

# Role of external ventricular drainage in spontaneous intraventricular haemorrhage patients in cileungsi district hospital

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## Abstrak

**Latar Belakang:** Perdarahan intraventrikel otak (intraventricular haemorrhage=IVH) memperburuk prognosis pada perdarahan intraserebri (intracerebral haematoma=ICH). Prosedur drainage cairan serebrospinal dari ventrikel otak (external ventricle drainage=EVD) bertujuan menurunkan tekanan intrakranial yang tinggi dikarenakan progresivitas IVH. Meskipun demikian, EVD merupakan prosedur pilihan karena terbukti tidak selalu efektif. Penelitian ini memperlihatkan faktor yang mempengaruhi keluaran pada pasien perdarahan intraventrikel dan apakah EVD memperbaiki keluaran pada pasien tersebut.

**Metode:** Penelitian potong-lintang retrospektif yang mengikutsertakan pasien IVH dan ICH yang berekstensi IVH (ICH-IVH) dengan EVD dan tidak di RSUD Cileungsi pada Januari sampai Desember 2018. Perbandingan antara grup EVD dan tidak berdasarkan jenis kelamin, umur, pulse pressure, Glasgow Coma Scale (GCS), jumlah perdarahan, skor volume perdarahan di ventrikel lateral, ketiga dan keempat pada CT scan, Charlson Comorbid Index (CCI) dan modified Rankin Scale (mRS). Untuk mengetahui faktor yang berperan dalam perbaikan keluaran dari pasien dengan EVD dilakukan analisis Spearman Correlation test (STATA 15).

**Hasil:** 100 pasien datang dengan diagnosis ICH spontan, 5 pasien IVH, dan 16 pasien ICH-IVH. Perdarahan di ventrikel empat merupakan pembeda yang signifikan antara pasien yang mendapatkan EVD atau tidak pada kelompok ICH-IVH ( $p=0,035$ ). Skor GCS ( $p=0,034$ ) berhubungan signifikan dengan prognosis ICH-IVH pasien dengan koefisien korelasi 0,671. EVD tidak memperbaiki keluaran dari IVH pasien atau ICH-IVH pasien.

**Kesimpulan:** GCS yang tinggi berkorelasi dengan prognosis baik pada grup ICH-IVH. Indikasi EVD pada adanya darah di ventrikel empat. EVD tidak memperbaiki keluaran pasien ICH-IVH spontan atau pasien IVH spontan tetapi sebaiknya dilakukan karena kemungkinan progresivitas menjadi hidrosefalus yang tipe penyumbatan yang dapat berakhir kematian. (*Health Science Journal of Indonesia 2020;11(1):1-8*)

**Kata kunci:** prognosis, IVH, ICH, EVD, RSUD Cileungsi

## Abstract

**Background:** Intraventricular haemorrhage (IVH) worsen the prognosis of Intracerebral hematoma (ICH). External Ventricular Drain (EVD) is inserted to reduce intracranial pressure that resulted from the progression of IVH. However, EVD is still an optional procedure because it is not always proven effective. This study was aimed to demonstrate prognostic factors of IVH and whether EVD insertion might improve the outcome.

**Methods:** This cross-sectional retrospective study included IVH patients and concomitant ICH-IVH that required or not EVD in Cileungsi Hospital from January to December 2018. We made comparisons between EVD insertion group and non-EVD group based on sex, age, pulse pressure, Glasgow Coma Scale (GCS), bleeding volume, score of bleeding volume in ventricle lateral, third and fourth based on CT scan, Charlson Comorbid Index (CCI) and modified Rankin Scale (mRS). To determine factors contributing to the good prognosis of EVD, Spearman Correlation test was used with STATA 15 software.

**Results:** 100 patients were diagnosed with ICH, five patients IVH, 16 patients ICH and IVH. Blood in the fourth ventricle made a significant difference between EVD and non-EVD groups in the concomitant ICH-IVH group ( $p=0.035$ ). GCS score ( $p=0.034$ ) correlated significantly with the prognosis of concomitant ICH-IVH patients that had EVD insertion with correlation coefficient 0.671. EVD did not improve the outcome in IVH patients nor patients with ICH-IVH.

**Conclusion:** EVD did not improve the prognosis of spontaneous concomitant ICH-IVH or spontaneous IVH patients, but it still needs to be inserted in case of developing obstructive hydrocephalus that might be lethal. (*Health Science Journal of Indonesia 2020;11(1):1-8*)

**Keywords:** prognosis, IVH, ICH, EVD, Cileungsi Hospital

Intraventricular haemorrhage (IVH), a collection of blood in the ventricular system, occurs in up to 45% of patients as an extension of spontaneous intracranial hematoma (ICH) or primary IVH, which the bleeding source in the ventricle chamber.<sup>1,2</sup> It is correlated with lower GCS and as a predictor of poor outcome.<sup>3</sup> In animal models such as canine and porcine IVH models, the increased amount of blood clot in the ventricle, the likelihood death of animals.<sup>4</sup> The same pathological process happened when blood clots expose to the ventricles leads to a decrease of cerebrospinal fluid (CSF) flow and later, inflammation, fibrosis, and hydrocephalus happened at the tissue level.<sup>5</sup> ICH accompanying IVH in a patient is predicted to reach a mortality rate of 50%-80%. Isolated or primary IVH patients are twice more likely to die, compared to a non-IVH group based on the modified Rankin Scale (mRS) when discharged from hospitals.<sup>6</sup>

Placement of ventricular catheter is increased nowadays for monitoring of intracranial pressure (ICP) and also as an adjunct to drainage CSF in acute hydrocephalus.<sup>7</sup> However, EVD or ventriculostomy or ventricular drain has its disadvantages; mechanical complications such as dislodgement and blockade are common findings.<sup>8</sup> These complications result in ventriculitis and meningitis that increase morbidity, hospital costs and are also difficult to treat.<sup>7</sup>

Even though many papers indicate the benefits of EVD in reducing intracranial pressure, this procedure is not adopted universally. The reasons behind this fact because several studies showed that the benefits are not seen.<sup>9,10</sup> Some authors have opinions that it needs to determine the first benefits of EVD such as control high ICP, reduce ventricular dilatation, or drainage the blood clot from the ventricular system. Nevertheless, some agreed that EVD should be done; otherwise, the prognosis of the patients might have been worst.<sup>2</sup> EVD is indicated for patients with massive intraventricular haemorrhage, hydrocephalus, or elevated ICP.<sup>11</sup>

Based on the uncertainty of the benefits of EVD in IVH patients, this study was done to evaluate whether EVD insertion may improve the outcome and demonstrate factors influencing the prognosis of IVH patients. The incidence of spontaneous IVH patients was low, as shown by Arboix,<sup>12</sup> primary intraventricular haemorrhage is accounted for 0.31% of all cases of stroke and 3.3% of intracerebral hemorrhages. Different clinical series of ICH showed the prevalence of primary IVH varied greatly from

2% in the series of Hameed<sup>13</sup> to 7% in the series of Ara.<sup>14</sup> There was a study that reports of 551 and only 15 of them were diagnosed with primary IVH (2.7%).<sup>15</sup> Due to the small number of IVH cases, this study included concomitant ICH cases that extend with IVH. This paper aims to evaluate the role of EVD in primary IVH and concomitant ICH cases that extend with IVH.

## METHODS

All patients diagnosed with ICH (ICD-9 code 431) in Cileungsi Hospital, Bogor Regency, West Java Province, Indonesia, from January to December 2018 were included as samples of the study. This hospital was a referral hospital in Bogor Regency and with a growing population of 5,131,798 people in 2014. This hospital is equipped with a comprehensive stroke unit, and it is seeing almost 500 stroke patients in a year.<sup>16</sup> This hospital was chosen because one neurosurgeon works and EVD was the standard of care to manage spontaneous IVH patients. Exclusion criteria were patients having craniotomy procedures, subarachnoid haemorrhage patients, traumatic ICH patients, ICH due to tumor or aneurysms, and patients with coagulation disorders. Independent variables were age, sex, pulse pressure, GCS scores, bleeding volume, scores of bleeding volume in lateral ventricles, third ventricle and fourth ventricle based on CT scan, and Charlson Comorbid Index scores (CCI). We divided each lateral ventricle with a score of 0 (no blood or a small amount of layering), 1 (up to one third filled with blood), 2 (one to two-thirds filled with blood), or 3 (mostly or completely filled with blood). The third and fourth ventricles scored 0 for no blood or 1 if they were partially or entirely filled with blood.<sup>17</sup> The dependent variable was the *modified Rankin Score* (mRS). The two groups: IVH patients; ICH-IVH patients, were divided based on having EVD procedures or not. The independent variables were categorized based on mRS to find out what factors contribute to the good prognosis of EVD patients. To assess the relationship between each independent variable with mRS, Chi Square, Fisher's exact and Spearman correlation tests were utilized using STATA software version 15. A neurosurgeon and two neurologists involved in data analysis and data grouping. Two radiology assistants were blinded to clinical outcomes and independently reviewed all the admission CT scans to verify ICH location, ICH volume, and IVH presence. (Figure 1).

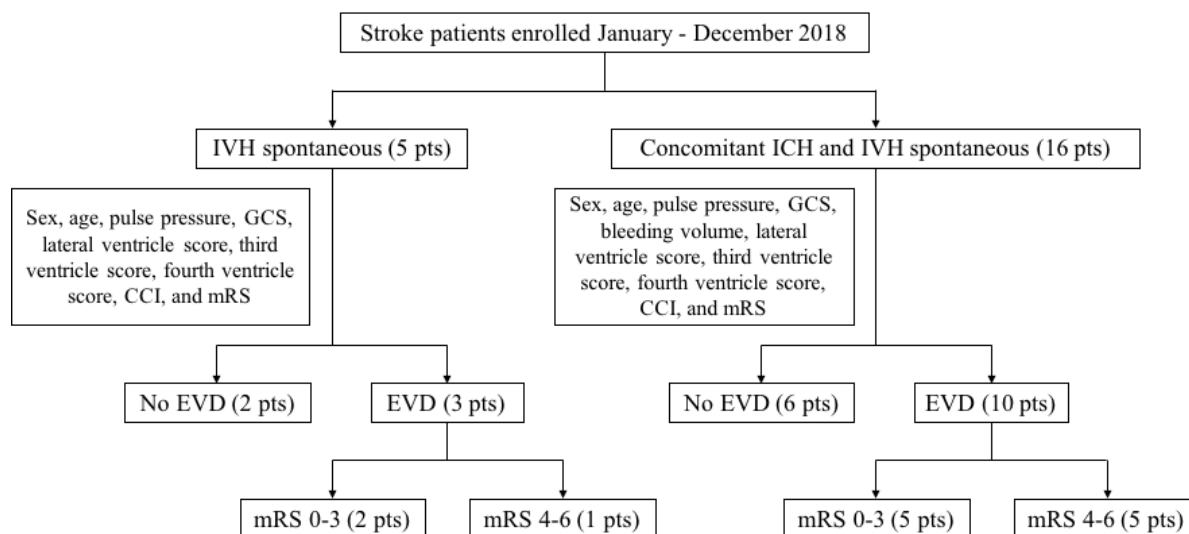


Figure 1. Schematic Diagram of Data Collection in Role of External Ventricular Drainage In Spontaneous Intraventricular Haemorrhage Patients In Cileungsi District Hospital

**Ethical Declaration**

Ethical approval was obtained from Universitas Pembangunan Nasional Veteran Jakarta Number B/1747/3/2019/KEPK.

**RESULTS**

From 313 stroke patients enrolled in Cileungsi District Hospital in 2018, 100 patients were diagnosed as spontaneous ICH, five patients were diagnosed as primary IVH, and 16 patients had ICH-IVH. Table 1 shows characteristics for IVH patients, 3 patients with EVD, and 2 non-EVD patients. EVD was inserted in patients with head CT scan showed blood almost completely fill the lateral ventricle, blood in the third ventricle and fourth ventricle. However, the difference in blood appearance in CT scan between EVD and non-EVD groups was not significant. EVD insertion also did not demonstrate any significant improvement in the prognosis of patients (p=1.000). Regarding the characteristics of IVH patients, lower age (mean age 42 years old), mean pulse pressure 67 mmHg, lower GCS (mean GCS 9) correlated not significantly with bad prognosis.

Table 2 shows the characteristics of concomitant IVH and ICH patients. EVD was inserted in patients with mean age 54,30±12,55, mean pulse pressure 70,70±22,68, GCS 10, mean bleeding volume (37,95±29,34), head CT scan showed blood almost

completely fill the lateral ventricle, blood in the third ventricle and fourth ventricle. This was supported by a significant difference between the head CT scan showed blood in the fourth ventricle (p 0,035). EVD insertion did not improve the prognosis of patients significantly (p=0,633). Characteristics of ICH and IVH that correlated with bad prognosis were mean age 59,14±14,20, mean pulse pressure 80,57±30,84, mean GCS 9,57±3,78, mean bleeding volume 38,32±26,87. However, the correlations were not significant.

It is imperative to get a picture of what comorbid diseases that existed in both group patients (Table 3). Charlson Comorbid Indeks (CCI) up to 20 patients of both groups had peripheral vascular disease or hypertension. Severe renal diseases were diagnosed in 5 patients.

Table 4 emphasizes what factors contribute to a good outcome in ICH-IVH that had EVD insertion. Mean age 60,80±15,02, mean pulse pressure 70,00±25,19, mean GCS 8,40±0,5, bleeding volume 42,79±33,50 affected significantly the prognosis of EVD patients. Only the GCS score (p = 0,034) correlated significantly with a prognosis of ICH-IVH patients that had EVD insertion with coefficient correlation 0.671.

Table 1. Characteristics of IVH patients

No	Characteristics	Non-EVD (n = 2)	EVD (n = 3)	<i>p value</i>	mRS 0-3 (good prognose) (n=9)	mRS 4-6 (bad prognose) (n=7)	<i>p value</i>
1	Sex			0,1			1
	Male	2	0		2	0	
	Female	0	3		2	1	
2	Age	(63,00±7,00)	(52,67±15,40)	0,136	(60,50±11,00)	42	0,082
	18-30 year	0	0		0	0	
	31-45 year	0	1		0	1	
	46-65 year	1	1		2	0	
	> 65 year	1	1		2	0	
3	Pulse pressure	(53,50±23,00)	(52,33±28,04)	1	(49,25±24,94)	67	1
	< 60 mmHg	1	1		2	0	
	60-71 mmHg	1	2		2	1	
	> 71 mmHg	0	0		0	0	
4	GCS	(13,00±2,80)	(13,00±3,40)	1	(14±2)	9	0,4
	13-15	1	2		3	0	
	9-12	1	1		1	1	
	3-8	0	0		0	0	
5	Lateral Ventricle			0,1			1
	Score 1	0	0		0	0	
	Score 2	2	0		2	0	
	Score 3	0	3		2	1	
6	Third Ventricle			0,1			1
	Score 0	2	0		2	0	
	Score 1	0	3		2	1	
7	Fourth Ventricle			0,4			1
	Score 0	2	1		2	1	
	Score 1	0	2		2	0	
8	CCI			1			0,4
	1-2	1	1		1	1	
	> 2	1	2		3	0	
9	mRS			1			
	0-3	2	2				
	4-6	0	1				
10	Mortality			1			
	Alive	2	2		4	0	0,2
	dead	0	1		0	1	
11	EVD						
	no				2	0	1
	evd				2	1	

Table 2 Characteristics of ICH-IVH patients

No	Characteristics	Non-EVD (n = 6)	EVD (n = 10)	<i>p value</i>	mRS 0-3 (n=9)	mRS 4-6 (n=7)	<i>p value</i>
1	Sex			<i>1</i>			<i>0,145</i>
	Male	4	6		4	6	
	Female	2	4		5	1	
2	Age	(51,17±11,27)	(54,30±12,55)	<i>0,145</i>	(48,44±7,24)	(59,14±14,20)	<i>0,229</i>
	18-30 year	0	0		0	0	
	31-45 year	2	1		2	1	
	46-65 year	4	7		7	4	
	> 65 year	0	2		0	2	
3	Pulse pressure	(88,67±27,19)	(70,70±22,68)	<i>0,611</i>	(75±21,52)	(80,57±30,84)	<i>0,504</i>
	< 60 mmHg	1	4		3	2	
	60-71 mmHg	1	0		0	1	
	> 71 mmHg	4	6		6	4	
4	GCS	(10,67±4,68)	(10,60±2,99)	<i>0,726</i>	(11,44±3,36)	(9,57±3,78)	<i>0,499</i>
	13-15	3	4		5	2	
	9-12	1	2		1	2	
	3-8	2	4		3	3	
5	Bleeding Volume	(26,93±31,90)	(37,95±29,34)	<i>0,118</i>	(28,03±34,40)	(38,32±26,87)	<i>0,302</i>
	< 20 cc	2	4		2	4	
	> 20 cc	8	2		7	3	
6	Lateral Ventricle			<i>0,837</i>			<i>0,683</i>
	Score 1	2	4		3	3	
	Score 2	2	2		3	1	
	Score 3	2	4		3	3	
7	Third Ventricle			<i>0,299</i>			<i>0,308</i>
	Score 0	3	2		4	1	
	Score 1	3	8		5	6	
8	Fourth Ventricle			<i>0,035*</i>			<i>0,358</i>
	Score 0	5	2		5	2	
	Score 1	1	8		4	5	
9	CCI			<i>1</i>			<i>0,063</i>
	1-2	5	8		9	4	
	> 2	1	2		0	3	
10	mRS			<i>1</i>			
	0-3	3	3				
	4-6	6	4				
11	Mortality						<i>0,262</i>
	Dead	1	3	<i>0,551</i>	1	3	
	Alive	5	7		8	4	
12	EVD						<i>1</i>
	no				3	3	
	EVD				6	4	

Table 3. Distribution of IVH patients and concomitant ICH-IVH patients based on comorbid condition and CCI

Condition	CCI	Number of patients	
		IVH	ICH-IVH
Myocardial infarct	1	0	2
Congestive heart failure	1	1	1
Peripheral vascular disease	1	4	16
Cerebrovascular disease	1	1	3
Chronic pulmonary disease	1	1	2
Diabetes Mellitus	1	1	0
Hemiplegia	2	1	5
Moderate or severe renal disease	2	2	3
Moderate or severe liver disease	3	0	1

CCI=1 refer to these conditions: myocardial infarct, congestive heart failure, peripheral vascular disease, cerebrovascular disease, chronic pulmonary disease, and diabetes mellitus. CCI=2 refer to these conditions: hemiplegia and moderate or severe renal disease. CCI=3 refer to moderate or severe liver disease.

Table 4. Correlation of Characteristics and Prognosis Based on mRS in ICH-IVH Patients Undergone EVD Insertion

No	Characteristics	mRS 0-3 (n = 5)	mRS 4-6 (n = 5)	p value	Correlation coefficient (r)
1	Sex			0.242	-0.408
	Male	2	4		
	Female	3	1		
2	Age	(47,80±4,78)	(60,80±15,02)	0.093	0.559
	18-30 year	0	0		
	31-45 year	1	0		
	46-65 year	4	3		
	> 65 year	0	2		
3	Pulse pressure	(71,4±22,8)	(70,00±25,19)	1.000	0.000
	< 60 mmHg	2	2		
	60-71 mmHg	0	0		
	> 71 mmHg	3	3		
4	GCS	(12,80±2,78)	(8,40±0,5)	0.034*	0.671
	13-15	4	0		
	9-12	0	2		
	3-8	1	3		
5	Bleeding Volume	(33,09±27,49)	(42,79±33,50)	1.000	0.000
	< 20 cc	4	4		
	> 20 cc	1	1		
6	Lateral Ventricle			1.000	0.000
	Score 1	2	2		
	Score 2	1	1		
	Score 3	2	2		
7	Third Ventricle			1.000	0.774
	Score 0	1	1		
	Score 1	4	4		
8	Fourth Ventricle			1,000	0.774
	Score 0	1	1		
	Score 1	4	4		
9	CCI			1,000	-0.200
	1-2	2	3		
	> 2	3	2		

## DISCUSSION

Primary IVH is defined as bleeding that has the source and is located in the ventricular chamber.<sup>4</sup> Around 45-70% of IVH is arising from an extension of intraparenchymal bleeding (secondary lesion) or bleeding from subarachnoid space extends into the ventricular system.<sup>1,2</sup> Risk factors for IVH include older age,<sup>18</sup> as in this study, the majority of patients' age group were above 46 years old. However, 3 patients were within 31-45 years age group in ICH and IVH group. These findings are also consistent with an inpatient database study from the Netherlands based on retrospective cohort study reported that the rate of ICH per 100,000 was 5.9 in 35-54 years, 37.2 in 55-74 years, and 176.3 in 75-94 years old in 2010. The incidence of spontaneous ICH increases with increased age.<sup>3</sup>

Pulse pressure is defined as the difference between systolic blood pressure (SBP) and diastolic blood pressure (DBP). In this study, mean pulse pressure in IVH patients that had bad prognosis was 67 mmHg, as opposed to ICH and IVH patients mean pulse pressure was 80,57±30,84 mmHg. These findings are also consistent with Chang et al<sup>19</sup> reported mean pulse pressure of mortality after intracerebral haemorrhage was 68.5 (±16.4) mmHg. Widened PP might be an independent predictor for higher mortality in ICH according to a study that included 672 patients.<sup>19</sup>

Regarding GCS, there were no patients with GCS < 8 in IVH group. In the ICH-IVH group, 6 patients were in a coma. EVD was inserted in high GCS patients such as 2 patients with GCS 13-15 in IVH patients and 4 patients in ICH-IVH patients. The reason for EVD insertion in high GCS patients was for



ventricular drainage or ICP monitoring. As current recommendations for the management of ICH with IVH or hydrocephalus are for ICP monitoring when GCS below 8 and for ventricular drainage or when there is a decrease of consciousness.<sup>20</sup> GCS did not make significant difference between EVD and non-EVD groups. However, there was a correlation between GCS and mRS in ICH-IVH group with EVD procedure. Higher GCS correlated with good outcomes in EVD patients as mean GCS  $12,80 \pm 2,78$  of patients resulted in good mRS and mean GCS  $8,40 \pm 0,5$  end in the poor outcome (mRS 4-6). This result was supported by Weir, who demonstrated prediction of 2-week mortality and 3-month recovery (survival, living at home) based on the GCS in a large cohort of individuals with acute stroke. He suggested that the total GCS score can predict early mortality and 3-month recovery.<sup>21</sup>

EVD did not correlate with improved outcomes in primary IVH patients nor ICH-IVH patients in this study. This result was supported by the fact that intraventricular blood and its breakdown cause inflammation of the ependymal layer and subependymal brain tissue. Besides, the clot also causes inflammation and fibrosis of arachnoid granulations, leading to delayed communications hydrocephalus.<sup>4</sup> This delayed process is manifested as loss of consciousness and sometimes, death. These results are consistent with Shapiro<sup>22</sup> et al suggested that ventriculostomy to reduce dilatation of the 4th ventricle does not improve the prognosis. Adam evaluated 22 patients with spontaneous ICH and hydrocephalus concluded that EVD drainage able to reduce the ventricular volume, but the prognosis is still poor.<sup>23</sup> Kumar collected 69 patients that treated with external ventricular drainage, and 52 patients were discharged in poor outcome.<sup>7</sup>

Comorbid conditions are best evaluated with the use of the Charlson Comorbid Indeks (CCI). CCI is an independent predictor of the death rate of surgery patients as well as long term survival.<sup>24</sup> Peripheral vascular diseases were the most comorbid condition in both groups. High blood pressure puts the pressure on the thin arterial brain wall to rupture. As a result, brain product release into the brain tissue. This fact also supported by a study that concluded that mean arterial pressure more than 120 mmHg was one of the risk factors of IVH.<sup>25</sup> A study of 14 primary IVH patients, 7 patients had associated hypertension.<sup>26</sup>

As seen in Table 1,2,3, the decision to insert the EVD, more likely based on the appearance of blood in the ventricle from the CT Scan imaging. 8 patients with score 1 in 4th ventricle and 3rd ventricle in ICH-IVH group had EVD procedure. Mean widths

of the third ventricle were  $4.23 \pm 1.25$ mm and  $3.81 \pm 0.87$ mm in males and females respectively, whereas the mean 4th ventricular widths were,  $7.87 \pm 1.30$  mm and  $7.54 \pm 1.33$ mm, in males and females.<sup>27</sup> This small size and inflammation process than progressing after there presence of clot or progressing to hydrocephalus were the plausible reasons to insert the EVD. These reasons were supported by the Naff<sup>28</sup> who concluded that IVH that is occluding one or both foramina of Monroe or third ventricle should be managed with EVD because prone to development of hydrocephalus. A study on IVH by Stein<sup>29</sup> inserted EVD in patients that CT scan showed complete obstruction of blood in the third ventricle or foramina Monroe. This study result showed that blood in the fourth ventricle makes a difference in EVD insertion in ICH and IVH patients. This finding is consistent with Hughes<sup>30</sup> that concluded patients with fourth ventricle blood or dilation are more likely to benefit from EVD procedure.

