High prevalence of physical inactivity among adolescents in Thua Thien Hue province in 2017

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Abstract

Background: Physical activity (PA) plays a vital role in both physical and mental development of adolescents. This study aims to determine adolescent physical activity status and several related factors and to preliminarily evaluate its effect on the development of adolescent height and weight. **Materials and Methods:** This analytical cross-sectional study involved 932 students, chosen by the multi-stage sampling method. The data were collected by a structured questionnaire referenced from GSHS and YRBS questionnaires and the measurement of height and weight. **Results:** Physical inactivity among adolescents accounted for 71.1% (95% CI: 68.1 - 74.0), in which female adolescents is higher than male adolescents (77.4% vs 60.6%). For every one-day increase of meeting the PA recommendation, there is a growth in adolescent height and weight corresponding to 0.41 (cm) (95% CI: 0.14-0.68) and 0.37 (kg) (95% CI: 0.14-0.61), respectively. Gender and received the parent concerns were two factors which are most effective to physical inactivity in adolescents. **Conclusions:** Lack of PA still being an alarming concern, especially among adolescent girls. Physical inactivity could affect the development of height and weight during adolescence. Taking more robust measures must be needed to improve PA for adolescents.

Keywords: Physical inactivity, adolescent, Thua Thien Hue province

1. INTRODUCTION

Physical activity (PA) helps to prevent diseases in healthy people and quickening recovery for sick people. Frequently doing physical activities can bring various health benefits such as strengthen and developing musculoskeletal system; reduce the risk of cardiovascular diseases (hypertension, stroke, etc.), diabetes, cancer, depression, et cetera [14, 15]. Physical activity is critically important for the natural development of physical and mental ability in adolescents, and its fluctuation in the adolescent development process can result in their psychophysiological and physical changes in the future [17].

It estimated that as many as 3.2 million deaths worldwide are attributable to physical inactivity [10]. According to the systematic review of 2384 articles, the proportion of adolescents lacking PA is 79.7% worldwide [4]. In the USA, the proportion of adolescents who do not meet the standards announced by the World Health Organization and the US Department of Health is approximately 87.4% [8]. In Vietnam, children aged under 18 years old account for 30% of the population following UNICEF statistics in 2012, 80.3% of which lack physical activity [2]. These numbers are alarming and also a major risk factor

leading to an increasing rate of non-communicable diseases, physical retardation and even cancer in Vietnam as well as around the world [15].

Therefore, to have deep interventions to the adolescent PA habits, initial research is needed to describe the children PA habits as well as the factors related to PA. In Vietnam, there were several studies of adolescent PA regionally and nationally. However, these studies are no longer appropriate due to their old rates in PA pattern and because a few involved factors mentioned. Meanwhile, in Thua Thien Hue Province, there is no specific research related to PA in adolescents. For all of the above reasons, we implemented the study with the aim to:

1. To determine the physical activity status and several related factors among adolescents in Thua Thien Hue Province in 2017.

2. To preliminarily evaluate the effects of physical inactivity on the adolescent development of height and weight.

2. MATERIALS AND METHODS

This analytical cross-sectional study was conducted among adolescents who aged from 10 to 19 years old in Thua Thien Hue Province from June 2017 to April 2018.

$$n = Z^2_{1-\alpha/2} \frac{(1-p)p}{(p\varepsilon)^2}$$

Sample size:

The sample size was calculated using the formula:

In which:

n: sample size; With a = 0.05, $Z^2_{1-\frac{\alpha}{2}} = 1.96^2$

We selected p = 0.197 [2], e: approximation error, we choose e = 0.2. Then, we computed the number of participants: n = 392. The coefficient of the design was 2.

We estimated the rate of inappropriate responses and refusal to join research at 20%. So, the sample size was 940.

In reality, we collected 952 responses. After taking out data cleaning, the final valid response number was 932.

Sampling method:

The multi-stage sampling method was used to select adolescents from Thua Thien Hue Province, which has 9 District-level sub-divisions and is subdivided into 3 geographical zones: mountainous area, plain area, and coastal area.

- The first phase: We selected randomly 2 districts representing each geographical zone, including Hue City, Huong Thuy (plain area), Nam Dong, A Luoi (mountainous area), and Phu Loc, Phu Vang (coastal area).

- The second phase: We randomly selected 2 secondary schools and 2 high schools in each district. In total, we selected 12 secondary schools and 12 high schools.

