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Associations of Chronotype, Daily Intake of Fat, Fiber, Magnesium, and Potassium with Blood Pressure among Adolescents

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A B S T R A C T

Circadian rhythm and daily intake of fat, fiber, and micronutrients have a different relationship to blood pressure. This study analyzed the relationship of chronotype, daily intake of fat, fiber, magnesium, and potassium with blood pressure in adolescents. One hundred and forty-three students from several schools in Kerinci Regency, Jambi Province participated in this cross-sectional study. Chronotype data and daily intake were obtained using a questionnaire. Chronotype was analyzed using chi-square while daily intake of fat, fiber, magnesium, and potassium were analyzed using rank spearman. The relationship variables were further analyzed using multiple linear regression. A total of 34.4% of adolescents were found to have stage 1 and 2 hypertension. In bivariate analyzed, chronotype was significantly related to systolic (p= 0.001 OR=3.68) and diastolic blood pressure (p=0.01 OR=3.03), while daily intake of fat was significantly related only to systolic blood pressure (p= 0.000 r=0.306). daily intake of fiber, magnesium, and potassium were not related to blood pressure. In multivariate analyzed, chronotype (p= 0,015 B= 5,53), daily intake of fat (p= 0,00 B= 0,31), and fiber (p= 0,041 B= -0,66) were significantly related to systolic blood. Daily intake of fat had the greatest influence on systolic blood pressure (Standardized Coefficient = 0.358). while on diastolic blood pressure, only chronotype (p= 0.013 B= 3,51) and daily intake of fat (p= 0,027 B= 0,1) were significantly related. Chronotype had the greatest influence on diastolic blood pressure (Standardized Coefficient = 0.211).

Kata kunci:

Chronotype
Lemak
Serat
Magnesium
Kalium
tekanan darah

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A B S T R A K

Irama sirkadian dan kebiasaan asupan lemak, serat dan mikronutrien memiliki hubungan yang berbeda terhadap tekanan darah. Penelitian ini menganalisis hubungan chronotype, kebiasaan asupan lemak, serat, magnesium, dan kalium dengan tekanan darah remaja. Seratus empat puluh tiga siswa dari bebearapa sekolah di Kabupaten Kerinci, Provinsi Jambi berpartisipasi dalam penelitian cross-sectional ini. Data cronotype dan kebiasaan asupan didapat dengan menggunakan kuesioner. Chronotype dianalisis menggunakan uji chi square sementara kebiasaan asupan lemak, serat, magnesium dan kalium dianalisis menggunakan rank spearman. Hubungan antar variabel lebih jauh dianalisis menggunakan regresi linier berganda. Total 34,4% remaja mengalami hipertensi stage 1 dan 2. Pada analisis bivariat, chronotype berhubungan signifikan terhadap tekanan darah sistolik (p= 0.001 OR=3.68) dan diastolik (p=0.01 OR=3.03) sementara kebiasaan asupan lemak berhubungan signifikan hanya dengan tekanan darah sistolik (p= 0.000 r=0.306). Kebiasaan asupan serat, magnesium dan kalium tidak berhubungan dengan tekanan darah. Pada

analisis multivariat, chronotype (p= 0,015 B= 5,53), kebiasaan asupan lemak (p= 0,00 B= 0,31), dan serat (p= 0,041 B= -0,66) berhubungan secara signifikan terhadap tekanan darah sistolik. Kebiasaan asupan lemak memiliki pengaruh terbesar terhadap tekanan darah sistolik (Standardized Coefficient = 0.358). Sementara pada tekanan darah diastolik, hanya chronotype (p= 0.013 B= 3,51) dan kebiasaan asupan lemak (p= 0,027 B= 0,1) yang berhubungan secara signifikan. Chronotype memiliki pengaruh terbesar terhadap tekanan darah diastolik (Standardized Coefficient = 0.211).

INTRODUCTION

According to *the National Health and Nutrition Examination Survey* (NHANES), one in 10 children aged 8-17 years suffers from prehypertension and hypertension (Kit *et al.*, 2015). Based on data from *The Brazilian Study of Cardiovascular Risks in Adolescents,* the prevalence rate of hypertension in adolescents aged 12-17 years is 9.6% (Bloch *et al.*, 2016). In Indonesia, the incidence of hypertension in 2013 at the age of 15-17 years nationally was 5.3% (6.0% for men and 4.7% for women) (Kementerian Kesehatan Indonesia, 2013). Hypertension is the highest disease case in Kerinci Regency, Jambi province. The prevalence of hypertension in Jambi province in 2019 was 18.5% and in Kerinci regency in 2018 it was 37.74%. Hypertension can lead to complications, therefore periodic early detection is needed, namely by routine blood pressure checks (Dinas Kesehatan Jambi, 2019; Kementerian Kesehatan Republik Indonesia, 2018).

