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Association of Household Income with Body Mass Index, Physical Activity and Cardiorespiratory Endurance among Primary School Children

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Abstract

The progress of urbanization in Malaysia is a positive sign for the country to cope with the current technology, but these circumstances lead to an increase in the cost of living. The urgency of life might force the low-income people to focus more on earning money and neglect physical activity. The relation between household income and physical activity are less concern among researchers. Thus, the purpose of this study is to expand the association of the income level of families on the health of children, especially their physical activity, cardiorespiratory-endurance and body mass index (BMI). A total of 141 children aged 10 to 12 years old were recruited in this study. The height and weight of the participants were recorded, and they were asked to perform a 1600 meters run for cardiorespiratory endurance test and fill up children's leisure activities study survey (CLASS). A correlation spearman was employed in this study. The results show a significant but low positive correlation in physical activity (r_s = 0.24, p < 0.05) and body mass index (r_s = 0.19, p < 0.05) toward socioeconomic status of family among children while, cardiorespiratory endurance shows significant but low negative correlation (r_s = -0.23, p < 0.05). From the result, it is indicating that household income influences the children's health literacy. Usually, the children tend to counterfeit their parent's lifestyle. In this case, primary school children are lacking health literacy and the importance of involving physical activity. There are immense benefits of performing regular physical activity such as improving cardio-endurance performance and could avoid non-communicable disease. This research can help everyone have a basic understanding of the association of household income and children's health literacy which may impact the future society.

Keywords: Body Mass Index, Cardiorespiratory Endurance, Household income, Physical Activity, School Children

Introduction

Malaysia is currently experiencing a rapid development process due to socio-economic development. It also impacts the demographic profile of the population. Socioeconomic status of family could contribute to the obesity issue and the effect on being physically active (Wan Puteh et al., 2019). Malaysia has the highest obesity rates and overweight among Asian countries, with 64% of the males while 65% of the female population overweight or obese. Obesity has proven to increase the risk of suffering from non-communicable disease. Another result is that the rate of diabetes in adults aged 18 years or over has risen from 11.6% to 17.5% over 9 years from 2006 to 2015. About 50% of diabetes or hypertension stays undiagnosed. Rate of Malaysian children obesity, the statistic was 12.7% for ages 9-16 according to the WHO (Yang et al., 2019).

The physical activity also can be correlated with the environment of the children, how their social and characteristics. The past study also said physical activity can be characterized by children's gender, family income, social support, and the recreational environment (Holderness et al., 2017; Sahoo et al., 2015). Physical activity is related to the prevalence of obesity, and it has been increasing substantially for over 40 years. The pattern of the overweight has been discovered to see the increasing obesity and how to prevent it from happening. Past study found that the increasing pattern of obesity is different between non-communicable disease and socioeconomic status (Jaacks et al., 2019; Aboshkair et al., 2012). Physical activity is needed in our daily life because it is important to make a person stay healthy and strong to do some work in a day. Lack of physical activity may lead to a weak body. Physical activity also can make a person stay in optimal level of health and can avoid sedentary behaviours (Milanović et al., 2021; Guthold et al., 2018). The progression of modern technology today like televisions, computers and video games have had an impact on physical activity for children. The effect of physical activity needs to be studied and need to be understood in order to promote the optimal physical and healthy lifestyle. Socio-demographic and health-related factors may influence the physical activity and fitness level in children (Islam et al., 2020). Physical fitness and physical activity are important for someone to gain basic knowledge about fitness and its benefits. More children get obese and can face a high risk of illness. The evidence was shown in research recently. Maintaining physical fitness at an early age is important to reduce fats and chronic disease when someone goes to elderly stage (Holderness et al., 2017). Health-related physical fitness may be influenced by multiple factors, like body size, volume of physical activity, and income level.

Socioeconomic status can influence someone to be overweight and obesity. Socioeconomic status can be the indicator in health status due to income level that may be frequently used (Yogman et al., 2018). The increasing overweight and obesity among adolescents are quite worrying because it can lead to severe noncommunicable disease. This statement is based on how children nowadays consume a lot of sugar-sweetened, inadequate physical activity and fast food that led to excess weight gain (Yang et al., 2019; Tung & Nasir, 2011). Malaysia is the first ranked in Southeast Asian according to WHO and these issues put Malaysia in a bit of a crisis regarding obesity. The increasing number of childhood obesity is crucial especially when there is no awareness about obesity from the adults. The children tend to eat anything following their own appetite. Recently, the world has normalized the usage of electronic gadgets, and this trend has become a bad lifestyle especially to the

youngsters. They tend to spend their time with gadgets and video games, which makes them less interested in exercise. According to previous study is also one of the most critical public health problems of the 21st century, with around one in ten young people aged 5–17 overweight or obese. Such rates are increasing steadily in several countries and regions in recent years. The number of teenagers with obesity issues in developing countries is higher than in developed countries, and this is attributed to a change in lifestyle and eating patterns (Izzah et al., 2019).