Chen<sup>12</sup> adopted other maneuvers using an endoscope tube for evacuating the blood from the ventricle. This technique was proven to reduce chronic hydrocephalus; however, the outcome of patients was still poor because the endoscope tube could not be inserted further down until the fourth ventricle and it also means that the hydrocephalus was not entirely resolved. Shapiro<sup>22</sup> concluded that the poor outcomes of IVH related to the fourth ventricle blood clot due to brainstem compression, leading to inadequate perfusion of the brainstem.

Our study is limited in the following ways (1) the limited number of samples of the study. Some patients with massive ICH and IVH or primary IVH died before medical treatment even started. (2) Some medical records were incomplete. However, this study reinforces the data of ICH and IVH spontaneous patients in Indonesia. As our understanding, stroke is the first leading cause of disabilities and the second-highest incidence after heart problems.

In conclusion, in our population, the decision to insert the EVD in ICH and IVH patients or primary IVH patients is solely based on the surgeons' preference. Based on our results, fourth ventricle blood significantly made a difference whether a patient requires EVD or not. Even though other characteristics did not show improving prognosis of IVH, but it still needs to be inserted in case of developing obstructive hydrocephalus that might cause the patient deceased.

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## Treatment patterns of acute respiratory tract infection in children under-fives in Bogor, Indonesia

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### Abstrak

**Latar Belakang:** Penggunaan obat yang tidak rasional menjadi masalah dalam pelayanan kesehatan, baik di negara maju maupun negara berkembang. Pengobatan Infeksi Saluran Pernafasan Akut (ISPA) tidak hanya tergantung pada antibiotik, tetapi dengan terapi penunjang untuk kasus yang disebabkan oleh virus. Penelitian ini bertujuan untuk mengidentifikasi pola pengobatan pasien ISPA pada balita di rumah sakit di Bogor, Indonesia.

**Metode:** Penelitian ini dilakukan dengan desain potong lintang menggunakan data rekam medis pasien balita dengan ISPA periode 1 Januari hingga 31 Desember 2015 di rumah sakit pemerintah dan swasta di Bogor. Analisis dilakukan dengan menggunakan uji Chi-Square.

**Hasil:** Rekam medis yang dikumpulkan dari kedua rumah sakit sebanyak 105 kasus. Pola pengobatan pada pasien ISPA rawat jalan ( $n=32$ ) di rumah sakit swasta adalah mukolitik (81,3%), dekongestan (56,3%), antipiretik (43,8%), dan antibiotik (6,3%). Sementara itu, rumah sakit pemerintah ( $n=8$ ) menggunakan antibiotik (75%), antipiretik (50%), dan mukolitik (50%). Pola pengobatan pada rawat inap di rumah sakit swasta ( $n=27$ ) adalah antibiotik (85,2%), antipiretik (63%), kortikosteroid (33,3%), dan mukolitik (25,9%), sedangkan rumah sakit pemerintah ( $n=38$ ) adalah antibiotik (92,1%), antipiretik (89,5%), kortikosteroid (31,6%), dan mukolitik (71,1%). Faktor-faktor yang mempengaruhi pengobatan pada rawat jalan tidak dapat diidentifikasi karena kurangnya informasi klinis dan hasil tes laboratorium. Pemberian antibiotik pada pasien rawat inap di kedua rumah sakit tidak berhubungan dengan kadar leukosit dan suhu tubuh.

**Kesimpulan:** Penelitian ini menunjukkan bahwa penggunaan antibiotik untuk ISPA belum sesuai dengan pedoman klinis yang pemberiannya harus didahului dengan pemeriksaan klinis dan mikrobiologis. Kepatuhan terhadap pedoman klinis sangat penting untuk mencegah terjadinya resistensi antibiotik dan mengurangi terjadinya reaksi obat yang tidak diinginkan. (*Health Science Journal of Indonesia 2020;11(1):9-14*)

**Kata kunci:** Anak, antibiotik, infeksi saluran pernafasan akut, pengobatan

### Abstract

**Background:** Irrational use of medicines has become a problem in health services, both in developed and developing countries. Treatment of Acute Respiratory Tract Infections (ARTIs) is not only dependent on antibiotics, but only with supportive treatment for cases caused by viruses. This study aimed to determine treatment patterns for children under-fives with ARTIs in hospitals in Bogor, Indonesia.

**Methods:** A cross-sectional study was conducted using medical records of patients under-fives with ARTIs in a government and a private hospital in Bogor from January 1<sup>st</sup> to December 31<sup>st</sup>, 2015. The analysis was performed using Chi-square test.

**Results:** There were 105 medical records collected from both hospitals. The pattern of ARTIs' outpatient treatments ( $n= 32$ ) at private hospital were mucolytic (81.3%), decongestants (56.3%), antipyretic (43.8%), and antibiotics (6.3%). Meanwhile, the government hospital ( $n=8$ ) used antibiotics (75%), antipyretics (50%) and mucolytic (50%). The pattern of ARTIs inpatient treatments in private hospitals ( $n=27$ ) were antibiotics (85.2%), antipyretic (63%), corticosteroids (33.3%), and mucolytics (25.9%). Otherwise, the government hospital ( $n=38$ ) used antibiotics (92.1%), antipyretic (89.5%), corticosteroids (31.6%) and mucolytics (71.1%). Factors affected outpatient treatment could not be traced because it lacked clinical information and laboratory test results. Meanwhile, antibiotic use for inpatients in both hospitals was not related to blood leukocytes level and body temperature.

**Conclusion:** This study showed that antibiotics prescribing for ARTIs is still not in accordance with the clinical guidelines that must be preceded by various clinical examinations and microbiological. Adherence to clinical guidelines is important to prevent antibiotic resistance and to decrease adverse effects. (*Health Science Journal of Indonesia 2020;11(1):9-14*)

**Keywords:** Acute respiratory tract infections, antibiotics, children, treatment

Acute respiratory tract infections (ARTIs) is a common disease that becomes a problem in developing countries.<sup>1</sup> ARTIs was defined as acute respiratory infections caused by an infectious agent which is transmitted from human to human.<sup>2</sup> Lower respiratory infections was the third leading cause of under-fives mortality worldwide and second leading cause of disability-adjusted-life-years.<sup>2</sup> Based on National Basic Health Research in 2018, ARTIs prevalence was higher in age group of under-fives children (7.8%). West Java has higher prevalence of ARTIs in under-fives children than national prevalence average (8.2%). Population characteristics with highest ARTIs were occurred in under-fives children (25.8%).<sup>4</sup>

There are several factors related to acute respiratory infections include nourished children, inadequate breast feeding, poor immunization status, attendance to daycare centers, large family size, poor parental educational status, parental smoking, living in the urban area and use of biofuels.<sup>5</sup>

Kinds of ARTIs that need antibiotics are bacterial pharyngitis caused by *Streptococcus pyogenes*, pneumonia and acute sinusitis caused by *Streptococcus pneumoniae*.<sup>6</sup> Some cases of ARTIs are caused by viruses, approximately, 35-87 percent of children with ARTIs are caused by viral infections and viral co-infections occurred in 4-33 percent of children hospitalized with ARTIs.<sup>7,8</sup> ARTIs that caused by viruses do not require antibiotics, but only supportive treatment.<sup>9</sup> It reduces symptoms and improves patient performance<sup>10</sup>. On the other hand, prescribing antibiotics for ARTIs is still become a common behavior among physician.<sup>11</sup>

In Indonesia, antibiotics prescribing for viral infection is still a lot. Irrational use of antibiotics rising bacterial resistance to antibiotics and drugs side effect.<sup>12</sup> Based on a study in Indonesia, 3.3 percent of pediatric patients were given antibiotics without indication.<sup>13</sup> This study aimed to determine treatment patterns for children under-fives with ARTIs in hospitals in Bogor, Indonesia, especially in private and government hospitals.

## METHODS

This cross-sectional was conducted from March to October 2016 in a private hospital and a government hospital in Bogor, Indonesia. Data were collected from medical records among patients under-fives

with ARTIs only (without other diagnoses) in those hospitals from January to December 2015. Sample calculation for this study used total sampling which met inclusion and exclusion criteria.

Inclusion criteria for the study were children aged 0-5 years old, had symptoms of pain including fever, cough, and also sore throat, runny nose, shortness of breath, or difficulty breathing, patients without other infection or underlying diseases.

Exclusion criteria for the study were incomplete medical records e.g. no medicines were recorded, immune deficiency, chronic disease e.g. liver, patient referral from other hospitals. The data which are taken for this study were sex, age, doctor in charge, funding source, diagnosis, leucocyte level, body temperature, and medicines.

Sex was divided into male and female. Children's age was divided into five categories: 0-12; 13-24; 25-36; 37-48; 49-60 months. Doctor in charge was categorized into three categories: pediatrician, ENT specialist, and general practitioner. Funding source was categorized into out of pocket, National Health Security (NHS), private insurance, company, and data not available (NA). Diagnosis was classified into Upper Respiratory Tract Infection (URTI), and Lower Respiratory Tract Infection (LRTI) according to the involved anatomic localization. These diagnoses were defined by professional health workers. Leucocyte count was categorized into three categories: high (>10,000 cell/ $\mu$ l blood), normal (4,000-10,000cell/ $\mu$ l blood), and no data available. Body temperature was divided into febrile, normal, and no data available.

Patient characteristics and other variables were analyzed using descriptive statistics. Chi-square test was used to determine selected factors related to antibiotic prescribing. The data were analyzed using Statistical Package for Social Sciences version 16 (SPSS).

Ethical approval for this study was obtained from Ethics Committee of National Institute of Health Research and Development, Ministry of Health Republic of Indonesia number LB.02.01/5.2/KE.138/2016. Permission from relevant authorities in connection with this study was sought before conducting the study.

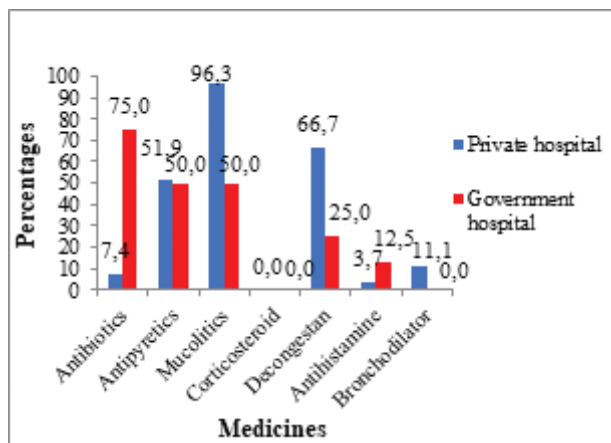
**RESULTS**

The total number of patients (Table 1) was 105 patients including 40 outpatients and 65 inpatients from both hospitals. The government hospital had 46 cases whereas the private hospital had 59 cases that met inclusion and exclusion criteria. About 65 percent of outpatients were male and 47.5 percent of children were 0-12 months old. Most outpatients were treated by pediatricians (95%), 10.8 percent of funding source was derived from out of pocket or personal expenses, most of them were diagnosed as URTI.

There were 60 percent of inpatients were male, and most of them were children 0-12 months old. Pediatricians were the main doctor who treated inpatients. About 58.5 percent of funding source of inpatients were NHS. Most the inpatients were diagnosed as URTI.

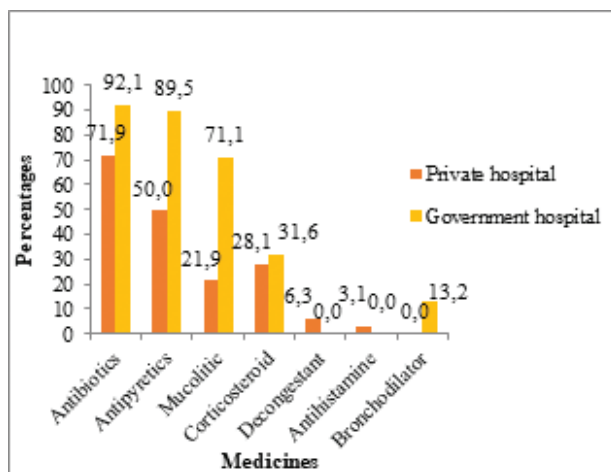
Table 1. Characteristics of Subjects with ARTIs (n=105)

	Inpatients			
	n	%	n	%
Hospital				
Government	8	20.0	38	58.5
Private	32	80.0	27	41.5
Sex				
Male	26	65.0	39	60.0
Female	14	35.0	26	40.0
Age (months)				
0-12	19	47.5	18	27.7
13-24	11	27.5	15	23.1
25-36	4	10.0	12	18.5
37-48	5	12.5	11	16.9
49-60	1	2.5	9	13.8
Doctor in charge				
Pediatrician	38	95.0	60	92.3
ENT specialist	0	0.0	2	3.1
General Practitioner	2	5.0	3	4.6
Funding source				
Out of pocket	4	10.8	20	30.8
NHS	3	8.1	38	58.5
Private insurance	0	0.0	3	4.6
Company	0	0.0	2	3.1
NA	33	89.2	2	3.1
Diagnosis				
URTI	40	100.0	35	74.5
LRTI	0	0.0	12	18.5
Leucocytes count				
High	1	3.0	45	71.4
Normal	2	6.1	17	27.0
NA	30	90.9	1	1.6
Body temperature				
Febrile	4	11.8	36	55.4
Normal	2	5.9	26	40.0
NA	28	82.4	3	4.6



Graph 1. Treatment Pattern of Outpatients with ARTIs

Graph 1. figured treatment patterns for outpatient. It showed that the private hospital prescribed more mucolitics than government hospital for outpatients. Nevertheless, government hospital prescribed more antibiotics than private hospital for outpatients.



Graph 2. Treatment Pattern of Inpatients with ARTIs

Graph 2 figured that government hospitals prescribed more antibiotics, antipyretics, and mucolitics than private hospitals. Antibiotics were the first in rank of inpatient prescribing, while antipyretics were the second in rank of inpatient prescribing.

Table 2 showed that type of hospital, patients' sex, type of doctors, funding sources, leucocytes level, and body temperature were not related to antibiotics prescribing for inpatients. Chi-square test showed that p-values for all variables are more than 0.05, which means there were no different proportions between each groups. So, the table showed there was no association between those variables with antibiotic prescribing.

Table 2. Several Factors of Inpatients Who Received Antibiotics

	Antibiotic				P value
	No (n=7)		Yes (n=58)		
	n	%	n	%	
Hospital					
Government	3	7.9	35	92.1	
Private	4	14.8	23	85.2	0.437
Sex					
Male	5	12.8	34	87.2	
Female	2	7.7	24	92.3	0.693
Doctor in charge					
General practitioner	0	0.0	3	100.0	
Pediatrician	7	11.7	53	88.3	
ENT Specialist	0	0.0	2	100.0	0.552
Funding source					
Out of pocket	2	10.0	18	90.0	
Private insurance	1	33.3	2	66.7	
NHS	3	7.9	35	92.1	
NA	0	0.0	2	100.0	0.429
Leucocytes level					
High	4	8.9	41	91.1	
Normal	3	17.6	14	82.4	
NA	0	0.0	1	100.0	0.573
Body temperature					
High	3	8.3	33	91.7	
Normal	4	15.4	22	84.6	
NA	0	0.0	3	100.0	0.487

## DISCUSSION

Most of the patients in both hospitals were male. This finding was similar from the study in India and Bangladesh that ARTIs are often found in male than female.<sup>1,14</sup> ARTIs is more severe and lead to higher mortality in males than females. Females have higher incidence of URTIs than males. Otherwise, males have higher chance of developing LRTIs than females. Various differences between male and female such as anatomic, immune response, lifestyle, behavioral, and socioeconomics may affect this findings.<sup>15-17</sup>

The age group affected most was 0-12 and 13-24 months. This is similar to the study in Southeast Nigeria. This can be caused by exposure to some risk factors, such as decreasing breast feeding that can reduce passive maternal immunity.<sup>5</sup>

This study showed that antibiotics were still prescribed for outpatient and inpatients. Study in Saudi Arabia also showed that antibiotics were still prescribed for outpatient. This can be occurred by severity of infections such as high fever and congested throat or

due to doctor's consideration that it can relief disease symptoms in the initial clinical features.<sup>18</sup>

In this study, antibiotics use was relatively higher in government hospital than private hospital. This may be occurred due to government hospital got more severe patients than private hospital. Study in Malaysia showed that doctors in public clinics faced more chronic and complex illness than in private clinics.<sup>19</sup> Study in Nigeria showed that over-prescription of antibiotics for under-fives children was occurred among Nigerian pediatric prescribers.<sup>20</sup> Study in Malaysia also showed that 31.8% of URTI prescriptions contained antibiotics. It also described that there was an association between different prescribers and diagnoses and there was a suggestion that medicine specialist are more competent in antibiotic prescribing.<sup>21</sup> Unnecessary use of antibiotics should be minimized to increase patient's benefit.<sup>18</sup> Although medical records data used in this study did not explain the type of cough, all patients with cough symptoms were given mucolytics. Mucolytic such as ambroxol, bromhexine, carbocysteine, and erdosteine, were used to relieve cough symptoms by reducing mucus elimination.<sup>22</sup>

This study showed that there is no association between body temperature and antibiotic prescribing. A similar study showed that the higher temperature, the more severe the throat congestion, and the presence of exudates on pharynx, the higher the likelihood to prescribe antibiotic.<sup>18</sup> The difference was probably due to different characteristics of subjects and setting area.

In Indonesia, the proportion of antibiotic use in hospitals was 84 percent including high inappropriate use of antibiotics. Overprescribed antibiotics are found in respiratory infections especially acute URTIs, although most are caused by viruses. It may be happened because of the over expectation of clinicians on antibiotics to prevent secondary infection caused by bacteria. Before starting therapy with antibiotics, it is very important to be sure whether the infection exists. This is due to several conditions that can provide symptoms similar to infection. Antibiotic prescribing must be proceeded by a clinical examination of Ear, Nose, and Throat (ENT), microbiological examination (bacterial culture), and other support examination.<sup>10</sup>

Overused of antibiotic may lead to increased prevalence of antibiotic resistance, cost, and incidence of adverse effect.<sup>23,24</sup> Indonesia's program to contain antimicrobial resistance (AMR) is in the early phase of implementation. National support such as funding is still needed to strengthen it.<sup>25</sup> Prescriber's compliance with



clinical guideline is also needed to prevent irrational use of antibiotics<sup>26</sup>. There are several advice for clinicians: do not use antibiotic therapy for bronchitis without suspect pneumonia; patient with streptococcal pharyngitis should be treated with antibiotics; patients with persistent symptoms of acute rhinosinusitis should be treated with antibiotics for more than 10 days; patients with common cold should not be given antibiotics.<sup>27</sup> Antimicrobial stewardship programs must also be implemented to improve antibiotic use in hospitals.

This study had several limitations that should be considered. The data was a retrospective data derived from medical records from two hospitals in Bogor that may raise potential biases and error. The results can not be applied generally in population. Factors affected outpatient treatment could not be traced because it lacked clinical information and laboratory test results including bacterial cultures. The small number of patients in this study could be because most patients with ARTIs went to primary health cares according to the national health insurance policy.

In conclusion, antibiotics prescribing for ARTIs is still not in accordance with the clinical guidelines that must be preceded by various clinical examinations and microbiological. Adherence to the clinical guidelines is important to prevent antibiotic resistance and to decrease the adverse effects.

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## AFB smear positive 1+: a dominant factor in Pulmonary TB household transmission

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### Abstrak

**Latar belakang:** TBC menjadi masalah kesehatan dunia, termasuk Indonesia karena kasus baru TB paru terus meningkat. Penelitian ini mengkaji faktor dominan yang mempengaruhi penularan kontak serumah pasien TB paru.

**Metode:** Studi observasional dengan desain analitik cross sectional ini menggunakan populasi seluruh penderita dan anggota keluarga pasien TB paru di Puskesmas Kedundung tahun 2015-2016. Sampel sejumlah 52 orang dihitung menggunakan rumus besar sampel infinit dan diambil secara konsekutif. Variabel penelitian meliputi perilaku pencegahan, Gradasi BTA dan penularan kontak serumah. Pengumpulan data menggunakan lembar wawancara, lembar pengumpul data, sputum pot steril. Data dianalisis menggunakan uji Spearman Rank dan uji regresi logistik binary dengan tingkat signifikansi 0,05.

