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The association between knowledge and cardiovascular risk in high school students in Bali Indonesia

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ABSTRACT

Cardiovascular disease is one of the health problems that cause significant health, economic, and social burdens. Generally, cardiovascular disease starts to appear clinically at the age of 40 years and over. Currently, diabetes can appear early because of an unhealthy lifestyle since childhood. Senior high school students, the nation's next generation, are essential assets for the country. The school-age intervention is expected to increase student awareness for anticipating cardiovascular disease. This study focused on evaluating the relationship between the level of knowledge related to cardiovascular disease and the risk of cardiovascular disease in high school students. This study is an analytic observational with a cross-sectional design with purposive sampling. The instruments used in this study to measure the level of knowledge and cardiovascular risk are a closed-ended questionnaire, digital sphygmomanometer, scale, height meter, body measuring tape, and blood glucose self-test device. The total study population was 207 students from two senior high schools in Bali. Almost one-third of the subjects have high blood pressure. Nearly a quarter of the subjects are overweight-obese and have waist circumference above normal. The result showed no significant difference relationship between the level of knowledge and cardiovascular risk (P >0.05). Therefore, further education is needed to instil healthy behaviors to control cardiovascular risk factors as early as possible. In conclusion, there is no relationship between the level of knowledge on cardiovascular risk in two senior high schools in Bali.

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Keywords: high school students, level of knowledge, risk of cardiovascular disease

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INTRODUCTION

Non-Communicable Diseases (NCD) mortality has kept increasing since 2000 globally, including cardiovascular disease (CVD), cancer, chronic respiratory disease, and Diabetes Mellitus (DM). In Indonesia, NCD has contributed to 73% of 1.4 million deaths, with most cases coming from cardiovascular diseases (WHO, 2018). One of the risk factors for cardiovascular disease is overweight. Overweight and obesity cause adverse metabolic effects on blood pressure, cholesterol, triglycerides, and insulin resistance. The increasing prevalence of obesity and other cardiovascular-related diseases is exacerbated by relatively low levels of awareness and control of illness (Suhadi et al., 2015). Furthermore, overweight individuals are at high risk of suffering hypertension and DM, which are risk factors for cardiovascular disease (Patterson et al., 2002).

Hypertension starts to become a significant problem in adolescents. According to Falkner and Gidding's research in 2011, hypertension generally occurs in 3.5% of the population at developmental age. The prevalence of hypertension and pre-hypertension in obese adolescents is even greater than this percentage (Falkner & Gidding, 2011). Globally survey in the <20 years age group between 1975-2016 showed an increase in obesity of 14%. Obese and overweight in the <20 years age group risen dramatically from 4% in 1975 to 18% in 2016 (Esfahani et al., 2016; WHO, 2021). Although childhood and adolescents have a low cardiovascular risk because their physiological functions are still good, it can cause serious health problems after adulthood. Obesity can be attributed to changes in vascular and cardiac anatomy and physiology (Suhadi et al., 2015).

The other problem, many adolescents have waist circumference and blood sugar above-average values. The genetic and environmental factor influences these conditions. Waist circumference and blood sugar that are above-average values can increase cardiovascular risk in the future (Magge et al., 2017). Therefore, childhood and adolescents must be instilled a level of knowledge about cardiovascular since an early stage to prevent cardiovascular risk. Increasing the knowledge about cardiovascular can help children and teenagers adopt a healthy lifestyle (WHO, 2021).

Knowledge is a continuous information development process due to new understandings or information (Abhary et al., 2009). Implementing good knowledge possessed by adolescents can be a factor that reduces the incidence of hypertension in adults (Falkner, 2010). The statement is in line with George et al., (2014) research, which states that an increase in knowledge will impact the formation of greater awareness so that it can be one way to prevent hypertension in adolescence. The formed knowledge is also influenced by several factors, namely: education, information/mass media, social, cultural, economic, environment, experience, and age (Budiman & Riyanto, 2013). Person behavior is caused due to four main reasons: knowledge, beliefs, attitudes, and important people as references (Auliana & Fardatin, 2008).

This study aimed to evaluate the relationship between the level of knowledge and risk of cardiovascular disease in high school students. The results of this study can give an advantage to the community, especially high school students, as information to reduce the incidence of cardiovascular disease by changing lifestyles since early stage.