Hypertension can be affected by various factors, one of which is circadian rhythm. Circadian rhythm is a 24-hour endogenous physiological rhythm in living things that regulates sleep schedules and affects physiological and behavioral functions (Ekayanti *et al.*, 2019). *Chronotype* is a manifestation of a person's circadian rhythm. Physiological disturbances by circadian rhythms with evening *chronotype* are supported by the study of Knutson & Schantz (2018) which showed that *definite evening chronotypes* have an increased chance of suffering from comorbidities (OR CVD 1.07, psychological 1.94, renal 1.10, neurological 1, 25) and mortality (OR 1.10) compared to the *definite morning.*

Blood pressure can also be affected by the daily intake of fat. Excessive fat intake can increase blood cholesterol. The cholesterol will stick on the walls of blood vessels which over time can make plaque and block blood vessels, it is called atherosclerosis. Atherosclerosis will narrow blood flow so that the blood volume and blood pressure will increase, leading to hypertension (Ramadhani *et al.,* 2017). This is in line with research conducted by Kartika *et al.,* (2016) which found a significant correlation between fat intake (p=0,009, OR:3,839, 95% CI: 1,357–10,861) and hypertension.

Inadequate daily intake of fiber can also affect blood pressure. Inadequate daily intake o fiber intake will reduce the excretion of fat and bile acids through feces, reabsorbingo the bloodstream (Shanti *et al.,* 2017). In addition, fiber intake can reduce sodium absorption so that preventing a volume increase in blood pressure (Kementerian Kesehatan Republik Indonesia, 2019; Sari *et al.*, 2016). This is in line with research by Ramadhani *et al.* (2017) which states that low fiber intake (< 20 g/day) can increase systolic (p = 0.001) and diastolic (p = 0.008) blood pressure.

Micronutrients can affect blood pressure, some of which are magnesium and potassium. Magnesium is an important nutrient for heart health. The main role of magnesium is to relax the heart muscle. According to *the US Department of Health and Human Services*, low blood magnesium levels are often found in people with hypertension. This is in line with the research conducted by Putri and Kartini (2014) which found a relationship between low magnesium intake (good if ≥80%) and the incidence of hypertension with p-value = 0.022.

Potassium can affect blood pressure. A high intake of potassium can reduce blood pressure. The intake of potassium can reduce systolic and diastolic blood pressure due to a decrease in vascular resistance. Vascular resistance is caused by the dilatation of blood vessels and an increase in the loss of water and Na from the body, resulting from the activity of the sodium and potassium pumps (Tulungnen *et al.,* 2017). This is in line with the research conducted by Kusumastuty *et al.* (2016) showed a relationship between potassium intake (adequate if >2000 mg/day) with systolic and diastolic blood pressure with p < 0.001. which can be interpreted as the higher the intake of potassium, the lower the blood pressure.

METHODS

This analytical observational study with a *cross-sectional* design was conducted from November to December 2021 in adolescents, who studied in senior high schools in Kerinci Regency, Jambi Province. The sample size was calculated using the estimated proportion formula:

$$n = \frac{z^2 p(1-p)N}{d^2 (N-1) + z^2 p (1-p)}$$

description:

n = number of samples
N = number of population
Z = degree of trust 95% with value 1,96 (significant level 5%)
p = prevalence, if unknown then use 50% or 0,5 (hypertension in Kerinci Regency was 37,74%)
d= the degree of deviation from the desired population: 10% (0,10), 5% (0,05)

The calculation got a minimum of 105 subjects (Masturoh & Anggita, 2018). Research subjects were selected

using *cluster random sampling* from all senior high schools in the Kerinci Regency. We got 7 schools out of 14 public senior high schools. Research subjects were eligible to participate in this study if studied in X-XII class and aged ≤18 years old. Selected research subjects were excluded if drinking alcohol, smoking, having ≥ 20 stress scores, and drinking coffee > 1 glass/day. The Research Ethics Committee has approved the protocol of this study, Faculty of Medicine of Universitas Sebelas Maret Surakarta with protocol number ID 01/02/10/108.

