Predictors and barriers to physical activity among rural preschool children in Kuching and Samarahan Divison, Sarawak, Malaysia

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Abstract

Introduction: Physical activity improves the physical and mental health of children as well as their social wellbeing. Physical activity of preschool children is influenced by individual, social, nutritional and environment factors.

Objectives: To determine the prevalence of physical activity and associated factors among preschool children in rural districts of Kuching and Samarahan Divison, Sarawak, Malaysia.

Method: A cross-sectional study was carried out on 227 children, aged 4 to 6 years, from KEMAS preschools and their parents from rural area of Kuching and Samarahan Division, Sarawak. Socio-demographic profile, physical activity, sedentary behaviour and perceived environmental factors were obtained using interview-guided validated questionnaires. Nutritional status of the children was measured using anthropometric measurement. Data were analysed using IBM SPSS version 22.0

Results: The proportion of physically active children in this study was 46.3%; 50.7% were found to have high screen time and 40.5% had high quiet play. The prevalence of overweight was 12.8% and the prevalence of obesity was 5.2%. Multivariate analysis revealed that the proportion of children who were physically active was higher among those who were of the Malay ethnicity with unemployed mothers, high safety and crime score, and walkable environment in the surrounding.

Conclusions: This study showed that only half of preschool children were engaged in physical activity in sufficient levels. The study also identified the several predictors related to physical activity using the socio-ecological model.

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Introduction

Physical activity is part of the physical, mental and social development of children[1]. Regular physical activity enhances growth, reduces the risk of cardiovascular disease, improves coordination and movement control, and reduces anxiety and depression[1]. The current guideline recommends that pre-schoolers should perform at least 60 minutes to several hours per day of unstructured physical activity[2]. According to a local study by Lee *et al* in 2016, only 40% of preschool children achieved the physical activity recommendation[3]. The prevalence of physical activity among rural pre-schoolers was 48.7% and among urban pre-schoolers 38.2%[3]. The physical activity of preschool children is influenced by individual, social, nutritional and environment factors[4].

Objectives

To determine the prevalence of physical activity and associated factors among pre-school children in rural districts of Kuching and Samarahan Divison, Sarawak, Malaysia

Method

A cross-sectional study was conducted in rural districts of Kuching and Samarahan division Asajaya, semi-urban of Samarahan district, Bau district and Lundu district, rural districts of Kuching division. This study focuses on students between the ages of 4 to 6 years of KEMAS preschools with enrolment of more than 10 students per school. Respondents with underlying medical conditions, physical disability, psychiatric disorders and respondents whose parents refused participation in the study were excluded.

The sample size was determined using Epi Info (Version 7) with a confidence interval of 95%, margin of error of 5%, and given that the prevalence physical activity among children in Malaysia is

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15.2% (Lee *et a*l, 2015)[5], that will be the figure used as the expected proportion. The formula used was sample size for proportion X = Zα/22 -*p*(1-p) / MOE2[6]. The result from this calculation indicates a minimal sample size of 199. A total of 250 respondents participated in the study. A total of 23 (9.2%) respondents did not complete the questionnaire and were excluded from this study. The children who participated in this research were mainly from ethnic group of Bidayuh, Iban and Malay. This study protocol was approved by Medical Research Ethics Committee of the University of Malaysia, Sarawak.

The Toy-box® study questionnaire, adapted from the Toy-box® study from the University of Greece[7], was used to determine the predictors and barriers in this study. The questionnaire consisted of 5 parts, namely, socio-demographic, nutritional status assessment, physical activity, sedentary behaviour and perceived environmental influences of physical activity. This Toy-box® questionnaire has proven to be reliable (92% of Toybox questions had a moderate to excellent test-retest reliability as intra-class correlation coefficient > 0.41 to 1)[7] and have good validity[8]. The Malay version of Toybox® questionnaire was developed by a Toybox® Malaysia Study Team from University Kebangsaan Malaysia and University of Malaysia, Sarawak. The translation procedures consisted of three steps which are: forward translation, backward translation and parent testing. The items in the socio-demographics part included asking parent about child's age, sex, ethnicity, father's educational level, mother's educational level, father's working status, and mother's working status.