**Hasil:** Perilaku pencegahan ( $p=0.093$ ), BTA positive 2+ ( $p=0.377$ ) tidak berpengaruh terhadap penularan kontak serumah pasien TB paru, sedangkan BTA positive 1+ mempengaruhi penularan kontak serumah pasien TB paru ( $p=0.007$ ). Nilai Exp (B) BTA positif (1+) menunjukkan 12,144 artinya pasien BTA positif (1+) memiliki risiko 12,144 kali lebih tinggi menularkan ke kontak serumah dibandingkan dengan BTA positif (3+). Sedangkan pasien BTA positif (2+) memiliki risiko 3,328 kali menularkan ke kontak serumah dibandingkan dengan BTA positif (3+).

**Kesimpulan:** Pasien TB paru dengan pemeriksaan BTA positif (1+) menjadi faktor dominan yang mempengaruhi penularan kontak serumah pasien TB paru. Upaya komunikasi dan edukasi personal hygiene, tingkat kepatuhan pengobatan pasien TB paru perlu ditingkatkan untuk menekan kejadian baru TB paru. (*Health Science Journal of Indonesia 2020;11(1):15-21*)

**Kata kunci:** Gradasi BTA, TB Paru, Perilaku Pencegahan, Penularan Kontak Rumah Tangga

### Abstract

**Background:** Tuberculosis has become a global health problem, included in Indonesia, new cases of pulmonary TB increase continuously. This study examined the dominant factors that influenced the transmission of household contacts in pulmonary TB patients.

**Methods:** This observational study was a cross-sectional analytic design which used a population of all patients and family members of pulmonary TB patients at the Kedundung Health Center in 2015 until 2016. A sample of 52 people was counted using the infinite sample size formula and taken consecutively. Research variables include prevention behavior, AFB smear gradation, and household contact transmission. Collecting data used interview sheets, data collection sheets, sterile sputum pots. Data was analyzed by chi-square test and binary logistic regression test with a significance level of 0.05.

**Results:** Prevention behavior ( $p=0.093$ ), AFB smear-positive 2+ ( $p=0.377$ ) did not affect on household contact transmission in pulmonary TB patients, whereas AFB smear-positive 1+ affected household contacts transmission of pulmonary TB patients ( $p=0.007$ ). The value of Exp (B), AFB smear-positive (1+) have a risk of 12.144 times transmitting to household contact when compared to AFB smear-positive (3+). Whereas patients with AFB smear-positive (2+) have a risk of 3,328 times transmitting to household contact when compared with AFB smear-positive 3+.

**Conclusion:** Pulmonary TB patients with AFB smear-positive (1+) was the dominant factor affecting household contact transmission. Communication and personal hygiene education efforts, the level of adherence in the treatment of pulmonary TB patients needs to be increased to suppress the new incidence of pulmonary TB. (*Health Science Journal of Indonesia 2020;11(1):15-21*)

**Keywords:** AcidFast Bacilli (AFB) gradation, pulmonary TB, Prevention Behavior, Transmission of Household Contacts

Tuberculosis becomes a major health problem in the world with the rate of finding new pulmonary TB incidence was not decrease. The Global Report confirms that nearly half a million more cases of illness than previously thought, and 9 million people have contracted TB by 2013, while 1.5 million have died from around the world.<sup>1</sup> In 2019, data were reported by 202 countries and territories that account for more than 99% of the world's population and the estimated number of TB cases. Indonesia was one of 14 countries that have the three high-burden country lists for TB, TB/HIV and MDR-TB defined by WHO for the period 2016–2020, and their areas of overlap.<sup>2</sup> The total incidence of TB in Indonesia in 2018 reached 570.289.<sup>2</sup> This fact was very different from the previous year. The prevalence rate in Indonesia of all TB types is 272 per 100,000 population or about 680,000 cases. Incidence of new TB cases with a positive smear of 183 per 100,000 population or about 460,000 cases.<sup>1</sup>

At the national level, East Java Province was the second largest number of pulmonary TB findings under West Java Province.<sup>3</sup> In 2012, the Crude Death Rate (CDR) was 63,03% with the number of new cases (positive and negative) as many as 41,472 patients and the new AFB positive as much as 25,618 cases.<sup>4</sup> The city of Mojokerto in 2014 was highest in East Java with 348 new sufferers per 100,000 population and by 2015 (5), the highest-ranking was Pasuruan with 256 new cases per 100,000 population.<sup>5</sup> There were 5 (five) health centers working in the health Office of Mojokerto City, among others Kedundung Public Health Center, Wates Public Health Center, Blooto Public Health Center, Gedongan Public Health Center, and Mentikan Public Health Center. The Kedundung Public Health Center which has the most of TB cases.

The number of new adult TB patients at Kedundung Public Health Center from January 2013 to December 2015 tends to increase annually, excluding cases of extra TB and TB in children. In 2013 new adult pulmonary TB patients increased from the previous year to a total of 39 people. In 2014 new adult pulmonary TB patients increased from the previous year to a total of 40 people. In 2015 new adult pulmonary TB patients increased from the previous year to a total of 46 people.<sup>5</sup> In the year 2016 (January-June), 46 patients had pulmonary TB, and the number of AFB smear-positive +3 as many as 17 people, AFB smear-positive +2 of 16 people, and AFB smear-positive +1 as many as 13 people. The previous research discovered of pulmonary TB sufferers known as passive promotive case finding

(passive patient discovery with active promotion) was required for all contacts of new positive AFB pulmonary TB patients with the same symptoms, should be sputum examined. An increase in the discovery rate of patients by 75% was obtained from families with positive AFB or Cure Rate, especially with AFB smear-positive (3+) were reached 66%, and the remaining 34% with AFB smear-positive (1+)(6). Therefore it is necessary to examine how much the AFB gradation smear-positive has influence transmission of household contacts in pulmonary TB patients.

## METHODS

This study was an observational study with a cross-sectional analytic design. The population taken is TB patients and all family members of household contacts in Kedundung Public Health Center (PHC) Mojokerto on treatment from 2015-2016. A sample of 52 people was counted using the infinity large sample formula and taken consecutively based on the inclusion criteria include: willing to be a respondent, family members who have contacted as household to the patient continuously in a year and have never been examined and 2 people represents a family member. Independent variables include prevention behavior, AFB smear gradation, while the dependent variable is household contact transmission. Prevention behavior variables will be categorized into 2, i.e. "less" if the number of scores is less than the average value (mean), and "good" if more than the average value (mean). While household contact transmission variable is categorized into two, yes and no. Option "Yes" if there are family members who suffer from pulmonary TB (the test results show an AFB smear-positive), and "No" if there are not family member suffering from pulmonary TB (AFB smear-negative). Collecting data were use questionnaires, data collection sheets, sterile sputum pots. Research steps include: collect the name and phone number of TB patients in Kedundung PHC, contact the respondent 1 day before the visit, prepare the AFB sputum extraction tool, home visit accompanied by 1 officer from the PHC, give informed consent before the examination. To determine the diagnosis of TB in children by conducting a tuberculin test by the doctor of the PHC, if the TB score of the child is more than 6 then it is referred for treatment<sup>(4)</sup>, the sputum taking during and tomorrow morning. This research involving 3 enumerators who had been trained. While the secondary data, taken from the medical record from Kedundung PHC Mojokerto, the data taken includes the positivity of the smear, structured

questionnaires, cameras for documentation, laptops, and stationery. The AFB smear gradation data of pulmonary TB patients, the prevention behavior of transmission, and the risk of pulmonary TB transmission at household contact were collected at the same time. The data were analyzed bivariate using a *chi-square test* and multivariate using *binary logistic regression* with a 95% confidence level. The questionnaire has been tested for validity and reliability, this study has passed the ethical clearance from the ethics commission of health research at the Medicine Faculty, Airlangga University, Surabaya with letter number 153/EC/KEPK/FKUA/2016.

## RESULTS

The results of this study include univariate, bivariate and multivariate analysis

### AFB Gradation Smear-Positive Of pulmonary TB Patients

Table 1. The Distribution of the AFB Gradation Smear-Positive of Pulmonary TB Patients at Kedundung Public Health Center Mojokerto

AFB Gradation	Amount	%
1+	9	17.3
2+	4	7.7
3+	39	75
Total	52	100

### Crosstabulation AFB Gradation Smear-Positive And Household contact Transmission of Pulmonary TB patients

Table 4. The AFB Gradation Smear-Positive And Household Contacts Transmission Of Pulmonary TB Patients At Kedundung Public Health Center Mojokerto

AFB Gradation Smear-Positive	Household Contacts Transmission				Total	%	Chi-Square Test P-value
	Yes	%	No	%			
1+	3	5,8	6	11,5	9	17,3	0,001
2+	3	5,8	1	1,9	4	7,7	
3+	35	67,3	4	7,7	39	75	
Total	41	78,9	11	21,1	52	100	

Table 4 showed 67,3 AFB smear-positive (3+) experienced household contacts transmission. Bivariate analysis show *p-value* 0,001, there is correlation between AFB gradation smear-positive with household contacts transmission of pulmonary TB patients.

Table 1 shows the majority of respondents belong to the AFB smear-positive 3+, as many as 39 people (75%).

### Prevention Behavior of Household Contacts Transmission in Pulmonary TB Patients

Table 2. The Distribution Of Prevention Behavior To Household Contacts in Pulmonary TB Patients at Kedundung Public Health Center Mojokerto

Behaviour	Amount	%
Less	22	42.3
Good	30	57.7
Total	52	100

Table 2 shows the most respondents behaved good in prevention of household contact transmission (57.7%).

### Household contacts Transmission of Pulmonary TB patients

Table 3. The Household Contacts Transmission Of Pulmonary TB Patients At Kedundung Public Health Center Mojokerto

Household contacts Transmission	Amount	%
Yes	41	78.8
No	11	21.2
Total	52	100

Table 3 shows the majority of respondents experienced of household contacts transmission (78.8%).

### Prevention Behavior with Household contacts Transmission of Pulmonary TB patients

Table 5. Prevention Behavior And Household Contacts Transmission Of Pulmonary TB Patients At Kedundung Public Health Center Mojokerto

Prevention Behavior	Household Contacts Transmission				Total	%	Fisher's exact Test <i>P-value</i>
	Yes	%	No	%			
Less	21	40,4	1	1,9	22	42,3	0,016
Good	20	38,5	10	19,2	30	57,7	
Total	41	78,9	11	21,1	52	100	

### Dominant Variable Affecting The Household Contact Transmission of Pulmonary TB Patient at Kedundung Public Health Center Mojokerto

Table 6. Multivariate Analysis Factors Affecting Household Contacts Transmission Of Pulmonary TB Patients At Kedundung Public Health Center Mojokerto

Variables	B	S.E	Wald	df	Sig.	Exp (B)
AFB Gradation			7,423	2	0,024	
(1+)	2,497	0,921	7,352	1	0,007	12,144
(2+)	1,202	1,360	0,782	1	0,377	3,328
Prevention Behaviour (Less)	-1,940	1,156	2,818	1	0,093	0,144
Constant	-1,569	0,573	7,493	1	0,006	0,208

Table 5 showed 40,4% less prevention behaviour experienced household contacts transmission and 19,2% good prevention behavior not experienced household contacts transmission. Bivariate analysis of prevention behavior and household contacts transmission show *p-value* = 0,016. It means there is a correlation between two variables.

Table 6 showed the dominant variable influence the household contacts transmission of a pulmonary TB patients is AFB Gradation Smear-positive (1+) (*p*= 0,007). The logistic regression test using *Backward Stepwise* (Wald) method, explain the AFB Smear-positif 1+ consistently correlated with household contacts transmission of Pulmonary TB patients. Therefore pulmonary TB patients who had AFB smear-positive 1+ were at risk of 12,144 times to transmit to household contact if compared to the reference group (AFB smear-positive 3+).

## DISCUSSIONS

The risk of household contact transmission of pulmonary TB patients is influenced by exposure levels with droplets. Pulmonary TB patients with AFB smear-positive provide a greater risk of transmission than pulmonary TB patients with AFB smear-negative.<sup>7</sup> Transmission sources are AFB smear-positive, at the time of coughing or sneezing, patients spread the germs in the form of

droplet nuclei, once a cough can produce about 3000 sputum droplets.<sup>8</sup> Transmission occurs in a room where sputum drips for a long time, ventilation can reduce the amount of droplet, while direct sunlight can kill germs.<sup>9</sup> Droplets can last for several hours in a dark and humid place. The transmission of a patient is determined by the number of germs that are removed from the lungs. The higher degree of AFB Gradation smear-positive of sputum examination results, the more contagious the patient. Factors that allow a person to be exposed to a TB germ are determined by the concentration of the spark in the air and the duration of the air.

Bivariate analysis showed the AFB gradation smear-positive correlates with household contact transmission of pulmonary TB patients. Pulmonary TB patients with AFB gradation of BTA 3 + / 2 + / 1 + (10), may affect the household contacts transmission, the higher of AFB gradation smear-positive will potential give higher transmission. Most of the transmission occurred in the intermediate household contact on the AFB gradation smear-positif 3 + patients. Some theories explain the gradation 3 + as the highest level of AFB as the main factor of transmission. It happens because the behavior of prevention of transmission by pulmonary TB patients to household contacts in the good category, evidenced from cross-tabulation table showed several pulmonary TB patients with AFB gradation smear-positive 3+ have good prevention behavior



of household contacts transmission. Pulmonary TB patients with AFB gradation smear-positive 3+ mostly live with 3 household contacts, the factors found during the study could affect pulmonary TB patients AFB gradation smear-positive 3+ is mostly transmitted by household contacts.

The prevention behavior of pulmonary TB patients correlates with household contact transmission. This preventive behavior is an individual health action aimed at preventing the emergence of pulmonary TB disease.<sup>11</sup> Behavior is influenced by two factors: external factors and internal factors. External factors or stimuli include environmental factors, both physical and non-physical in the form of social, cultural, economic, political, and others.<sup>12</sup> One's behavior consists of knowledge, attitudes, and actions. The lack of knowledge of pulmonary tuberculosis patients about the mode of transmission, the hazards, and how pulmonary TB treatment will affect the attitudes and actions, and the behavior of a person. Uncertainty about the mode of transmission and low behavior can lead to higher transmission, and otherwise, this is a risk factor for transmission of pulmonary TB.

Health behavior is a basic response to a stimulus associated with illness and disease, health care system, food, and environment. This limit has two main elements, namely the response or stimulus or stimulant. Response or human reaction either passive (knowledge, perception, and attitude), or active (real action). Stimulus or stimulation can consist of 4 (four) main elements namely, illness and disease, health, and environmental services system.<sup>13</sup>

The spread of pulmonary tuberculosis is one of them caused by the transmission of household contacts that have a strong contribution<sup>14</sup>, the prevention behavior will be done by the patient itself to prevent pulmonary TB transmission. The result of the study<sup>9</sup> states that pulmonary tuberculosis transmission can occur due to the effect of household contacts, so the prevention behavior of pulmonary TB patients plays an important role in suppressing the transmission and spread of pulmonary tuberculosis disease.

The identification of household contacts transmission was known from the laboratory test of household contact sputum, the most dangerous source of transmission is adult pulmonary tuberculosis patients and adults who suffer from pulmonary tuberculosis with cavities (hole in the lungs). Such cases are highly infectious and can transmit the disease through coughing, sneezing and conversation.

The more frequent exposure and length of contact, the greater likelihood of transmission. Source of transmission for infants called close contacts are his or her parents, a housemate or a frequent visitor and often<sup>15,16</sup> interacting are people who live together every day and every time with pulmonary TB sufferers, such as family, friends, and co-workers.

The results of this study are largely following the behavioral theories already stated, that there is a significant relationship between the prevention behavior of pulmonary tuberculosis patients with household contact transmission, where most transmission of household contact is low with the prevention behavior of pulmonary TB patient transmission.

The prevention behavior of pulmonary TB patients can be influenced by age, most patients aged > 60 years have good preventive behavior. There are several reasons behind this behavior because patients want to have a long life, want to stay productive, and want to be independent (do not want to bother other family members). Besides, they are more trusting about certain information provided by health workers without proving it first.<sup>11</sup>

According to this research the prevention behavior of pulmonary TB patients affected by education factors, because most of the pulmonary TB patients with high education are well behaved. The person who has higher education will easier to adsorb and respond to the information to be applied in daily activities.

But the result of this research shows the AFB smear-positive 1+ was significantly affected by household contact transmission. This is contrary to existing theories. Rheegandono et al reported their research that of 7 pulmonary TB patients with AFB gradation smear-positive 3+ have transmitted to 2 by 3 people (42,9%) of family members and pulmonary TB patients with AFB gradation positive 2+ could transmit to 1 person (14,3%) of family members. Whereas pulmonary TB patients with AFB gradation smear-positive 1+ did not transmit to their family members.<sup>6</sup>

While the smear-positive smear 3+ has more germs than BTA positive 1+, but not significantly affect the transmission of household contacts of patients with pulmonary TB. And it was different from Rachman et al research, he states that the positive smear gradation in pulmonary TB patients is one of the keys of pulmonary TB, because the transmission of

pulmonary TB is determined by the number of germs released from the lungs of pulmonary TB patients, the higher the positivity of the AFB smear gradation, the more infectious the patient is.<sup>17</sup> But according to this research, the number of germs at the AFB gradation smear-positive 1+ is greater than the AFB smear-positive 2+ which reaches only 1-10 BTA in 100 fields of view. Researchers think that the germs of AFB gradation smear-positive 1+ are found in a wider area of 100 visual fields, although the number of germs found is less than AFB smear-positive 2+ and 3+.

Besides, other factors influence the transmission of pulmonary TB on household contact, namely the condition of the humidity of the room of the house, the risk of contracting depends on the level of exposure to sputum (droplet nuclei), the room where sputum droplet for a long time, whether there is ventilation, the presence of direct sunlight, lighting, room humidity, long exposure to germs<sup>8</sup> lighting, air humidity, behavior.<sup>18</sup> Other factors that affect the transmission is the frequency of contact with the patient, age, occupancy density, immune system, education, occupation, behavior.<sup>19, 20</sup>

According to the observation of the health behavior of pulmonary TB patients and their families. Most people with pulmonary TB with AFB gradation smear-positive 1+ living in a house that does not meet the requirements of a healthy home, one of which is lack of ventilation and lighting, most of the transmission occurred in the household contact because the behavior of prevention of transmission by pulmonary tuberculosis patients against home contact is not all good. Preventive behavior did not affect the transmission of household contact. The absence of preventive behavior variables in the final model of binary logistic regression test can be due to computerized prevention behavior variables considered as confounding or confounding variables affecting the relationship between independent and dependent variables.

TB patient with AFB smear-positif (1+) as the dominant factor influences household contact transmission according to the logistic regression test using *Backward Stepwise* (Wald) method. This result came as the logistic regression test using the *Enter* method. Pulmonary TB patients who had AFB gradation smear-positive 1+ were at risk of 12,144 times to transmit to household contact if compared to the reference group (AFB smear-positive 3+). At the final result of binary logistic regression

AFB smear-positive 2+ was not significantly influence the household contact transmission of pulmonary TB. An AFB smear-positive 3+ was not entering into the logistic regression model because it became a reference group so can not be explained more.

Indeed the results of this study are very contradictory to existing theories, but the conditions and facts that exist in the field can change previous findings. But related to the sample size that may only be 52 peoples, and using a non-parametric test which certainly does not require data normality, therefore there are many limitations in this study that might be corrected in subsequent studies.

In conclusion, most of the smear-positive gradation of a pulmonary tuberculosis patient in Kedundung Public Health Center was AFB 3+, behavior prevention of pulmonary tuberculosis patient mostly good, there is the transmission of household contacts of a pulmonary tuberculosis patient, there is a relation between AFB gradation smear-positive of pulmonary tuberculosis patient with household contact transmission, there is a correlation between the prevention behavior of pulmonary tuberculosis patients with the transmission of household contact, AFB smear-positive (1+) become dominant factor related to household contact transmission of pulmonary TB patient in Kedundung public health center.

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## The influence of body image and gender in adolescent obesity

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### Abstrak

**Latar Belakang:** *Body image adalah persepsi penampilan fisik diri sendiri. Mispersepsi berat badan pada remaja dapat menyebabkan rasa ketidakpuasan terhadap tubuh dan obesitas pada remaja. Jenis kelamin juga berperan dalam obesitas remaja dan body image. Remaja yang obes memiliki risiko penyakit tidak menular lebih besar dibandingkan remaja dengan berat badan normal. Maka dari itu, penelitian ini bertujuan untuk melihat pengaruh body image dan jenis kelamin pada obesitas di remaja.*

**Metode:** *Desain penelitian ini adalah observasional dengan pendekatan cross sectional. Penelitian ini dilakukan pada bulan November 2019 di SMK Negeri 9 Surakarta. Jumlah subjek dari penelitian ini sebanyak 57 siswa yang dipilih dengan cara two stage sampling. Body image dan obesitas dinilai melalui kuesioner MBSRQ-AS, Grafik IMT berdasarkan usia dan lingkaran pinggang. Data yang telah terkumpul diolah dengan independent T-test, fisher exact test, uji regresi logistik dengan nilai signifikansi  $p < 0,05$ .*

**Hasil:** *Terdapat perbedaan yang signifikan dalam skor body image antara kelompok obesitas dan non obesitas ( $p = 0,006$ ) dan rata-rata skor laki-laki lebih tinggi dibandingkan perempuan. Selain itu, laki-laki memiliki skor lebih tinggi dalam setiap aspek body image dibandingkan perempuan. Hubungan signifikan juga ditemukan antara body image dan obesitas ( $p = 0,045$ ), dan jenis kelamin dengan obesitas ( $p = 0,009$ ).*

**Kesimpulan:** *Ada hubungan yang signifikan antara citra tubuh dan jenis kelamin dengan obesitas pada remaja dan skor citra tubuh berbeda secara signifikan antara kelompok obesitas dan non obesitas dan antara siswa pria dan wanita. (Health Science Journal of Indonesia 2020;11(1):22-6)*

**Kata kunci:** *body image, obesitas, jenis kelamin, remaja*

### Abstract

**Background:** *Body image is a perception of our physical appearance. Weight misperception in adolescent lead to body dissatisfaction and obesity in adolescent. Gender also plays a role in adolescent obesity and body image. Obese adolescents have greater risk of non-communicable diseases than adolescents with normal weight. therefore, this research aims to discover body image and gender influence on adolescent obesity.*

**Method:** *This study is an observational design with cross sectional approach. The study was conducted in November 2019 at SMK Negeri 9 Surakarta. The subjects were 57 sophomore that were chosen randomly with simple random sampling. Body image and obesity were measured using MBSRQ-AS questionnaire, BMI for Age Charts and waist circumference. Data was processed by independent T-test, fisher exact test, logistic regression test with significance value  $p < 0.05$ .*

**Results :** *There is a significant difference in body image scores between obese and non obese group ( $p = 0.006$ ) and male students scored higher in every aspect of body image than female students. A significant relationship was found between body image and obesity ( $p=0,045$ ), and gender with obesity ( $p = 0.009$ ).*

**Conclusion:** *There is a significant relationship between body image and gender with obesity in adolescents and body image scores differ significantly between obese and non obese group and between male and female students. (Health Science Journal of Indonesia 2020;11(1):22-6)*

**Keywords:** *body image, obesity, gender, adolescents*



Obesity defined as an abnormal accumulation of excess fat in adipose tissue that can lead to other health problems and also known as one of the health problems in the world.<sup>1</sup> Adolescents obesity is a global concern because of its impacts on health and high rate incidence in the world.<sup>2</sup> In 2016, WHO reported that over 340 million children and adolescents aged 5-19 were obese.<sup>3</sup> Adolescent's obesity has a greater risk of developing non-communicable diseases compared to normal weight counterparts and often have psychological and social problems such as self-confidence, misperception on body image, depression, anxiety and discrimination.<sup>4</sup>

Based on Erik Erikson's Psychosocial Development theory, adolescence is the stage of finding an identity.<sup>5</sup> This makes adolescents is a crucial period in forming body image.<sup>6</sup> Their perception of the ideal body can be influenced by gender, media, ethnics, and social interaction.<sup>7</sup> Ideal body perception between female and male is different. Female tends to want a thin body but male likes bulky body more.<sup>8</sup> Media is responsible for the thin body as an ideal body image. Thin ideal body stigma causes obese adolescents to tend to feel dissatisfied with their body or called body dissatisfaction.<sup>9</sup> This weight misperception can cause body dissatisfaction that induces maladaptive eating behavior in adolescents.<sup>10</sup> The prevalence of weight misperception also increases along with the prevalence of adolescent obesity.<sup>11</sup>

This study aims to analyze the relationship between body image and gender with obesity in adolescents. This research is also useful to increase knowledge related to body image and obesity and can be used as a source to educate teenagers in evaluating their bodies and using a body image approach to promote adolescents obesity prevention.