- The third phase: We used the Probability Proportional to Size sampling method. The proportion of students between the secondary and high school is 65% and 35%, respectively. Then, we computed the number of students chosen into the sample in each school. In each school, we selected randomly 1 class in each grade, then we made a list of students in that class and randomly selected the corresponding student number.

Participant inclusion and exclusion criteria:

Participant inclusion criteria: Adolescents aged from 10 to 19 years old and are able to read and communicate in Vietnamese

Participant exclusion criteria: Adolescents with a history of mental disorders, inability to read, communicate in Vietnamese, deafness, blindness.

Data collection:

Data collection tool:

This study used a structured questionnaire designed to base on Youth Risk Behavior Surveillance Questionnaire (YRBS) and Global School-based Student Health Survey (GSHS) Questionnaire, designed by the United States Center for Disease Control and Prevention. The questionnaire was adjusted to suit the conditions of Vietnamese people and was tested on a pilot group having the same characteristics as the target population.

Evaluation criteria:

Recommended levels of physical activity: Children and adolescents should accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity daily and should include vigorous-intensity physical activity at least 3 days a week. [2, 8, 17]. Therefore, adolescents with physical inactivity are those who did not meet the above recommendation.

Nutrition evaluation: Based on the classification of Z-score for BMI for age of World Health Organization [16].

Data analysis:

Data were entered by using Epidata. SPSS Statistics 20.0 and R 3.4.2 were used to analyze data, including computing the frequency, determining the relationships by Pearson's Chi-square test, multiple logistic regression, and multiple linear regression. Prevalence with 95% confidence intervals (CI) was calculated for inactivity. Test for the difference of means by One-way ANOVA. The significant level at 0.05.

Ethical considerations:

- The research proposal was approved by the Ethics Committee of Hue University of Medicine and Pharmacy and received ethical clearance before being conducted.

- The purpose and content of the study will be clearly explained to the study objects and their guardian (father/mother).

- All participants in the study participate voluntarily, and the subjects and their guardians signed a written informed consent form to participate in the study as prescribed for a scientific study.

- All information about object of study will be encoded, kept confidential and used only for study purposes.

3. RESULTS

General characteristics of research objects

Characteristics of research objects show in Table 1. The table reveals that female accounted for approximately two-thirds of the study objects (62.7%). The majority of study objects lived in rural areas (72.2%) and the plain area (42.8%). The poor and near-poor households made up 9.7% of the study objects. The percentage of ethnic minorities constituted 9.0% of the study objects. The majority of the study objects had a greater than or equal to "Good" study results (85.1%). 14.2% of adolescents were overweight or obese, in which the ratio of male and female adolescents was approximately 1.48.

Table 1. General characteristics of adolescents in the study

General characteristics		Gender		Total
		Male	Female	
Age group	10-13 years	165 (41.0)	237 (59.0)	402 (43.1)
	14-16 years	145 (34.6)	274 (65.4)	419 (45.0)
	17-19 years	38 (34.2)	73 (65.8)	111 (11.9)
Living area**	Urban area	118 (45.6)	141 (54.4)	259 (27.8)
	Rural area	230 (34.2)	443 (65.8)	673 (72.2)
Geographical areas	Mountainous area	82 (35.0)	152 (65.0)	234 (25.1)
	Plain area	160 (40.1)	239 (59.9)	399 (42.8)
	Coastal area	106 (35.5)	584 (64.5)	299 (32.1)
Economic conditions***	Poor / Near-poor	29 (32.2)	61 (67.8)	90 (9.7)
	Normal	319 (37.9)	523 (62.1)	842 (90.3)
Ethnicity*	Kinh People	326 (38.4)	522 (61.6)	848 (91.0)
	Ethnic minorities	22 (26.2)	62 (73.8)	84 (9.0)
Recent study results***	≥ Good	268 (33.8)	525 (66.2)	793 (85.1)
	< Good	80 (57.6)	59 (42.4)	139 (14.9)
Weight (kg)***		44.8 ± 12.2	41.8 ± 8.2	152.8 ± 12.0
Height (cm)*		154.2 ± 14.7	151.9 ± 10.1	42.9 ± 10.0
Overweight-Obesity	Yes	62 (47.0)	70 (53.0)	132 (14.2)
	No	286 (35.8)	514 (64.2)	800 (85.8)
Total		348 (37.3)	584 (62.7)	932 (100.0)

