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(Original article)

The effect of night shift working in teenage students on their cardiorespiratory fitness, quality of life, and mental health

ผลการทำงานกะกลางคืนต่อสมรรถภาพระบบหัวใจและหลอดเลือด คุณภาพชีวิต และสุขภาพจิตในเด็กนักเรียนวัยรุ่น

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ABSTRACT: Children in many countries are facing premature employment and illegal labor forces, which affect their physical development, quality of life, mind, emotion, and society. This study aimed to investigate the effect of levels of night shift working on cardiorespiratory fitness together with the quality of life and mental health problems. Ninety-six teenagers, aged between 15-18 years, were divided into a non-night shift and night shift working groups divided by the intensity of work. This study used the YMCA step tests, the Health Survey Short Form 36 (SF-36), the Thai Perceived Stress Scale-10 (T-PSS-10), and the Center for Epidemiologic Studies Depression scale (CES-D), the Thai version. This study found that heartbeat count has increased, from the YMCA step test, in working girls compared with non-working girls ($p<0.05$). The level of cardiorespiratory endurance has shown a “very good” category in the non-working group was 33.3% and would decrease according to the intensity of work, i.e., 28.6%, 8.3%, and 11.3% (low, moderate, and high intensity respectively). Results from the ‘Health Survey Short’ Form 36 found that the scores of Role-emotional categories in working groups were significantly higher than in non-working groups ($p<0.05$). Moreover, mental health problems assessed from stress and depression screening tests at a heavy level were mostly found in the numbers of the night shift working teenagers. The night shift working may affect cardiorespiratory endurance in girls. However, a number of teenagers having depression and high stress were found in the night shift working group more than in the other groups.

Keywords: Cardiorespiratory fitness; Children; Quality of life; Mental health; Night shift working; Teenagers

บทคัดย่อ: เด็กในหลายประเทศกำลังเผชิญกับการจ้างงานก่อนวัยอันควรและการใช้แรงงานผิดกฎหมาย ซึ่งส่งผลต่อพัฒนาการทางร่างกาย คุณภาพชีวิต จิตใจ อารมณ์ และสังคม การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาผลกระทบของระดับงานกะกลางคืนต่อสมรรถภาพหัวใจและหลอดเลือดร่วมกับคุณภาพชีวิตและปัญหาสุขภาพจิต อาสาสมัครเป็นนักเรียนอายุระหว่าง 15-18 ปี จำนวน 96 คน ถูกแบ่งออกเป็นกลุ่มไม่ทำงานกะกลางคืนและกลุ่มทำงานกะกลางคืน โดยแบ่งตามความหนักของการทำงาน ใช้การทดสอบ YMCA step test และใช้แบบสอบถามประกอบด้วยแบบทดสอบคุณภาพชีวิต (SF-36) แบบวัดความรู้สึกเครียด (T-PSS-10) และแบบคัดกรองภาวะซึมเศร้าในวัยรุ่นฉบับภาษาไทย (CES-D) ผลการศึกษาพบว่าอัตราการเต้นของหัวใจเพิ่มขึ้นจากการทดสอบ YMCA step test ในเด็กวัยรุ่นหญิงที่ทำงานเมื่อเทียบกับเด็กวัยรุ่นหญิงที่ไม่ทำงานอย่างมีนัยสำคัญทางสถิติ ($p<0.05$) ระดับสมรรถภาพระบบหัวใจและหลอดเลือดแสดงให้เห็นว่ากลุ่มที่ไม่ทำงานอยู่ในระดับ "ดีมาก" 33.3% และจะลดลงตามความหนักของการทำงาน ได้แก่ 28.6% 8.3% และ 11.3% (ความหนักต่ำ ปานกลาง และสูง) ตามลำดับ ผลจากแบบทดสอบคุณภาพชีวิต (SF-36) พบว่า คะแนนบทบาทในการควบคุมอารมณ์ในกลุ่มเด็กวัยรุ่นที่ทำงานมีค่าสูงกว่ากลุ่มเด็กวัยรุ่นที่ไม่ทำงานอย่างมีนัยสำคัญทางสถิติ ($p<0.05$) นอกจากนี้ ปัญหาสุขภาพจิตที่ประเมินจากการตรวจคัดกรองความเครียดและภาวะซึมเศร้าในระดับหนักมักพบในจำนวนเด็กวัยรุ่นที่ทำงานกะกลางคืน การทำงานกะกลางคืนอาจส่งผลต่อสมรรถภาพระบบหัวใจและหลอดเลือดในเด็กวัยรุ่นหญิง อย่างไรก็ตาม พบว่ากลุ่มทำงานกะกลางคืนมีจำนวนเด็กที่มีภาวะซึมเศร้าและความเครียดสูงมากกว่ากลุ่มอื่น

