

Effects of Age and Experience on Physical Activity Accumulation During Kin-Ball

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In 2008, the U.S. Department of Health & Human Services (USDHHS) released a document titled *Physical Activity Guidelines for Americans* (USDHHS, 2008). These guidelines suggest that children accrue at least 60 min or more of physical activity daily (most of which should be either moderate- or vigorous-intensity aerobic physical activity) and adults achieve at least 150 min/week of moderate-intensity (or 75 min/week of vigorous-intensity) aerobic physical activity.

Concurrent with these recommendations, increasing emphasis has been placed on the development of comprehensive school physical activity programs that encompass physical activity programming before, during, and after the school day (National Association for Sport and Physical Education, 2003). Even the federal government passed legislation (PL 108-265) that requires all districts with federally funded school meal programs to develop and implement wellness policies. Given the shift toward promoting physical activity as a primary objective of physical education, a number of exploratory and intervention studies have examined the extent of activity accrued during physical education lessons. As an executive summary, the following key points are notable. First, while over 90% of American students meet the objectives of Healthy People 2010, less than 3% actually meet Objective 22.6, which relates to bouts of continuous vigorous physical

activity (Pate et al., 2002). Second, boys accumulate higher levels of physical activity than girls (McKenzie, Marshall, Sallis, & Conway, 2000). Third, students in grades 10–12 are significantly less likely than younger groups to meet recommended activity guidelines. Fourth, there is a decline in physical activity in girls during adolescence (Kimm et al., 2002).

While fitness activities produce the most moderate-to-vigorous activity during physical education (McKenzie et al., 2000), many students report sports such as basketball, football, bowling, swimming, and volleyball as their most preferred activities in contrast with aerobics, distance running, and fitness (Hill & Cleven, 2005). Consequently, as Hill (2000) noted, physical educators should strive to discover and develop new and innovative ways to engage their students and create a more enjoyable atmosphere. In particular, identifying team sport games that engage all students in moderate-to-vigorous physical activity (MVPA), regardless of gender or skill level, should be explored. Nonetheless, there has been a history of discriminative and abusive practices during game play in physical education (see Hastie, 2003).

With a specific agenda of creating a fun activity that emphasized teamwork, cooperation, and sportsmanship, Mario Demers, a Canadian physical education professor, created Kin-Ball in the mid 1980s (International Kin-Ball Federation, 2009). The game involves three teams of four players each in which a large ball (4 feet diameter and 2.2 pounds weight (1.22 m and 1 kg, respectively) is sent into space so that one of the other designated teams cannot retrieve it before it touches the ground (International Kin-Ball Federation, 2009).

Specifically, the team that has the ball chooses one of its opponents (usually the one with the most points) by calling its color, preceded by “Omnikin” and then hits the

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ball toward a strategic place where opponents will be least likely to retrieve it. At the time of the strike, all players of the sending team must be in contact with the ball. If the nominated team does not succeed in catching the ball or makes a mistake according to the game rules, *both* of the other two teams receive a point.

Currently, the International Federation of Kin-Ball has over 3.8 million registered participants in North America (Canada and the United States), Europe (Belgium, France, Spain, Denmark, Switzerland, and Germany), and Asia (Japan and Malaysia; International Kin-Ball Federation, 2009). Nonetheless, there is no current research available concerning the sport with regard to physiological demand, skill acquisition, psychological aspects, or sociological issues. Given that the sport is becoming increasingly popular in physical education, together with the concern that students become more engaged in physical activity during their lessons, the specific question addressed in this study was: "To what extent does Kin-Ball provide players/students the opportunity to accumulate moderate-to-vigorous physical activity?"

Method

Participants

A total of 130 Kin-Ball players participated in this study. Participants were categorized into groups: (a) experience level, (b) age, and (c) gender. Experience level was denoted as either novice (those who had not played the game before and required initial training) or experienced (those who were participating in formal leagues and had played for at least 1 year). Three age categories were: 10–11 years old, 14–16 years old, or 18–24 years old. Effectively, these groups correlated to fifth-grade students, high school students, and university students. Table 1 presents the demographic information of participants in this study. All participants provided informed consent, and the authro's university institutional review board for human subjects research approved the study.

Settings and Kin-Ball Training for Novices

Novice participants were from two elementary schools, two high schools, and two undergraduate classes at a southeastern U.S. university. All students were from intact classes, and the training and games took place during their regularly scheduled physical education lessons. None had either played or seen Kin-Ball played prior to the study. To ensure instructional fidelity, all participants received formal training in Kin-Ball basics prior to data collection. The extent of this training was determined by answering the question: "Do these students have the basic knowledge and skills that would allow them to play

a "good" game of Kin-Ball?" A good game was defined as a game in which the referee does not have to stop play for faults, such as the same hitter serving twice in a row, an incorrectly formed pyramid (three people in contact with the ball), or a short hit (6 feet [1.83 m] or less). That is, the role of the referee was to adjudicate boundaries and scoring.