*Data are frequency (%) or mean±SD; *P<0.05; **P<0.01; ***P<0.001*

High prevalence of physical inactivity among adolescents

Adolescents lacking in PA in Thua Thien Hue Province in 2017 accounted for a high percentage (71.1%), and this estimate ranged from 68.1 to 74.0 percent with 95% probability that covers population parameter, in which this proportion of female (77.4%) was statistically significantly higher compared to male (60.6%). Physical inactivity proportion in children aged from 10-13 years accounted for 75.2%, and this was significantly higher than two remain groups (14-16 years: 49.7%; 17-19 years: 39.5%), p < 0.05. Male juveniles with poverty or near poverty were higher of physical inactivity proportion than male ones without the same condition (79.3% vs 58.9%). Similarly, male adolescents who are learning performance under good (72.5) were also higher of physical activity shortage than those with learning performance greater or equal to good (57.1%). 65.9% of adolescents with overweight-obesity state was physically inactive. (Table 2)

Table 2. Prevalence of physical inactivity among adolescents in 2017

Characteristics	Physical inactivity					
	Male		Female		Total	
	n (%)	95% CI	n (%)	95% CI	n (%)	95% CI
Age groups [T,M]						
10-13 years	124 (75.2)	67.8 - 81.5	194 (81.9)	76.3 - 86.5	318 (79.1)	74.8 - 83.0
14-16 years	72 (49.7)	41.3 - 58.1	206 (75.2)	69.6 - 80.2	278 (66.3)	61.6 - 70.9
17-19 years	15 (39.5)	24.0 - 56.6	52 (71.2)	59.2 - 81.2	67 (60.4)	50.6 - 69.5
Living area						
Urban	69 (58.5)	49.0 - 67.5	108 (76.6)	68.7 - 83.3	177 (68.3)	62.3 - 74.0
Rural	142 (61.7)	55.1 - 68.0	344 (77.7)	73.5 - 81.4	486 (72.2)	68.7 - 75.6
Economic conditions [M]						
Poor/near poor	23 (79.3)	60.3 - 92.0	46 (75.4)	62.7 - 85.5	69 (76.7)	66.6 - 84.9
Other	188 (58.9)	53.3 - 64.4	406 (77.6)	73.8 - 81.1	594 (70.5)	67.3 - 73.6
Geographical areas						
Mountainous area	52 (63.4)	52.0 - 73.8	111 (73.0)	65.2 - 79.9	163 (69.7)	63.3 - 75.5
Plain area	103 (64.4)	56.4 - 71.8	192 (80.3)	74.7 - 85.2	295 (73.9)	69.3 - 78.2
Coastal area	56 (52.8)	42.9 - 62.6	149 (77.2)	70.6 - 82.9	205 (68.6)	63.0 -73.8
Recent learning results [M]						
< Good	58 (72.5)	61.4 - 81.9	47 (79.7)	67.2 - 89.0	105 (75.5)	67.5 - 82.4
≥ Good	153 (57.1)	50.9 - 63.1	405 (77.1)	73.3 - 80.7	558 (70.4)	67.1 - 73.5
Ethnicity						
Kinh People	194 (59.5)	54.0 - 64.9	403 (77.2)	73.4 - 80.7	597 (70.4)	67.2 - 73.5
Ethnic minorities	17 (77.3)	54.6 - 92.2	49 (79.0)	66.8 - 88.3	66 (78.6)	68.3 - 86.8
Overweight-Obesity						
Yes	34 (54.8)	41.7 - 67.5	53 (75.7)	64.0 - 85.2	87 (65.9)	57.2 - 73.9
No	177 (61.9)	56.0 - 67.5	399 (77.6)	73.8 - 81.2	576 (72.0)	68.7 - 75.1
Total [G]	211 (60.6)	55.3 - 65.8	452 (77.4)	73.8 - 80.7	663 (71.1)	68.1 - 74.0

[T] *P-value of Chi-square test < 0.05 for the entire sample;* [M] *P-value of Chi-square test < 0.05 for males only;* [F] *P-value of Chi-square test < 0.05 for females only;* [G] *P-value of Chi-square test < 0.05 for the proportion difference about physical inactivity between male and female.*

Factors associated with physical inactivity in adolescents

Table 3 shows the association of related factors with physical inactivity. There were 5 factors associated with physical inactivity among adolescents: age, gender, geographical areas, learning results and the parents' understanding of their child difficulties and worries. The result reveals that the younger the adolescents, the higher possibility of getting physical inactivity. Probability of being physical inactivity of adolescents decreases 77% for each year of age increase. The Odds of female adolescents were 2.68 times more likely to lack PA than the Odds of male ones. In three geographical zones, the adolescents living in the plain area (OR = 1.57, 95% CI: 1.07 - 2.30, p < 0.05) had higher Odds of lacking in PA than the adolescents living in the mountainous region. The Odds in adolescents who have learning results greater than or equal to "Good" were 1.59 times more likely to lack PA than the opposites. The adolescents whose parents do not understand their difficulties and worries have 1.72 times higher Odds of getting PA shortage than those whose parents do.