คำสำคัญ: สมรรถภาพระบบหัวใจและหลอดเลือด; เด็กวัยรุ่น; คุณภาพชีวิต; สุขภาพจิต; ทำงานกะกลางคืน; วัยรุ่น

1. INTRODUCTION

The children's inappropriate working environments and high-risk jobs were all induced by accidents, injuries, and illnesses due to being exposed to dangerous conditions for a long time, such as working at night, etc.[1-4] According to previous studies, children who works, have less growth than normal children, who do not work, and they tend to also have depression and psychological problems. Not to mention that they would have higher risk of exposure to toxic substances, as well as the occurrence of physical diseases.[5-7] At the same time, reports on children working in Brazil[8] revealed that children who were forcefully sent to work have changes in their physical fitness such as heart disease, kidney disease, and stress.[5] Most importantly, physical fitness on the endurance of respiratory and cardiorespiratory systems which are functioned corresponding to the ability of producing oxygen to the muscles and body cells during physical exertion or physical activities.[9] From the data by the Department of Labor Protection and Welfare, it has shown that the trend of more than 125,000 children with their age of 15-17 working in different workplaces, were found in Bangkok and urban cities, followed by northeastern, central, northern and southern Thailand.[10] Physical fitness on the endurance of heartbeat and cardiovascular systems referred to the physical ability of using such a different individual's muscles to perform various activities taken from its energy production from oxygen, as well as good health conditions were indicated in this physical fitness. In this study, a step-up test based on using wooden boxes (YMCA step-test) is currently the most widely used because of hassle-free, convenient methods and the fewer numbers of spaces.[11] Additionally, health conditions were carried out with an assessment test on children's life quality and a questionnaire related to health survey short form 36 (SF-36). This can also be assessed with the levels of health conditions in many studies.[12, 13] Although, mental health is a common thing in everyday life and it is one of the factors that can affect health conditions, such as feeling stressed or feeling sad. It is a feeling or state that occurs internally that can be perceived individually and difficult to observe the people. Consequently, if that feeling exists for a long time and became so severe, it can affect the performance of daily duties. Thus, this study used the Thai version of the commonly used tests for adolescents: the Center for Epidemiologic Studies-Depression Scale (CES-D)[14] and the Thai Perceived Stress Test. Moreover, to complete this form, the stress scale-10 (T-PSS-10)[15] was used as a tool to help assess mental health problems. The purposes of this study were to investigate the effect of teenager's night-time work, affecting their cardiorespiratory fitness, quality of life and mental health problems, as well as to compare the levels of cardiorespiratory fitness, quality of life, and mental health problems found between teenage students who worked at night and ones that do not.

2. METHOD

2.1 Participants

Based on the cross-sectional study, secondary school students of Pathum Thani, Thailand, this school has been verified to have a high number of teenage students working at night as follow; 96 school students aged 15-18 years have a normal BMI of 18.5-24.9 kg / m^2 healthy. The exclusion criteria are the ones with neurological or musculoskeletal disorders, which they must use medication and people with abnormal heart conditions affecting daily life whom require physical activity under the guidance of a doctor. Work that indicates physical and mental health hazards, morals, and child development[3] by collecting data after being approved by the Human Research Ethics Committee of Science, COA NO.309/2562.

2.2 Measures and procedures

Using Cluster Random Sampling, this study uses working hours per week as a work class break according to Paschall's study, which is divided into group 1, teenagers who did not work at night, group 2 is a low level of the night shift working teenagers by working 1-10 hours per week. Group 3 is a moderate level of the night shift working teenagers by working 11-20 hours per week. Group 4 is for a high level of the night shift working teenagers by working more than 20 hours per week.[16] The tools used in this study are as follows: 1) Cardiorespiratory fitness testing using a wooden box (YMCA Step Test) requires its participants to perform box stepping for 3 minutes and categories its participants as a result of heart rate after the test people who exercise regularly will have a slower heart rate after testing than those who have never exercised.[11] 2) The quality of life test uses the Ziebland's[12] Health Survey Short Form 36 (SF-36) test by Watcharee Lemanakul and Paranee, with scores consisting of 36 questions about quality of life in 8 dimensions with the Cronbach's alpha coefficient alpha coefficient of 0.88. The content validity index was 0.87.[13] 3) Center for Epidemiologic Studies-Depression Scale (CES-D) Thai version, with a score from 0-60, if the total score is higher than 22 then it is considered a depression with reliability coefficient (alpha)= 0.83 and has a classification. (High discriminant validity).[14] In addition, Sensitivity= 0.6140, Specificity= 0.848, and positive predictive value= 0.385[15] and 4) Thai Perceived Stress Scale-10: T-PSS-10 with scores from 0-40 points 1-13 points mean low level of stress 15-26 points mean moderate stress 27-40 means high level stress[17] Thai version with Cronbach's alpha= 0.85 also has ICC= 0.82.[18]