## METHODS

### Study design

This study is an observational analytic design with a cross sectional approach.

### Study subjects

The study takes place at SMK Negeri 9 Surakarta which is under Banyuanyar Public Health Center territory work area in November 2019. Subjects of this study were sophomore in multimedia and visual communication design class that were chosen randomly by simple random sampling. The sample

size was calculated using the Lemeshow formula and 55 samples were obtained. This study also had an ethical clearance from Faculty of Medicine, Universitas Sebelas Maret, number 331/UN27.06/KEPK/EC/2019.

### Study variables

The dependent variable was obesity. In this study, obesity was measured by using WHO's BMI for age chart and measuring tape. The measuring tape was used for measuring waist circumference. Measurement of waist circumference and BMI is needed in this study to increase the sensitivity and specificity.<sup>12</sup> The cut-offs for obesity in this study were  $>+2SD$  and/or  $>86,45$  cm for male's waist circumference and  $>76,50$  cm for female's waist circumference. Adolescent does not have universal cut-offs. Therefore, waist circumference's cut-offs is based on research that was conducted in Indonesia by Mulyasari and Pontang.<sup>13</sup> Independent variable was body image and gender. Body image is an individual's perception of their physical appearance based on self observation and other's opinions. MBSRQ-AS was used to assess body image. There were five aspects of body image in MBSRQ-AS, appearance evaluation, appearance orientation, overweight preoccupation, body area satisfaction, and self-classified weight. Self-classified weight will not be assessed. In this section, the question is a categorical question that can't be scored. This questionnaire consists of appearance orientation, appearance evaluation, overweight preoccupation, and body area satisfaction questions with total 34 items, and each item was scored between 1 to 5. The total score from each individual was divided by total item and then converted to two decimals. Individuals with scored 2,50 or higher belong to body image positive group, but if the score is below 2,50, it will belong in body image negative group.

### Data analysis

Firstly data were analyzed with Kolmogorov-smirnov normality test and Homogeneity test. The data was normal and homogenous. To determine the relationship between 2 variables, the independence T-test, Mann Whitney, and fisher's exact test were used. Independence T-test and Mann Whitney are used to analyze body image and obesity, while fisher's exact test is used to analyze gender and obesity. To evaluate the two independent variables on influencing the dependent variable this study used logistic regression. In logistic regression, two



variables can be included simultaneously to get an adjusted odds ratio. All of these tests was run by SPSS 24 Software for Windows.

## RESULTS

Characteristics subject from this study were categorized into several variables, like age, gender, physical activity, and parents socioeconomic conditions. Based on gender and age, there were 40 male students and 17 female students with age ranges from 16 to 18 years old (Table 1). According to table 1, total of 35 students had moderate physical activity, and based on the distribution of parents' socioeconomic conditions, 59.6% were reported to have low income category and based on their obesity status, 13 students belong to obese groups and 44 in non-obese groups.

According to a univariate analysis of body image, all of the subjects in this study were reported to have a positive body image ( $\geq 2,50$ ). But there were significant body image score differences between male and female students where male student scores higher than the female students (Table 2). This correlation was tested using an independent T-test.

Table 1. Subject's characteristic

Characteristics	N	%
Gender		
Male	40	70,2
Female	17	29,8
Age		
16 years old	39	68,4
17 years old	17	29,8
18 years old	1	1,8
Physical Activity		
Low	22	38,6
Moderate	35	61,4
Parents Income		
Low	34	59,6
High	23	40,4
Obesity		
Obese	13	22,8
Non Obese	44	77,2

Independent T-test was used to evaluate the correlations between body image and obesity and obtained p value = 0.006 which means there are significant differences in body image mean scores between the obese and non-obese groups (Table 4). The obese group has a smaller mean body image score than non-obese group.

Table 2. Gender, obesity and body image scores

	Body image scores					P
	Min	Max	Mean	95% CI		
				Low-er	Upp-er	
Gender						
Male	2,71	4,19	3,22	0,03	0,39	0,03
Female	2,61	3,48	3,00			
Obesity						
Obese	2,71	3,39	2,94	-0,475	-0,083	0,006
Non Obese	2,74	4,19	3,22			

In addition to body image, gender is also associated with obesity. Based on the fisher's exact test results showed the value of p = 0.001 (Table 5). Therefore, it can be concluded that gender variables have a significant relationship with obesity.

Table 3. Correlation between body image scores and obesity

	Gender		P
	Male	Female	
Obese	4	9	0,001
Non obese	36	8	

This study assessed four body image aspects in MBSRQ-AS questionnaire. There are appearance evaluation, appearance orientation, overweight preoccupation, and body area satisfaction. Appearance evaluation shows how individuals see their overall appearance. Based on table 6, the subject of this study have a high score in this section. Meanwhile, appearance orientation will show the subject's concern about their body through the effort that they made to change and it was reported that female students and the obese groups have a bigger tendency to do something about their appearance than male students and non-obese group.

Table 4. Independent T-Test and Mann Whitney results of body image aspect scores with obesity and gender

Body image	Obesity		P	Gender		P
	Obese	Non obese		Male	Female	
Appearance evaluative	3,3	3,38	0,58	3,38	3,30	0,61
Appearance orientation	2,73	2,95	0,09	2,94	2,83	0,38
Overweight preoccupation	2,67	3,34	<b>0,01</b>	3,30	2,98	0,21
Body area satisfaction*	3,03	3,42	0,074	3,46	3,05	<b>0,03</b>

\*Analyzed with Mann Whitney

Overweight preoccupation is individual's fear becoming fat and body area satisfaction is a satisfaction of particular body parts. Table 6 showed

that overweight preoccupation has a significant relationship with obesity which means the obese group is reported to have greater weight gain anxiety. Furthermore, the body area satisfaction aspect has significant relationship with gender. It can be concluded that male and female have a different body parts preference.

Body image, gender, and obesity were analyzed using multivariate logistic regression analysis. The logistic regression analysis obtained p value = 0.045 for body image and 0.009 for gender. body image's adjusted odds ratio is 0.035, which means higher body image scores will reduce the possibility of getting obese. From table 7, gender's adjusted odds ratio is 7.43 and it shows that female students have a higher risk to become obese than male students.

Table 5. Association between Body Image, Gender and Obesity

Variables	Odds Ratio (OR)	CI 95%		P
		Upper	Lower	
Body Image	0,035	0,001	0,928	<b>0,045</b>
Gender				
Male (0)	7,143	1,617	31,554	<b>0,009</b>
Female (1)				

## DISCUSSIONS

Body image scores and gender have a significant correlation with obesity. An adjusted odds ratio of body image score is 0.035, which means respondent with low body image scores has a higher obesity risk than respondent with high body image scores. Based on gender's adjusted odds ratio, it is known that female respondents are at risk 7,143 times becoming obese. Body image can influence obesity through weight misperception. This misperception is divided into underestimation and overestimation. Underestimation is found in an obese who does not consider themselves obese.<sup>14</sup> Overestimation can usually be found in someone who has normal weight but feeling fat. Overestimation and underestimation of body weight can cause inappropriate eating behavior and cause obesity. Negative body image or dissatisfaction with the body can cause inappropriate eating behavior.<sup>15</sup> Another factor that can affect obesity in this study is gender. Female was reported to have a higher risk of becoming obese because of the increase of estrogen hormone in female.<sup>16</sup>

Body image scores differ between male and female respondents. These differences can be caused by the fact that men tend to be more confident and

have better self-concept (a person's perception of their appearance, abilities, and role) compared to women.<sup>17</sup> A study by Jain & Tiwari found that the boy's perception about the ideal self not only came from a muscular body but also the ability to solve problems and good manners.<sup>18</sup> Men's physical changes at puberty such as the formation of muscles and enlargement of shoulder width is in accordance with the ideal idea of the masculine body. Therefore, adolescent boys tend to be more satisfied with their bodies.<sup>19</sup> Another alike results were found in research conducted in Indonesia that men tend to have higher body image scores compared to women.<sup>20</sup>

In spite of having different body image score, all respondent in this study is classified as body image positive. Factors that influencing body image scores in this study are age, gender, and intrapersonal interaction. Most respondent in this study is at age 16 and body dissatisfaction towards body increases with age.<sup>21</sup> Body dissatisfaction most often appears at the age of 18 years old to 25 years old and tends to persist or worsen with age.<sup>22</sup> Based on the section self-classified weight in MBSRQ-AS questionnaire, the majority of respondents (38.6%) felt that their bodies were considered thin by others. This shows that the respondent's environment did not give negative comments on his appearance. Interpersonal relationships with family and peers can affect body image.<sup>23</sup> Comments from family and peers about appearance is one of the factors that can prevent negative body image in adolescent girls.<sup>24</sup> Majority student in SMKN 9 Surakarta is a male student. Male tends to have a positive body image when they were a teenager. This uneven ratio between male and female student influence peer interaction and eventually prevent female student having body image negative.

In conclusion, it can be concluded that student with low body image score and female more likely to become obese and obese student tends to have a low body image score. An intervention strategy to prevent adolescent obesity may also be based on body image, especially by using the overweight preoccupation aspect.

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## Dietary intake changes in adolescent girl after iron deficiency anemia diagnosis

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### Abstrak

**Latar Belakang:** Defisiensi zat besi dapat terjadi karena rendahnya konsumsi makanan yang mengandung tinggi zat besi dan tingginya konsumsi makanan yang dapat menghambat absorpsi zat besi. Meningkatkan asupan zat gizi adalah salah satu cara paling efektif untuk memutus rantai permasalahan anemia defisiensi zat besi. Tujuan penelitian ini untuk mempelajari perubahan asupan gizi dan kesadaran akan kesehatan pada remaja perempuan sebelum dan setelah diagnosis anemia defisiensi besi.

**Metode:** Penelitian menggunakan desain kohort dengan subyek sebanyak 62 orang dari 2 Sekolah Menengah Pertama di Wates setelah dilakukan tes hemoglobin (metode cyanmethemoglobin) dan baru didiagnosis anemia defisiensi besi. Asupan energi, zat gizi makro (protein, lemak, karbohidrat), zat gizi mikro (zat besi, vitamin C, tembaga, zink, vitamin B12), faktor penghambat serapan (tanin, oksalat, fitat, serat), juga asupan, buah, sayur, kopi, dan teh diperoleh dengan semi quantitative food frequency questionnaire (SQFFQ), 3 bulan sebelum dan 3 bulan setelah diagnosis anemia defisiensi besi. Data dihitung dengan Nutrisurvey<sup>®</sup> and STATA 12<sup>®</sup> menggunakan paired T-test.

**Hasil:** Tidak ada perubahan signifikan ( $p > 0,05$ ) pada asupan energi, protein, lemak, zink, vitamin B12, tembaga, serat, tanin, dan oksalat. Terdapat peningkatan signifikan asupan karbohidrat ( $p = 0,0161$ ), zat besi ( $p = 0,0057$ ), fitat ( $p = 0,000$ ), dan vitamin C ( $p = 0,0017$ ). Tidak ada perubahan signifikan rata-rata asupan buah, sayur, dan teh ( $p > 0,05$ ), tetapi konsumsi kopi lebih tinggi ( $p = 0,0018$ ).

**Kesimpulan:** Diagnosis anemia defisiensi besi mengarahkan pada perubahan asupan zat gizi. Subyek menjadi lebih sadar pada asupan zat gizi setelah diagnosis anemia defisiensi besi. Dibutuhkan usaha lebih untuk merubah asupan buah dan sayur yang rendah dan konsumsi teh dan kopi yang tinggi. (*Health Science Journal of Indonesia 2020;11(1):27-31*)

**Kata Kunci:** perubahan asupan gizi, kebiasaan makan, remaja perempuan, anemia defisiensi zat besi

### Abstract

**Background:** Iron deficiency may happen because of low consumption of foods rich in bioavailable iron and high consumption of foods rich in inhibitors of iron absorption. Improving dietary intake is the most effective way to break the chain of iron deficiency anemia problems. This study aimed to study the changes in dietary intake and health awareness among adolescent girl before and after iron deficiency anemia diagnosis.

**Method:** Cohort study with 62 subjects from 2 junior high school in Wates after hemoglobin test (cyanmethemoglobin method) and were newly iron deficiency anemia diagnosed. Intake of energy, macronutrient (protein, fat, carbohydrate), micronutrient (iron, vitamin C, Copper, Zinc, vitamin B12), inhibitor factors (tannin, oxalate, phytate, fiber), also intake of fruit, vegetable, coffee, and tea, collected using semi quantitative food frequency questionnaire (SQFFQ), 3 months before and 3 months after iron deficiency anemia diagnosis. Data calculated with Nutrisurvey<sup>®</sup> and STATA 12<sup>®</sup> for paired T-test.

**Result:** No significant changes ( $p > 0,05$ ) in energy, protein, fat, zinc, vitamin B12, copper, fiber, tannin, and oxalate intake. There were significant improvement in intake of carbohydrate ( $p = 0,0161$ ), iron ( $p = 0,0057$ ), phytate ( $p = 0,000$ ), and vitamin C ( $p = 0,0017$ ). No significant changes in mean intake of fruit, vegetable, and tea servings ( $p > 0,05$ ), but higher consumption of coffee ( $p = 0,0018$ ).

**Conclusion:** Iron deficiency anemia diagnosis resulted in dietary intake changes. Subjects were more aware of their dietary intake after iron deficiency anemia diagnosis. Small fruit and vegetable intake and high tea and coffee consumption suggested that efforts were needed to encourage dietary changes in these foods. (*Health Science Journal of Indonesia 2020;11(1):27-31*)

**Keywords:** dietary changes, eating habit, adolescent girl, iron deficiency anemia



Iron deficiency affects more than 2,2 billion people around the world, 15,6 percent of them are 12-19 y-old adolescent girl, and mostly coming from developing countries.<sup>1</sup> Iron requirements are increased during adolescence time to fulfil growth spurt needs and replace menstrual losses. Iron requirements even higher in adolescents coming from developing countries because of some iron loss factor like infectious disease, parasitic infertation, and limited iron bioavailability in food.<sup>2</sup>

Iron deficiencies can decrease neuropsychologic function (psychomotor, mental, behavioral, and cognitive) also impair student work capacity (performance and achievement) in school.<sup>3</sup> This impairment happens because iron deficiencies decrease number of dopamine D2 receptors and norepinephrine synthesis which resulted in residual abnormalities like sleep, learning, and memory disorders.<sup>2</sup> Study by Dziembowska (2018) showed iron deficiency status in female were related to characteristics of electroencephalogram (EEG) and cognitive performance.<sup>4</sup>

Iron deficiency may happen because of low consumption of foods rich in bioavailable iron, high consumption of foods rich in inhibitors of iron absorption, such as phytate, inadequate intestinal iron absorption, or blood loss that associated to reduction of total body iron.<sup>5</sup> If the iron deficiency continues for a longer time, synthesis of iron-containing protein like hemoglobin will fall below cut off value and progressed to iron deficiency anemia. Improving dietary intake is the most effective way to break the chain of iron deficiency anemia problems. Dietary changes act as a complement of pharmacological therapy by providing additional nutrients and preventing adverse interaction between dietary supplements and food.<sup>6</sup> Therefore, we conduct this study to assess the changes in dietary intake and health awareness among adolescent girls before and after iron deficiency anemia diagnosis.

## METHODS

This research was a prospective pre-post test cohort study conducted from January to June 2016 in Wates, Kulon Progo, Special Region of Yogyakarta, Indonesia. Research has been approved by Ethical Board of the Faculty of Medicine, Universitas Gadjah Mada with Ethical Clearance number KE/FK/655/EC June 10, 2015.

The population of this study was female students

between 12-15 years old from 2 junior high schools in Wates, Kulon Progo (SMPN 2 Wates and SMPN 3 Wates). These junior high schools were randomly chosen from 8 junior high school in Wates, Kulon Progo. All subjects were randomly chosen using Microsoft Excel® and agree to join the study by signed informed consent approved by the Institutional Review Board of the Faculty of Medicine, Universitas Gadjah Mada. Based on Slovin formula, minimum subjects included in the study were 62 (52 students with additional of 20 percent loss to follow up).

Iron deficiency anemia status was determined by performing blood hemoglobin test (cyanmethemoglobin method) and serum ferritin test (ELISA method) in Biochemistry Laboratory, Faculty of Medicine, Universitas Gadjah Mada. Anemia assessment was held in Januari 2016. Subjects were selected if values of blood test were abnormal for age group 12-18 year old (hemoglobin < 12 g/dL and serum ferritin < 15 µg/L). Students were chosen if they were newly iron deficiency anemia diagnosed and have not taken any medication related to iron deficiency anemia diagnosis. Demographic characteristic data were collected using paper based questionnaire. To measure the changes of dietary, intake of energy, macronutrient (protein, fat, carbohydrate), micronutrient (iron, vitamin C, Copper, Zinc, vitamin B12), inhibitor factors (tannin, oxalate, phytate, fiber), and intake of fruit, vegetable, coffee, and tea, were collected using semi quantitative food frequency questionnaire (SQFFQ), 3 months before and 3 months after iron deficiency anemia diagnosis. All data were administered by nutritionist during school days.

Data were calculated using Nutrisurvey® and STATA 12®. Demographic characteristics data were analyzed descriptively. Dietary changes were tested using paired T-test. Results were statistically significant if  $p < 0,05$ .

## RESULTS

Among 189 schoolgirls, 69 were newly diagnosed with iron deficiency anemia (incidence=36,5 percent), but 7 students refused to participate in the study. Most subjects came from middle low income family with family income less than 2 million rupiah. Subject parents were mostly well educated with average finished senior high school. Based on screening results, hemoglobin mean of subjects were 10,365 g/dL and serum ferritin mean was 8,885 µg/L.

Table 1. Demographic Characteristic of Adolescent Girl

Characteristic	n (%)
Living place	
With parents	54 (87,10)
With grandparents	5 (8,06)
Dormitory	3 (4,84)
Family income per month	
< 1 million rupiah	22 (35,48)
1-2 million rupiah	35 (56,45)
> 2 million rupiah	5 (8,06)
Mother formal educational background	
Not finish primary school	5 (8,06)
Finish primary school	15 (24,19)
Finish junior high school	11 (17,74)
Finish senior high school	25 (40,32)
Finish university	6 (9,68)
Father formal educational background	
Not finish primary school	9 (14,52)
Finish primary school	10 (16,13)
Finish junior high school	10 (16,13)
Finish senior high school	29 (46,77)
Finish university	4 (6,45)
Mother occupation	
Not working (stay at home)	34 (54,84)
Government employee	4 (6,45)
Private employee	2 (3,23)
Other	22 (35,48)
Father occupation	
Government employee	6 (9,68)
Private employee	4 (6,45)
Entrepreneur	10 (16,13)
Other	42 (67,74)
Menstruation status	
Already menstruating	40 (64,51)
Still not menstruating	22 (35,48)
Menstruation regularity	
Regular	31 (77,5)
Irregular	9 (22,5)
Menstruation duration	
3-5 days	27 (67,5)
More than 5 days	13 (32,5)

Based on dietary survey using semi quantitative food frequency questionnaire, there were no significant changes ( $p>0,05$ ) in energy, protein, fat, zinc, vitamin B12, copper, fiber, tannin, and oxalate intake before and after iron deficiency anemia diagnosis. But there was significant improvement ( $p<0,05$ ) in the intake of carbohydrate, iron, phytate, and vitamin C after iron deficiency anemia diagnosis. There are no significant changes ( $p>0,05$ ) in the mean intake of fruit, vegetable, and tea servings, but higher consumption of coffee ( $p=0,0018$ ).