Elementary School Training. The fifth-grade students needed 150 min of training to reach the good play level. In the first lesson, students watched a video of a Kin-Ball game and began skill training. The following four lessons involved kinetic training that was broken down into two parts. The first introduced students to ball catching, balancing, and hitting. They practiced in a nonplaying situation in which they would continuously catch, balance, and hit the ball to another team. In the second part, they practiced in a play situation with appropriate calling and rules, just as high school and college participants did.

High School Training. Students needed 130 min of training to reach the good play level. On the first day, they watched the same Kin-Ball video as the elementary students and had the opportunity to understand kinetically the concept of the game and its basic rules. The following lessons consisted of a short practice to reinforce a few rules, followed by practice games.

University Training. These students needed 100 min of training to reach the good play level. On the first day, they watched the same Kin-Ball video as the previous two groups and then received a handout that explained the game more fully. A few questions regarding rules were then clarified followed by ball familiarization skills. On the second day, students played a series of games to more completely understand the game concept and its basic rules.

Settings and Kin-Ball History of Experienced Players

Participants categorized as experienced were members of Kin-Ball leagues in Quebec, Canada. All these play-

Table 1. Participant details

Category	N	Boys		Girls		
		Age (years) M	SD	N	Age (years) M	SD
Novice						
Fifth grade	12	11.3	.51	12	11.1	.29
High school	12	15.3	1.31	12	16.4	1.04
University	14	21.5	.67	10	21.8	1.46
Experienced						
Fifth grade	12	11.5	.94	12	10.5	.25
High school	6	15.2	.44	5	13.4	.42
University	12	20.3	1.27	12	23.2	.94

Note. M = mean; SD = standard deviation.

ers had competed in at least one tournament and played in numerous league games. Each participant also practiced at least once a week during the competitive season.

Data Collection

In formal competition, a Kin-Ball game is played over three 15-min periods. Hence, 15 min captures the essence of play within the context of a real game. For consistency, data collection for the novice and experienced participants occurred during the first 15 min of an officiated Kin-Ball game. Furthermore, most elementary school physical education lessons are 60 min or less; thus, allocating 15 min to game play is a realistic expectation for lessons that may also include fitness management and other tasks.

We used the System for Observing Fitness Instruction Time (SOFIT) instrument (McKenzie, Sallis, & Nader, 1992) to determine the extent of MVPA. SOFIT is a momentary time sampling and interval (every 20 s) recording system designed to quantify physical activity levels and the opportunities children and youth have for physical activity in physical education classes. Numerous studies have shown that SOFIT provides valid and reliable measures in the populations in which it has been used (McKenzie et al., 1994; Rowe, Schuldheisz, & van der Mars, 1997; Rowe, van der Mars, Schuldheisz, & Fox, 2004).

For this study, we followed data collection procedures prescribed in the SOFIT manual (McKenzie, 2006). Specifically, we shifted from male to female across teams at

1-min observation intervals, (e.g., one male pink, followed by one female black, to one male blue, to one female grey etc), using 10-s observe, 10-s record intervals. Reliability between two coders reached 92% agreement based on the formula:

$$\text{Percent Agree} = (\text{Total \# Agree}) / (\text{Total \# Observations}) \times 100.$$

While the SOFIT instrument allows for analyzing contextual and teacher behavioral variables within a physical education lesson, we did not examine actual physical education instruction, but simply game play. As a result, these variables were not included in the analysis.

Data Analysis

We used a 2 (experience level) x 2 (sex) x 3 (age) analysis of variance to determine any differences in the time players spent standing, walking, and running. We set the alpha level at .05 a priori and used SPSS version 16 to analyze the data.

Results

Figure 1 shows the time spent in the various physical activity categories during a 15-min period of Kin-Ball. Across the entire sample, 72.3% of the game time involved