MATERIALS AND METHOD

Materials

This study uses a cardiovascular knowledge closed-ended questionnaire to measure the cardiovascular disease risk level of knowledge, blood pressure measurement using Omron® digital sphygmomanometer, weight scale, height meter and waist circumference, and blood sugar levels using the Gluco Dr® device. Digital sphygmomanometer, glucometer, scale, and height meter instruments have been validated before the research started. A case report form is prepared for weight, height, waist circumference, blood sugar, and blood pressure data.

Methods

This research was an observational analytic study with a cross-sectional design. The respondents were determined by purposive sampling. The inclusion criteria were students from two high schools in Bali who are willing to fill out a questionnaire, do health examinations, and sign an informed consent. The procedure has received approval from the Health Research Ethics Commission, Faculty of Medicine, Duta Wacana University (D.I.Yogyakarta, Indonesia) with 731/C.16/FK/2018.

Two hundred ten respondents followed this study, but we excluded three respondents because they did not fill in the data completely. The minimum number of samples is calculated with software from the web "the sample size calculator" (https://clincalc.com/stats/samplesize.aspx) with one study group vs. population design and the dichotomous data as the primary endpoint. The incidence population of the study parameter was 18% (Esfahani et al., 2016; WHO, 2021) and the incidence study group was 27.1% (Suhadi et al., 2020). We set α 0.05, β 0.2, power 0.8, and got a minimal sample of 153 respondents.

A questionnaire was used in this study to obtain the level of knowledge from students. The questionnaire contains statements about healthy lifestyle knowledge related to cardiovascular disease risk. The questionnaire used a closed-ended questionnaire consisting of 19 favorable and non-favorable questions. The Scoring system for favorable questions are Strongly Disagree (-2), Disagree (-1), Doubtful (0), Agree (1), and Strongly Agree (2). The scoring system for non-favorable questions are Strongly Disagree (2), Disagree (1), Indecisive (0), Agree (-1), and Strongly Agree (-2). The questionnaire was validated by conducting a trial on 30 respondents at a high school in Yogyakarta. We discard six questions because they do not meet the requirements of the correlation coefficient in the validation test. We use the remaining questions which meet the requirements with a correlation coefficient ≥ 0.30. The reliability test was made and obtained the Cronbach α value >0.6, which indicates that the questionnaire used is reliable.

The data from the questionnaire were categorized, namely the level of knowledge and cardiovascular risk factors. The data of knowledge level are categorized into good knowledge level and bad knowledge level. The assessment of good and bad knowledge levels is the sum of scores from favorable and non-favorable questions. The cut-off score is 19, assuming that participants have a good level of knowledge. If respondents can answer the questions correctly, they get a minimum of 1 point from each correct answer totaling 19.

BMI data were obtained using an equation (1), and the data is used to calculate the BMI percentile with software from the web "BMI Percentile Calculator for Child and Teen: Results on a Growth Chart (CDC, 2018b). Trained assistant does waist circumference and blood pressure measurements. Blood sugar levels measurement only done to willing respondents through a peripheral vein.

$$BMI = \frac{Weight\ (kg)}{(Height\ (m))^2} \qquad (1)$$

The normal limit values used include the waist circumference of Asian men ≤90 cm, Asian women ≤80 cm, systolic blood pressure ≤120 mmHg and diastolic blood pressure ≤80 mmHg, pulse 60-100 beat/minute, BMI 18.5–24.9, BMI percentile 5th to <85th, and random blood sugar ≤140mg/dL (ADA, 2021; AHA, 2021; CDC, 2014; WHO, 2011).

Data Analysis

The characteristics of the student, including the level of knowledge, BMI percentile, waist circumference, blood pressure, and blood sugar levels, will be conducted by descriptive analysis. The four parameters of the risk of cardiovascular disease will be grouped into two categories based on the normal value limit of each parameter (Normal and abnormal blood pressure; Controlled and uncontrolled blood glucose level; Normal–Underweight and Overweight-Obesity BMI percentile; and Normal and high waist circumference). In addition, the level of knowledge will be grouped into two

categories based on the score earned (Good and bad level of knowledge). Furthermore, Chi-Square statistic analysis is used for the withdrawal conclusion to see the relationship between the level of knowledge and the risk of cardiovascular disease in two senior high schools in Bali.