The weight of respondents was measured by weighing scale brand Omron HN289. The height of respondents was measured using the stadiometer brand SECA 213. The body mass index (BMI) of respondents was calculated using the standard formula: weight in kilograms divided by the square of height in metres. Then the results of BMI of children was entered into World Health Organization (WHO) Anthro Software (Version 3.2.2). Subsequently, this software was automated to classify according to WHO BMI for Age (Boys or Girls), as thinness (< -2SD), normal weight (≥ -2SD to < 1 SD), overweight (≥ 1 SD to < 2 SD) or obese (≥ 2 SD). Nutritional status of parents was assessed through questionnaire by asking their weight and height. Parent's BMI was classified according to WHO BMI classification for adults (1998). Underweight is BMI <18.5 kg/m^2, normal BMI is 18.5 to 24.9 kg/m^2, overweight is 25.0 to 29.9 kg/m^2 and obese is more than 30.0 kg/m^2.

The physical activity was measured by a subjective method. Parents were asked to complete 2 questions about their child's physical activity. Question 1: Time spent by their children in physical activity per day on a weekday. The answers were reported in subjective terms, how many hours and minutes per day. Question 2: Time spent by their child in physical activity per day during the weekend. The answers were reported in subjective terms, how many hours and minutes per day.

The sedentary behaviour was measured with a subjective method as well. Parents were asked to report about their children's sedentary behaviour. Question 1: Time spent on screen activities such as watching television (TV), digital versatile disc (DVD) and video in their leisure time (screen time). Question 2, Time spent on other than screen activities (quiet play) such as reading books, playing blocks, playing dolls, paint and construction) during leisure time. The answers were reported in subjective terms, how many hours and minutes per day.

With regard to perceived environmental factors, the questions consisted of 5 main ones related to the child's home and neighbourhood environment. Question 1: the description of the backyard: the choice of answers 1) No backyard 2) No private backyard 3) Small backyard example 1 car size, 4) A medium yard (e.g. A standard block of land) 5) A large yard (1000m^2 or more). Question 2: the places where children can be physically active such as playground, natural reserve such as river, beaches and natural pool. Question 3: the availability of electronic items at home. The choice of answers area 1) Television 2) DVDs or video players, 3) Electronic games such as PlayStation, Xbox and other consoles 4) Computer 5) Gadgets such as phone iPad or tablet 6) Internet available in the house. Question 5 consisted of 8 sub questions regarding the safety of the surrounding environment using the 5-point Likert Scale. The questions included safety to play outside, availability of usable footpath, major barrier to danger, traffic along the street, sufficient traffic lights or pedestrians, level of crime in the neighbourhood, local shop in walking distance and the dangers in parks that makes you avoid taking your child there. These 8 sub questions later were themed as walkability environment (sub-question 2, 3, 7), crime and safety (sub-question 1, 6, 8) and traffic hazard (sub-question 4, 5).

Data analysis: The data were recorded and analysed using Statistical Package for Social Sciences (SPSS) version 22.0. The continuous data were presented in terms of mean and standard deviation for normally-distributed data and medians and interquartile ranges for non-normally-distributed data. The categorical data were presented in term of frequency and percentages. The dependent variable was dichotomized into 2 categories which were

physically active and physically inactive. Descriptive analyses were computed for socio-demographic factors, nutritional status of respondents and their children, physical activity, sedentary behaviour and perceived environmental factors to physical activity. For inferential analyses of this study, a Pearson χ^2 test was used to determine the association between the independent variables and dependent variable (physical activity) as the variables were categorical in nature. Only variables with p value <0.1[9] were entered to "enter" method of binary logistic regression to examine the predictors.