Physical activity is one of the most important parts to stay healthy and energetic. Parental income also plays a big role to make sure that the children have a good physical activity at their home or school. Parents are the most important people to make sure that their children are at their best. Parents must promote physical activity to their children so that the children will stay healthy (Yogman et al., 2018). Physical activity among children is also based on a parent's perception about the Physical activity itself. This is because some parents do not let their children play outdoors due to danger that might happen (Su et al., 2019). Cardiovascular endurance is also important in children's growth. Lack of physical activity and uncontrolled unhealthy food intake might bring cardiovascular disease to the children. This is because, nowadays, cardiovascular disease has been the main concern globally, especially in low-income families. This thing happens because low-income families mostly lack knowledge about how important physical activity and daily food intake is to children's cardiovascular endurance and to avoid risking disease (Gray et al., 2018). Therefore, socio-economic, physical activity, and obesity predominance is the main reason why there are so many children who are physically inactive in Malaysia. This issue still lacks evidence and still needs to be investigated and more study needs to be done. Therefore, this research is to determine the parental income of the family can relate with the health of children, especially their physical activity, cardiorespiratory-endurance, and body mass index (BMI).

Method

Research Design

The study applied a cross-sectional design involving Malaysian school children aged 10-12 years in the standard forth to sixth. This study was designed to explore the association between parental income status with physical activity habits, cardio-respiratory endurance capability and body mass index. The participants were recruited from selected primary schools and with the consent from parents or guardians. The participants were given a briefing about the protocol and risk potential were explained to the participants before distributing the consent form to be filled by their parents or guardian. The approval for data collection from the Education Planning and Research Department (EPRD), Ministry of Education Malaysia, and the State Education Department as well as the school authorities prior to data collection were obtained prior the data collection.

The Participants

The purposive sampling technique was employed, where the selection of the participants was based on certain criteria. The participants must be categorised under Bottom-40 according to Malaysian Economic Planning Unit Classification. Then, they were divided into three groups of household income which are upper income family (UIF), middle income family (MIF) and lower income family (LIF). The monthly income for UIF is more than RM3500, whereas for MIF and LIF are RM1500-RM3499 and less than RM 1500, respectively.

Measuring Equipment

Body composition measurement

BMI is the ratio of body weight to height squared (kg/m²). BMI is only a basic index of obesity and does not estimate the body fatness of the participants. It is used to analyze and differentiate the participants according to underweight, normal, overweight, and obese categories (American College of Sports Medicine, 1991).

Physical measurement

Children will be divided into three categories which consist of upper class of family, middle class of family and lower class of family. A common method to measure aerobic cardiovascular endurance/ cardiorespiratory endurance, which is the endurance run/ walking test (1600m).

Questionnaire

The pattern of physical activities among school children was using Children's leisure activities study survey (CLASS) which comprises 27 items to capture a typical week's physical activity undertaken in different behavioral domains such as sports, leisure activities, and transport. The questionnaire was a slightly modified version of an existing survey instrument that has been shown to provide reliable estimates of the type and frequency of 10- to 12-year-old children's physical activity. Direct measures such as observation and accelerometers can be used but not feasible in large epidemiologic studies. Therefore, this study did not use accelerometers to measure the energy expenditure for physical activity because this study consists of 141 participants, which can be considered a large sample.

The participants were given an envelope to take home to their parents, the children's leisure activities study survey (CLASS). The questionnaire was supposed to be answered by their parents, siblings or who are responsible to take care of the participants. In the proxy – report CLASS questionnaire, parents were asked their children the type and amount of time that their children spent in physical activity. The Children 's leisure activities study survey (CLASS) for each physical activity in the checklist, parents were asked to circle "yes" or "no", indicating whether their child does that activity during typical week (Monday to Friday) and during typical weekend (Saturday and Sunday). "Typical week" was defined as being during the current school term, not including school holidays. If they circled "yes", parents were asked to report the frequency of the activity (how many times Monday – Friday and Saturday - Sunday) and the total time their children spent in that activity (minutes or hours Monday – Friday and Saturday - Sunday).

