Exercise intensity and enjoyment response of selected traditional games in children

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ABSTRACT

Background: Given that few children engage in the minimal requirement of moderate-to vigorous physical activity (MVPA), traditional games have been promoted as one of the strategies to improve MVPA levels to facilitate health enhancement, particularly in school settings. Nevertheless, little is known about the exercise intensity and enjoyment levels of traditional games in children.

Methods: Participants (n = 600; 300 boys; age 10.1 ± 0.8) performed five selected traditional games (i.e. *Bola Beracun, Baling Tin, Polis Sentri, Belalang Belatuk* and *Galah Panjang*) for 20 min. Activity counts per minute (CPM), metabolic equivalent (METs) and activity time spent were recorded via accelerometer during all traditional games. Enjoyment responses were recorded before and after the traditional games.

Results: No significant differences were observed across all traditional games for each variable (CPM, METs and enjoyment responses; p > 0.05). However, all selected traditional games played for 20 min elicited sufficient levels of MVPA based on CPM and METs thresholds (>500 CPM and >3 METs). The post-enjoyment score was significantly higher in all traditional games compared to pre-enjoyment (p < 0.01; effect size >0.47).

Conclusions: Incorporating traditional games in a school setting for 20-min per session may facilitate sufficient levels of MVPA and augment enjoyment in children to promote multiple health benefits and future exercise engagement, respectively.

Key Words: Enjoyment, exercise intensity, intermittent exercise, school setting

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INTRODUCTION

A growing body of evidence indicates that regular engagement in physical activity (PA) reduces the risk of many health conditions (e.g. obesity and cardiovascular disease). However, participation in PA remains low in children, and it is declining across age groups. According to the Global School-based Student Health Survey, in Malaysia, only 24% of boys and 15% of girls meet recommended PA guidelines of a minimum of 60 min of moderate-to-vigorous PA (MVPA) every day (Lau et al. 2013). This pattern is alarming, given behaviours established during this period are likely to continue into adulthood (Patnode et al. 2011). Effective interventions that encourage adoption and long-term adherence to PA are therefore warranted.

Schools represent an ideal platform for enhancing PA and fitness, particularly during physical education (PE) lessons in children populations. However, Lonsdale et al. (2013) revealed that PA levels within PE lessons are generally insufficient. Moreover, previous school-based interventions to improve PA in children have been mostly ineffective (Borde et al. 2017;

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Metcalf et al. 2012). In Malaysian schools, low levels of PA among primary school children have been attributed to the lack of sporting facilities/equipment and challenges associated with the secondary status of PE subject in the school curriculum. Specifically, it is not uncommon that PE subject is replaced with other examination-related subjects (Wee 2013). Consequently, PE lessons may not occur frequently enough to achieve the health gains and recommended PA levels in schoolchildren. Given evidence showing that few children engage in the minimal requirement of PA, and the associated health risks of insufficient PA (Dobbins et al. 2013; Metcalf et al. 2012), there is a strong rationale to study alternatives form of PA, with one strategy focussing on time efficient and cost-effective PA programmes.

One form of PA that can be executed with minimal equipment, facilities, low cost and within a short period is traditional games. Traditional games can be defined as any game passed from the previous generation to the next generation in society and are commonly played by children during their leisure time (Salma 2018). Among the many types of traditional games played in Malaysia are *Baling Tin, Galah Panjang* (runner and tagger), *Polis Sentri* (Police and Thief) and *Belalang Belatuk* (Rahman 1998). Central to any traditional game is its emphasis on fun and enjoyment rather than competition. Furthermore, traditional games are expressive activities that do not rely on fixed rules. These elements may intrigue children of various backgrounds, including those who consider themselves as non-sports persons. Indeed, Louth and Jamieson-Proctor (2019) revealed that incorporating traditional games within PE lessons in schools may facilitate students' engagement in PA regardless of individuals' sports orientation (i.e. sportspersons vs. non-sports persons). Most importantly, traditional games are typically intermittent, which is consistent with the pattern of PA behaviours in children (i.e. intermittent PA rather than continuous PA) (Barkley et al. 2009).