2.3 Statistical data analysis

The finished computer program IBM SPSS Statistics 20 tests the distribution of data by using the Kolmogorov-Smirnov test uses an independent t-test to see the differences between night shift working and non-night shift working teenagers. One way ANOVA is used to compare the differences between the levels of work in night shift working teenagers, set the statistical significance level of 0.05.

3. RESULTS

3.1 General characteristics of volunteers

The subjects in this study were 96 teenagers aged between 15-18 years old who are studying in secondary schools and divided into 24 non-night shift working teenagers and 72-night shift working teenagers. The BMI (kg/m^2) for all subjects is normal in both the non-night shift working and the night shift working group worked at the low level, the moderate level, and the high level (21.22±2.05 kg/m^2, 20.85±2.10 kg/m^2, 20.90±2.63 kg/m^2, and 20.65±2.15 kg/m^2, respectively). The level of work consisted of a low level of working (7 teenagers), a moderate level of working (12 teenagers), and a high level of working (53 teenagers), most of whom were 34 boys (64.2%). Most of the age in the non-night shift working group was 17 years that found in 18 teenagers (75.0%). In the night shift working group, most of them were working in the moderate level and working continuously for 3-6 months, with 9 teenagers (75.0%). Family status in the non-night shift working group found that all of fathers and mothers live together (100.0%). The divorce among parents found in the night shift working teenagers who worked at all levels and found that fathers or mothers died among the high levels of working teenagers. The sleep time of teenagers who do not work at night is mostly 6-8 hours, 14 teenagers (58.3%) and sleep time is reduced in the group of teenagers who work at night. It was found that the teenagers in group 3, in the night shift working worked at a high level (5.7%), only sleep for 4 hours. The bedtime of the teenagers who do not work at night is mostly 10.00-12.00 pm in 17 teenagers (70.8%). And they tend to go to bed late after 12.00 pm., especially for 17 teenagers from the night shift working who worked at a high level of work (32.1%). Good levels of cardiorespiratory fitness were found in the 8 teenagers of the non-night shift working group (33.3%), 2 teenagers of the low-level night shift working group (28.6%), 1 teenager of the moderate-level night shift working group (8.3%) and 6 teenagers of the high-level night shift working group (11.3%). The average score of overall quality of life in the non-night shift working teenagers is similar to the night shift working teenagers who worked at a low level (108.83 ± 11.50 and 108.77 ± 8.65), respectively, and higher than the average quality of life score in the night shift working teenagers who worked at a moderate and a high level (102.14 ± 12.57 and 106.67 ± 11.26), respectively. Depression was found in 5 teenagers of the non-night shift working group (20.8%), 1 teenager of the night shift working group worked at a low level (14.3%), 4 teenagers of the night shift working group worked at a moderate level (33.3%) and 14 teenagers of the night shift working group who worked at high level (26.4%). Most of the stress levels are at the moderate level. In which the 2 teenagers of the night shift working group who worked at a high level were found at the high level of stress (3.8%), as shown in Table 1.