Data of basic characteristics among selected adolescents were collected using an open questionary and *chronotype* data were collected using the Morningness Eveningness Questionnaire Self-Assessment (MEQ-SA) (Yula, 2021), which were then classified as morning (score >50) and evening (score ≤50). Daily intake of fat, fiber, magnesium, and potassium were taken using the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) (the standard form of SQ-FFQ), which was then classified as

1. Inadequate fat (<80% AKG), fiber (<25 g/day), magnesium (male <250 mg/day and female <220 mg/day), and potassium (<4700 mg/day)
2. adequate fat (80-110% AKG), fiber (≥25 g/day), magnesium (male ≥250 mg/day and female ≥ 220 mg/day and potassium: ≥4700 mg)
3. excessive fat (>110% AKG).

The Perceived Stress Scale (PSS-10) (Indira, 2016) determined stress scores among selected adolescents. A stress score ≥20 was excluded from this study.

Blood pressure data were measured using a sphygmomanometer (Onemed, made in Indonesia) and were classified as normal (<120 mmHg for systolic and <80 mmHg for diastolic), prehypertension (120-129 mmHg for systolic and <80 mmHg for diastolic), stage 1 hypertension (130-139 mmHg for systolic and 80-89 mmHg for diastolic) and stage 2 hypertension (≥140 mmHg for systolic and 90 mmHg for diastolic). Before the research began, the subjects were asked to fill out the informed consent as they approved participating in this study.

All collected data were analyzed using the IBM Statistics 25 version. Categorical data were presented as frequency, and percentage, while numerical data were presented as mean ± standard deviation. The *chi-square* was used to analyze the relationship between *chronotype* and systolic and diastolic blood pressure. Because the numerical data were abnormal distribution, The *rank spearman* test was used to analyze the relationship between daily intake of fat, fiber, magnesium, and potassium with systolic and diastolic blood pressure. The significant relationships of individual variables were then further analyzed using the *multiple linear regression* test with a p-value <0.05, considered as a significant relationship.

RESULTS AND DISCUSSION

RESULTS

Characteristics of Research Subjects

Based on table 1 shows the characteristic of the subjects. The result showed that the majority of the subjects were *morning type* with 90 subjects (62,9%), the majority of the subjects were fat adequate with 65 subjects (45,5%), the majority of the subjects were an inadequate daily intake of fiber with 108 subjects (75,5%), the majority of the subjects were an adequate daily intake of magnesium with 91 subjects (63,6%), the majority of the subjects were inadequate daily intake of potassium with 122 subjects (85,3%), the majority of the subjects were normal blood pressure with 48 subjects (33,6%), while the minority of subjects were stage 2 hypertension with 23 subjects (16.1%).

Table 1.
Characteristics of Research Subjects

Variable	Frequency[¥]	Percentage %[¥]	X̄ ± SD
Dichotomy *chronotype*			
- Morning (score >50)	90	62.9	-
- Evening (score ≤50)	53	37.1	
Daily intake of fat			
- Inadequate (<80% AKG)	62	43,4	63.22 ± 15.62
- Adequate (80-110% AKG)	65	45,5	
- Excessive (>110% AKG)	16	11,2	
Daily intake of fiber			
- Inadequate (<25 g/day)	108	75.5	13.48 ± 8.54
- Adequate (≥25 g/day)	35	24.5	
Daily intake of magnesium			
- Inadequate (ML < 250 mg/day or FM <220 mg/day)	52	36.4	301.54 ± 110.63
- Adequate (ML 250 mg/day or FM 220 mg/day)	91	63.6	
Daily intake of potassium			
- Inadequate (<4700 mg/day)	122	85.3	2501.23 ± 1209.61
- Adequate (≥4700 mg/day)	21	14.7	
Blood pressure			
- Normal BP (≤120/80 mmHg)	48	33.6	Systolic : 120.91 ± 13.88
- Prehypertension (120–129/<80 mmHg)	46	32.2	Diastolic : 70.84 ± 8.09
- S1 hypertension (130–139/80–89 mmHg)	26	18.2	
- S2 hypertension (≥140/90 mmHg)	23	16.1	

[¥]Parts of this table are in accordance with and with permission from our previous study (Ridhoka *et al.,* 2022)

Relationship between Independent Variable and Dependent Systolic Blood Pressure

Based on table 2 the information that can be obtained are only the daily intake of fat that had a significant relationship with systolic blood pressure. r=0.306 on daily fat intake means a daily fat intake had a weak correlation with systolic blood pressure. The daily fiber, magnesium, and potassium intake had a very weak negative correlation and no significant relationship with systolic blood pressure (p>0.05).

