a method of measuring the physical activity levels obtained by goalies in hockey, since accelerometers do not account for various factors that the goalies experience such as their amount of

equipment, their muscular endurance, and their flexibility.

In conclusion, the results of this study demonstrate that children do not obtain sufficient physical activity from one session of organized hockey and additional forms of moderate or more intense physical activity must be included each day to meet the minimal physical activity recommendations for children to ensure not only optimal growth and development, but physical and mental health as well. As a result parents and other caregivers, coaches, teachers, and other physical activity promoters should continue to encourage participation in a wide variety of physical activities to ensure that children obtain the optimal health benefits from their participation.

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ACTIVITY IN CHILDREN'S ORGANIZED HOCKEY

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