Table 3. Multiple logistic regression analysis to determine factors related
to physical inactivity among adolescents

Factors		Physical inactivity			
		β	OR	95% CI	P-value
Age		-0.27	0.77	0.70 - 0.83	<0.001
Gender	Male	-	1	-	-
	Female	0.99	2.68	1.97 - 3.65	<0.001
Geographical areas	Mountainous area	-	1	-	-
	Plain area	0.45	1.57	1.07 - 2.30	0.022
	Coastal area	0.21	1.23	0.82 - 1.84	0.316
Learning results	≥ Good	-	1	-	-
	< Good	0.46	1.59	1.02 - 2.47	0.039
Received the parent concerns	Yes	-	1	-	-
	No	0.54	1.72	1.24 - 2.37	0.001

The association of lacking physical activity on the development of adolescent height and weight

The height and weight data of adolescents were approximately normally distributed as assessed by visual inspection of their histograms and Q-Q Plots. Two multivariate linear regression analyses conducted to determine the relationship between the number of days a week that adolescents do at least 60 minutes of physical activity and their height and weight.

As can be seen from the Figure 1, the height of adolescents is more likely to increase corresponding to the raise of days that meet the recommendation on PA after adjusting for age, gender and economic condition. There is a slight growth in adolescent height of 0.41 (cm) for every one-day increase of meeting the PA recommendation. Particularly, Figure 1 also reveals that there is a range of mean differences about adolescent height between the number of days that meet the PA recommendation from 0 to 4 and the number of days from 6 to 7. At least six days a week of meeting PA recommendations have a significant increase in adolescent height.
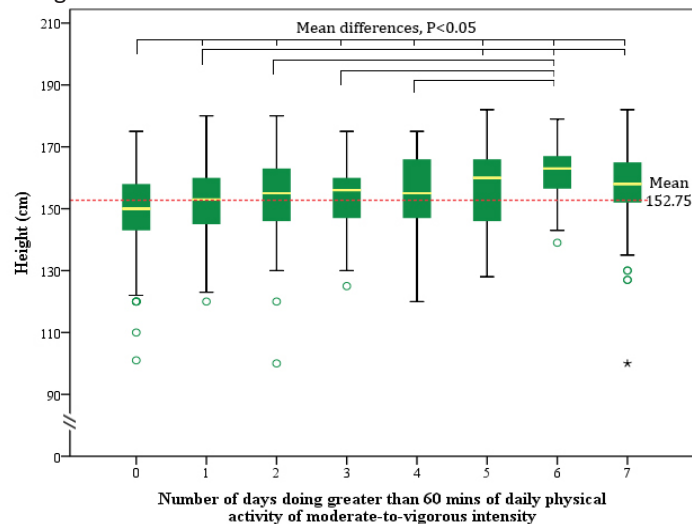

Factors	Height (cm)		
	β*	95% CI	P value
Number of days reaching recommendations on PA	0.41	0.14 - 0.68	0.003

*Adjusted for age, gender, and economic conditions

Figure 1. A multivariate linear regression analysis of determining relationship between number of days that adolescents reach recommendation on PA and their height

Figure 2 shows that there is the same tendency with the adolescent height that the adolescent weight has a slight increase of 0.37 (kg) for every single day increase of reaching recommendations on PA. The differences on weight mean between the number of days meeting PA recommendations also can be seen that the weight of adolescents who have from 4 to 7 days is relatively higher than those who have under 3 days a week doing at least 60 minutes of moderate-to-vigorous intensity.