Based on table 3 the information that can be obtained are *chronotype* had a significant relationship with systolic blood pressure. OR value of 3.6 on *chronotype* means adolescents with *evening chronotypes* are 3.6 times more likely to have hypertension (stage 1 or 2).

Relationship between Independent Variable and Dependent Diastolic Blood Pressure

Based on table 4 the information that can be obtained are there were no significant relationship between daily intake of fat, fiber, magnesium, and potassium with diastolic blood pressure. The daily intake of fat (r=0.094) had a very weak correlation with diastolic blood pressure, while the daily intake of fiber, magnesium, and potassium had a very weak negative correlation with diastolic blood pressure.

Based on table 5 the information that can be obtained are *chronotype* had a significant effect on diastolic blood pressure. OR value of 3.03 on *chronotype* means adolescents with *evening chronotypes* have 3.03 times more likely to have hypertension (stage 1 or 2)

Table 2.
Relationship between Independent variable with Systolic Blood Pressure Using Rank Spearman

variable	r	description	*p-value*
Daily intake of fat	0.306	Weak correlation	0.000
Daily intake of fiber	-0.117	Very weak negative correlation	0.163
Daily intake of magnesium	-0.128	Very weak negative correlation	0.129
Daily intake of potassium	-0.148	Very weak negative correlation	0.077

Table 3.
Relationship between Chronotype and Systolic Blood Pressure Using Chi-Square

Independent Variable	Systolic Blood Pressure		OR	95% CI		*p-value*
	No hypertension	Hypertension		*Lower*	*upper*	
chronotype						
- *Morning type* (*score* >50)	69	21	3.68	1.778	7.618	0.001
- *Evening type* (*score* ≤50)	25	28				

Table 4.
Relationship between Independent variable with Diastolic Blood Pressure Using Rank Spearman

variable	r	description	*p-value*
Daily intake of fat	0,094	Very weak correlation	0,265
Daily intake of fiber	-0.019	Very weak negative correlation	0.825
Daily intake of magnesium	-0.047	Very weak negative correlation	0.573
Daily intake of potassium	-0.048	Very weak negative correlation	0.573

Table 5.
Relationship between Chronotype and Diastolic Blood Pressure Using Chi Square

Independent Variable	Diastolic Blood Pressure		OR	95% CI		*p-value*
	No hypertension	Hypertension		*Lower*	*upper*	
chronotype						
- *Morning type* (*score* >50)	76	14	3.034	1.363	6.751	0.01
- *Evening type* (*score* ≤50)	34	19				

Simultaneous Relationship of Independent Variables with Systolic Blood Pressure

Based on table 6 the information that can be obtained are *chronotype* and daily intake of fat had a significant relationship with systolic blood pressure (p<0.05). daily intake of fat had the greatest influence among other variables (***Standardized Coefficient*** = 0.358), Every 1 g increase in fat intake raises systolic blood pressure by 0.318.

Simultaneous Relationship of Independent Variables with Diastolic Blood Pressure

Based on table 7 the information that can be obtained are *chronotype* and daily intake of fat had a significant relationship with diastolic blood pressure (p <0.05). *chronotype* had the greatest influence among other variables (***Standardized Coefficient*** = 0.211).

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Table 6.
Simultaneous Relationship between Independent Variables and Systolic Blood Pressure

Variable	*Unstandardized Coefficient*		*Standardized Coefficient*	t	*P value*
	B	Std. Error	Beta		
(constant)	95.387	5.978		15.956	0.000
Chronotype	5.535	2.237	0.193	2.474	0.015
Daily intake of fat	0.318	0.073	0.358	4.360	0.000
Daily intake of fiber	-0.666	0.322	-0.409	-2.066	0.041
Daily intake of magnesium	-0.007	0.028	-0.053	-0.237	0.813
Daily intake of potassium	0.004	0.003	0.307	1.352	0.179
R Square	0.213				
F	7.436				
Sig. F	0.000				

Table 7.
Simultaneous Relationship between Independent Variables and Diastolic Blood Pressure