Table 1 General characteristics of the subjects

General characteristics	Non-nightshift working teenagers (%)	Nightshift working teenagers (%)		
		Level of work intensity		
		Low	Moderate	High
No. of subjects	24 (25.0)	7 (7.3)	12 (12.5)	53 (55.2)
- Boy	11 (45.8)	2 (28.6)	4 (33.3)	34 (64.2)
- Girl	13 (54.2)	5 (71.4)	8 (66.7)	19 (35.8)
Ages				
- 15 years old	1 (4.2)	0 (0.0)	0 (0.0)	5 (9.4)
- 16 years old	4 (16.7)	2 (28.6)	2 (16.7)	19 (35.8)
- 17 years old	18 (75.0)	4 (57.1)	8 (66.7)	19 (35.8)
- 18 years old	1 (4.2)	1 (14.3)	2 (16.7)	10 (18.9)
Time of working				
- 3-6 months	0 (0)	4 (57.1)	9 (75.0)	44 (83.0)
- 6-12months	0 (0)	0 (0)	0 (0)	3 (5.7)
- >12 months	0 (0)	3 (42.9)	3 (25.0)	6 (11.3)
Family status				
- Both parent	24 (100.0)	5 (71.4)	9 (75.0)	39 (73.6)
- Divorced parent	0 (0.0)	2 (28.6)	3 (25.0)	9 (17.0)
- Father died	0 (0.0)	0 (0.0)	0 (0.0)	3 (5.7)
- Mother died	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.8)
Sleep duration				
>8 hours	1 (4.2)	0 (0.0)	0 (0.0)	5 (9.4)
6-8 hours	14 (58.3)	1 (14.3)	3 (25.0)	23 (43.4)
4-6 hours	8 (33.3)	6 (85.7)	9 (75.0)	22 (41.5)
<4 hours	1 (4.2)	0 (0.0)	0 (0.0)	3 (5.7)
Bedtime				
8 pm.-10 pm.	5 (20.8)	4 (57.1)	2 (16.7)	9 (17.0)
10 pm.-12 pm.	17 (70.8)	2 (28.6)	6 (50.0)	27 (50.9)
12 pm.-2am.	2 (8.3)	1 (14.3)	3 (25.0)	15 (28.3)
2 am.-4 am.	0 (0.0)	0 (0.0)	1 (8.3)	2 (3.8)
Extra class				
- class	7 (29.2)	3 (42.9)	4 (33.3)	1 (1.9)
- no class	17 (70.8)	4 (57.1)	8 (66.7)	52 (98.1)
Cardiorespiratory fitness				
- very low	10 (41.7)	2 (28.6)	4 (33.3)	26 (49.1)
- low	2 (8.3)	0 (0.0)	4 (33.3)	5 (9.4)
- moderate	4 (16.7)	3 (42.9)	3 (25.0)	12 (22.6)
- good	0 (0.0)	0 (0.0)	0 (0.0)	4 (7.5)
- very good	8 (33.3)	2 (28.6)	1 (8.3)	6 (11.3)
Depression				
- normal	19 (79.2)	6 (85.7)	8 (66.7)	39 (73.6)
- depressed	5 (20.8)	1 (14.3)	4 (33.3)	14 (26.4)
Stress level				
- low	1 (4.2)	0 (0.0)	0 (0.0)	4 (7.5)
- moderate	23 (95.8)	7 (100.0)	12 (100.0)	47 (88.7)

3.2 Heart rate

It has illustrated that the average heart rate from YMCA step test in the non-night shift working teenagers was less than the average heart rate in the night shift working teenagers ($p < 0.05$) only in girls, as shown in Table 2.

Table 2 The comparison of heart rate from the YMCA step test between non-night shift working and night shift working teenagers.

Parameter	Non-nightshift working teenagers.	Nightshift working teenagers.	p-value
Heart rate in all subjects (beats/min.)	121.71±24.34	127.17±21.80	0.305
Heart rate in boys (beats/min.)	126.55±24.34	123.83±20.88	0.713
Heart rate in girls (beats/min.)	114.58±22.96	132.03±22.52	0.027*

Independent t-test *p<0.05

3.3 Quality of life

The results of the study were based on the quality-of-life test in the non-night shift working teenagers. Furthermore, it was found that there was no difference in the scores from the quality-of-life test in all levels of working of the night shift working teenagers. When comparing each dimension, it has found that in the dimension of role that is limited due to emotional problems (Role-emotional) that there is a statistically significant difference between non-nightshift working and the night shift working teenagers ($p < 0.05$). It has also found that the level of working in the moderate and high, has average score more than the night shift working teenagers who worked at a low level and non-nightshift working teenagers (5.50 points, 5.38 points, 4.57 points and 4.92 points respectively), as shown in Fig. 1.