## DISCUSSION

Adolescence characterized by large growth spurt and during this period iron requirements increase

as result of increase lean body mass and onset of menstruation.<sup>7</sup> Overall daily iron requirements increase to as much as 26 mg per day. Based on assessment, there were improvements in iron dietary intake after diagnosis, but subjects still consumed less than 19 mg iron per day which indicates negative iron balance. Iron food is divided into two forms, iron heme and iron nonheme. More than 40 percent of iron in meat are iron heme (protoporphyrin iron) with 15-35 percent bioavailability, which is present in meat, poultry, and seafood.<sup>1</sup> Most iron in diet is iron nonheme (found in pulse, grain, and fruit) with 5-20 percent bioavailability depends on iron facilitators and inhibitors of absorption.<sup>6</sup>

Table 2. Dietary Changes Before and After Iron Deficiency Anemia Diagnosis

	Before Diagnosis (n=62)	After Diagnosis (n=62)	p-value
Energy (kcal)	1517,95 ± 56,96	1616,87 ± 60,92	0,1201
Carbohydrate (g)	264,10 ± 9,29	288,71 ± 11,24	0,0161*
Protein (g)	47,37 ± 2,66	46,66 ± 2,31	0,8233
Fat (g)	33,19 ± 2,11	35,19 ± 2,32	0,4438
Iron (mg)	16,33 ± 0,95	19,81 ± 1,12	0,0057*
Tanin (mg)	7495,37 ± 480,12	7779,00 ± 668,18	0,6904
Oxalate (mg)	0,14 ± 0,02	0,13 ± 0,02	0,7176
Phytate (mg)	284,93 ± 21,29	439,73 ± 26,78	<0,0001*
Vitamin C (mg)	92,19 ± 11,81	165,06 ± 23,68	0,0017*
Copper (mg)	8,89 ± 5,06	6,10 ± 5,17	0,5141
Zinc (mg)	1,07 ± 0,21	1,03 ± 0,24	0,8389
Vitamin B12 (mg)	3,63 ± 0,49	2,77 ± 0,27	0,1040
Fiber (g)	7,51 ± 0,51	9,10 ± 0,86	0,0508
Vegetable (g)	113,06 ± 14,13	116,79 ± 21,56	0,8319
Fruit (g)	150,00 ± 16,17	155,55 ± 21,87	0,8202
Coffee (ml)	14,17 ± 3,68	35,52 ± 7,03	0,0018*
Tea (ml)	155,41 ± 16,82	149,83 ± 19,24	0,7954

\*) = p-value significant ( $p<0,05$ )

Iron deficiency anemia is a common problem in adolescent group due to improper diet and lack of nutrition awareness. Prevention, detection, or management effort of anemia in adolescent until now are not received much attention.<sup>8</sup> Family ability to buy iron rich foods, family health awareness, and family health knowledge are defining factors of iron deficiency anemia. Most subjects in this study were coming from low income family and cannot afford to buy high quality iron source foods in daily basis. Inadequate intake of iron because of household insecurity of food resulted in iron deficiency anemia.<sup>9</sup> Parents educational background also define subjects awareness to health. Most subjects were thinking that iron deficiency anemia is not an issue that need higher

attention, so that subjects were having little tendency to change their eating habits. Besides diet factors, unhealthy household environment and inadequate health service (poor hygiene, environmental sanitation and waste disposal) also can influencing high prevalence of iron deficiency anemia.<sup>9</sup>

Positive changes happen in vitamin C intake which can enhance absorption of iron. Subjects tend to have higher vitamin C consumption after they were diagnosed having iron deficiency anemia. This may related to several factors such as increased knowledge and perception of vitamin C health benefits or other dietary behaviors, so that they can increase their hemoglobin level. In fact, some food component can promote absorption of iron almost 3 times like ascorbic acid.<sup>10</sup> But there also some components inhibit absorption of iron especially nonheme iron like phytates (5 and 6 phosphate inositol) from cereal, legume, and nut products, coffee, tea, milk, dietary fibers, lignins, phenolic polymers, products of nonenzymatic Maillard browning, phosphate containing carbonated beverages, multivitamin containing calcium, zinc, manganese, or copper, usage of antacid, H2 blocker, pump inhibitors, and tetracycline.<sup>2,11</sup>

Giving iron deficiency anemia diagnosis did not change subjects dietary patterns on food components that can inhibit absorption of iron. Subjects still have drunk tea and coffee habit after eating that can add the negative impact of iron deficiency anemia. Insufficient iron intake and high iron inhibitor intake (like phytate and tannin) will make subjects susceptible to iron deficiency anemia because of low iron store.<sup>10</sup> Tannin and catechin in tea can inhibit bioavailability of non heme iron by 79-84 percent.<sup>12</sup> Increased consumption of coffee can reduce serum ferritin by 18,8 percent. Coffee intake reduced absorption of non heme iron by 40 percent.<sup>13</sup> Tea and coffee consumption with meals are not recommended for people suffering from anemia.

The diet survey in subjects indicated poor intake of green leafy vegetables, fruits, and iron rich foods. Data from Health Behaviour in School-Aged Children (HBSC) also showed that fruit and vegetable consumption tends to decrease between ages 11 and 15 because increased autonomy in food choice.<sup>14</sup> Adolescents are taking control of what, when, and where they eat and typically consume a greater proportion of their total food intake outside home. Their concern about body shape and adiposity also changes adolescent eating behaviour.<sup>15</sup> This is attributed to modernization influences which given

subject choose more fast food and following fads diets, so that subject was more likely to consume less nutritious foods like vegetable and fruit.

Dietary pattern problems in adolescents are determined by some factors such as low knowledge of parents, low parental and peers support, low family income, poor eating attitude, missing family meals, and increasing food and snack consumption out of home.<sup>16</sup> Family meals are important key in adolescent food intake because it is time to socialize and teach them eating habits and proper nutrition. Adolescents who share more than 3 times family meals a week more likely to have healthier dietary pattern and less likely to have eating disorder.<sup>17</sup>

Adolescents who eat out of home frequently and missed family meals are having poor quality of diet including low consumption of fruit, vegetable, and dairy products. Parent educational background is related to adolescents diet quality and healthy eating. Adolescents with higher parental educational background consumed higher fruit and vegetable than adolescents with lower parental educational level. This could also happen because socio-economic status, especially low income and low accessibility to healthy diet. Parents with lower educational level gave less attention to their children which conclude to higher incidence of missing family meals and higher incidence of eating out of home.<sup>18</sup>

In conclusion, iron deficiency anemia diagnosis resulted in dietary intake changes. Subjects were more aware of their dietary intake after iron deficiency anemia diagnosis. Small fruit and vegetable intake and high tea and coffee consumption suggested that efforts were needed to encourage dietary changes in these foods. Subjects should be encouraged to increase their diet with foods rich in heme iron, such as red meat (full of hemoglobin and myoglobin) or liver. Vitamin C is also needed to increase iron absorption and can be increased in diet by addition of fruits. Tea consumption can inhibit iron absorption. So iron deficiency person needs to wait for 1 to 2 hours after meals before consuming tea or even remove tea from their diet. Further research should be conducted in wider community settings to cover non-school going girls.

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## Comparison of BCYE and BMPA media on recovery rate of *Legionella pneumophila*

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### Abstrak

**Latar belakang:** *Legionella pneumophila* (*L. pneumophila*) telah banyak diketahui sebagai penyebab legionellosis; habitat nya di berbagai sumber air, lingkungan lembab dan hangat. Metode kultur menggunakan media spesifik masih menjadi baku emas untuk identifikasi *L. pneumophila*. Penelitian ini bertujuan membandingkan recovery rate *L. pneumophila* ATCC®33823 pada medium spesifik BCYE, dan medium selektif BMPA.

**Metode:** Dilakukan dilusi serial pada suspensi 0,5 McFarland *L. pneumophila* ATCC®33823; 100 ul dari tiap tingkat dilusi diinokulasi pada medium Buffered Charcoal Yeast Extract (BCYE) dan medium BMPA (medium BCYE yang ditambahkan suplemen BMPA- $\alpha$ ), secara duplo. Konsentrasi suspensi dihitung menggunakan metode Angka Lempeng Total (ALT) dari Standar Nasional Indonesia No. 01-2332.3-2006. Persentase recovery rate dihitung dan dianalisis secara statistik menggunakan SPSS versi 23,0.

**Hasil:** Jumlah koloni *L. pneumophila* yang tumbuh pada medium BMPA jauh lebih tinggi daripada yang tumbuh di medium BCYE; konsentrasi tertinggi yang diperoleh adalah pada medium BMPA sebesar  $1,45 \times 10^7$  CFU/ml. Persentase recovery rate pada medium BMPA adalah 96,67%, dan 60,67% pada medium BCYE.

**Kesimpulan:** Recovery rate medium BMPA untuk pertumbuhan koloni *L. pneumophila* ATCC®33823 jauh lebih tinggi daripada media BCYE, karena itu medium BMPA dapat direkomendasikan untuk kultivasi *L. pneumophila*, khususnya pada program surveilans berbagai sumber air dengan biaya lebih terjangkau. (*Health Science Journal of Indonesia* 2020;11(1):32-7)

**Kata kunci:** *Legionella pneumophila*, medium spesifik, BCYE, BMPA, recovery rate

### Abstract

**Background:** *Legionella pneumophila* (*L. pneumophila*) has been known as the etiology of legionellosis; they live in aquatic environment, warm and moist. Culture method using specific medium remains as the gold standard in the identification of *L. pneumophila*. This study aimed to compare the recovery rate of *L. pneumophila* ATCC® 33823 on the specific medium BCYE for the cultivation of Legionella, and BMPA, the selective medium.

**Methods:** Suspension of *L. pneumophila* ATCC® 33823 of 0.5 McFarland was diluted to 10 fold serial dilution; 100 ul of each dilution was inoculated on Buffered Charcoal Yeast Extract (BCYE) medium, and BMPA (BCYE supplemented with BMPA- $\alpha$ ) in duplicate manner. The concentration was calculated using Total Plate Count standard as of Indonesian Nasional Standard number 01-2332.3-2006. The percentage of recovery rate was calculated, and the statistical analysis was performed using SPSS version 23.0.

**Results:** Numbers of colonies of *L. pneumophila* grew on BMPA was much higher than on BCYE medium; the highest concentration was yielded on BMPA medium i.e.  $1.45 \times 10^7$  CFU/ml. The recovery rates were 96.67% and 60.67% on BMPA medium and BCYE subsequently.

**Conclusion:** The recovery rate of the BMPA medium on the colony growth of *L. pneumophila* ATCC®33823 was markedly higher than the BCYE, therefore BMPA medium can be suggested to be used in the cultivation of *L. pneumophila* especially in the routine surveillance program for water sources with less cost. (*Health Science Journal of Indonesia* 2020;11(1):32-7)

**Keywords:** *Legionella pneumophila*, specific medium, BCYE, BMPA, recovery rate

*Legionella pneumophila* (*L. pneumophila*) causes legionellosis with pneumonia as one of the most common clinical manifestations.<sup>1,2</sup> The incidence of legionellosis in the United State has increased around 4.5 times since 2000, meanwhile cases requiring hospitalisation exceeded average frequency.<sup>3, 4</sup> *L. pneumophila* are widespread in freshwaters such as lakes, rivers, and groundwater. These bacteria gain entry to the man-made water reservoir<sup>5, 6</sup> and were detected by Bryne et. al in Pittsburgh (70%) and Paris (60%)<sup>6</sup> and Al-Matawah Q et. al (2015) in Kuwait which was dominated by *L. pneumophila* serogroup 7.<sup>7</sup> In Indonesia, *L. pneumophila* was found in the swimming pool sample in Surabaya and cooling water samples in Jakarta.<sup>8,9</sup> Cases of legionellosis in Indonesia were reported in Bali, Karawaci Tangerang and other cities; a survey conducted in 2001 showed that the cases were related to transmission of bacteria from cooling towers.<sup>10</sup> Regarding these reports, it assumes that *Legionella* commonly colonize man-made water system, leading to transmission of disease via aerosol.<sup>11-13</sup> However, legionellosis cases are still underreported, therefore surveillance of *L. pneumophila* is necessary for a long-term approach in eradicating infection. Ministry of Health Republic of Indonesia (2019) has released a regulation no.7/2019 on routine surveillance that should be performed in the water system, especially in cooling towers.<sup>14, 15</sup>

The cultivation method remains as the gold standard in *L. pneumophila* detection.<sup>16,17</sup> Since the concentration of this bacteria in the building water system was very low and could not be detected by routine sampling,<sup>18</sup> Charcoal Yeast Extract (CYE) agar supplemented with Buffered Charcoal Yeast Extract (BCYE), a supplement containing L-cysteine, is used as specific medium.<sup>20, 21</sup> Addition of selective supplements consist of antimicrobials could promote *L. pneumophila* growth and reduce the competing bacteria and fungi.<sup>22-24</sup> Since the use of lots of media for identification of *Legionella* is not cost effective, we aimed to evaluate the recovery rate of *L. pneumophila* ATCC®33823 on CYE supplemented with BCYE and BCYE-BMPA supplements.

## METHODS

This study was descriptive-analytic research, conducted in the Microbiology Laboratory of Department Microbiology School of Medicine and Health Sciences, Atma Jaya Catholic University Indonesia, from August 2019 to September 2019; this had passed the ethical evaluation by the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia No. 10/08/KEP-FKUAJ/2019.

## Bacterial Suspension

Culti-Loops™ *L. pneumophila* ATCC 33823 (Thermo Scientific™) was streak directly according to manual instruction on CYE agar supplemented with BCYE supplement, followed by incubation at 37°C in the presence of 5% CO<sub>2</sub> for 3 to 7 days. Observation of the growth of colonies was conducted after 72 hours incubation and regularly every 48 hours to find the growth of expected colonies. Colonies with *Legionella* morphology characteristics were harvested in 5.0 ml of sterile Phosphate Buffered Saline (PBS) and adjusted to 0.5 McFarland turbidity standard.

## Cultivation and Enumeration

Dilution of 10<sup>-1</sup> was made by transferring 1 ml of 0.5 McF bacterial suspension to 9 ml of diluent (PBS) in the first tube (Tube I) and homogenised by vortex. Every dilution was prepared from drawing 1 ml aliquot from previous dilution. The method was performed in the same manner as above until 10<sup>-8</sup> dilution. A total of eight tubes represented for dilution of 10<sup>-1</sup>-10<sup>-8</sup> was obtained, assigned as tube I-VIII. Every suspension must be mixed well using vortex prior to drawing an aliquot for each subsequent serial dilution. The concentration of viable bacteria from each tube was subjected to enumeration by Total Plate Count (TPC) standard from Indonesian Nasional Standard (SNI) number 01-2332.3-2006.<sup>25</sup>

Inoculation was carried out on media as followed: *Legionella* CYE agar base medium (CM0655 Oxoid™) was added with *Legionella* BCYE Growth Supplement (SR0110 Oxoid™), referred as BCYE medium, and BCYE medium plus *Legionella* BMPA-α selective supplement (SR0111 Oxoid™) consists of Cefamandole, Polymyxin B, and Anisomycin, referred as BMPA medium. Both media were tested for fertility by inoculating Culti-Loops™ *Staphylococcus epidermidis* ATCC®12228 as recommended by the manufacturer. The expected result was absence of the growth of *Staphylococcus epidermidis* on BMPA medium, while the growth was observed on BCYE medium. A total of 100 ul aliquots from each dilution was plated onto each media in duplicate manner by spread plate techniques. The inoculated culture media were incubated and inspected in the same condition as above. Viable colonies were counted using colony counter and the concentration (CFU/ml) of sample tested was calculated.

## Identification of morphology characteristics and agglutination test

Characteristics of *Legionella* colonies identified as greyish-white shiny colonies with the typical ground

glass appearance, Gram-negative rods, oxidase-positive, catalase-positive. Latex agglutination test was performed for *L. pneumophila* serogroup identification; Microgen® Legionella Agglutination Kits M45CE was used. The agglutination is expected to occur for the *L. pneumophila* ATCC®33823 using reagent test 2-15. This strain of *L. pneumophila* is identified by the manufacturer as serogroup 7.

#### Concentration and recovery rate measurement

The concentration was measured using the TPC formula, based on Indonesian SNI No. 01-2332.3-2006, shown below:

$$N = \frac{\Sigma C}{[(1 \times n_1) + (0,1 \times n_2)] \times (d)}$$

N : Number of product colonies, expressed in colonies per ml or colonies per g

Σ C : Number of colonies in all plates counted

$n_1$  : Number of plates in the first dilution calculated

$n_2$  : Number of plates in the second dilution calculated

d : First dilution calculated

The calculation then multiplied by 10 due to the volume used was 0.1 ml.

#### Recovery rate

$$\frac{N1}{N0} \times 100\%$$

N1 : Number of colony forming units per ml (CFU/ml) obtained

N0 : Number of colony forming units per ml (CFU/ml) as equal to 0.5 McFarlands ( $1.5 \times 10^7$  CFU/ml)

The percentage of recovery rate was calculated by dividing the concentration obtained by the initial concentration and multiplied by 100.<sup>26, 27</sup>

#### Statistical analysis

Statistical analysis was carried out using a t-independent test to compare the concentration (CFU/ml) on BCYE and BMPA media using SPSS software version 23.0, 2015 with  $P < 0.05$  was significance, and 95% confidence interval. Normality of the data was tested using Shapiro Wilk test. If the value is greater than 0.05, it shows a normal distribution. Mann Whitney U test was used instead if the distribution was not normal.

#### RESULTS

The identification of the colonies was conducted on day 5 of incubation since at this time of incubation colony morphology has shown its best. The bacteria colonies were identified by morphologies characteristics, Gram staining, biochemical and agglutination test as mention in the method above. The results on all plates by a 100 ul diluted bacterial suspension from tube I to tube VIII showed colonies with characteristics of *L. pneumophila*; agglutination occurred when tested with Microgen® Legionella Agglutination Kits M45CE, which confirmed of the presence of *L. pneumophila* serogroup 2-15. The growth of expected colonies of *L. pneumophila* was observed on BCYE plates inoculated by the bacterial suspension from tube I to tube V, while on BMPA plates, colonies growth was observed up to tube VI, which was 10 fold more diluted than tube V. Numbers of colonies on each plate were counted, and the concentration of the bacterial suspension in each tube was calculated using the TPC formula (Indonesian SNI No. 01-2332.3-2006). The results were as shown in Table 1 and 2.

Table 1. Colonies number of *L. pneumophila* ATCC 33823 and the concentration yielded from the cultivation on BCYE medium

Tube	Dilution	Colonies number			Concentration (CFU/ml)
		I	II	Mean	
I	$10^{-1}$	TNTC*	TNTC*	TNTC* TNTC*	TNTC* TNTC*
II	$10^{-2}$	TNTC*	TNTC*	540	$0.54 \times 10^7$
III	$10^{-3}$	510	570	90.5	$0.91 \times 10^7$
IV	$10^{-4}$	95	86	5	$0.50 \times 10^7$
V	$10^{-5}$	2	8	0	0
VI	$10^{-6}$	0	0	0	0
VII	$10^{-7}$	0	0	0	0
VIII	$10^{-8}$	0	0		

\*Too Numerous Too Count

The highest concentration obtained on BCYE and BMPA media was of those that were inoculated by bacterial suspension of tube IV which gave a concentration of  $0.91 \times 10^7$  CFU/ml and  $1.45 \times 10^7$  CFU/ml respectively. Further, on the BMPA plates,

colonies growth was observed up to tube VI, and resulted to a concentration of  $1.00 \times 10^7$  CFU/ml, while it only showed colonies up to dilution  $10^{-5}$  (tube V), which produced a concentration  $0.50 \times 10^7$  CFU/ml on BCYE medium.

Table 2. Colonies number of *L. pneumophila* ATCC 33823 and the concentration yielded from the cultivation on BMPA medium

Tube	Dilution	Colonies number			Concentration (CFU/ml)
		I	II	Mean	
I	$10^{-1}$	TNTC*	TNTC*	TNTC*	TNTC*
II	$10^{-2}$	TNTC*	TNTC*	TNTC*	TNTC*
III	$10^{-3}$	840	990	915	$0.92 \times 10^7$
IV	$10^{-4}$	150	140	145	$1.45 \times 10^7$
V	$10^{-5}$	5	14	9.5	$0.95 \times 10^7$
VI	$10^{-6}$	1	1	1	$1.00 \times 10^7$
VII	$10^{-7}$	0	0	0	0
VIII	$10^{-8}$	0	0	0	0

\*Too Numerous Too Count

The recovery rate of BCYE and BMPA medium was calculated by dividing the concentration obtained, i.e. from tube IV of the BCYE and BMPA by the initial concentration of the bacterial suspension used, i.e. 0.5 McFarland ( $1.5 \times 10^7$  CFU/ml) and multiplied by 100; thus showed 60.67% and 96.67% respectively, where the BMPA medium had a much higher recovery rate than BCYE medium. Colonies grew from tube IV were chosen referring to SNI number 01-2332.3.-2006 in which showed colonies range from 25-250 colonies. The distribution of data obtained using Shapiro Wilk test showed normal distribution. Comparison of the concentration from each medium was carried out from tube III-V as shown in Figure 1, and was statistically analysed using t-independent test, the result showed p-value of 0.102 ( $P > 0.05$ ). Both medium showed similar growth capability for *L. pneumophila*, nevertheless, the BMPA medium had much higher recovery rate than the BCYE.

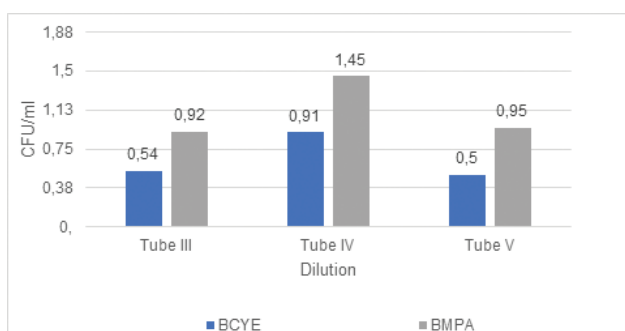


Figure 1. The concentration (CFU/ml) of tube III, IV, and V plated on BCYE and BMPA media

This figure showed the concentration (CFU/ml) obtained from three different dilutions of bacterial suspension inoculated on BCYE and BMPA agar. The CFU/ml showed up from the cultivation on BMPA agar was higher than on BCYE. Moreover, the highest concentration was obtained from the suspension dilution of  $10^{-4}$  cultivated on BMPA medium.

## DISCUSSION

The present study used different medium formulations for the recovery of *L. pneumophila* strain. We compared the recovery rate and concentration on BCYE and BMPA medium and showed the BMPA medium had better performance than BCYE. A study by Descours et. al (2014) showed selective media supplemented with antibiotic and anti fungi yielded higher isolation rates than BCYE medium.<sup>28</sup> On the contrary, however, statistical analysis demonstrated no significant difference in *L. pneumophila* growth on BCYE and BMPA media ( $P=0.102$ , t-independent test).

The ability of a medium for the isolation of *L. pneumophila* varies depend on the sample types and medium composition. Edelstein (1981) isolated *L. pneumophila* from the contaminated water specimen and showed a significant difference of mean viable counts on BCYE and BMPA media.<sup>29</sup> BCYE medium is specific but not selective for the isolation of *L. pneumophila* due to absence of antibiotics component to inhibit contaminants. Our study, however, we used sterile Phosphate Buffered Saline (PBS) that has



been seeded with *L. pneumophila*, of which none of the contaminants were present. Thus, it could be assumed that there would be no significant difference in growth on BCYE and BMPA media using PBS seeded with *L. pneumophila*.

Pharmacopeia recommends a recovery rate of 50%-200%, whereas the recovery rate of *L. pneumophila* on BCYE (60.67%) and BMPA (96.67%) media were within the range.<sup>30</sup> Recovery rates could vary depending on the type of water sample.<sup>31</sup> Boulanger and Edelstein stated that the results obtained could be different between seeded water samples and actual water specimens, further the presence of other flora in water specimens could decrease the recovery of *L. pneumophila*.<sup>27</sup> Fliermans et al. (1981)<sup>31</sup> found the recovery rate of Legionella from seeded water samples was consistently around 80%, whereas the BMPA medium in the present study showed higher i.e. 96.67%. Our earlier study of water resources from tap water, water reservoir, condensed water from split air conditioning (AC), and hot water obtained from two private hospitals in Jakarta showed a better growth of *L. pneumophila* on BMPA.<sup>32</sup> Edelstein (1981)<sup>29</sup> recommended a laboratory with limited funds could use BMPA medium which might show lower yield instead of using BCYE medium with a higher risk of contamination. The present study is in agreement with Edelstein that the use of BMPA medium increases both selectivity and sensitivity of *L. pneumophila*.