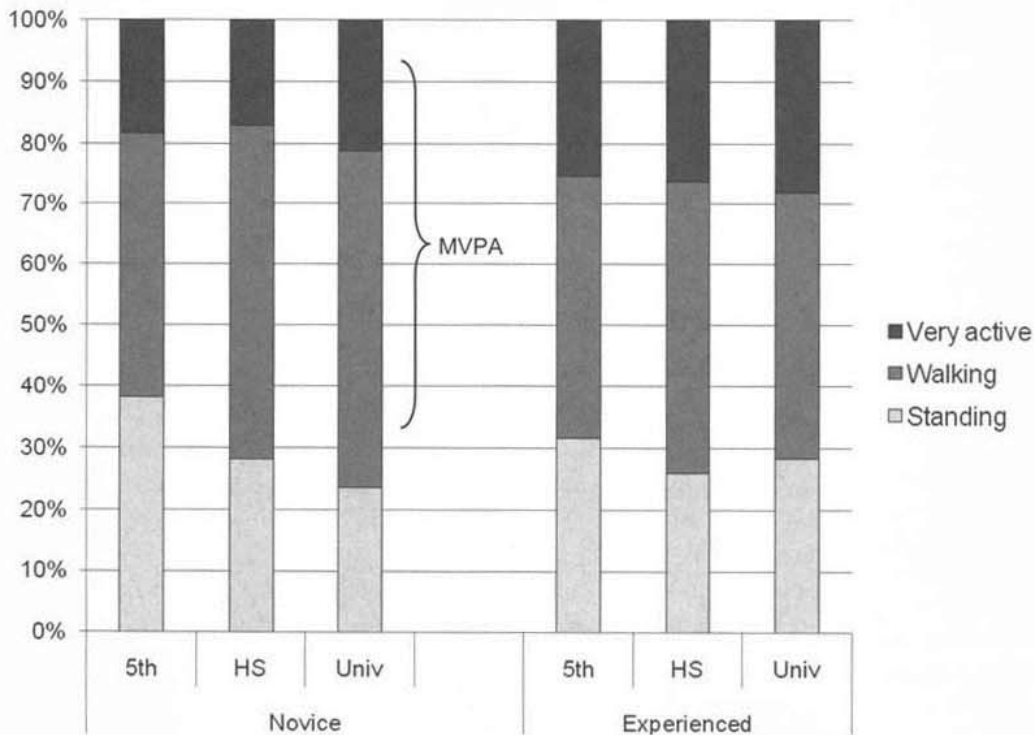


Figure 1. Percentage of physical activity during a 15-min period of Kin-Ball.

participants in MVPA (45.6% walking and 26.7% very active). There were no instances of lying down or sitting.

There were no significant differences in MVPA for age, $F(1, 11) = 2.13, p < .05, \eta^2 = .415$, sex, $F(1, 11) = .79, p < .05, \eta^2 = .056$, or experience level, $F(1, 11) = .48, p < .05, \eta^2 = .073$, although the experienced players had more MVPA in very active versus walking, $F(1, 11) = 6.86, p < .05, \eta^2 = .533$. Experienced players spent 26.7% of game time being very active, compared with 18.7% for novice players.

Discussion

The purpose of this study was to determine the amount of physical activity achieved during Kin-Ball play. The results showed that across all age groups and experience levels approximately 70% of game time was spent in MVPA. Given the goal that students achieve 33–50% of their lesson time in MVPA (Council on Physical Education for Children, 2004; USDHHS, 2000), the results of this study indicate that Kin-Ball participation can provide an activity that reaches these targets. Of course, the small cell sizes of the participant pool somewhat temper this claim.

Accumulated MVPA during Kin-Ball did not differ between gender and age. Previous scholarship on children and adolescent physical activity showed that gender was the most important demographic correlate of physical activity for this age group (Sallis, Prochaska, & Taylor, 2000). Based on the results of this study, Kin-Ball appears to be a suitable physical activity to eliminate the disparity between male and female students in the physical education curriculum in K–12 and college. Furthermore, the amount of training was minimal for all age groups (100–150 min). While the game involves only nine players, a typical class in many physical education settings could comfortably accommodate two games. Another common alternative during a Kin-Ball unit (and most other team sports) could include small group lead-up activities using smaller training balls to engage students in high levels of physical activity.

As a result of the increased prevalence in obesity levels and hypokinetic diseases, it is important to identify activities that appeal to a large range of individuals while targeting the correlates of physical activity engagement. Important psychological, social, and environmental physical activity correlates for children, adolescents, and adults include: physical activity enjoyment, parental support, social support, opportunities for physical activity, community support for physical activity, access to exercise facilities, and time outdoors (Gordon-Larsen, McMurray, & Popkin, 2000; Trost, Owen, Bauman, Sallis, & Brown, 2002; Sallis, Prochaska, & Taylor, 2000). Kin-Ball is an option for targeting this array of correlates in physical education. Moreover, Kin-Ball could extend past the physical education experience and provide a recreational activity

in recreational leagues or community activities, thereby providing additional access to physical activity.

Interestingly, experience level had a significant influence, with experienced players spending more of their active movement in the very active category. It may be that as players become more familiar with the game they become more efficient in their decision making. As Mann, Williams, Ward, and Janelle (2007) noted, experts are superior to nonexperts in picking up perceptual cues, as revealed by measures of response accuracy and response time. This improved response selection may have resulted in quick movement to the appropriate places on the court. Nonetheless, this finding is a positive outcome for physical education, as it provides a baseline at which students are achieving the stated activity goals; with practice and experience, the increased levels of vigorous activity can enhance this goal. For future studies, it would be interesting to see if novice and experienced participants in other physical education activities make such changes. As an example, consider badminton. Novice students frequently have short rallies with a lot of misses until they reach a point at which they develop significant object control; then these rallies lengthen as they become more cooperative. With skill improvements, rallies again become shorter as players use more sophisticated skills and tactics to end the rallies, until finally, at the elite level, rallies can last longer than 50 crossings of the net (Hastie, Sinelnikov, & Guarino, 2009). In conclusion, the results of this study suggest that Kin-Ball would be an appropriate activity for physical education. Incorporating Kin-Ball into a physical education environment provided equal opportunities for physical activity for male and female students, regardless of age and level of play. Furthermore, Kin-Ball provided a fun group activity while meeting the physical activity recommendations.

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