4. DISCUSSION

Previous studies have shown that environmental conditions can affect the physical fitness and physical activity of volunteers.[5, 19, 20] According to studies from Mitchell and the faculty, studies on environmental factors are related to death from diseases of the cardiovascular system and also related to physical activity.[20] Our study found that the heart rate from the YMCA step test in teenagers who worked at night in all levels of work intensity showed without statistically significant differences. And there was no difference in comparison between the night shift working group and non-night shift working group as well. In this study, data was collected among all volunteers in secondary schools in Pathum Thani Province, Thailand. Therefore, it may be possible that both volunteers in the group which are non-night shift working and the night shift working groups have not much different in term of environment that may result in their physical activity, exercise behavior and physical fitness. As a result, the cardiorespiratory fitness from this study was not different. However, it was found that the level of cardiorespiratory fitness was very good at a

percentage of the non-night shift working teenagers more than those in the night shift working teenagers. Cardiorespiratory fitness decreased proportionally to the intensity of work found in the group of the non-night shift working found 8 teenagers, representing 33.3%, 2 teenagers from the low level of the night shift working group, accounting for 28.6%, 1 teenager from the moderate level of the nightshift working group, accounting for 8.3%, and 6 teenagers from the high level of the night shift working group, representing 11.3 percent (Table 1), it is therefore possible that the level of the night shift working intensity among teenagers affects the cardiorespiratory fitness.

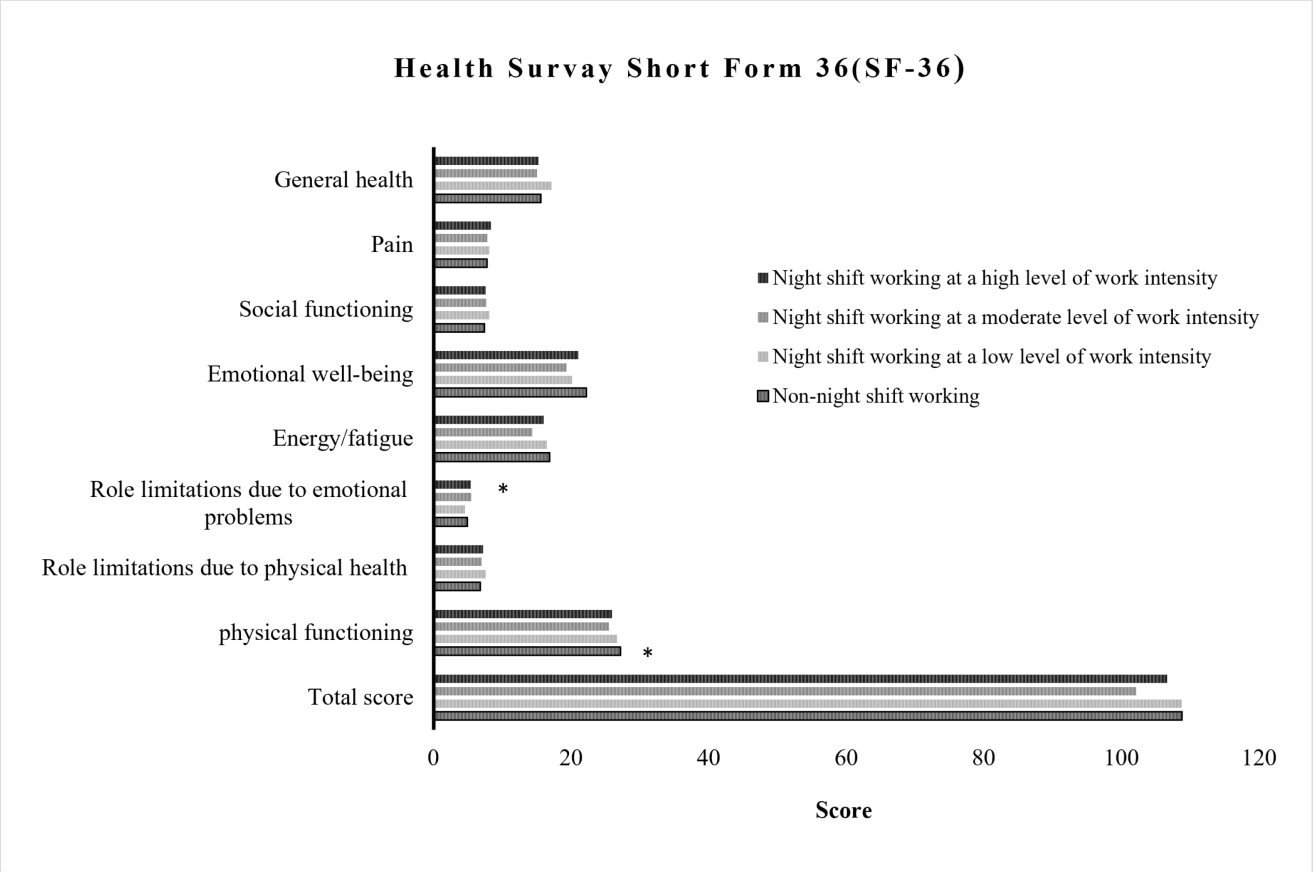

Fig. 1 The quality of life from SF-36 in the group of non-night shift working and night shift working teenagers classified by the level of work