Factor	Weight (kg)		
	β*	95% CI	P value
Number of days reaching recommendations on PA	0.37	0.14 - 0.61	0.002

*Adjusted for age, gender, and economic conditions
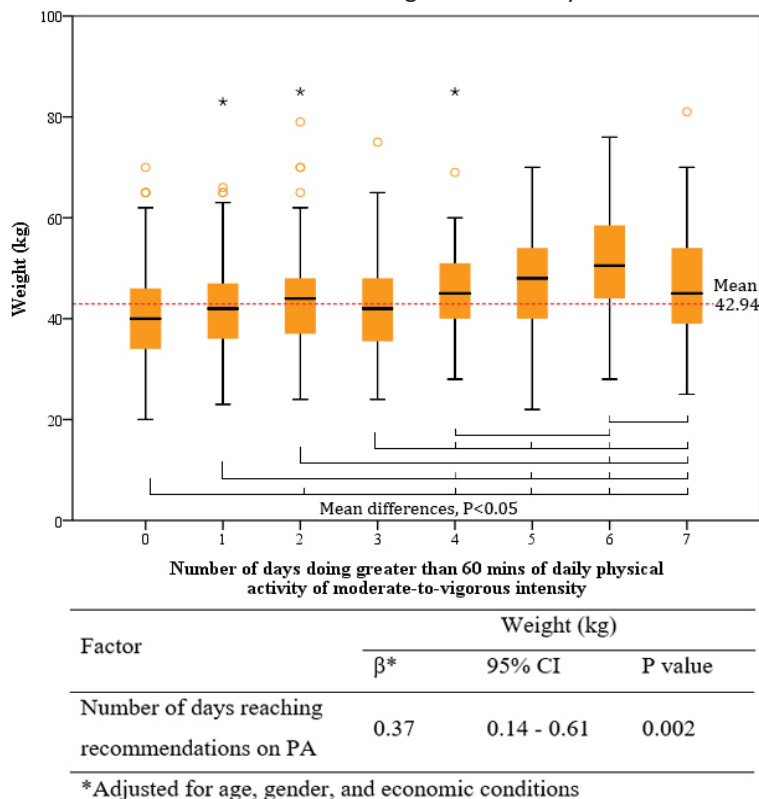
Figure 2. A multivariate linear regression analysis of determining relationship between number of days that adolescents reach recommendation on PA and their weight.

4. DISCUSSION

Our result reveals that physical inactivity was highly prevalent among adolescents in Thua Thien Hue Province, especially in female adolescents, and in the male adolescent who aged from 10 to 13 years old. This lack of PA increases the risk for 30 chronic diseases such as cardiovascular diseases, diabetes, metabolic syndrome,...[1]. Our result was lower of the proportion of PA shortage comparing to worldwide prevalence in 2013 (79.9%) [6], national research from 13 to 17 year-old students in 2013 (80.3%) [2]. The lower prevalence but still high in physical inactivity in our study compared to the others could understand because of identical to the slight decreasing trend in most countries in the world [7, 18]. Strategies of health promotion could have initial efficiencies in order to improve physical activity state among adolescents around the world, but it still needs more efforts to enhance

PA in adolescents. Our study also shows that the parents' concerns about their children play a vital role in the state of physical activity in adolescents (OR=1.74, 95% CI: 1.24 - 2.37, p < 0.05). In modern society, parent tends to spend more time doing their jobs, making money, and social relationships than taking care of their children. This leads to various harmful consequences in the child's development of psychology and behaviour, including physical inactivity.

Lack of PA in adolescence may result in two contrasted consequences: the first one is an increase in overweight and obesity risk, the other is the under-development of weight and height. Our results reveal that adolescents have a lower number of days meeting PA recommendations, the lower in height and weight. Those could be due to the underdeveloped bone in both mass and density during adolescence. Physical activity represents a

major mechanical loading factor for bone through a combination of growth (determining bone size), modelling (determining the shape of bone) and remodelling (maintaining the functional competence of bone) [5]. Under normal conditions of development, roughly half of the peak bone mass is gained during the adolescent period. Besides, diet and PA account for 20-40% of variability in peak bone mass [9]. Some studies show that the lack of PA during adolescence results in a decrease in the maximum development of bone mass thus increases the risks of osteoporosis in later life [6, 19]. Daily physical activity positively influences measurements of BMC and BMD. In a study by Slemenda et al. [13], researchers noted the importance of physical activity during adolescence by estimating that those who were active would display a 5–10% higher bone mass compared with those who were inactive. Besides, researchers have found height and weight to significantly and positively correlated with BMC and BMD in young children [3, 11, 12]. Thus, physical inactivity may lead to underdeveloped height and weight in adolescents.