Variable	*Unstandardized Coefficient*		*Standardized Coefficient*	t	*P value*
	B	Std. Error	Beta		
(constant)	59.736	3.725		16.037	0.000
Chronotype	3.519	1.394	0.211	2.524	0.013
Daily intake of fat	0.102	0.045	0.197	2.239	0.027
Daily intake of fiber	-0.116	0.201	-0.122	-0.578	0.564
Daily intake of magnesium	0.002	0.017	0.033	0.138	0.890
Daily intake of potassium	0.000	0.002	0.041	0.168	0.867
R Square	0.101				
F	3.074				
Sig. F	0.012				

DISCUSSION

The relationship between *chronotype* and blood pressure

The number of subjects who are not morning type or tended to be morning type (*intermediate - definitely evening type)* are 87 people or 60.8%. Based on the results of the bivariate analysis using the *chi-square*, the OR value was 3.6 (95% CI 1.778-7.618), which means the *evening chronotype* has a risk of 3.6 times more likely to have hypertension (stages 1 and 2). In addition, the p-value of this analysis is 0.001, this value indicates that there is a significant relationship between *chronotype* and blood pressure (p <0.05). Another study conducted by Muscogiuri *et al.,* (2021) showed that the *definite evening chronotype* has an increased chance of suffering from CVD Odds Ratio (OR) = 5.89 95% CI 1.14-30.60; *p* = 0.035, although it does not show a specific *chronotype* to blood pressure, hypertension is already a CVD.

Circadian rhythm is a 24-hour endogenous physiological rhythm in living things that regulates sleep schedules and affects physiological and behavioral functions. *Chronotype* is a manifestation of the circadian rhythm. *Evening chronotype* can shift the circadian rhythm by 2-3 hours disrupting natural physiological processes. In humans, the SCN (suprachiasmatic nucleus) controls the circadian rhythm. The suprachiasmatic nucleus regulates molecular and cellular functions that can affect blood pressure, respiration, pulse, sleep time, body temperature, and other body metabolism (Ekayanti *et al*, 2019; Almoosawi, 2019).

The relationship between daily intake of fat and blood pressure

The number of subjects who are excessive fat intake are 16 people (11,2%). Based on the results of bivariate analysis using the rank spearman test, the p-value of this analysis was 0,00 for systolic and 0,265 for diastolic, this value indicates that there is a significant relationship between daily intake of fat and systolic blood pressure (p <0,05) but no significant for diastolic blood pressure (p >0,05). The r value 0,306 (systolic and 0,094 (diastolic) on daily fat intake means that daily fat intake has a weak correlation on systolic blood pressure and a very weak correlation on diastolic blood pressure. This research is in line with research conducted by Ramadhani *et al.,* (2017) that get result fat intake has a significant relationship with systolic (p= 0,000) and diastolic (p= 0,004) blood pressure.

Excessive fat intake can lead to hypertension due to fat intake can increase cholesterol in blood vessels that can stick on walls of blood vessels which can make plaque and block blood vessels therefore blood pressure will be an increase (Hasiando *et al*., 2018)

The relationship between daily intake of fiber and blood pressure

The number of subjects who have an inadequate daily intake of fiber are 108 people (75.5%). Based on the results of the bivariate analysis using the *Spearman rank*, the p-value from this analysis was 0.163 for systolic and 0.825 for diastolic, this value indicates that there is no significant relationship between daily intake of fiber and blood pressure (p > 0.05). The r values of -0.117 (systolic) and -0.019 (diastolic) on daily fiber intake mean that daily fiber intake has a very weak negative correlation to blood pressure. This study is in line with the research conducted by Kholifah *et al.,* (2017) which stated that there was a negative relationship between fiber intake with systolic blood pressure (p = 0.001), and there was no significant relationship between fiber intake with diastolic blood

pressure (p = 0.374). In theory, fiber intake has a relationship with blood pressure.

Adequate fiber intake can lower the lipid profile to maintain normal blood pressure, fiber can increase intestinal viscosity which can reduce bile acid absorption and increase cholesterol catabolism. Increased cholesterol catabolism causes a decrease in total cholesterol and LDL-cholesterol which can reduce the incidence of cardiovascular disease. High cholesterol disrupts the work of the endothelial layer which causes a decrease in the function of vasodilation of blood vessels induced by Na monoxide. In addition, high cholesterol can also cause atherosclerosis which causes the thickening of the walls of the arteries which can also increase blood pressure (Pal *et al.,* 2012; Arifani *et al.,* 2019).