One way ANOVA *p<0.05

From the study of Martinez-Vizcino, it investigated exercise programs in school-age children on the risk changes of heart disease and metabolic variables (cardiometabolic risk factors). The results showed that the percentage of body fat%, waist circumference and LDL levels in the blood decreased the weight of the fat free mass. Female but in males, only the waist circumference is reduced. This study concludes that exercise programs have a significant effect on changes in females more than males.[21]

The results of the study showed that school-age boys may have better adaptation to change than school-age girls, which is consistent with the results of this study. It was found that the night shift working girls had a heart rate from the YMCA step test more than those in the non-night shift

working teenagers with statistical significance at p <0.05 (Table 2) but no such change was found in the night shift working boys. Therefore, it can be explained that working at night may affect the level of cardiorespiratory physical fitness. Over and above, it may be due to the influence of hormonal changes. This is consistent with the study of Emami et al., that conducted a comparative study of balance between the early follicular phase and the ovulation phase. During ovulation, meanwhile estrogen is higher. The results showed that during ovulation will have better balance in the early stages of ovulation in accordance with previous studies found that estrogen affected muscle strength.[22]

From the above reasons, it may be concluded that working at night may influence hormonal balance in teenagers. This may result in the night shift working girls who have lower physical fitness levels in the respiratory and circulatory systems than the girls who do not work. However, the endurance and circulatory system endurance can predict the risk of cardiovascular disease.[23] From this study, it has been spotted that the level of cardiorespiratory fitness in both boys and girls were very low. Both in the group of the non-night shift working teenagers and the nightshift working teenagers (Table 1). The mean scores from the quality-of-life test in the non-night shift working teenagers and the nightshift working teenagers are not different. It is possible that both groups of subjects lived in the same area, which has same environments in each group may have similar effects on quality of life.[20] In addition, both groups of subjects are undergoing significant physical developmental changes. There is a development of muscle strength and hormonal changes in the age of strength.[5, 6, 19] may be able to adapt and do not affect the quality of life much. In the long run if there are problems affecting both the body and the mind, happening continuously, it may affect the quality of life. When analyzing each dimension of quality of life, it has been discovered that the non-night shift working boys had the average quality of life in terms of physical functioning better than the night shift working boys with statistical significance (p <0.05). However, it was found that the score in the dimension of role that is limited due to the emotional problems in the night shift working group (worked at the moderate and high level) more than the non-nightshift working group for both boys and girls with statistical significance (p <0.05).

It can be said that work can be beneficial for the management of emotional problems. In other words, working may give teenagers the opportunity to solve problems many times, which can lead to solutions to the problems that arise in the future. It affected the emotional adjustment to be more stable and cautious. In addition, many previous studies have shown that working in adolescents can benefit various values, such as developing work skills, develop behavior, developing time management for teenagers, punctuality, self-control, increase adolescent income increase work experience.[4, 24] Therefore, this may be concluded that even working at night and the intensity of working at night, do not affect the overall quality of life. Nevertheless, having the opportunity to work is still beneficial to the ability to solve problems and emotional management. However, working too hard or doing it untimely can affect the quality of life in teenagers, which can be explained by the studies of Graves and his coworkers that studied work and work levels on the score from the quality-of-life test found that the working group of students has a low quality

of life. When working levels increase, the quality-of-life values will decrease as well. But working at a lower level of working (less than 10 hours per week) will not have an effect on working students.[4] The significant difference in scores from the depression test in the night shift working teenagers and the non-night shift working teenagers in this study was not found. According to the Ornek and his coworkers, working on girls aged 15-18 years with average work hours 78.1 ± 10.7 hours per week. They noticed that 49.5% of working teenagers have mental health problems. The factors that result in the above symptoms are "no rest period between work" and "no leave, sick leave, vacation"[25] According to the data in this study, it has been obtained that the nightshift working teenagers had a rest period during work and have a day off or a vacation, as well as night shift working teenagers at night who work continuously for less than one year, that is, most work at night for 3-6 months, accounting for 85%, as shown in Table 1.