In conclusion, the present study demonstrated the recovery rate of *L. pneumophila* was markedly higher on the BMPA medium than BCYE. Therefore, the BMPA medium can be suggested to be used for cultivation of *L. pneumophila*, especially in the routine water sources surveillance program with less cost.

### Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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## Correlation of noise level exposure on the reaction time of workers at a manufacturing company in Bandung, Indonesia

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### Abstrak

**Latar Belakang:** Para pekerja sering kali terpaksa berhadapan dengan kebisingan tinggi ditempat kerja. Kebisingan mengganggu perhatian yang diperlukan terus-menerus dan menurunkan produktivitas kerja, oleh sebab itu pekerja yang melakukan pengamatan dan pengawasan terhadap satu proses produksi atau hasilnya, dapat membuat kesalahan akibat dari terganggunya konsentrasi dan kurang fokusnya perhatian. Pada penelitian ini dilakukan pengukuran waktu reaksi cahaya dan suara untuk menilai fokus perhatian/konsentrasi.

**Metode:** Studi analitik dengan desain komparatif cross sectional. Penelitian ini dilakukan pada perusahaan manufaktur yang memproduksi benang nylon sintetik. Membandingkan rerata selisih waktu reaksi cahaya dan suara sebelum dan setelah bekerja dengan pajanan kebisingan pada kelompok subjek yang bekerja pada intensitas kebisingan di atas NAB (area braiding) dibandingkan dengan yang di bawah NAB (area waring), dimana sebelumnya dilakukan pengukuran intensitas tingkat kebisingan di kedua area tersebut.

**Hasil Penelitian:** Perbedaan bermakna waktu reaksi cahaya yang melambat pada subjek yang bekerja dengan pajanan kebisingan di atas NAB sebelum dan setelah bekerja ( $p=0.007$ ), namun tidak dengan waktu reaksi suara. Tidak terdapat perbedaan bermakna waktu reaksi cahaya dan suara pada subjek yang bekerja dengan pajanan kebisingan di bawah NAB sebelum dan setelah bekerja. Terdapat perbedaan bermakna rerata selisih waktu reaksi cahaya yang melambat pada subjek yang bekerja pada pajanan kebisingan di atas NAB dengan di bawah NAB,  $p=0,017$ , namun tidak bermakna terhadap rerata selisih waktu reaksi suara.

**Kesimpulan:** Terdapat perbedaan rerata selisih waktu reaksi cahaya pada pekerja yang bekerja dengan pajanan kebisingan di atas NAB dibandingkan dengan pekerja yang bekerja dengan pajanan kebisingan di bawah NAB, sehingga tingkat intensitas kebisingan tinggi (di atas NAB) mempengaruhi waktu reaksi cahaya dan menjadi lebih lambat. (*Health Science Journal of Indonesia 2020;11(1):38-44*)

**Kata Kunci:** waktu reaksi cahaya; waktu reaksi suara; kebisingan

### Abstract

**Background:** Workers are often exposed to high noise level at their workplaces. Noise can disrupt the worker's concentration and focus and in the end, may cause lower productivity. Thus, workers whose main job descriptions are to supervise workflow from one phase to another are prone to mistakes due to the loss of concentration and focus. In this research, we used reaction timer with light and sound stimuli to assess attention or concentration.

**Methods:** The study was an analytical study with comparative cross sectional design, comparing a mean difference between light and sound reaction time before and after work. This research was conducted at a manufacturing company that produces synthetic nylon fibers. The subjects were divided into two groups; the workers with noise intensity above TLV (braiding's area) and with noise intensity below TLV (waring's area). Prior to the study, the research has measured the intensity of the noise level in the workplace area.

**Result:** A significant difference was found in the light's reaction time who work with noise exposure above TLV ( $p=0.007$ ) and it was found to be slower after work with the workers who are exposed to noise above TLV. There was also a significant mean difference for the light's reaction time between the above TLV noise group and below TLV noise group ( $p=0.017$ ). There was no significant difference in sound reaction time.

**Conclusion:** There was a significant mean difference in light reaction time for the workers who work with noise exposure above TLV compare with the workers who work in below TLV, so that high intensity of noise level is found to affect and decrease the light reaction time of the workers. (*Health Science Journal of Indonesia 2020;11(1):38-44*)

**Keywords:** light's reaction time, sound's reaction time, noise.

Workers are often exposed to high noise level at their workplaces.<sup>1</sup> Noise can disrupt the worker's concentration and focus and in the end, may cause lower productivity. Thus workers whose main job descriptions are to supervise workflow from one phase to another are prone to make mistakes due to the loss of concentration and focus.<sup>2</sup> Level of concentration reflects cognitive performance.<sup>3</sup> Exhaustion can decrease work capacity and work endurance that is signified by a decrease in workers' motivation and their activity levels thus decreasing their work productivity.<sup>4</sup> Work exhaustion can decrease workers' reaction time.<sup>5,6</sup>

In 2015, Hansen et al in their Norwegian study, evaluated 87 marines who were assigned at 4 different locations with various noise decibels <72,6 dB, 72,6 – 77,0 dB, 77,1 – 85,2 dB, and >85,2 Db (the study used personal noise dosimeter). After 4 hours (7.5 ± 2.5 hours; with range of 4.3 – 9.5 hours), the subjects which were exposed to noise performed a cognitive function test (visual attention and time reaction). The study concluded that there was a significant decrease in time reaction and visual attention in the subjects that were exposed to noise >82.5 dB.<sup>7</sup>

This company has approximately 300 employees including office staff. The main productions are waring process ("waring") which produces fishing net, and braiding process ("braiding") which produces fishing lines. Fishing lines which are produced in this manufacture is second best quality in the world nowadays. All that process was worked continuously for 24 hours a day and divided into two work shifts. In the preliminary study, the author found that the workers in the braiding area complained of tiredness or exhaustion, lack work concentration, error tendencies when following orders from their supervisors at the braiding area, work accidents like head trauma with machine body, finger crushed by the machine at waring area. In braiding and waring area, workers do not always use their hearing protective equipment.

This study investigated the correlation of noise level exposure on the reaction time of workers at a manufacturing company in Bandung, to know whether a decrease speed of light and sound's reaction time before and after work with the noise exposure compared at braiding and waring area.

## METHODS

This study was an analytical cross sectional comparative design. This study compared reaction

time between a group of respondents who work at noise exposure above TLV and below TLV. TLV becoming the boundary in this study for 12 hours of work in noise that was 83,2 dBA where the formula was obtained from ACGIH (American Conference of Governmental Industrial Hygienist).<sup>8,9</sup>

The research was started in September 2017 and samplings were taken until November 2017.

The inclusive criteria were workers who work with noise in the production process and work continuously with noise exposure in their workplace for at least four hours a day. The exclusion criteria were workers who have sickness (URTI and pain at their hands); workers who consume alcohol, antihistamine and tranquilizer drugs before the study is started.

Before this study started, the author explained to the subjects about all the procedurs and measured noise intensity at braiding and waring area at four different points in each area with a sound level meter from Balai K3 Bandung which has been calibrated and measured by the certified officer. Questionnaires were filled by all the subject about age, education level, right or left handed, caffeine consumption, period of work and time traveling to the workplace and sleep quality before work using a questionnaire from PSQI (Pittsburg Sleep Quality Index) which has been validated in Bahasa.<sup>10</sup>

Reaction time was measured with a reaction timer Lakassidaya type of SLS-L77 product of 2016 and has been calibrated. This tool has obtained a rightful authority patent certification in Indonesian occupational medicine. Reaction time was measured before and then 4 hours after work continuously with noise exposure for every worker. Every subjects were tested with light (yellow beam) and sound's (beep) stimulus and tested 20 times each of stimulus, measurements were taken by the list at point six until point fifteen then be averaged.<sup>3</sup> The reason was, at first until the fifth measurement is supposed in adaptation process with that tool, and at sixteenth until twentieth measurement are supposed in tired condition.<sup>11,12</sup> All the subject was obtained by consecutive's technic sampling.

Statistic analysis used SPSS version 20. The author has obtained approval and permission from the company to conduct the research in the company. Research has also been approved by Medical Research Ethics Commission of the Faculty of Medicine, Universitas Indonesia, Number 1019/UN2.F1/ETIK/2017.



## RESULTS

Table 1. The Distributions Table Based on Relation Between Characteristic and Variables

Variables	Braiding area (Above TLV) n=47	Waring area (Below TLV) n=47	p-value	n=94	Percentage (%)
Ages (years)					
median (min – max)	22.0 (17-48)	27.0 (16-42)	<0.001*	94	
Education level					
Basic (SD, SMP)	14 (28,57%)	35 (71,43%)	<0.001#	49	100
Middle-High (SMA/SMK, Akademi, PT)	33 (73,33%)	12 (26,67%)		45	100
Sleep Quality (Total score from PSQI)					
≤5 (good)	22 (40%)	33 (60%)	0.036#	55	100
6-21 (bad/poor)	25 (64,10%)	14 (35,90%)		39	100
Left/Right handed					
Right	45 (50%)	45 (50%)	1.000	90	100
Left	2 (50%)	2 (50%)		4	100
Caffeine consumption					
No Consumption in latest 12 hour	30 (61,22%)	19 (38,78%)	0.039#	49	100
Consumption in latest 12 hour	17 (37,78%)	28 (62,22%)		45	100
Period of work					
<3 years	38 (84,45%)	7 (15,55%)	<0.001#	45	100
≥3 years	9 (18,36%)	40 (81,64%)		49	100
Time travelling to the workplace					
<30 minutes	41 (52,56%)	37 (47,44%)	0.410	78	100
≥30 minutes	6 (37,50%)	10 (62,50%)		16	100

\* tested by unpaired T-Test.; # tested by chi square

In table 1, the authors compared each category at the workplace which was divided into noise intensity above TLV (braiding area) and below TLV (waring area). There are significant differences of age with median value of age in braiding area which was 22 years old and 27 years old in waring's area. There are significant differences proportion of characteristics in

education level, sleep quality, caffeine consumption, and period of work.

TLV for 12 hour of noise intensity has been measured for 83,2 dBA according to ACGIH. From the table 2, braiding area has four points measurements with the noise intensity above TLV for 12 hours, in waring area has the noise intensity below TLV for 12 hours.

Table 2. The Result of Noise Intensity Measurement in Braiding and Waring's Area

Location of Measurement	Method	Devices	Units	Result in Braiding's area	Result in Waring's area
Point A	SNI 7231 : 2009	Sound Level Meter	dBA	90,7	79,9
Point B	SNI 7231 : 2009	Sound Level Meter	dBA	92,1	81,4
Point C	SNI 7231 : 2009	Sound Level Meter	dBA	92,0	81,8
Point D	SNI 7231 : 2009	Sound Level Meter	dBA	91,2	78,1

Table 3. Table of difference average light and sound's reaction time before and after work with noise exposure above TLV and below TLV

Reaction Time	Above TLV (Braiding Area)*		Difference mean of reaction time (ms)	p-value
	Before work (ms) Median (min-max)	After work (ms) Median (min-max)		
Light	220,13 (156,48 – 301,21)	229,30 (173,16 – 350,24)	18,07	0,007
Sound	191,79 (147,97 – 278,68)	200,41 (152,87 – 295,92)	7,16	0,374
Below TLV (Waring Area)#				
	Mean ± SD	Mean ± SD		
Light	212,69 ± 41,35	213,78 ± 29,48	1,98	0,412
Sound	192,95 ± 33,59	191,47 ± 26,25	-1,47	0,376

\* tested with Wilcoxon; # tested with paired T-Test

In table 3, a median for light reaction time before work was 220,13 millisecond and after work with noise exposure above TLV was 229,30 millisecond. The average difference of light reaction time was 18,07 millisecond slower after work and the average of these differences is significant with p-value 0,007 for light reaction time before and after work. A median for sound reaction time before work was 191,79 millisecond and after work with noise exposure above TLV was 200,41 millisecond. The average of differences sound reaction time was 7,16 millisecond slower after work and the average

of these differences is not significant with p-value 0,374 for sound reaction time before and after work.

A mean value of light reaction time before work was 212,69 millisecond and 213,78 millisecond after work with noise exposure below TLV. The difference mean of light reaction time was 1,98 millisecond slower after work and it was not significant with p value 0,412. A mean value of sound reaction time before work was 192,96 millisecond and 191,47 millisecond after work with noise exposure below TLV. The difference mean of sound reaction time was 1,47 millisecond faster after work and it was not significant with p value 0,376.

Table 4. Table of mean difference light and sound reaction time before and after work with noise exposure above TLV and below TLV

	Above TLV (ms)	Below TLV (ms)	p-value
	Mean ± SD	Mean ± SD	
Mean of difference light reaction time	18,07 ± 39,46	1,98 ± 33,14	0,017*
Mean of difference sound reaction time	7,16 ± 41,90	-1,47 ± 32,18	0,133

\* tested by unpaired T-Test

Table 4 shows a worker group in braiding area has mean differences for light reaction time which was 18,07 millisecond slower and worker group in waring area has mean differences for light reaction time which was 1,98 millisecond slower. There was a significant difference in the mean differences for light reaction time for noise exposure above TLV compared with the noise exposure below TLV ( $p=0,017$ ). In table 4, worker group in the braiding area has mean differences for sound reaction time which was 7,16 millisecond slower and workers group in waring area has mean differences for sound reaction time which was 1,47 millisecond faster after work There was a significant difference in the mean differences for sound reaction time for noise exposure above TLV compared with the noise exposure below TLV ( $p=0,133$ ).

To prevent from the measurement bias, all measurements in table 3 and 4 were measured by researcher's assistant who was trained before by the expert in using calibrated reaction timer and the measurement was also performed on several workers who were not respondents in this research.

## DISCUSSIONS

There are significant differences in mean for age, difference of proportion characteristic in education level, sleep quality, caffeine consumption and period of work with noise exposure at braiding and waring area.

There was a significant difference in median of age in workers who work at braiding area and waring area. There is no requirement from this company for the workers in braiding area to be younger than the workers in waring area. Workers in braiding area have never been moved to waring area which has noise intensity below TLV.

There was a correlation between education level and workplaces in braiding and waring area where the most of workers with low education level worked at waring area and workers with middle high education level placed in braiding area. There is no requirement from this company for the workers in braiding area to have a higher education level than the workers in waring area.

There was a correlation between sleep quality and workplaces in braiding and waring area where most of workers with good quality of sleep worked at waring area and they who have poor quality of sleep worked at braiding area. This study did not try to find whether high noise exposure experienced by the workers would affect their sleep quality.

There was a correlation between caffeine consumption and workplaces in braiding and waring area, where most of the workers consuming caffeine worked at waring area. There is no requirement from this company for the workers to consume caffeine before work on both sites.

There was a correlation between the period of work and workplaces in braiding and waring area. Most of the workers in braiding area have period of work

below 3 years and vice versa, workers in waring area have period of work above 3 years. The turnover rate of workers in this company is approximately 3 years. Thus it can be assumed that the workers who work with high noise exposure below 3 years have not accumulated the side effect of the hearing risk.

A significant difference of mean light reaction time before and after work with noise exposure above TLV is in accordance with the research conducted by Hansen et al in Norwegia.<sup>7</sup> This study observed 87 marines assigned at 4 different locations with various noise decibels <72,6 dB, 72,6 – 77,0 dB, 77,1 – 85,2 dB, and >85,2 dB (the study used personal noise dosimeter), it has a significant decrease of time reaction of visual attention in the subjects after 4 hour-exposure with noise >82.5 dB. In this study has measured noise intensity at five points difference in the braiding area with equivalent values above TLV. They can induce tiredness because of high noise exposure that was exposed to the workers continuously for their 12 hour-shift works and all the workers did not use personal protection devices. It is different from the workers working at waring area where the equivalent values were measured below TLV although they have the same workload.

There is no significant difference in mean sound reaction time before and after work with noise exposure above TLV. Based on a study from California Training Institute in 2010, mean of sound reaction time is faster than light reaction time. It is because sound stimuli need approximately 8-10 millisecond to reach the central nerves system in brain while light stimuli need approximately 20-24 milliseconds.<sup>13</sup> That explanation is assumed to happen in this study where the subjects who were given sound stimuli have not too different reaction time between before and after work although their mean reaction time decreased after work with noise exposure. In addition, the subjects who had their reaction time measured 4 hours after work know how to conduct the tests so that there is a psychophysiological process in brain related to motivation, attention, and respond to the stimulus.<sup>14</sup>

There is no significant difference in mean light and sound reaction time before and after work with noise exposure below TLV. Disturbance of cognitive performance can consist of four main components: reading process, recall memory, recognition process, and attention where its component has a strong relation with noise exposure.<sup>15</sup> Noise exposure below TLV is not related with a wary cognitive

performance. However based on last study, they can affect the cognitive performance in decreasing ability to comprehend a reading or decreasing short memory function and recognition process.<sup>4,16</sup> In this study, subject's cognitive performance was not measured memory function tests like a study was observed by M.M Haines in London (2001), subjects who work at area where the noise intensity is below TLV were measured by light and sound reaction time with no statistically significant mean differences. In addition, a noise intensity measured was found to be below from TLV. In theory, it is mentioned that high noise level for a long period can induce tiredness and stress.<sup>3,5</sup>

There is a significant the mean difference of light reaction time for the subjects who were work with noise exposure above and below TLV but it is not significant for sound reaction time.

From the preliminary survey, this company does not have a health and safety environment programs such as periodical medical check up, environmental exposure monitoring, engineered machines which emit high noise. These matters can affect the workers for working with the noise exposure continuously 12 hours. In braiding area, the workers became easily tired.

This result has a similarity with the study by Hansen K.I. et al in 2015 which studied the speed of reaction time at Norwegian army who worked with noise intensity above 85,2 dBA compared with them who worked with noise intensity <72,6 dBA, 72,6 – 77,0 dBA, 77,1 – 85,2 dBA, the result showed significant value for attention visual reaction time (mean 380 ms, deviation standard 40).

The study researched by Balakrishnan in India tested reaction times with light stimulus red, green, and yellow. The result showed that yellow light stimulus slower approximately 25 miliseconds compared with red and green light stimulus ( $p < 0,001$ ). It was because the time needed to process yellow colour is more complex in central nervus system than the color green and red, so that they need much longer time.<sup>17</sup> In this study, the reaction timer use yellow light stimulus and all the subject was exposed by noise, so that this factor can be assumed as to why the light reaction time in this study become slower. Kahneman in 1973 explained that moderate noise intensity that occurs in a long time continuously can disturb attention and concentrations.<sup>18</sup>

In this study there are no significant mean differences in sound reaction time before and after work for

the subjects who work with noise exposure above and below TLV. On statistical analysis showed no significant difference in mean sound reaction time before and after work with noise exposure both above TLV and below TLV. This explanation can be related to the difference of individual's sound sensitivity where it can be measured with comparing a performance or ability to detect a noise or not. It is usually not related with the quality of hearing. Peoples who have higher sound sensitivity are known have a lack of attention and ability to work compared with them who have lower sound sensitivity. Individual's sound sensitivity is not always related to decreasing work performance and its relation to noise level.<sup>19</sup> It can be related to period of work. The worker's period of work where exposed by noise intensity continuously while working may have accumulation of effects in individual that can affect to reaction time. In this study, the average of worker's turnover rate in braiding area is 3 years, 38 subjects have period of work below 3 years and 9 subjects have period of work above 3 years. It can be assumed that the workers who have period of work below 3 years have not accumulated negative effects from noise exposure related to their hearing physiology that can affect individual's sound sensitivity. According to the study researched by Anggraini in 2006 and Budiyanto in 2010 that investigated a correlation between period of work the workers exposed high noise intensity with subjective complaints who worked with noise intensity in range 86,8 dBA -91,2 dBA and work stress. This study divided period of work. They defined the short period if it was below 6 years, medium period if it was in the range 6-10 years and long period if it was above 10 years. The result shows a significant correlation between period of work between the workers who are exposed to high noise intensity. The subjective complaints coming from the situation are fatigue, lack of focus concentration, uncomfortable feeling of condition at work and work stress.<sup>20,21</sup>

The sound frequency used in reaction timer was within normal threshold that can be heard by human which is 20Hz - 20.000Hz.<sup>2</sup>

In conclusion, in this study, the mean of difference light reaction time before and after work was 18,07 millisecond slower for the workers at braiding area and 1,98 millisecond slower for the workers at waring area, with the difference was statistically significant. The mean difference of sound reaction time before and after work was 7,16 millisecond slower for the workers at braiding area and 1,47 millisecond faster

for the workers at waring area, with the difference was not statistically significant. The researcher's suggestion for the workers in braiding area is a recommendation for using hearing protection devices because the workers in this area are found to experience a decrease in reaction time while exposed by high noise intensity during work. Company needs to do an engineering control to reduce the noise level produced by the machines such as installing sound box and sound absorbent material.

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## Risk factors associated with Dengue incidence in Bandung, Indonesia: a household based case-control study

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### Abstrak

**Latar belakang:** Bandung memiliki daerah perkotaan dengan kualitas bangunan rumah yang memadai, namun masih memiliki kasus endemik Demam Berdarah Dengue (DBD) yang tinggi. Penelitian ini bertujuan untuk mengetahui karakteristik kejadian demam berdarah di tingkat rumah tangga.

**Metode:** Data dianalisis dari 781 rumah tangga yang terdiri dari 261 kasus dan 522 kontrol. Pemilihan sampel menggunakan metode kasus kontrol berpasangan dengan rasio 1:2. Tahapan penelitian terdiri dari pengamatan status rumah menggunakan form ceklis pemeriksaan dan wawancara menggunakan kuesioner tertutup. Analisis data korelasi pairwise spearman, kemudian regresi logistik biner digunakan untuk prediksi faktor risiko.

**Hasil:** Faktor risiko usia produktif dan rendahnya tingkat pendidikan kepala keluarga, toilet yang kotor, dan status rumah tidak sehat memiliki pengaruh yang signifikan terhadap peningkatan kasus demam berdarah di Kota Bandung ( $p < 0.05$ ). Faktor determinan adalah usia produktif kepala keluarga (31 - 60 tahun) dimana memiliki kemungkinan 2,53 (95%CI 1.34-4.78;  $p < 0.05$ ) kali lebih besar untuk memiliki anggota rumah tangga yang menderita DBD di Bandung.