Relationship between daily intake of magnesium and blood pressure

The number of subjects who have an inadequate daily intake of magnesium are 52 people (36.4%). Based on the results of the bivariate analysis using the *Spearman rank*, the p-value from this analysis was 0.129 for systolic and 0.573 for diastolic, this value indicates that there is no significant relationship between daily intake of magnesium and blood pressure (p > 0.05). The r values of -0.128 (systolic) and -0.047 (diastolic) on the daily intake of magnesium mean that daily intake of magnesium has a very weak negative relationship to blood pressure. This study is in line with research conducted by Cahyahati *et al.,* (2018) which stated that there was no relationship between magnesium intake and systolic (p = 0.173) and diastolic (p = 0.397) blood pressure.

This study found that magnesium had no relationship with blood pressure. However, in theory, magnesium has a role in lowering blood pressure. magnesium inhibits calcium from entering the extracellular space thereby preventing vasoconstriction of blood vessels causing vasodilation. In line with that, magnesium is considered good for heart health because it can relax the heart muscle (Zhang, 2016; Budiasih, 2009).

The relationship between daily intake of potassium and blood pressure

The number of subjects who have an inadequate daily intake of potassium are 122 people (85.3%). Based on the results of the bivariate analysis using the *Spearman rank*, the p-value of this analysis is 0.077 for systolic and 0.573 for diastolic, this value indicates that there is no significant relationship between daily intake of potassium and blood pressure (p > 0.05). The r values of -0.148 (systolic) and -0.048 (diastolic) on daily intake of potassium mean that daily intake of potassium has a very weak relationship with blood pressure. This study is in line with the research conducted by Kautsar *et al.* (2016) showed no significant relationship between potassium intake and blood pressure with p = 0.758. In theory, potassium intake has a relationship with blood pressure.

Potassium is considered to lower blood pressure. Potassium can reduce vascular resistance, potassium decreases intravascular volume through decreased sodium reabsorption in urine. Decreased sodium reabsorption will cause a decrease in the sodium levels in the blood vessels thereby preventing an increase in blood pressure by the nature of sodium which can cause water retention in the blood vessels. (Weaver, 2013; Tulungnen *et al.,* 2017). In addition, potassium can attract extracellular fluid into the intracellular so that there is a decrease in extracellular fluid volume, this can cause a decrease in blood pressure (Atun *et al.,* 2014).

The relationship of independent variables (*chronotype,* daily intake of fat, fiber, magnesium, and potassium) with blood pressure

The results of multivariate analysis get the highest score of *Standardized Coefficient* is the daily intake of fat variable with a score of 0.358 on systolic blood pressure and *chronotype* variable with a score of 0,211 on diastolic blood pressure, this means that the daily intake of fat variable was the variable that had the most influence on systolic blood pressure and *chronotype* on diastolic blood pressure when compared to other variables simultaneously. The B value of daily intake of fat in this multivariate analysis was 0.318, which means that every 1 g increase in fat intake raises blood pressure by 0.318 mmHg. In addition, the *chronotype* variable was also significantly related to systolic blood pressure with a p-value of 0.015. The value of the *Standardized Coefficient of chronotype* was the second highest value after the daily intake of fat with a value of 0.193. *Chronotype* (p= 0.015 on systolic and p=0,013 on diastolic) and daily intake of fat (p= 0.001 on systolic and 0,027 on diastolic) were significantly related to blood pressure.

Excessive fat intake causes an increase in cholesterol deposits in the blood. This cholesterol deposit will accumulate in the walls of blood vessels and will become plaque that causes blockages on blood flow. This blockage causes reduced blood vessel elasticity therefore the volume and blood pressure will increase. This mecanism can lead to hypertension (Kartika *et al.,* 2016)

The evening chronotype will shift the circadian rhythm by 2-3 hours. The resulting misalignment between wake-sleep, light-dark, and fast-eating cycles will further disrupt natural physiological processes. In humans, the SCN (suprachiasmatic nucleus) controls the circadian rhythm. The suprachiasmatic nucleus regulates molecular and cellular functions that can affect blood pressure, respiration, pulse, sleep time, body temperature, and other body metabolism. Disruption of the suprachiasmatic nucleus will disrupt physiological processes in the body (Ekayanti *et al*, 2019; Almoosawi, 2019).

CONCLUSIONS AND SUGGESTION

Chronotype and fat intake have a relationship with the blood pressure but fiber, magnesium, and potassium have no relationship with blood pressure among adolescents in Kerinci regency, Jambi province.

Suggestion for further research using *path* or *SAM* analysis is necessary for figuring out which variable has a direct or indirect relationship to blood pressure.

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