Despite evidence for traditional games to promote multiple benefits, little is known about the intensity of the games (e.g. MVPA) and the enjoyment responses that different types of games may elicit. Elucidating this information is important, as both exercise intensity and enjoyment response are the key indicators to facilitate the multiple health benefits and promote future exercise adherence in children, respectively. Thus, the present study aimed to determine the exercise intensity and enjoyment response of selected traditional games in Malaysia among schoolchildren. It was hypothesised that all the selected traditional games would elicit MVPA levels of activity and greater exercise post-enjoyment compared to pre-enjoyment.

METHODS

Participants

Six hundred boys and girls (300 boys; mean age: 10.2 ± 0.8) from local primary schools participated in this study. A total of five primary schools were selected in local cities with various numbers of students with the exclusion of the sports schools (sports academies/projects) to ensure a representative sample. Information concerning the study's aims and content was presented to the parents in an information booklet. The parents were also provided with a telephone number to inquire about additional information or clarify the study's objective and extent. Subsequently, informed written consent was obtained from the parent/guardian of all children who assented to participate. All participants indicated that they were in good health and had no history of medical conditions that may compromise their participation in the study. The study procedures were approved by the university's ethical advisory committee.

Anthropometric measures

Height was measured to the nearest 0.01 m using a standardised, wall-mounted stadiometer (Holtain Ltd., Pembrokeshire, UK), with participants standing in bare feet and their head in the Frankfort plane. Body mass was determined to the nearest 0.01 kg using electronic scales (Seca 880, Digital Scales, Seca Ltd., Birmingham, UK) with participants dressed in light clothing and without shoes. Body mass index (BMI) was calculated as body mass (kg) divided by stature (m) squared. Age and sex-specific BMI cut points for overweight and obese status were determined from Cole et al. (2000).

Experimental design

This cross-sectional study was designed to determine the exercise intensity of the five selected traditional games based on activity counts per minute (CPM), metabolic equivalents (METs) and time spent during low, moderate and vigorous intensity. All these outcomes were measured via a Tri-axial GT3X+ accelerometer (Actigraph, Pensacola, FL, USA). Other measurements include post-activity heart rate (HR) and pre- and post-exercise enjoyment via the PA Enjoyment Scale (PACES) questionnaire. Detailed descriptions of each of these measures are provided below. The data collection was conducted in the respective schools during the PE session, and each of the participants completed only one traditional game (i.e. 120 children for each traditional game).

Selected traditional games

All five selected traditional games were selected from a collection of Malaysian traditional games listed in the books of *Siri Panduan Permainan Tradisional Kanak-Kanak* (Nasarah and Nasarah 2005). The selection was based on the similarity of the games' structure (i. e. intermittent activity). Five traditional games selected for the present study were *Bola Beracun* (poison ball), *Baling Tin*, *Galah Panjang* (runner and tagger), *Belalang Belatuk* and *Polis Sentri* (Police and Thief). Briefly, the *Bola Beracun* (Poison ball) is a variation of dodgeball, but it can be played in with flexible place and space which only requires a single ball (any type of ball). The *Galah Panjang* is a type of game that requires the player to cross the lines of an obstacle course that aims to test the skill of the player running past the opponents. The *Baling tin* is a strategic team game involving the mechanism of 'build-destroy-rebuild a pyramid'. Whereas both the *Belalang Belatuk* and *Polis Sentri* (Police and Thief) games aim

to test the ability of the player to catch other players. The detailed explanations for each of the traditional games can be found elsewhere (Nasarah and Nasarah 2005; Zulkifli et al. 2014). The games were played by the participants following the guidelines stated in the books of *Siri Panduan Permainan Tradisional Kanak-Kanak* (Nasarah and Nasarah 2005). Time spent on all the activities was about 20 min per activity. All games used a same size playing area (badminton court dimensions).

Exercise intensity measurements

Participants wore a hip-worn tri-axial GT3X+ accelerometer (Actigraph, Pensacola, FL, USA) to assess their activity levels during the entire session of the traditional game (i.e. 20 min per game). The GTX3+ has been previously validated as an accurate and reliable measure of children's activity (Hänggi et al. 2013). The accelerometers were provided to the children immediately after completing the anthropometric and pre-enjoyment questionnaire. Before the testing, each accelerometer was calibrated based on the manufacturer's recommendations. The accelerometer was set to record at 100 Hz. Data were analysed at 60 s epoch intervals to establish steps count per minute (CPM) and time spent in MVPA using a cut-off point of $\geq$500 CPM (Freedson et al. 2005). In addition, time spent in sedentary (SED), light PA (LPA), moderate PA (MPA) and vigorous PA (VPA) were also recorded. We used Freedson et al. (2005) classification for all four intensities when assessing PA, including MVPA, in children and youth ages 5–15 years (Kim et al. 2013). The data were processed using the ActiLife software (version 6.13.3, ActiGraph Inc., Pensacola, FL, USA). The GT3X+ was synchronised to the time of the computer clock. During the testing session, the starting time of each exercise bout was read on the computer used to set the GT3X+ and annotated.