The Children's leisure activities study survey (CLASS), was developed based on 27 items for physical activity. The questionnaire was developed in English and then translated into Bahasa Malaysia. This pilot study was conducted for 30 participants between ages ten to twelve years old to answer the questionnaire. The Cronbach alpha for the children's leisure activities study survey (CLASS) was α=0.82.

Procedure

Approval to conduct this study was permission from the headmaster and consent was given by parents. The response rate was 100% from the participants, headmaster and their parents. This data was collected in 2018.

Statistical Analysis

The data in the study will be analysed using the Statistical Package for Social Sciences (SPSS) version 26 software. Descriptive statistics in the form of frequencies, means ± standard deviation (x ± SD) will be used for applicable variables. The significance that will be identified in this study is $p<0.05$, which refers to a 5% chance that a significant result is a false positive. The data had been analysed using Pearson correlation to identify the association between parental income status of family towards physical activity, cardiorespiratory-endurance and body mass index (BMI).

Result

Demographic Distribution of Respondents

Table 1 shows that, a total number of participants between genders were (n =141). It showed 59 male students (41.84%) and 82 students were female (58.17%). Meanwhile, almost half of the participants in the categories of lower parental income status for both male (45.76%) and female (48.78%). Besides, the upper parental income level between male (28.81%) and female (18.3%) is less than half among the participants. The body mass index (BMI) of the respondents from different genders were presented, half of the male (59.32%) participants were normal BMI and female (40.24%). Next, the underweight category among the participants is too small, which is only 1.23% for females and male (8.47%).

Table 1
The demographic data of the participants

(N=141)		Male (n=59), %	Female (n=82), %
Parent income status	Lower	45.76	48.78
	Middle	25.42	32.93
	Upper	28.81	18.3
	Total	100	100

*Note: Income status: - Lower Income Family - < RM1500, Middle Income Family– RM1500 – RM3500, Upper Income Family - > RM3500 (Malaysian Economic Planning Unit Classification,2007)

Table 2 showed the distribution characteristic of study respondents by gender. The overall mean for Age of the participant was 11.35 ± 0.66 years old, meanwhile the mean by gender for parental income status for male was 1.83 ± 0.85 and female was 1.70 ± 0.77. Next, height for male was 141.09 ± 7.67cm and weight was 39.14 ± 9.96kg, height for female was 141.91 ± 9.23cm and weight was 45.24 ± 11.73kg. The overall mean for body mass index was 2.65 ± 0.87 kg/m^2, while vo2max was 43.06 ±3.78 ml- kg^{-1}. min^{-1}respectively and physical activity was 3802.95 ± 466.25 min/week.

Table 2
The descriptive statistic of the variables

Variables	Mean (SD)
Body mass index	2.65 (0.87)
VO_{2MAX}	43.06 (3.78)
Physical activity - CLASS	3802.95 (466.25)

Table 3 showed the Pearson correlation was used to explore the relationship between parental income status towards physical activity, cardiorespiratory endurance and body mass index (BMI). Results showed there was a positive relationship between parental income status towards physical activity and body mass index. Meanwhile, there are negative correlations between parental income status and cardiorespiratory endurance.

Table 3
Correlations between parental income status toward physical activity, cardiorespiratory endurance, body mass index (BMI)

Variable	Physical activity - CLASS	VO_{2MAX}	Body mass index
Parental Income Status	0.198*	-0.255*	0.227*

*Significant at $p<0.05$
**significant at $p<0.001$

Discussion

The present study determined the relationship between parental income status towards physical activity, cardiorespiratory endurance, and body mass index (BMI), among school children in Teluk Intan, Perak. The study respondents were selected among ten to twelve years old, who may be at a higher risk to establish many undesirable lifestyle habits such as physical inactivity, poor eating behaviour, and misperception of physical fitness. This study shows that level of physical activity among male and female was slightly similar, and it was significantly associated with parental income status, those who had low level of physical activity were at higher risk of being overweight or obese. Previous study demonstrates that physical activity can influence a very strong and complex relationship that exists between socioeconomic status and academic achievement. In other words, the relationship between socioeconomic status is altered as physical activity conditions change (Kern et al., 2018). In addition, another study reported similar findings that the children who lived in poverty will lack physical activity, meaning that, they do less physical activity rather than other children that lived in middle and higher socioeconomic status (Kim et al., 2020). In this study children's engagement in recess and physical education activity quantities are not certain, because researchers get the data collection only from the CLASS questionnaire that mention only 60 minutes for physical education class activity. Thus, it reflects the commitment to physical activity and physical fitness among school children. Another study reported that the presence of a stronger moderating effect of physical activity opportunities in the rural area may indicate that greater opportunities on physical activity and more impactful on children from lower parental income status (Kern et al., 2018). However, this study, conducted at urban area in Perak, but this phenomenon is beyond the scope of the current school-level study, but may be related to the added neurocognitive or psychological wellbeing among school children.