For these reasons, there may be no difference in depression scores among the night shift working and the non-night shift working teenagers. Yet, the number of teenagers with depression found in the night shift working group who worked at the moderate and the high level than the low level of the night shift working group and in the non-night shift working group (Table 1). Therefore, it should be noted and evaluated the depression of working teenagers. These working teenagers may have an increased risk of depression and have a greater effect on depression when working continuously for a long time.[25] Studies from Davidson and colleagues found that sleep affects the secretion of growth hormones which will be secreted a lot of sleep at night for the first 90 minutes and it is related to the slow wave sleep. If there is no deep sleep, it will affect the secretion of the growth hormone.[26]

A study by Lac and colleagues found out that among the people who worked at night with insufficient sleep, have more effects on cortisol secretion than normal.[27] In this study, there was no difference in the scores from the stress test between the night shift working and the non-night shift working teenagers. It is evident that low and moderate levels of stress can be found in all groups of teenagers (Table 1). This may be the result of both groups of teenagers having sleep at night and the time when going to bed differently. The result achieved has revealed that not only the night shift working teenagers were more likely to sleep late than non-night shift working teenagers which may result in stress from insufficient rest, but also that the non-night shift working teenagers have a special supplementary education rate more than the night shift working teenagers. This proved that the likelihood of stress can be found in both the night shift working and the non-night shift working teenagers. Though, it was found that the high stress found only in the night shift working teenagers worked at the high level (Table 1). According to the pointing study and the group, there was a relationship between family problems and stress in children during adolescence [28], which is consistent with depression scores. This is more common in teenagers who work at night as well. It can be said that night shift working may be at risk of developing emotional problems, including stress and depression. It was consistent with the report of the study of psychopathological variables, psychopathology, the quality of life and suicidal risk. On top of that, when there were emotional problems, it would affect behavior in a way, resulting in a low quality

of life may increase the risk of suicide in the end.[29] Therefore, it may be vigilant to help solving mental health problems that may be found in both non-working and working teenagers. Supports from family members or close ones can reduce the risk of self-harm that may arise from the innocence of children during adolescence.

Some limitation should be noted in the present study that might affect the results of the study. Firstly, number of subjects with a high level of work intensity was higher than subjects with a low level of work intensity; therefore, it might be interpreted with caution regarding the effect of night shift working on cardiorespiratory fitness. In addition, other factors that might affect in cardiovascular fitness (e.g., physical activity) or mental health problems (e.g., school problems, study problems or family relationships) were not reported. Thus, a future study should be focused on the other factors that might be related to working in children during adolescence.

5. CONCLUSION

For the teenage schoolgirls, working at night can affect the cardiorespiratory fitness. although mental health problems assessed from stress and depression found in the night shift working and the non-night shift working boys and girls. It has demonstrated that the number of teenagers with depression and high stress are found in a group of high level of work of the night shift working teenagers, which was more than any other groups. In this study, it will be useful for teenagers, parents, teachers, including employers in-joint planning to find solutions to prevent, solve and reduce problems that may affect the growth of both physically and mentally in the night shift working teenage students

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REFERENCES

1. Child labour [Internet]. [cited 2022 January 26]. Available from: https://en.wikipedia.org/wiki/Child_labour.
2. Department of Labour Protection and Welfare. National policies and plans for the elimination of child labor in the worst type of fiscal year 2009 to 2014. Ministry of Labour; 2009.
3. Department of Labour Protection and Welfare. Situation report child labor in the worst type during 2013 - 2015. Ministry of Labour; 2015.
4. Graves JM, Mackelprang JL, Barbosa-Leiker C, Miller ME, Li AY. Quality of life among working and non-working adolescents. Qual Life Res. 2017;26(1):107-20.

5. Ozdirenc M, Ozcan A, Akin F, Gelecek N. Physical fitness in rural children compared with urban children in Turkey. Pediatr Int. 2005;47(1):26-31.

6. Stalsberg R, Pedersen AV. Are differences in physical activity across socioeconomic groups associated with choice of physical activity variables to report? Int J Environ Res Public Health. 2018;15(5):1-23.

7. Sughis M, Nawrot TS, Haufroid V, Nemery B. Adverse health effects of child labor: high exposure to chromium and oxidative DNA damage in children manufacturing surgical instruments. Environ. Health Perspect. 2012;120(10):1469-74.