**Kesimpulan:** Usia dan pendidikan kepala rumah tangga, kebersihan toilet dan status rumah sehat memiliki peran penting dalam mempengaruhi kejadian demam berdarah. Dengan demikian, petugas kesehatan perlu melakukan promosi kesehatan mengenai DBD secara intensif kepada kepala rumah tangga. (*Health Science Journal of Indonesia 2020;11(1):45-51*)

**Kata kunci:** Demam Berdarah Dengue (DBD), kepala rumah tangga, usia, sanitasi rumah, Kota Bandung

### Abstract

**Background:** Bandung have urban areas with adequate housebuilding quality, yet still has high Dengue endemic cases. This study aims to investigate the characteristics of dengue incidence at the household level.

**Methods:** Data analyzed from 781 households consisted of 261 cases and 522 controls. We applied matched case-control samples with a ratio of 1:2 (case: controls). The stages of the research consisted of a house status observation using a form inspection checklist and interviews using a closed-ended questionnaire. The data analyzed by pairwise spearman correlation and binary logistic regression for risk factor prediction.

**Results:** Risk factors for productive age and low level of education of family heads, dirty toilets, and unhealthy house status have a significant effect on the increase of dengue cases in Bandung ( $p < 0.05$ ). The determinant factor is the productive age of the head of the family (31 - 60 years), it means that the family who has a family head in a productive age is 2.53 (95% CI 1.34-4.78;  $p < 0.05$ ) times more likely to have a household member suffering from DHF in Bandung.

**Conclusion:** The age and the level of education of the household heads, toilet hygiene, and healthy home status have an essential role in influencing dengue fever. Therefore, health workers need to perform an intensive health promotion regarding DHF to the household heads. (*Health Science Journal of Indonesia 2020;11(1):45-51*)

**Keywords:** Dengue, head of household, ages, house sanitation, Bandung City

Dengue haemorrhagic fever (DHF) is a mosquito-borne disease caused by Dengue virus and transmitted by *Aedes aegypti* and *Ae. albopictus*. Dengue infection has become a major public health problem worldwide, especially in Asia. In recent decades, the disease outbreak has been reported in 128 countries with more than 3.79 billion people are at risk, mostly in urban and semi-urban areas.<sup>1</sup> In Southeast Asia, Dengue is endemic in 12 countries. An estimated 2.9 million dengue infections occur annually with 5,906 among them died, thus impacting the annual economic burden of US \$ 1.65 (the US \$ 1.06 - the US \$ 2.41) per capita.<sup>2</sup>

The government of Indonesia has conducted various efforts to prevent dengue transmission by physical, biology, chemical, empowering of community, and integrated management control, but dengue morbidity keeps increasing. Indonesia has reported that the morbidity rate of dengue still increases to 700 times in the last 45 years, whereas the mortality rate decreases to 56.16 times.<sup>3</sup> dengue vector-density and human mobility cause rapid spread of dengue virus in Indonesia. We investigated the changes in dengue haemorrhagic fever (DHF) However, Indonesia has not succeeded in preventing and controlling *Ae. Aegypti* from dengue virus transmission in both rural and urban settlements.

Household activities may play a role in the transmission of Dengue Fever. Various factors, such as house sanitation, room construction, occupants' behavior, management of water containers<sup>4</sup> sanitation and hand hygiene in low- and middle-income settings and provide an overview of the impact on other diseases.

**METHODS:** For estimating the impact of water, sanitation and hygiene on diarrhea, we selected exposure levels with both sufficient global exposure data and a matching exposure-risk relationship. Global exposure data were estimated for the year 2012, and risk estimates were taken from the most recent systematic analyses. We estimated attributable deaths and disability-adjusted life years (DALYs, socio-economic conditions and knowledge about dengue fever have the potential to influence the incidence of dengue fever. Communities with less stable socio-economics condition tend to have inadequate or unhygienic houses. The previous study about risk factor analysis showed that residents in rented houses are more at risk of dengue than those who live in their own houses (AOR = 2.2, 95% CI= 1.1 - 4.6;  $p < 0.05$ ). In addition, residents of unhygienic dwellings were more likely to get dengue compared to residents in hygienic houses (AOR = 3.4, 95% CI = 1.0 – 11.7;  $p < 0.05$ ).<sup>5</sup> The behavior of increasing house hygiene and vector control

efforts were also closely related to the knowledge and attitudes of the community. Several studies have suggested that proper education and beliefs about dengue are related to the prevention of dengue.<sup>6-8</sup> These determinant factors significantly affect the ongoing transmission of dengue in several regions.

The region with the highest risk of increasing DHF cases is the area in the center of Bandung, with peak cases from January to August. Many people are at risk of catching the dengue fever in the center of Bandung due to socio-economic conditions, especially slum housing conditions, population density, relatively high mobility, and low education levels.<sup>9</sup> Respati's research (2018) states that the most decisive risk factors in the prevention and control of dengue in Bandung are community participation, housing, environmental factors, and climate.<sup>10</sup>

In Bandung, most of the citizens use containers for collecting and storing water for daily needs. These conditions will trigger an increase in the population of *Aedes* and the potential for the Dengue transmission. In 2010, at least of 3,430 Dengue cases were reported in this city. However, in the following two years (2013), the dengue cases were increased to 5,736 cases.<sup>11</sup> The free larvae index was also increased and close to the national target at 93.38%.<sup>12</sup> In this study, we have investigated the characteristic of the dengue incidence at the household level in Bandung, Indonesia

## METHODS

### Study Subjects

Bandung is the capital of the West Java Province, located at coordinates of 107° E and 6°55' S. Bandung has 75 PHCs (Primary Health Care/*Pusat Kesehatan Masyarakat*), as a unit in sub-district level that responsible for the community health efforts, consisting of public health activities for the population within their working area. This study has been carried out in 4 PHCs areas, i.e. Dago, Sekejati, Kopo, and Cipamokolan. The location of this study was determined based on the highest dengue case. This study also refers to research on Determining Risk Factors for Residential Sanitation in Dengue Hemorrhagic Fever (DHF) in Bandung in 2016.<sup>13</sup> This study aims to explain what factors cause the number of healthy home coverage continues to show an increasing trend every year, despite the increasing trend of dengue fever as well.

This research is observation research with a matched case-control design with a ratio of 1:2 so that the confounding factor in both groups can be controlled. The case group population is a house that has household members who have had DHF in 2015 in Bandung, while the control population is a house where household members have never had DHF in Bandung. The sample size was calculated using the odds ratio estimation formula, and a total sample of 783 households was obtained, consisting of 261 case groups and 522 control groups. The criteria for selecting a research location were if the puskesmas has a high number of dengue cases in 2015 in the city of Bandung. The sample selection of case group households uses a systematic random sampling technique, while the control group uses purposive sampling techniques with the criteria of a control group household being at a radius of 100 meters from the sample cases.

### Data Collection

Data were collected through observation and interviews. The observation using the Ministry of Health's standard questionnaire viz healthy housing inspection checklist to determine the house status based on the regulation of the Ministry of Health, Republic of Indonesia No. 829/Menkes/VII/1999. There were four observed places, such as living/family room, bedroom, bathroom, and kitchen. This study evaluated all room construction (ceilings, walls, floors, windows, vents, chimney, and lighting), and sanitation facilities (water facilities, toilets, wastewater disposal, and garbage cans). After observation on four rooms, KAP interviews using structural questionnaire were conducted with some question to respondents about vector, transmission, and control of Dengue

### Data Analysis

Status of a healthy house determined by calculating the weight of each component. The result of the calculation compared with the average standard value. The value for room construction is 44, and the value for sanitation facilities is 31. Based on the Arikunto criteria (2003), a 75% cut-off<sup>14</sup> can be used to determine the status of healthy and unhealthy houses. Then the house is characterized as a healthy house if the total amount achieved is 641 - 855 and an unhealthy house if the total amount obtained is less than 641. Then, the data analyzed by bivariate analysis using pairwise Spearman correlation. After that, multivariate analyses were performed to determine the dominant risk factor in affecting the incidence of Dengue in Bandung. Later, those

variables were analyzed through binary logistic regression using Minitab version 19.

### Ethics Approval

As this research involving humans as subjects, the research ethics approval was required. Therefore, research ethics approval letter has been published by the National Institute of Health Research and Development of Indonesia with Registration Number LB.02.01/5.2/KE.056/2016. The respondents gave a statement written in informed consent.

## RESULTS

### Characteristics of Dengue Incidences

The data samples of 783 respondents were successfully collected, which distributed to four Public Health Centers. As for the distribution consisted of 67 cases and 134 controls in Dago PHCs, 60 cases and 120 controls in Sekejati PHCs, 72 cases and 144 controls in Kopo PHCs, also 62 cases and 124 controls in Cipamokolan PHCs.

Result of the head of household characteristic component for case and control groups showed that the majority of households considered as a settled family with the indicator of age included into the productive period (95.02% and 88.70%), level of education ranged from high school to higher education (65.52% and 56.90%), and income (70.11% and 65.33%) was more than the regional minimum wage of Bandung (2,310,000 IDR), respectively. There are different age period and education level of head of household between case and control group ( $p < 0.05$ ) (Table 1). Overall, the value of the house component consisting of the construction of houses, and sanitation facilities, both in case and control group was relatively similar. For a few different house components, namely the ventilation, and chimney, ( $p < 0.05$ ) (Table 1).

House status showed that the majority of the Bandung citizen still included in the category of an unhealthy house, both in case and control group (83.14% and 89.08%). Moreover, the significantly different result was related to the house status to the incidence of Dengue in Bandung ( $p < 0.05$ ) (Table 2). The majority of Bandung citizen had inadequate knowledge (75.48% and 72.99%) regarding the transmission and eradication of Dengue, yet they had a right attitude (93.87% and 91.76%), and action (60.15% and 66.48%) concerning the prevention of Dengue. No significant different results related to knowledge, attitudes, and practices to the incidence of Dengue ( $p > 0.05$ ) (Table 3).



Table 1. Association between house components with Dengue incidences

No	House Components	Houses		p-value
		Case, n=261	Control, n=522	
1	Household head characteristics			
	<i>Age of household head</i>			0.004*
	Productive ( 16-60 Year)	248(95.02)	463(88.70)	
	Not Productive (>60 Year)	13(4.98)	59(11.30)	
	<i>Education of household head</i>			0.020*
	≥ Senior High School	171(65.52)	297(56.90)	
	< Senior High School	90(34.48)	225(43.10)	
	<i>Income of household head`</i>			0.180*
	≥ 3,000,000 IDR	183(70.11)	341(65.33)	
	< 3,000,000 IDR	78(29.89)	181(34.67)	
2	House constructions			
	<i>Ceiling</i>			0.477
	Healthy	203(77.78)	394(75.48)	
	Unhealthy	58(22.22)	128(24.52)	
	<i>Wall</i>			0.635
	Healthy	233(89.27)	460(88.12)	
	Unhealthy	28(10.73)	62(11.88)	
	<i>Floor</i>			0.789
	Healthy	237(90.80)	477(91.38)	
	Unhealthy	24(9.20)	45(8.62)	
	<i>Bedroom window</i>			0.956
	Healthy	184(70.50)	367(70.31)	
	Unhealthy	77(29.50)	155(29.69)	
	<i>Living room window</i>			0.206*
	Healthy	230(88.12)	475(91.00)	
	Unhealthy	31(11.88)	47(9.00)	
	<i>Ventilation</i>			0.045*
	Healthy	140(53.64)	319(61.11)	
	Unhealthy	121(46.36)	203(38.89)	
	<i>Chimney</i>			0.011*
	Healthy	161(61.68)	369(70.69)	
	Unhealthy	100(38.32)	153(29.31)	
	<i>Sunlight</i>			0.076*
	Healthy	155(59.39)	275(52.68)	
	Unhealthy	106(40.61)	247(47.32)	
3	Sanitation facilities			
	<i>Clean water</i>			0.858
	Healthy	201(77.01)	399(76.44)	
	Unhealthy	60(22.99)	123(23.56)	
	<i>Toilet</i>			0.234*
	Healthy	152(58.24)	327(62.64)	
	Unhealthy	109(41.76)	195(37.36)	
	<i>Waste disposal</i>			0.946
	Healthy	218(83.52)	437(83.72)	
	Unhealthy	43(16.48)	85(16.28)	
	<i>Garbage disposal</i>			0.559
	Healthy	193(73.95)	396(75.86)	
	Unhealthy	68(26.05)	126(24.14)	

> House components is Part of Physical building inside of house and householder behaviours, and was revealed of healthy when it's still functioning well and could prevent the disease's transmission;  
\* Candidates for Multivariate Analysis.

Table 2. Association of house status with Dengue incidences

No	House Status	Houses		p-value
		Case, n=261	Control, n=522	
1	Houses			
	Healthy	44(16.86)	57(10.92)	0.019*
	Unhealthy	217(83.14)	465(89.08)	

> Houses status are revealed healthy when whole of the house components assessment has value more than 641.25 based on Decree of the Minister of Health of the Republic of Indonesia No.829/Menkes/VII/1999 concerning the requirements of healthy housing

Table 3. Association of knowledges, attitudes, and practices with Dengue incidences

No	Variables	Houses		p-value
		Case, n=261	Control, n=522	
1	Knowledge			0.456
	Good	64(24.52)	141(27.01)	
	Poor	197(75.48)	381(72.99)	
2	Attitudes			0.293
	Positive	245(93.87)	479(91.76)	
	Negative	16(6.13)	43(8.24)	
3	Practices			0.082*
	Good	157(60.15)	347(66.48)	
	Poor	104(39.85)	175(33.52)	

\* Candidates for Multivariate Analysis

## Determinants of Dengue

The goodness of fit on logistic regression analysis showed that p-value of Hosmer Lemeshow was 0.499, indicated that the model is fit to be postulated. The value of concordant is 65.1, which means that probably there is only 65.1% risk factor variable correlated with the incidence of Dengue in Bandung. Risk factors that influence the increase in DHF are the age and the education of the household head, toilet, and the status of the healthy house ( $p < 0.05$ ). As for the most dominant risk factor of the spread of Dengue in Bandung is the age of household head which is still productive which leads to a tendency of dengue infection risk with OR 2.53 (95% CI, 1.34-4.78).

## DISCUSSIONS

In this study, the majority of cases of dengue infection in Bandung in 2016 lived in urban areas with good socioeconomic status, but they lived in houses with poor sanitation and lack of practice and behavior in vector control. This study also revealed that dirty toilets, bathtubs that are rarely drained, frequent use of insecticides, and lack of vector control efforts will

increase the risk of family members infected with dengue fever / DHF. In Kediri-Indonesia it was found that the activity to prevent Dengue through mosquito breeding sites eradication in the form of water container management has a significant correlation with the increase in Dengue cases.<sup>15</sup> Previous studies also reported that the condition of toilets in parts of Kuala Lumpur<sup>16</sup> and Thailand<sup>17</sup> related to the existence of *Aedes* spp; as well as in Venezuela. It stated that the practice of vector prevention was negatively associated with dengue cases.<sup>18</sup>

The attitudes and actions of the people of Bandung City have shown functional categories in efforts to control the vector of DHF, but it is not supported by good knowledge as well. The impact is the community makes efforts to clean the house environment as daily tasks, but the city has not made an effort to eradicate mosquitoes routinely and precisely. Some people of the City of Bandung admit that attempts to drain water are often but not routine and not accompanied by brushing actions, so the possibility of mosquito eggs attached to the walls of water containers can grow into adult mosquitoes. Therefore, comprehensive knowledge about Dengue should also be taken into consideration since inadequate knowledge will not have an impact on the behaviors of mosquito breeding sites eradication in total.<sup>19-21</sup>

The existence of water containers in the toilet can become a potential habitat for *Aedes aegypti* breeding such as bathtubs and buckets.<sup>22,23</sup> Stagnant water in containers that are not drained and brushed for more than nine days can be a habitat that is loved by *Aedes aegypti* to complete the life cycle of mosquitoes ranging from eggs, larvae, pupae, to adults.<sup>24</sup> *Aedes aegypti* adults infected with dengue virus can become dengue vectors during their lifetime between 15-65 days<sup>25</sup>; as long as its blood needs are met, *Aedes aegypti* will always be active inside the house. Therefore, in dengue-endemic areas, it was reported that household members who live at house with dengue patient have the opportunity to become infected with dengue 3.2 times (95% CI 1.8-5.7).<sup>26</sup>

The results of the binary logistic regression analysis showed that the productive age of the head of the household had a dominant role in dengue transmission in the city of Bandung (Table 4). This finding explains that the activity of the head of the household outside the home all day has caused the lack of time and ability to coordinate other family members to carry out DHF control efforts.

Table 4. Binary Logistic Regression Analysis on determinants of dengue incidence characteristics

No	Variables	Odds Ratio 95% CI	p-value
1	Age of household head	2.53 (1.34-4.78)	0.004**
2	Education of household head	1.39 (1.00-1.93)	0.048*
3	Living room window	0.65 (0.39-1.77)	0.095
4	Chimney	0.73 (0.52-1.03)	0.078
5	Toilet	0.68 (0.48-0.96)	0.027*
6	Practices	0.73 (0.53-1.00)	0.055
7	Healthy house	1.72 (1.05-2.83)	0.031*

Important information in this study is that the majority of DHF patients and their household heads are in the phase where they are productive. They occupy a sturdy house but pay less attention to aspects of vector control of DHF. This phenomenon is probably due to the lack of complete community knowledge about DHF. This phenomenon can result in the spread of DHF from the workplace to the residential environment, and transmit DHF to household members who live at home, to reduce family productivity. The mean number of workdays lost for adult DHF patients was 7.6 (SD 3.1) days;<sup>27</sup> as well as the head of the family who must treat patients while in hospital. Therefore, serious efforts are needed from the Bandung local government to provide systematic education on the control of DHF vectors at the household level to the head of the household, so that they are motivated to make efforts to eradicate mosquito nests regularly and appropriately. The hope is that the head of the house can invite all members of his family to start a clean and healthy life, especially in preventing dengue transmission.

The limitation of this study was that this study did not do in-depth interviews related to the explanation of why the people of Bandung City were low in knowledge but had good vector control attitudes and actions, though the means to access media information about DHF is very easy to obtain. Besides, no more digging about the mobility of household heads in maintaining the socioeconomic status of the community in the city of Bandung.

In conclusion, the description above explains that the incidence of Dengue caused by are the age and the education of the household head, toilet condition, and the status of healthy house. Therefore, it is necessary to establish cadres to promote the information about Dengue to the household heads. And also, the cadres must inspect and clean houses where larvae of *Aedes* spp. are found.

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## Evaluation of caregiver intervention on recovery of patient stroke: a systematic review

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### Abstrak

**Latar belakang:** Stroke merupakan kontributor utama pada kecacatan jangka panjang. Keadaan tersebut dapat menyebabkan kelangsungan hidup stroke bergantung pada caregiver, yang mungkin seorang profesional atau anggota keluarga, sehingga tujuan dari tinjauan literatur ini untuk memberikan informasi terkait hasil dari intervensi yang diperantarai oleh caregiver pada penderita stroke.

**Metode:** Systematic Review ini disusun dengan melakukan pencarian literature dengan memasukkan kata kunci yang relevan berdasarkan database PubMed, Proquest, Ebsco, Science Direct, dan Google Scholar, dengan mengikuti panduan PRISMA.

**Hasil:** Diperoleh 6 artikel yang sesuai dengan kriteria inklusi dan didapatkan hasil bahwa intervensi yang diperantarai caregiver dapat menurunkan tingkat keparahan dan kematian, pemulihan fungsi fisik, perubahan kemampuan fungsi kognitif, kecemasan dan kualitas hidup pada penderita stroke. Selain itu dapat meningkatkan pengetahuan, keterampilan dan kepuasan caregiver.

**Kesimpulan:** Perawat dapat memberdayakan caregiver dalam merawat pasien stroke dengan tujuan terjadi peningkatan pemulihan fisik, mental serta menurunkan angka kematian. (*Health Science Journal of Indonesia 2020;11(1):57-69*)

**Kata Kunci:** Caregiver, Intervensi keperawatan, Penderita stroke

### Abstract

**Background:** Stroke is a major contributor to long-term disability. This situation can lead to stroke survival depending on the caregiver, who may be a professional or family member, so the purpose of this literature review is to provide information regarding the outcome of caregiver-mediated interventions in stroke patients.

**Method:** The Systematic Review was compiled by searching literature by entering relevant keywords based on the PubMed, Proquest, Ebsco, Science Direct, and Google Scholar databases, following the PRISMA guidelines.

**Results:** Obtained 6 articles that fit the inclusion criteria and found that caregiver-mediated interventions can reduce the severity and death, recovery of physical function, changes in cognitive function abilities, anxiety and quality of life in stroke patients. Moreover, it can increase knowledge, skills and caregiver satisfaction.

**Conclusion:** Nurses can empower caregivers in caring for stroke patients with the aim of increasing physical, mental recovery and reducing mortality. (*Health Science Journal of Indonesia 2020;11(1):57-69*)

**Keywords:** Caregiver, Nursing interventions, Stroke patients

Globally, stroke is the third leading cause of death after coronary heart disease and cancer. In 2015 it reached 11.8% of total deaths worldwide.<sup>1</sup> According to the World Health Organization, (2018), stroke continues to increase each year and by 2020 it is estimated that more than 60 million people, where there are almost 6,000,000 people (10%) of the world's population each year die. In 2030 the estimated death rate with a disability reaches 200 million.<sup>3</sup> A stroke can strike someone every 40 seconds and can kill every 3 minutes 45 seconds, and each year can kill nearly 133,000 people.<sup>4</sup>

Deaths from strokes are highest in developing countries, 3 which rank highest among them China with nearly 1,700,000 people, India with almost 800,000 people and Russia with more than 500,000 people.<sup>2</sup> Indonesia, which is also a developing country, cannot be separated from the incidence of deaths from stroke. According to the 2018 RISKESDAS data, the prevalence also continues to increase, from 7% in 2013 to 10.9% in 2018.<sup>5</sup>

Disability or sequelae are experienced by 75% of stroke sufferers, 15% -30% of them experience severe disability.<sup>6</sup> Residual symptoms suffered by post-hospitalized stroke patients cause survival depends on the caregiver, so it takes the role of caregivers both professional and their own families.<sup>7</sup> Current clinical practice guidelines recommend caregivers come from the immediate family of stroke sufferers so they can become active members of their rehabilitation team by participating in goal setting and decision making to facilitate functional and integrated community recovery<sup>8</sup>, according to Friedman, Bowden, & Jones, (2010) family is the main health care provider for sufferers who experience chronic pain.