In addition, the following prediction equations (Freedson et al. 1998) to estimate METs or activity energy expenditure from CPM were also used in this study.

$$\text{METs} = 2.757 + (0.0015 \times \text{CPM}) - (0.08957 \times \text{age [yr]}) - (0.000038 \times \text{CPM} \times \text{age [yr]}).$$

Heart rate measurements

HR was recorded before and after the activity using a wireless chest strap telemetry system (Polar Electro, Kempele, Finland) with a watch worn on the right wrist. The 208-0.7 (age) equation was used to predict HR_{max} in children as proposed by Mahon et al. (2010).

Perceived enjoyment

Pre- and post-exercise enjoyment were measured using the modified PACES, which has been validated for use in children (Moore et al. 2009). The PACES consists of 16 items attached to a 5-point bipolar scale (score 1= 'strongly disagree' to score 5 = 'strongly agree'). The original English version of PACES was translated into Bahasa Malaysia using forward-backwards translation procedures (Hashim 2019). In the present sample, the PACES exhibited high internal consistency (Cronbach's $\alpha > 0.85$).

Participants completed the PACES within 5 min of the beginning and the end of each exercise session.

Statistical analyses

All statistical analyses were conducted using SPSS (SPSS 22.0; IBM Corporation, Armonk, NY, USA). Descriptive characteristics (mean ± standard deviation) between boys and girls were analysed using independent samples *t*-tests. We initially employed a two-way ANOVA (Gender × Games) for all of the dependent variables and found no significant gender differences for all of the measured dependent variables. Subsequently, we used pooled data to analyse the difference between the games on the dependent variables using a one-way ANOVA. For the enjoyment score, a mixed ANOVA (Games × pre × post) was used. In the event of significant effects, follow-up pairwise comparisons were conducted to examine the location of mean differences. Effect size (ES) was calculated using Cohen's d (1988), where an ES of 0.20 was considered to be a small change between means, and 0.50 and 0.80 interpreted as a moderate and large change, respectively.

RESULTS

The participants' descriptive characteristics are presented in Table 1. All the characteristics did not differ between gender. A total of 98 (52 girls) and 25 children (11 girls) were categorised as overweight and obese using cut-off scores suggested by Cole et al. (2000). The remaining children were categorised as either underweight (50 participants) or normal weight (427 participants). All the selected traditional game elicited HR responses between 60% and 70% of HR_{max}.

Counts per minute

Descriptive statistics for the activity CPM during all games are illustrated in Table 2. There were no significant differences across all traditional games ($p = 0.61$), but CPM revealed a moderate ES between each game (ES = 0.40–0.59). All the selected traditional games exhibited MVPA levels of activity with a CPM threshold exceeds 500 CPM.

Total time spent in different intensity

Descriptive statistics for the total time spent in SED, LPA, MPA, and VPA for each traditional game are presented in Table 3. One-way ANOVA revealed significant differences between games ($p = 0.58$). *Post hoc* analysis revealed that time spent in MPA was significantly higher compared to SED, LPA and VPA

Table 1: Descriptive characteristic of the participants

	Boys (*n*=300)	**Girls (*n*=300)**	***P***	**ES**
Age (years)	9.9±0.7	10.1±0.8	0.53	0.27
Stature (m)	1.37±0.1	1.35±0.7	0.39	0.04
Body mass (kg)	34.6±7.2	33.0±6.6	0.43	0.23
BMI	18.4±3.3	18.1±3.5	0.35	0.09
HR_{max} (bpm)	201±11	201±9	0.51	0.00

Values are reported as mean±SD. BMI: body mass index, HR_{max}: Maximal heart rate, SD: Standard deviation, ES: Effect size

across all traditional games (all ES >2.15). Furthermore, time spent in VPA was significantly higher compared to LPA across all games (all ES >1.23). All the traditional games elicited time spent in MVPA for about 14–15 min per game.