Results

The mean age was 5.25 years (SD 0.74), ranging from 4 to 6 years. The 4 years old group accounted for 18.1% (n = 41), the 5 years old group for 38.8% (n = 88) while the 6 years old group accounted for 43.2% (n = 98). The mean duration of total physical activity was 69.8 minutes (SD = 33.01) minutes per day.

Table 1 is a frequency and χ^2 analysis of socio-demographic characteristics, children BMI, parental BMI in relation to physical activity level.

Table 1: *χ^2 analysis between physical activity and socio-demographic characteristics and body mass index (BMI) of respondents and parents (n=227)*

Variables	Frequency	Physical Activity Level		χ^2 (dF)	p-value
	n (%)	Active, (%)	Inactive, (%)		
Gender					
Male	122 (53.7)	56 (45.9)	66 (54.1)	0.01 (1)	0.90
Female	105 (46.3)	49 (46.6)	56 (53.3)		
Age (Years)					
4	41 (18.1)	16 (39.0)	25 (61.0)		
5	88 (38.8)	32 (36.4)	56 (63.6)	9.91 (2)	0.00**
6	98 (43.1)	57 (46.3)	41 (41.8)		
Ethnicity					
Bidayuh	94 (42.7)	34 (42.5)	60 (50.5)		
Malay	63 (26.5)	38 (60.3)	25 (39.7)	8.87 (2)	0.01*
Iban and others	70 (30.8)	33 (47.1)	37 (52.9)		
Mother's education level					
Nil and Primary	19 (8.4)	07 (37.8)	12 (63.2)		
Secondary	187 (82.4)	88 (47.1)	99 (52.9)	0.74 (2)	0.69
Tertiary	21 (9.2)	10 (46.3)	11 (52.4)		
Father's education level					
Nil and Primary	28 (12.3)	15 (53.5)	13 (46.5)		
Secondary	174 (76.4)	127 (72.9)	47 (26.1)	6.34 (2)	0.04*
Tertiary	25 (11.3)	14 (56.0)	11 (44.0)		
Mother's employment status					
Employed	89 (39.2)	31 (34.8)	58 (65.2)	7.68 (1)	0.00**
Unemployed	138 (60.8)	74 (53.6)	64 (46.4)		
Father's employment status					
Employed	218 (96.0)	06 (66.7)	03 (33.3)	0.01 (1)	0.98
Unemployed	09 (04.0)	150 (68.8)	68 (31.2)		
Children's BMI					
Thinness	17 (7.5)	12 (70.6)	05 (29.4)		
Normal	169 (74.4)	82 (51.5)	80 (48.5)	11.07 (3)	0.01*
Overweight	11 (4.8)	02 (18.2)	09 (81.8)		
Obese	30 (13.2)	09 (30.0)	21 (70.0)		
Mother's BMI					
Underweight	13 (05.7)	07 (53.8)	06 (46.2)		
Normal	93 (41.0)	38 (40.9)	55 (59.1)	2.33 (3)	0.50
Overweight	72 (31.7)	34 (47.2)	38 (52.8)		
Obese	49 (21.6)	26 (53.1)	23 (46.9)		
Father's BMI					
Underweight	17 (07.5)	08 (47.0)	09 (53.0)		
Normal	88 (38.8)	40 (45.5)	48 (54.5)	7.02 (3)	0.07
Overweight	77 (33.9)	43 (55.8)	34 (44.2)		
Obese	45 (19.8)	14 (31.1)	31 (68.9)		

**Significant at the 0.05 level (2-sided) **Significant at the 0.01 level (2-sided)*

The 6 year old children were significantly more active compared to the 4 and 5 year old children. Malay children were found to be significantly more active than children of Iban and Bidayuh ethnicity. Children whose father had secondary education tended to have more active children compared to children whose father had tertiary and primary education. Unemployed mothers were found to have more active children compared to employed mothers. Obese and overweight children tended to be less active compare to normal and thin children. Other variables such as gender, mother's education level, father's employment status, father's BMI and mother's BMI were not associated with physical activity level.

Table 2 showed a χ^2 analysis between physical activity with sedentary behaviour and independent t-test of perceived environmental barriers and motivators score with physical activities.