8. Lee C, Orazem PF. Lifetime health consequences of child labor in Brazil. Child labor and the transition between school and work. research in labor economics. 31: Emerald Group Publishing Limited; 2010. p. 99-133.

9. Bungmark W. The exercise with folk plays activity for enhance physical fitness in overweight children. Veridian E-Journal. 2018;11(1):2137-47.

10. Nakornthap A. The turning point of underprivileged children, the future of the nation. Bangkok: Quality Learning Foundation (QLF); 2014.

11. Van Kieu NT, Jung SJ, Shin SW, Jung HW. The validity of the YMCA 3-minute step test for estimating maximal oxygen uptake in healthy Korean and Vietnamese adults. J Lifestyle Med. 2020;10(1): 21–9.

12. Deepika RL, Betsy CW, David OG, Nancy FW, Michael JL, Bertha C, Hoda AC, et al. Medical outcomes study 36-item short-form survey versus gait speed as predictor of preclinical mobility disability in older women: the women's health initiative. J Am Geriatr Soc. 2018;66(4):706–13.

13. Leurmarnkul W, Meetam P. Properties testing of the retranslated SF36 (Thai Version). Thai J.Pharm.Sci. 2005;29(1-2):69-88.

14. Rujiradarporn N, Trangkasombat U. Depression in senior high school students in Bangkok Metropolis. J Psychiatr Assoc Thailand. 2013;54(4):337-46.

15 Williams. JW, Pignone M, Ramirez G. Identifying depression in primary care: a literature synthesis of case-finding instruments. Gen. Hosp. Psychiatry. 2022;24(4):225-37.

16. Paschall MJ, Flewelling RL, Russell T. Why is work intensity associated with heavy alcohol use among adolescents? J Adolesc Health. 2004;34(1):79-87.

17. Sangboonthai T, Somprasert C, Vuthiarpa S, Bunthumporn N. The correlation between perceived stress events, social support and the psychological impact of sexually assaulted women. J Psychiatr Ment Health Nurs. 2015;29(3):73-84.

18. Wongpakaran N, Wongpakaran T. The Thai version of the PSS-10: An Investigation of its psychometric properties. Biopsychosoc.Med. 2010;4:6.

19. Chung JW, Chung LM, Chen B. The impact of lifestyle on the physical fitness of primary school children. J Clin Nurs. 2009;18(7):1002-9.

20. Mitchell R, Popham F. Effect of exposure to natural environment on health inequalities: an observational population study. Lancet (London, England). 2008;372(9650):1655-60.

21. Martinez-Vizcaino V, Sanchez-Lopez M, Notario-Pacheco B, Salcedo-Aguilar F, Solera-Martinez M, Franquelo-Morales P, et al. Gender differences on effectiveness of a school-based physical activity intervention for reducing cardiometabolic risk: a cluster randomized trial. IJBNPA. 2014;11:154.

22. Emami F, Kordi Yoosefinejad A, Motealleh A. Comparison of static and dynamic balance during early follicular and ovulation phases in healthy women, using simple, clinical tests: a cross sectional study. Gynecol Endocrinol. 2019;35(3):257-60.

23. Nauman J, Nes BM, Lavie CJ, Jackson AS, Sui X, Coombes JS, et al. Prediction of cardiovascular mortality by estimated cardiorespiratory fitness independent of traditional risk factors: The HUNT Study. Mayo Clinic proceedings. 2017;92(2):218-27.

24. Lemma S. The power of relationship: A study of key working as an intervention with traumatised young people. J Soc Work Pract. 2010;24(4):409-27.

25. Ornek OK, Esin MN. Psychological health problems among adolescent workers and associated factors in Istanbul, Turkey. Saf Health Work. 2018;9(1):101-8.

26. AlDabal L, BaHammam AS. Metabolic, endocrine, and immune consequences of sleep deprivation. Open Respir Med J. 2011;5:31–43.

27. Lac G, Chamoux A. Elevated salivary cortisol levels as a result of sleep deprivation in a shift worker. Occupational medicine (Oxford, England). 2003;53(2):143-5.

28. Ponting C, Lee SS, Escovar EL, Rapp AM, Camacho A, Calderon I, et al. Family factors mediate discrimination related stress and externalizing symptoms in rural Latino adolescents. J. Adolesc. 2018;69:11-21.

29. Ati NAL, Paraswati MD, Windarwati HD. What are the risk factors and protective factors of suicidal behavior in adolescents? A systematic review. J Child Psychol Psychiatry. 2021,34(1):7-18.