RESULT AND DISCUSSION

Respondents of this study were all senior high school students in their first and second years in Bali. Bali is one of the provinces with a high prevalence of obesity in adolescents above the Indonesian national average (Kemenkes RI, 2018). Two hundred ten respondents followed this study, but three respondents did not fill in the data completely, so the total obtained was two hundred seven respondents. Unfortunately, only one hundred and thirty-four respondents were willing to check their blood sugar from the total obtained respondent, and it does not fulfill a minimal sample.

In this study, physical measurements were carried out, which were then compared with the normal limit values of each measurement. As described in Table 1, the average physical examination (waist circumference, BMI, BMI percentile, systolic blood pressure, diastolic blood pressure, and pulse) and blood sugar showed a good profile. Our respondents show low cardiovascular risk factors due to their good physiological function in adolescence. However, if bodyweight in adolescence is not controlled properly, it can trigger obesity someday (WHO, 2021).

Table 1. Respondents Characteristics

Characteristics	Sum(n)	Mean±SD	Median (Min-Max)
Age (years)	207	15.63±0.54	16 (15-17)
Weight (kg)	207	56.32±11.49	55 (38-110)
Height (cm)	207	160.32±8.71	159.4 (140-183)
Waist circumference (cm)	207	75.71±8.08	74.5 (48-112)
Body Mass Index	207	21.87±3.72	21 (15.7-34.9)
Body Mass Index Percentile	207	57.75±27.43	60 (2-99)
Systolic blood pressure (mmHg)	207	110.3±11.07	110 (89-141)
Diastolic blood pressure (mmHg)	207	70.45±7.62	69 (53-99)
Pulse (beat/minute)	207	92.04±15.01	92 (50-129)
Blood sugar levels (mg/dL)*	134	91.88±11.7	91 (65-140)
Knowledge level (Score)	207	17.7±6.04	17 (0-33)

*Blood sugar levels measurement carried out on respondents who were willing

Table 1 shows that the pulse value entered in a good profile is 92 beat/minute, but even though the pulse is in the normal range, the pulse value is close to the upper limit of the normal value. Based on research by Hart (2015) dan Lindgren et al. (2018), the long-term impact caused when a high resting pulse value is above 80 beats/minute can trigger an increased risk of cardiovascular disease. In addition, several things can affect the resting pulse, namely age, sexual maturity, height, physical activity, and the socio-cultural level of parents are independent determinants of the resting pulse (Rabbia et al., 2002). Therefore, it is necessary to control as early as possible through controllable factors.

The average knowledge level of students is 17.7, which is still below the good threshold value of 19. According to Budiman and Riyanto (2013), age will affect a person's grasping power and mindset that form a person's level of knowledge. With increasing age, more the individual's perception and attitude will develop. This condition makes the knowledge gains will be better according to age. According to Slameto (2003), the difference in the level of knowledge in each high school teenager is also influenced by the internal factors of each individual who are different, including their physical, mental, social health, level of intelligence, attention, interests, and talents. Based on the result, many high school students still need health education related to cardiovascular risk factors. At adolescence,

the formation of behaviour is essential to prevent risk factors for cardiovascular disease (CVD) in their old age (Pyakurel et al., 2017).

Table 2. Relationship between knowledge level and cardiovascular risk

		Knowledge Level		P Value	OR (95% CI)
		Bad n (%)	Good n (%)		
Blood Pressure	Abnormal	42	24	0.187	0.668 (0.37-1.20)
	Normal	76	65		
Blood Glucose level	Uncontrolled	0	1	-**	-
	Controlled	76	59		
BMI Percentile	Overweight-Obesity	30	18	0.380	0.744 (0.38-1.44)
	Normal–Underweight	88	71		
Waist circumference	High	22	13	0.443	1.340 (0.63-2.83)
	Normal	96	76		

*P Value <0.05 indicates a significant difference between groups
** Cannot be determined

Table 2 shows the test results of the relationship between the level of knowledge and cardiovascular risk. The p-value obtained is >0.05, indicating no relationship between the level of knowledge and cardiovascular risk factors. In addition, the blood sugar test cannot be analyzed statistically related to the relationship with the level of knowledge because there were unfilled columns. Insignificant results could be due to respondents having a young age and having healthy physiological conditions, where most of the respondents had good results in measuring cardiovascular risk parameters. In addition, the knowledge possessed by adolescents will develop with age. Over time, more and more information will be obtained and assembled in such a way as to form complete knowledge and be applied in the form of behavior. The impact of the level of knowledge is useful for the long term to shape behavior towards maintaining the individual's health in the future (Budiman & Riyanto, 2013; Zaenurrohmah, 2017). Therefore, the impact of the level of knowledge is not very visible on the young respondents. Although there is no statistical relationship between the level of knowledge and cardiovascular risk in this study, the results obtained show that many high school students fall into the high-risk category.