Targeting at-risk groups on physical inactivity is a critical requirement for conducting an efficient intervention. Our results reveal that most of the physical inactivity adolescents were girls, or in a plain area, or have under good learning result, or not received parent concerns. In Vietnam, physical activities in secondary school and high school is still limited. The majority of students aged 10-19 years old rely on school-based physical activity programs. However, those activities are limited in both quantity and quality. Although there are some sports available such as football, basketball, badminton, aerobics, the adequacy of the training required for these sports depends on the local schools' financial capacity. Since each student has their preference with regards to sports, some may be unwilling to engage in physical exercises. Besides, the students only engage in PA for 4 hours one day per week in school. Thus they may not meet the standards for physical activity. Therefore, we recommend that school administrations should promote school-based physical activities about at least 5 days per week and 1 hours per day. The schools should encourage their students to engage in physical activity at least 60 minutes per day and for at least 5 days per week. Finally, the schools should diversify the choice of sports to meet the needs of students.

5. CONCLUSION

Prevalence of physical inactivity among adolescents in Thua Thien Hue Province has been at a high level, especially in adolescent girls. Lack of PA during adolescence may result in underdevelopment of height and weight. Therefore, adolescents at risk should have the proper physical training to promote their health and overall physical development.

REFERENCES

1. Booth FW, Roberts CK, Laye MJJCP. Lack of exercise is a major cause of chronic diseases. 2011;2(2):1143-211.

2. Centers for Disease Control and Prevention & World Health Organization. Global school-based student health survey 2013. 2013. Available from: https://www.cdc.gov/gshs/index.htm.

3. Chan GMJAJoDoC. Dietary calcium and bone mineral status of children and adolescents. 1991;145(6):631-4.

4. de Moraes ACF, Guerra PH, Menezes PRJNh. The worldwide prevalence of insufficient physical activity in adolescents; a systematic review. 2013;28(3):575-84.

5. Heinonen AJJ, Finland: University of Jyvaskyla. Exercise as an osteogenic stimulus [PhD thesis]. 1997.

6. Janz KJMp. Physical activity and bone development during childhood and adolescence. Implications for the prevention of osteoporosis. 2002;54(2):93.

7. Kalman M, Inchley J, Sigmundova D, Iannotti RJ, Tynjälä JA, Hamrik Z, et al. Secular trends in moderate-to-vigorous physical activity in 32 countries from 2002 to 2010: a cross-national perspective. 2015;25(suppl_2):37-40.

8. Katzmarzyk P, Denstel K, Beals K, Bolling C, Wright C, Crouter S, et al. The 2016 United States report card on physical activity for children and youth. 2014.

9. Kelly P, Eisman J, Sambrook PJOi. Interaction of genetic and environmental influences on peak bone density. 1990;1(1):56-60.

10. National Center for Chronic Disease Prevention and Health Promotion. Physical Activity Facts. Centers for Disease Control and Prevention; 2008. Available from: https://www.cdc.gov/healthyschools/physicalactivity/facts.htm.

11. Ondrak KS, Morgan DWJPES. Factors influencing bone mineral density and content in young girls. 2006;18(1):101-12.

12. Rubin K, Schirduan V, Gendreau P, Sarfarazi M, Mendola R, Dalsky GJTJop. Predictors of axial and peripheral bone mineral density in healthy children and adolescents, with special attention to the role of puberty. 1993;123(6):863-70.

13. Slemenda CW, Miller JZ, Hui SL, Reister TK,

Johnston Jr CCJJob, research m. Role of physical activity in the development of skeletal mass in children. 1991;6(11):1227-33.

14. U.S. Department of Health and Human Services. Physical Activity Guidelines for American 2008. Available from: https://health.gov/paguidelines/pdf/paguide.pdf.

15. World Health Organization. Global Strategy on Diet, Physical Activity and Health : a framework to monitor and evaluate implementation. Geneva: World Health Organization; 2006. Available from: https://apps.who.int/iris/handle/10665/43524.

16. World Health Organization. Growth reference data for 5-19 years: BMI-for-age. World Health Organization; 2007. Available from: https://www.who.int/toolkits/growth-reference-data-for-5to19-years/indicators/bmi-for-age.

17. World Health Organization. Global recommendations on physical activity for health. Geneva: World Health Organization; 2010. Available from: https://apps.who.int/iris/handle/10665/44399.

18. World Health Organization. Regional Office for E. Adolescent obesity and related behaviours: trends and inequalities in the WHO European Region, 2002–2014. Copenhagen: World Health Organization. Regional Office for Europe; 2017 2017.

19. Zulfarina MS, Sharkawi AM, AQILAH-SN Z-S, Mokhtar S-A, Nazrun SA, Naina-Mohamed IJIjoph. Influence of adolescents' physical activity on bone mineral acquisition: a systematic review article. 2016;45(12):1545.