Metabolic equivalents

Descriptive data for MET of the games are illustrated in Table 4. One-way ANOVA revealed significant differences between games ($p = 0.02$). *Post hoc* analysis revealed a greater METs in *Bola Beracun* compared to *Galah Panjang, Belalang Belatuk* and *Polis Sentri* ($p < 0.01$, all ES > 0.73). Furthermore, *Baling Tin* elicited greater METs compared to *Belalang Belatuk* and *Polis Sentri* ($p < 0.05$, all ES = 0.58).

Exercise enjoyment responses

No significant games by time interaction ($p = 0.38$) or main effect of games ($p = 0.42$) were found for enjoyment responses. However, there was a main effect of time ($p < 0.01$). Specifically, enjoyment score was significantly higher post games compared to pre games regardless of the type of games (*Bola Beracun* = 63 ± 8 vs. 68 ± 10, ES = 0.62; *Baling Tin* = 66 ± 7 vs. 70 ± 9, ES = 0.57; *Galah Panjang* = 63 ± 10 vs. 68 ± 11, ES = 0.50; *Belalang Belatuk* = 63 ± 9 vs. 68 ± 12, ES 0.47; *Polis Sentri* = 63 ± 9 vs. 69 ± 12, ES = 0.57).

DISCUSSION

The present study determined the intensity of five Malaysians' traditional games with intermittent nature (i.e. *Bola beracun, Galah Panjang, Baling Tin, Belalang Belatuk* and *Polis Sentri*) and their associated enjoyment responses in children. The key findings of this study are: (1) all five selected traditional games elicited MVPA based on CPM and METs; (2) more significant time spent in MPA compared to other intensities (i.e. SED, LPA and VPA) across all traditional games; and (3) greater post-enjoyment compared to pre-enjoyment across all traditional games.

Table 2: Activity count per minute for five different types of traditional games

Type of games	Mean±SD
Bola Beracun	1070±295
Baling Tin	975±164
Galah Panjang	952±191
Belalang Belatuk	967±181
Police and Thief	925±182

SD: Standard deviation

Consistent with the study hypotheses, exercise intensity measured via CPM and METs during five selected traditional games generated MVPA levels of activity. The quantification of MVPA across all traditional games in the present study is consistent with accelerometer cut points (i.e. >500 CPM and >3 METs) of a specific age (aged 9–10 years) provided by Freedson et al. (2005). Our finding indicates that 20 min of playing traditional games could provide the participants with sufficient levels of MVPA during the PE lessons in school, as reported in a recent study among adolescents (Azlan et al. 2020). The authors revealed that traditional game-based PE lessons (i. e. *Galah Panjang and Baling Selipar*) played for 40 min elicited a greater level of MVPA compared to 'free-play PE lessons in boys and girls aged 13.4 ±0.5 years. However, the study by Azlan et al. (2020) was based on a combination of two selected traditional games. Although their finding was valuable, it does not allow an in-depth quantification of a single traditional game. Our study extends this previous study by including a few traditional games (i.e. *Bola beracun, Belalang Belatuk* and *Polis Sentri*) with additional data on METs to quantify the exercise intensity of each traditional games. Indeed, both CPM and METs are required to quantify the accuracy of PA levels in children (Kim et al. 2013).

We also observed more significant time spent in MPA (~10 min; ~50% of total playing time) and VPA (~4 min; ~20% of total playing time) across all traditional games. This data strengthens the evidence generated via CPM and METs, indicating that all five selected games elicited greater MVPA within the 20 min of playing time (70% of total playing time). Previous studies have demonstrated that youth may need only a small volume (e.g. 4 min) of vigorous-intensity PA for health benefits (Carson et al. 2014; Hay et al. 2012). Furthermore, the remaining 30% (~6 min) of total playing time in sedentary PA and LPA times generated during traditional games reinforce the games' intermittent nature (i.e. activity that consists of light, moderate and vigorous intensities). Therefore, the application of traditional games is meaningful in children as their PA is characterised by intermittent behaviour rather than continuous PA (Armstrong et al. 1990; Bailey et al. 1995; Barkley et al. 2009). Indeed, intermittent activity has been shown to provide a motivation factor and an attractive form of exercise in children because the activity mimics their typical PA behaviour (Barkley et al. 2009; Epstein and Roemmich 2001).