Table 2: *χ^2 analysis between physical activity and sedentary behaviour perceived environmental barriers and motivators score (n=227)*

Variables†	**Frequency**	**Physical Activity Level**		**χ^2 (dF)**	**p-value**
	n (%)	**Active, (%)**	**Inactive, (%)**		
Screen time					
Low	112 (49.3)	50 (44.6)	62 (55.4)	0.23 (1)	0.63
High	115 (50.7)	55 (47.8)	60 (52.2)		
Quiet Play					
Low	135 (59.5)	85 (45.9)	100 (54.1)	0.03 (1)	0.84
High	92 (40.5)	20 (47.6)	22 (52.4)		
Availability of screen at home: - Television					
Yes	223 (98.2)	98 (46.6)	112 (53.4)	0.19 (1)	0.66
No	05 (01.8)	07 (41.2)	10 (58.8)		
DVD					
Yes	33 (14.5)	16 (48.5)	17 (51.5)	0.07 (1)	0.78
No	195 (85.5)	89 (45.9)	106 (54.1)		
Console					
Yes	09 (04.0)	03 (33.3)	06 (66.7)	1.57 (1)	0.21
No	218 (96.0)	102 (45.4)	116 (54.6)		
Computer					
Yes	14 (6.2)	06 (42.9)	08 (57.1)	0.06 (1)	0.79
No	213 (93.8)	99 (46.5)	114 (53.5)		
Tablet / iPad					
Yes	38 (16.7)	18 (31.6)	20 (68.4)	1.20 (1)	0.27
No	189 (83.3)	87 (49.2)	102 (50.8)		
Own hand phone					
Yes	56 (24.7)	15 (26.7)	41 (73.3)	11.33 (1)	0.00**
No	171 (63.3)	90 (73.6)	81 (26.4)		
Size of home compound					
Small and medium	40 (17.6)	30 (66.7)	10 (33.3)	0.89 (1)	0.34
Large	187 (82.4)	126 (67.3)	61 (32.7)		
Availability of playground					
Yes	35 (15.4)	28 (80.0)	07 (20.0)	0.69 (1)	0.40
No	192 (85.4)	95 (49.4)	97 (50.6)		
Natural Reserves					
Yes	50 (28.2)	20 (40.0)	30 (60.0)	1.47 (1)	0.22
No	177 (71.2)	88 (49.7)	89 (50.3)		
Variables ǂ		**Active Mean ± SD (score)**	**Inactive Mean ± SD (score)**	**t (dF)**	**p-value**
Walkability environment		10.20 ± 1.75	9.66 ± 1.83	2.27 (255)	0.02*
Crime safety		10.27 ± 1.95	11.18 ± 1.87	-3.57 (225)	0.00**
Traffic hazard		4.85 ± 1.11	4.71 ± 1.10	0.93 (255)	0.35

**Significant at the 0.05 level (2-sided) **Significant at the 0.01 level (2-sided)*

† χ^2 Analysis, ǂ independent t-test

A significant relationship was found between physical activity and children who owned a hand phone (χ^2 (2) = 11.33, p < 0.05). Other variables such as screen time, quiet play, availability of screen item such as TV, DVD, tablets, game console, computer, availability of nearby playground and size of home compound were not associated with physical activity level.

Following the result of χ^2 analysis, the significant variables were taken for further analysis of logistic regression. The cut-off point of p value was less than 0.1 (Tabachnik & Fidell, 2007)[9]. The binary logistic regression was performed to ascertain the effects of the safety crime score, walkable environment score, mother employment status, age, ethnicity, children BMI and father education level on likelihood that the participant active in physical activity. The exploratory data analysis reveal that the data had low multicollinearity (r < 0.7), the independent variable are linearly related to the log odds and minimum sample size to performed logistic regression is 130 (50 + k x 10). The binary logistic regression using the 'enter' method and the model was statistically significant χ^2 (11) = 66.293, p < 0.001) as shown in table 3.