Health enhancing effects of physical activity and health related fitness of low-income children to experience both health complications. This study showed a significant relationship between parental income status and cardiorespiratory endurance. Physical fitness, especially cardiorespiratory endurance is considered as a significant marker of health (Garza, 2012). Parental income status was often indicated as a factor that influences physical activities and associated health. The findings of this present study showed that 141 participants were slightly similar to vo2 max between parental income status categories. This finding was

aligned with previous study which found that school children from socioeconomic status had a greater influence on cardiorespiratory endurance (Greenleaf et al., 2010). Besides, other studies showed a similar finding that higher socioeconomic status has a great influence on physical fitness. However, another study reported that there was no relationship between cardiorespiratory endurance fitness (VO_{2MAX}) and socioeconomic status (Esmaeilzadeh et al., 2013). The discrepancies among studies might be due to the specific social and cultural contexts of each country. Thus, different environmental factors or different income levels of families together with the different methodologies used to assess fitness and socioeconomic status might reflect the result of the study. In the present study, the same method was used to measure cardiorespiratory endurance with a one-mile test, but this study only determined the differences in family income level. Another previous study used different methods to identify parental income status for example socioeconomic status was computed from parent education and occupational status using the four factors of Hollingshead index (Aboshkair et al., 2012; Esmaeilzadeh et al., 2013).

The data gathered between family contributions or parental income status to inform their children about obesity showed a positive correlation. The data gathered also indicated significant correlations among those two variables, ($r=0.277$, $p=0.007$). According to past study, the study showed the opposite result as the researchers indicated that improving family lifestyle could have numerous beneficial outcomes, including reducing the prevalence of childhood obesity. The study also found that this relationship is consistent throughout early childhood (Gray et al., 2018). This means that parents are responsible to educate their children about the awareness of obesity and the factors that will lead to overweight or obesity. In line with this statement, the results of another study present a variety of options for practical application. What clearly emerges from the results is the association between environmental and behavioral factors and children's obesity. The result from the current study indicated that children's daily activity did not influence obesity among the participants. The statement has not been supported, as the researchers stated the more the students spent their times on sedentary lifestyles such as watching television and when students spent more times on watching television it will increase the consumptions of advertisement in goods, including sweetened cereals, sweets, sweetened beverages, and salty snacks will lead the students to consume unhealthy foods (Sahoo et al., 2015). Based on the current study, the result showed that family contributions to awareness of obesity did not influence childhood obesity. Compared to previous research, the findings from the current study found opposite results. This may be due to the children themselves not having enough or lack of self-motivation to perform the healthy lifestyle even though the children have a well-functioning family to be aware of the implication of obesity. This means that the current study found that even the parents fully guide the children about obesity, if the children themselves did not make the move so there will be no influence from family contribution to decrease the rate of obesity among children. Children nowadays tend to be influenced by unhealthy lifestyles that have been promoted through social media and television-reduction programs for children. This has been supported by another study which stated if the students spend more time in a sedentary lifestyle, it will make the students being left living in unhealthy lifestyles (Sahoo et al., 2015).

Conclusion

In conclusion, it shows that physical activity, physical fitness and BMI among school children are influenced by different family income levels. Physical activity among school

children has become an important issue in public health. Proactive instruments are helpful in identifying more factors that influence physical activity and to increase the level of physical activity among school children. However, families from different socioeconomic backgrounds need to encourage their children in different ways to be physically active. Aerobic capacity has been used as an important measure of cardiorespiratory endurance in school children. The understanding factor related to aerobic capacity was imperative in improving cardiorespiratory endurance among school children. The different in family income levels is one of the indicators that may influence the fitness level of their children that might leads to sedentary lifestyle and indirectly may affect the children health. The prevalence of obesity could have turned into a prolonged epidemic with significant differences in family income level. Therefore, parents should be the main target for education to modify children's weight management and physical fitness by educating them with correct knowledge on diets, food intake and physical activity. Parents should also be encouraged to bring their children to sports clubs or recreational facilities to increase their physical activity levels and adopt healthy eating habits to prevent the development of obesity. School teachers and counsellors can be trained to identify excessive body weight concerns and to promote a better understanding of weight management practices among school children.

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