It is well established that perceptions of enjoyment and pleasurable regulate the motivation to participate in PA or exercise among

Table 3: Total time spent in different intensity in each selected traditional games

Type of games	SED (min.s)	LPA (min.s)	MPA (min.s)	VPA (min.s)	MVPA (min.s)
Bola Beracun	4.21±2.22	2.04±1.16	10.54±2.29	4.45±3.12	15.39±5.43
Baling Tin	4.17±2.21	2.24±1.24	10.06±1.58	5.08±2.23	15.14±4.21
Galah Panjang	3.24±1.59	2.15±1.13	11.09±2.13	4.20±1.47	15.29±4.00
Belalang Belatuk	3.18±1.14	2.19±0.51	11.17±1.42	3.47±1.49	15.04±3.31
Police and Thief	4.32±2.23	2.53±0.87	10.09±1.76	4.08±1.86	14.17±4.02

Values are reported as mean±SD. SED: Sedentary time, LPA: Light physical activity time, MPA: Moderate physical activity time, VPA: Vigorous physical activity time, SD: Standard deviation, MVPA: Moderate-to vigorous physical activity

Table 4: Metabolic equivalents for five different types of traditional games

Type of games	METs value
Bola Beracun	4.86±1.06*
Baling Tin	4.51±0.77#
Galah Panjang	4.22±0.63
Belalang Belatuk	4.10±0.63
Police and Thief	3.83±0.76

Values are presented as mean±SD. *Significantly greater METs compared to *Galah Panjang*, *Belalang Belatuk* and *Police and Thief* ($p<0.01$), #Significantly greater METs compared to *Belalang Belatuk* and *Police and Thief* ($p<0.05$). METs: Metabolic equivalents

youth (Dishman et al. 2005). Our data demonstrated that exercise enjoyment was greater after (post-enjoyment) each of the selected traditional games compared to enjoyment before playing the games (pre-enjoyment) (ES = 0.47–0.62). We reason that the absence of physical competency requirements to play the game may be an important factor in increasing enjoyment levels before and after the games. Given that traditional games neither require any intricate skills nor have any fixed rules, they may trigger enjoyment regardless of the children's background (e.g. non-athlete, overweight). This notion is consistent with a previous traditional games-based study in children, which showed preference and enjoyment to the traditional games compared to organised sports due to the activity requiring lower specific skills and less competitiveness (Azlan et al. 2020). Indeed, evidence has indicated that physical competence is linked with enjoyment and one of the strongest predictors of intrinsic motivation in PA (Biddle et al. 2003).

Although our study provides valuable findings to traditional games literature, it has some limitations. Firstly, our results are restricted to the HR responses observed following (delayed for ~1 min) the completion of the games. Therefore, an in-depth quantification of the traditional games based on HR responses may be limited in the present study. One previous study has reported that continuous physiological monitoring (e.g. HR responses) throughout the exercise intervention can demonstrate participants' compliance to specific exercise intensity (e.g. moderate or high-intensity exercise), particularly during the intermittent type of activity (Malik et al. 2017). Nevertheless, our data (i.e. 60%–70% of HR_{max}) suggests that traditional games elicited moderate intensity, supporting the pattern we observed in CPM and METs. The present study is also limited to the selected traditional games. Consequently, the results may not apply to other varieties of traditional games. Despite this limitation, the selection of traditional games in this present study was based on the similarity of the structure of the games. Future research should investigate the effect of a traditional game-based intervention (more extended period) on cardiorespiratory responses, health parameters (e.g. body composition and blood glucose), and other perceptual responses relating to affect responses and perceptual efforts.

CONCLUSION

The present study contributes to the limited literature examining exercise intensity and enjoyment responses to the selected traditional games in children. When performing the traditional games in a school setting, children elicited sufficient levels of MVPA within 20 min of playing time. Furthermore, the intermittent nature of some traditional games may augment feelings of enjoyment in schoolchildren. These findings support the usefulness of incorporating traditional games in a school setting to encourage PA participation in schoolchildren while promoting health benefits and well-being in this cohort. Indeed, both exercise intensity and enjoyment response are the key indicators to the vehicle the multiple health benefits and promote future exercise adherence in children, respectively.

Conflicts of interest
There are no conflicts of interest.

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