Table 3: ***Summary of Binary Logistic Regression analysis in Predicting Physical Activity (n=227)***

Variables	B	SE	Wald Test	Adjusted OR	95% CI	
					Lower	Upper
Safety Crime Score						
High				1.000		
Low	1.627	0.404	16.180	5.087***	2.303	11.237
Walkable Environment Score						
Low				1.000		
High	1.198	0.372	10.388	3.313**	1.599	6.864
Mother Employment Status						
Employed				1.000		
Unemployed	0.934	0.341	7.511	2.546**	1.305	5.731
Ownership of Hand phone						
Yes				1.000		
No	0.870	0.397	4.807	2.388*	1.097	5.199
Age (Years)						
4				1.000		
5	-0.095	0.460	0.043	0.909	0.369	2.242
6	0.768	0.442	3.016	2.155*	0.906	5.124
Ethnicity						
Bidayuh				1.000		
Malay	0.892	0.400	4.968	2.441*	1.114	5.350
Iban and others	0.768	0.399	0.964	1.480	1.480	3.237
Children BMI						
Overweight and obese				1.000		
Normal	0.444	0.664	0.504	1.558	0.424	5.731
Thinness	-0.295	0.572	0.606	0.744	0.243	2.285
Father Education level						
Tertiary				1.000		
Secondary	0.742	0.502	2.181	2.100	0.785	5.350
Primary	0.385	0.701	0.302	1.470	0.372	5.12

p value significant at < 0.05, p < 0.01**, p < 0.001****
Note: β = value used in the equation, indicates the effect of predictor variables on predicting the variables; SE = standard error; CI = confidence interval.

The model explained 33.8% of the variance in physical activity and correctly classified 72.2% of cases. Low safety crime score was 5.087 times to more likely result in physical activity among preschool children. High walkable environment score was 3.313 times higher than low scores. An unemployed mother has a child with 2.546 times of odds to be physically active compared to employed mother. Respondents of Malay ethnicity have a 2.441 times to be physically active compared to Iban mothers and mothers of other ethnicities. The 6 years old was 2.155 times more likely to be physically active than 4 years old. Ownership of phones by children has been shown to be a barrier in this study.

Discussion

Being physically active especially during this period of age is crucial to ensure a healthy development physically, mentally as well as the social well-being of children. This study noted that the participation in physical activity among rural preschool children in Samarahan and Kuching division was insufficient as the prevalence of physically active is only 46.3%. According to Lee *et al* (2016)[3], the prevalence of physical activity among rural pre-schoolers in Malaysia was 48.7%. However, Lee *et al* (2016)[3] used different definition of active play; 60 minutes of structured and 60 minutes of unstructured physical activity. However, a very limited study used an objective measure such as accelerometer and pedometer in measuring physical activity among preschool children in Malaysia.

The binary logistic regression showed that the strongest predictors of physical activity among rural pre-schoolers is related to perceived crime and safety of parents. As stated above, the perceived crime and safety issues is described through the safety of the child to play outdoor by the parent, level of crime in surrounding environment and the presence of danger that could cause injury in surrounding environment. Although the fear of crime is just an emotional response, having thoughts about criminal and safety issues causes inhibition of action and finally result in limiting the ability of social and physical functioning of their children. This study found that low score of perceived crime and safety issues was related to higher physical activity among children. Low score of perceived safety and crime issues among parents prove to have 5.09 times likelihood of being more physically active compared to high scores. The parents' perceptions to serve as a gatekeeper for their children's physical activity have been found in previous studies[10,11].

Another environmental influence is walkable environment in surrounding area. The walkable environment plays an important role in shaping preschool children's physical activity. It is described as an easy walking distance from homes to local store, the presence of safe footpath and roads to school with no major barriers such as holes in the walking pavement and its environment proven to be a concern among parents to let their children to go outside and play. In this study, this variable has proven to be the second highest predictor of preschool children's physical activity level. High score of perceived walkability environment had 3.13 times likelihood result in physical activity. Walkability environment proved to result in physical activity significantly to both high income countries and middle-income countries. A study in United States and Europe showed that the people living in areas with good walkability environment have high physical activity level[12,13]. The prevalence of physical active among high scorer of walkability environment (35.0%) was higher by 13.9% compared to low-walkability areas (21.1%) in Brazil, a middle-income country[14]. This study reported a similar trend that the prevalence of physically active among high score of walkability environment was 50.4% compared to low score of walkability environment at 41.4%.