The results show one-third of respondents have abnormal blood pressure. This condition indicates that the respondents have a greater risk of cardiovascular disease in adulthood. Abnormal blood pressure in adolescents can be caused by several factors, including family history that has been linked to increased risk, BMI percentile, increased sodium consumption, consuming high-fat foods, physical inactivity, stress, and low vegetable and fruit consumption. In addition to the above factors, increased blood pressure can also be temporary. The reason is maybe before taking blood pressure the student did not rest after physical activity, was in a pleasure or stress state, spoke at the time of measurement, held back urination, and consumed coffee containing caffeine (Anyaegbu & Dharnidharka, 2014; Monk, 2010; Riley et al., 2018).

This study also obtained results that one-fifth of respondents have problems with BMI percentile and approximately one-sixth of respondents have an abnormal waist circumference. Abnormalities in these two parameters lead to the incidence of obesity and central obesity. The increase in abnormalities in these two parameters can be caused by several factors, including education, place of residence (urban/rural), socioeconomic, fast food, physical activity, and genetics. The level of education will determine a person's ability to access health information and handle that information to have the best lifestyle. Increased risk also occurs in individuals living in rural areas because there is limited access to information and rural health facilities tend not to have available nutritionists, dieticians, or weight management experts. In addition, a high level of finance will affect the allocation of large funds for food. The type of food consumed, such as fast food, will increase the risk due to the high calories

contained in these foods. In addition, the intensity of low activity levels causes an increased risk due to the accumulation of calories from the food consumed. Genetic factors will affect the risk of obesity, where genetics can affect calorie intake and increase hunger (CDC, 2018a; Gbary et al., 2014; Rachmi et al., 2017). The impact that can be caused when these two parameters are not controlled is an increase in the incidence of cardiovascular disease.

The measurement of blood sugar levels showed that the majority of respondents had controlled blood sugar levels. These results are in line with the condition of the respondents who are adolescents with good physiological conditions. But it is necessary to do control to prevent diabetes mellitus, which is a trigger for cardiovascular disease in adulthood. This statement is in line with Noordam et al. (2011), where increased blood sugar levels can occur with increasing age. In addition, increased blood sugar levels that lead to diabetes mellitus began to be found in the age range of 24-32 years, where the factors that played a role were age and lifestyle (Nguyen et al., 2014).

Cardiovascular risk can reduce in several ways. One of them is to increase physical activity. According to D'Agostino et al. (2018), outdoor activities for 40 minutes a day in children and adolescents for one year can reduce blood pressure and obesity. In addition, awareness to behave in a healthy life have an impact on reducing cardiovascular risk. Based on the research results by Sanagawa et al. (2017), the knowledge that forms awareness in behavior, namely about limiting salt consumption, correlates with a decreased family history of hypertension. So, it is in line with the research of Yadav and Wagle (2012) that explains there is a significant relationship between the level of knowledge and behavior. Respondents with a good level of knowledge will impact the formation of good behavior. Furthermore, this reinforces that the importance of knowledge is expected as a basis for healthy behavior, namely preventing an increase in cardiovascular risk in adolescence which is expected to carry this habit with them throughout their lives. Awareness of behaving in a healthy life needs to be instilled as early as possible to apply these good habits into adulthood to reduce cardiovascular risk factors.

This study has limitations in verifying the collected questionnaire data, causing inappropriate data to affect the research. Blood pressure checks are only done on one day, which can cause bias. Furthermore, the questions on the questionnaire still do not describe the real conditions that may cause the respondents results to be biased. The number of respondents who are willing to have their blood sugar measured voluntarily does not meet the minimum sample size requirements, which can cause the results obtained to be less representative of the population studied. In addition, there are many confounding factors to knowledge and physical assessments that should be identified (including health behaviors, individual health knowledge, social media effect, and family background).

CONCLUSION

Knowledge level has no relationship with cardiovascular risk in two senior high schools in Bali. In addition, half of the respondents have high cardiovascular risk factors, so further education is needed to instill healthy living behaviors to control these risk factors as early as possible.

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