In this study, the findings showed that a majority of mothers are working (65.2%). The participation of mother in labour indeed has advantages and disadvantages to their family and children. One of the disadvantages is related to mother's working hours and children's physical activity. Indeed, employed mothers were associated with physical inactivity of children. This study showed that unemployed mother had 2.54 times likelihood in physical activity of children. The reason behind this issue is related to physical activity level of the mother[15]. Mother-child daily activity levels were positively associated at all activity intensities (sedentary, low, and moderate to vigorous physical activity, $p < 0.001$). Employed mothers are less likely to perform physical activity, subsequently affecting their children's daily activities and finally resulting in an increased in sedentary activity for both the mother and children[16].

About 25% of the preschool children had their own hand phone. The ownership of hand phone was significantly associated with high screen time in this study and physical inactivity. This finding was supported by Paudel *et al* (2017) who reported that the ownership of mobile devices among children were more likely to have higher mobile screen time. The children aged between 4 to 8 years were more likely to have higher mobile screen time compared to older children of 8 years and above. These suggest that for a child aged less than 8 years old, the environment factors (providing a mobile device to children) have an influence in shaping their behaviour. Therefore, providing a mobile device to children at early stage of their life proved to have detrimental effects to children's health[17].

With an increase in age, the physical activity of rural preschool children tends to increase as well. This statement is proven as 6 years old was the fourth strongest predictors. 6 year old had 2.15 times ($p<0.05$) likelihood to result in physical activity. The finding of this study showed that 4 year olds tend to spend more time on screen activity (56.1% had excess screen time limit) compared to 6 year olds (46.9% had excess screen time limit). Second reason related to age was high crime and safety score which was noted among 4 years old (53.7%) than 6 years old (45.5%). The mother tends to limit their younger children to play outside in fear of injury and children

being kidnapped, therefore resulting in a lack of physical activity[18].

In term of ethnicity, the Malays have higher odds to be physically active (adjusted odd ratio 2.44) compared to other ethnic groups in this study. This result proved to be consistent with other studies in Malaysia (Lee *et al* 2016). The physical activity among Malay ethnics was higher than other ethnics with relation to the children's BMI. The relationship between children BMI and physical activity was significant in this study. Thin and normal BMI children were more physically active than overweight and obese children. Looking into the details of data, the prevalence of thinness group among Malay children was higher (37.1%) compared to Iban (19.0%) and Bidayuh (16.0%). The prevalence of overweight and obesity was found to be higher among Bidayuh (18.1%) than Iban (12.7%) and Malay (8.6%). Therefore, the ethnic group which had more prevalence of thinness and normal BMI were found to be more physically active than others.

Limitations of this study include its cross-sectional design, confined study area and use of subjective measurement of children's physical activity. The cross-sectional in nature, as such, the determinants of physical activity from this cross-sectional survey lack temporal sequence thus limiting the assessment of causality in the observed associations of the variables studied. This research was only conducted in rural districts of Samarahan and Kuching division, at such limited and confined area reduces the ability to generalize the findings to other rural pre-schoolers in Sarawak. This study relied fully on parent's report especially on children physical activity measurement. Subjective measurement raised a lot of issues especially related to recall biases and social desirability biases either under-reported or over-reported. Despite these limitations, this study served as a point of reference for further research involving larger sample groups and have utilized the objective methods of measurement physical activity using the pedometer or accelerometers.

Conclusions

This study showed that only half of preschool children were engaged in physical activity in sufficient levels. The study also identified the several predictors related to physical activity using the socio-ecological model.

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