However, families need information, education and social support to be able to carry out care when patients go home<sup>10</sup>, therefore the role of nurses as educators can provide interventions providing special skills and information related to caregivers to reduce their burden and empower families in the care of stroke patients.<sup>11</sup> Young & Lutz, (2010) revealed, stroke patients have better recovery results if they have a strong social support system and good family functions to help their recovery needs.<sup>12</sup> Good knowledge and skills will improve the quality of care provided by caregivers.<sup>13</sup> Several previous studies have involved caregivers by increasing skills and knowledge about post-stroke care. However, the results presented are different, so the review of

this literature aims to provide information related to the results of interventions conducted by caregivers that are useful in improving the condition of stroke patients, especially when returning home.

## METHODS

In preparing this systematic review based on PRISMA and Cochrane guidelines.<sup>14</sup> Collection of relevant articles in the Pubmed, Proquest, Ebsco, Science Direct and Google Scholar databases. The PICOS keywords used are: P (caregiver OR family caregiver OR family), I (stroke patients), C (-) O (stroke recovery OR function recovery), S (RCT AND Quasi Experiment), and article filtering strategy explained in the flow chart (Diagram 1). To be more specific, the author also determines several inclusion criteria, namely: (1) publication in the last 5 years from 2014 to 2019, (2) full text, (3) original article, (4) discusses caregiver intervention in stroke patients, and (5) ) the article uses English. And exclusion criteria such as: (1) articles do not involve caregivers, (2) Qualitative, review, pilot studies, only abstracts, individual reports, and newsletters, and (3) articles published before 2014.

## Ethical Clearance

The authors declare there is no any ethical issues that may arise after the publication of this manuscript.

## RESULTS

The results of a search on 5 databases obtained 2,057 articles and found a double publication of 993 articles. So that there are 1,064 articles left. The article was then scanned according to inclusion and exclusion criteria totaling 1,056 articles so that the remaining 8 articles, but 2 of them were excluded because they did not fit the topic which eventually obtained six research articles that met the requirements. The research was conducted in several countries such as Thailand, Taiwan, South Korea, Indonesia and China. The methods used in these studies are the Randomized Controlled Trial (n = 3) and the Quasy Experimental Design (n = 3). Research articles in the years 2015-2019.

## Evaluation of interventions conducted by Caregiver;

### 1. Decreased severity of stroke and death

It was found three articles related to additional rehabilitation therapy given by caregiver had

more significant results in decreasing the severity of stroke, common complications that usually occur in stroke sufferers (aspiration pneumonia, urinary tract infections, pressure sores, joint contractures and recurrent strokes) reduced and mortality rates in the group given caregiver intervention reported lower mortality than the control group who only received conventional rehabilitation therapy.<sup>15</sup>

**2. Improved clinical conditions in stroke patients**

From the six articles reviewed, there were several results of improvement in clinical conditions in each article. Four articles get the same results, namely an increase in the Barthel Index score or an increase in Activity Daily Living (ADL) ((15–18). Two articles have resulted in an increase in the Berg Balance score (15,16). One article found the results of increased muscle strength, mobility, physical composite, free running speed and 6 minute walking distance.<sup>16</sup>

**3. Changes in cognitive abilities in stroke patients**

From the entire literature reviewed, two articles revealed the results of cognitive changes in stroke patients in the experimental group

compared to the control group, measured using the Mini mental status examination (MMSE) instrument.<sup>15,19</sup>

**4. Anxiety in stroke patients**

One of the six articles reviewed that found the results of decreased anxiety and depression in stroke patients managed by caregivers were measured using the *Hospital Anxiety and Depression Scale (HADS)*.<sup>19</sup>

**5. Quality of life of stroke sufferers**

One of the articles reviewed had significant results on improving the quality of life of stroke patients handled by caregivers compared to those not, measured using a 12-item-scale Stroke-specific quality of life (SSQoL) instrument to measure the quality of life for post-sufferers stroke.<sup>18</sup>

**6. Caregiver burden and satisfaction**

Of the six articles reviewed, there was one that assessed the workload and satisfaction of caregivers while caring for stroke patients, measured using the Canadian Occupational Performance Measure (COPM) instrument to assess caregiver satisfaction and family burden scale and caregiver burnout scale to assess caregiver burden.<sup>19</sup>

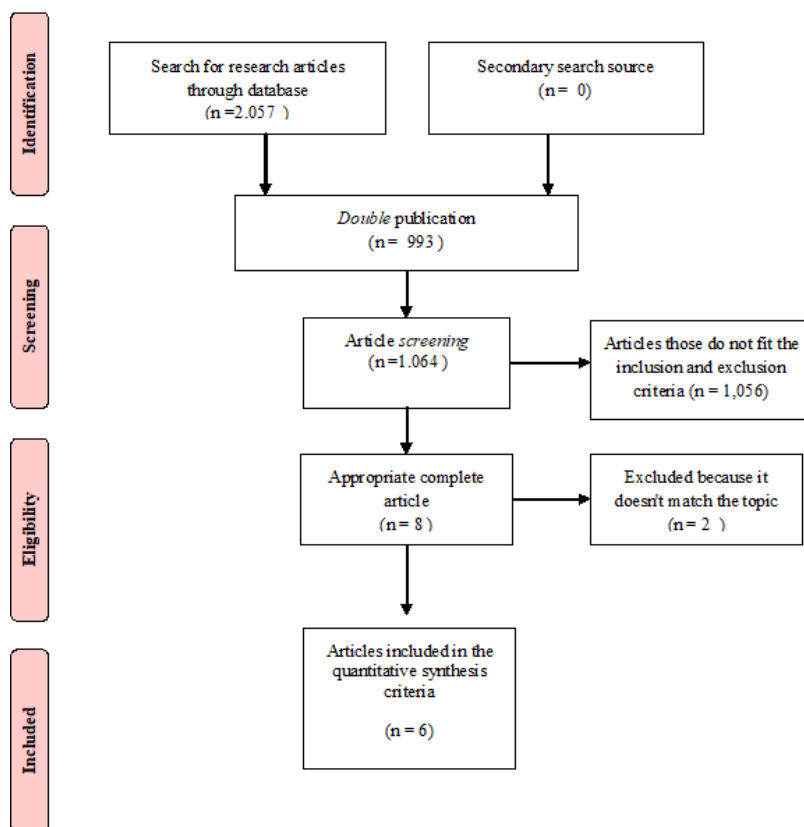


Figure 1. Flow diagram

No	Title / Author, Year	Design	Aim	Intervention	Responden	Instrument and Follow-up	Result	Conclusion
1	Caregiver-Mediated Intervention Can Improve Physical Functional Recovery of Patients With Chronic Stroke : A Randomized Controlled Trial / (20), Taiwan	RCT	find out whether home-based interventions that are mediated by families can improve physical function and social participation in stroke sufferers	Provision of exercise for 12 weeks, according to the home-based intervention program which is divided into 3 phases: 1. Phase 1 (weeks 1-4) to improve the function of the patient's body and structural components 2. Phase 2 (weeks 5-8) to improve the ability of sufferers to carry out daily activities in their neighborhood. 3. Phase 3 (weeks 9-12) to help sufferers return to the community and participate in activities in their environment.	51 stroke patients and their caregivers (intervention 25 people and control 26 people)	1. Evaluate physical recovery in stroke sufferers using the stroke impact scale, the Berg Balance scale, the 10 meter walking test, the 6 minute walk test and the barthel index. 2. Evaluate the caregiver using the caregiver load scale	Home-based interventions significantly increase the Stroke Impact Scale score: strength (control vs. intervention, respectively: 1.4 vs 15.5; P = 0.002), mobility (-0.5 vs 13.7; P <0.001), physical composites (-0.7 vs. 11.2; P <0.001), and the general recovery domain (0.2 vs 17.4; P <0.001). CHI also significantly increased the speed of free walking (-1.4 vs. 7.5 cm / s; P = 0.006), 6 minutes walking distance (-10.5 vs 15.8 m; P = 0.003), Berg Balance Scale score (-0.8 vs 4.5; P = 0.006), and the Barthel Index score (0.6 vs 7.2; P = 0.008) But the CHI program did not significantly influence the increase in caregiver burden	Home-based interventions can improve physical functional recovery and, perhaps, social participation in sufferers with chronic stroke
2	A Community Based Program for Family Caregivers for Post Stroke Survivors in Thailand / (17), Thailand	Quasi Experimental	Evaluating post-stroke care programs in community settings in Thailand	Interventions given to families for 4 weeks by providing information and practice skills related to post-stroke care, which are then evaluated 2 months after the intervention related to family skills and daily activities of patients (ADL) and complications. The interventions provided are: 1. Week 1: provide post-stroke care information and practice skills for 5 days (1 session per day) a. Day 1: basic knowledge of	62 pairs of stroke sufferers and families (31 pairs per group)	1. Evaluation of post-stroke care skills compiled solely by researchers adapted from the fundamental nursing skills checklist of the Thai Red Cross College of Nursing. Which has been validated. 2. Evaluation of physical functional	After participating in this program, family caregivers in the experimental group significantly improved their post-stroke care knowledge and skills compared to those in the control group (F = 585.81, p <0.001). ADL among post-stroke sufferers in the experimental group increased significantly over time and was higher than in the control group (F = 46.01, p <0.001). In addition, complications among sufferers in the experimental group ability to perform ADL	This research provides evidence of the importance of family caregivers who have important skills for caring for post-stroke sufferers at home. The results showed that family caregivers who participated in post-stroke care intervention programs had improved post-stroke care skills, resulted in increased ability to perform ADL



<p>pathology, consequences, severity, golden period, stroke recovery, support for sufferers to carry out routine daily care, complications</p> <p>b. Day 2: pressure sores, wound care, UTI</p> <p>c. Day 3: nutrition, treatment</p> <p>d. Day 4: mobilization, rehabilitation</p> <p>e. Day 5: how to manage emotions and stress, social support.</p> <p>2. Weeks 2 &amp; 3: focus on reviewing topics discussed in week 1 including family skills. The activity is carried out every week and lasts 2 hours</p> <p>3. Week 4: home visits as a follow-up from researchers to evaluate post-test interventions, and identify mobility needs for the care of sufferers such as canes, walkers or wheelchairs.</p> <p>4. Week 8: home visit. Researchers evaluate the care of sufferers, encourage and advise them related to their problems and obstacles. Assessing the needs of patients and families which are then coordinated with the CHC</p> <p>Families of stroke patients in the control group only received routine care from CHC</p> <p>All sufferers in the control and</p>	<p>ability / ADL using MBI (The Modified Barthel Index) developed by Shah et al.</p> <p>3. Evaluation of complications in patients is measured using a dichotomous scale based on literature review by assessing 5 common complications of patients (aspiration pneumonia, UTI, pressure ulcers, joint contractures, and recurrent strokes) that have been tested for validity and reliability.</p>	<p>were less than in the control group</p>	<p>and reduced complications in post-stroke patients.</p> <p>For further studies, researchers must consider for people with disabilities and must monitor the program's long-term effectiveness to confirm the maximum concrete benefits for sufferers.</p>
<p>3 Effect of a Quasi</p>	<p>Evaluate the</p>	<p>Evaluate the severity</p>	<p>No differences between groups</p> <p>Caregiver education</p>

<p><i>Caregiver's Education Program on Stroke Rehabilitation</i> (15), Korea Selatan</p>	<p>effects of educational programs and stroke caregiver satisfaction and functional recovery of sufferers in addition to conventional rehabilitation care</p>	<p>experimental group received two daily conventional rehabilitation therapy sessions (5 days / week for 4 weeks). One session consists of physical therapy and occupational therapy, and occasional speech therapy for half an hour, all in one and a half hours. Patients in the experimental group received additional rehabilitation therapy based on an educational program, which included family members or formal caregivers, which were organized by physiotherapists and carried out by physiotherapists and occupational therapists when transferred to the 2 Departments of Physical and Medical Rehabilitation. Additional rehabilitation therapy given to caregivers is carried out for 10-20 minutes after dinner on weekdays and after breakfast and also dinner on weekends, and is carried out for 4 weeks after completing the education program</p>	<p>A total of 181 respondents. Patients who received additional rehabilitation therapy were assigned to the experimental group (n = 81), the control group (n = 100) who only received conventional treatment.</p>	<p>of stroke sufferers using: 1. K-NIHSS, the Korean version of the National Institutes Of Health Stroke Scale 2. Korean version of mini mental status examination (K-MMSE) 3. Modified Barthel Index (K-MBI) 4. The Berg Balance Scale (K-BBS). Evaluation is carried out within 3 days of transfer to the Department of physical rehabilitation, and 3 days after the patient returns.</p> <p>Caregiver satisfaction using measurements: Canadian Occupational Performance Measure (COPM)</p> <p>Caregiver expenses using: 1. Family burden scale 2. Caregiver burnout scale Evaluation is carried</p>	<p>were observed between the initial K-NIHSS, K-MMSE, K-BBS, K-MBI scores, and time from entry to transfer. Patients with moderate or severe stroke in experimental conditions showed more significant improvement than the control group as determined by K-NIHSS and K-BBS, and the tendency for K-MMSE and K-MBI scores to increase. Significantly greater satisfaction for family members and formal caregivers of patients with stroke while moderate severity in the experimental group.</p>	<p>programs for stroke subjects have positive results on functional improvement of patients and caregiver satisfaction. The authors believe that additional rehabilitation therapy with educational programs helps sufferers achieve functional improvement for the return of optimal social life.</p>
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4	Increase in the functional capacity and quality of life among strokepatients by family caregiver empowerment program based onadaptati on model / (18), Indonesia	<i>Quasi-experim ental research with a pre and post test control group design</i>	Identify the effect of family empowerment programs based on the adaptation model (CEP-BAM) on the functional capacity and quality of life of patients after a stroke	In the intervention group the CEP-BAM program was divided into 3 phases: 1. Pre-education phase Psychological approach to fostering a trusting relationship between sufferers and their families. 2. Intervention Performed 6 interventions during the meeting with family and sufferers: a. Family caregiver education about stroke, prevention of recurrent stroke and stroke problems (first meeting with family caregiver in the first week). b. Family education and training about adaptive coping strategies after stroke. Efforts to achieve physical recovery include regular physical examinations, treatments, physical exercise and dietary stroke (second meeting with family caregiver in the first week). c. Family training in adaptation exercises after stroke includes part I body movements, including ambulation in bed, sitting in bed, standing and moving from bed to wheelchair and vice versa	80 samples (40 participants in the intervention group and 40 participants in the control group)	out before and after it is given Education 1. Bartel's Index to measure functional capacity after a stroke 2. Stroke-specific quality of life (SSQoL) 12 item-scale (short version) to measure quality of life after stroke Measurements were taken 4 times before the intervention (pre-test), in the last week of the fourth month (post-test 1), the fifth month (post-test 2) and the sixth month after the intervention (post-test 3)	This study proved a significant difference in functional capacity and quality of life between the two groups and between the pre-test and six months after the intervention (P <0.05). The quality of life of the intervention group at the sixth month after the intervention was better than the control group (33.40 ± 3.65 vs. 30.60 ± 2.78) with a significant difference (P <0.05).	CEP-BAM effectively increases the functional capacity and quality of life of patients after a stroke in the sixth month after the intervention. Nine out of ten domains of functional capacity increased in the intervention group after CEP-BAM, while two domains (eating and dressing) increased significantly in the 6 months after CEP-BAM. This intervention model can be used as a standard procedure in the management of post-stroke patients in community settings, especially for patients with mild to moderate disability after a stroke.
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- (third meeting with family caregiver in the first week).
- d. Family training on adaptation exercises after stroke includes body movements part 2, such as walking exercises and joint movements (fourth meeting with family caregiver in the second week).
  - e. Family training on adaptation exercises after stroke, such as doing basic daily activities and roles, including bathing, using toileting, dressing and feeding exercises (fifth meeting with family caregiver in the second week).
  - f. Family education about strategies to support sufferers and maintain an adequate psychological state of self when caring for sufferers (the sixth meeting with family caregivers in the third week).
3. Monitoring / evaluation
- a. Encourage families to guide sufferers to do adaptation exercises regularly.
  - b. Monitor notes made by the family: type and time of exercise, and the ability of sufferers to adapt.
  - c. Support the family when they have difficulty in caring for sufferers
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<p>The control group received a standard intervention in the form of a public health care program (CHN) integrated with a health program at the Community Health Center. The programs provided are:</p> <ol style="list-style-type: none"> <li>Early detection of recurrent stroke</li> <li>Health counseling</li> <li>Basic health care</li> <li>Referral to the nearest health service if the patient has a health problem</li> </ol>	<p>144 sufferers (77 interventions, 77 controls)</p>	<p>1. Demographic and clinical data of patients and families using a questionnaire that has been provided consists of: age, sex, duration of education, location of lesions, smoking status, hypertension, hyperlipidemia, and diabetes, gender caregiver and caregiver education</p> <p>2. Cognitive assessment of patients using the Montreal Cognitive Assessment (MOCA) score.</p>	<p>An increase in the Montreal Cognitive Assessment (MOCA) score from baseline to 12 months (M12 - baseline) in the FMEP group was higher than in the control group, and FMEP caused a decrease in the level of cognitive decline (MOCA score <math>\leq 26</math>) after 12 months compared to the control group. Changes in Hospital Anxiety and Depression Anxiety and depression score (M12 - baseline) scale decreased in the FMEP group compared to the control group. Fewer participants with depression and lower levels of depression were observed in the FMEP group compared to the control group</p>	<p>FMEP can reduce cognitive impairment, anxiety, and depression in people who have had a stroke</p>		
<p><b>5</b> Effect of family education program on cognitive impairment, anxiety, and depression in persons who have had a stroke: A randomized controlled study/ (19), Tiengkok</p>	<p>144 sufferers (77 interventions, 77 controls)</p>	<p>The caregiver intervention group was given an FMEP intervention and the patient received conventional care. FMEP consists of:</p> <ol style="list-style-type: none"> <li>The first 2 weeks of caregivers receive 5 education sessions on understanding of stroke, the effects of stroke, general problems, physical care, and mental health care.</li> <li>The next 3-8 weeks, caregivers are invited to attend weekly workshops that provide counseling, communication, and assistance to resolve any problems they face. Meanwhile, post-stroke care specialist nurses, rehabilitation specialists, or social workers make visits as needed and to provide further support</li> <li>3-12 months post stroke, a monthly call is made to the caregiver to get a stroke patient and</li> </ol>	<p>Evaluate the effects of family member education programs (FMEP) / family member education programs on cognitive disorders, anxiety, and depression in people who have had a stroke</p>	<p>1. Demographic and clinical data of patients and families using a questionnaire that has been provided consists of: age, sex, duration of education, location of lesions, smoking status, hypertension, hyperlipidemia, and diabetes, gender caregiver and caregiver education</p> <p>2. Cognitive assessment of patients using the Montreal Cognitive Assessment (MOCA) score.</p>	<p>An increase in the Montreal Cognitive Assessment (MOCA) score from baseline to 12 months (M12 - baseline) in the FMEP group was higher than in the control group, and FMEP caused a decrease in the level of cognitive decline (MOCA score <math>\leq 26</math>) after 12 months compared to the control group. Changes in Hospital Anxiety and Depression Anxiety and depression score (M12 - baseline) scale decreased in the FMEP group compared to the control group. Fewer participants with depression and lower levels of depression were observed in the FMEP group compared to the control group</p>	<p>FMEP can reduce cognitive impairment, anxiety, and depression in people who have had a stroke</p>

6	<p>The effect of caregiver education program on functional independence and Mortality in first-ever stroke (21)</p>	<p>Evaluate the effect of the caregiver education program (CEP) / caregiver education program as a stroke rehabilitation modality using historical data that is still correlated with current practice in the stroke unit.</p>	<p>The CEP intervention program is conducted in the form of interactive discussions guided by neurologists using projector overhead and posters. The contents of the CEP were adapted and modified from the caregiver support program at Mount Sinai Medical Center, Cleveland, Ohio, which aims to prepare caregivers in adapting to the disabilities of stroke patients and reducing anxiety and to involve caregivers in the rehabilitation process. The discussion starts in the second week of entry, and consists of 4 sessions, namely:                  Session 1: information about the type of stroke and its risk factors.                  Session 2: information about the types of disabilities that may occur after a stroke                  Session 3: education about the role of caregivers in overcoming post-stroke morbidity and outpatient preparation                  Session 4: education about caregiver efforts in secondary or tertiary prevention related to diet, lifestyle, and emotional problems.</p>	<p>172 subjects who had a first stroke and did not have other comorbidities or invasive treatment at the time of recruitment were divided into groups that received CEP (n = 88) as an experim</p>	<p>3. Assessment of mental status of patients using the Minimum Mental State Examination (MMSE) score.                  4. Assessment of anxiety and depression using the Chinese version of the Hospital Anxiety and Depression Scale (HADS)</p> <p>1. An independent functional assessment uses the Barthel activity daily living (ADL) index.                  2. Mortality report</p>	<p>No statistical differences were found at the baseline of the two groups. CEP significantly increases functional independence (RR = 1.30, 95% CI 1.03-1.63) of stroke patients. Although the effect was not significant on three-month survival, the group that received CEP had a lower mortality rate</p>	<p>Caregiver education programs have positive results on functional independence of sufferers, especially in the elderly, attainment of low formal education and caregiver socioeconomic status, lighter presentation of stroke and caregiver to the nuclear family.</p>
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## DISCUSSIONS

The results of the sixth literature review found that before providing intervention to stroke patients, caregivers were first given health education and training on post-stroke care.<sup>15-19,21</sup> Knowledge is closely related to the behavior that will be taken in conducting post-stroke care because with that knowledge the caregiver will have a reason or a strong foundation in taking an action. The American Heart Association (AHA) states that the most effective education program must include problem solving that supports skills development as well as how to meet physical care needs.<sup>2</sup>

### 1. Decreased severity of stroke and death

Of the six articles reviewed, three of them found a decrease in severity and mortality in stroke patients managed by caregivers.<sup>15,17,21</sup> There are several instruments used to measure the severity of stroke patients such as the Korean version of the National Institutes of Health Stroke Scale (K-NIHSS), and the Thai version of the Fundamental Nursing Skills Checklist of the Thai Red Cross College of Nursing Study (Hong et al., 2017; Pitthayapong et al., 2017). Other related findings about the lack of knowledge possessed by caregivers will have an impact on the occurrence of recurrent strokes, patients can not perform activities independently and even death can occur.<sup>23</sup> This proves that the role of the caregiver in caring for family members who suffer from stroke is very important, especially in terms of decreasing the severity and prevention of recurrent attacks, the caregiver can be a controller or reminder to stroke patients to comply with any therapy or treatment given.

### 2. Improved clinical conditions in stroke patients

Of the six articles reviewed there were four articles that used instruments in the form of Barthel Index scores or an increase in Activity Daily Living (ADL)<sup>15-18</sup> to assess the improvement of clinical conditions that occur in stroke patients, and two other articles using the Berg Balance scoring instrument.<sup>15,16</sup> In addition, the other clinicians' outputs measured from one of the articles reviewed were increased muscle strength, mobility, physical composite, free-running speed and 6-minute walking distance.<sup>(16)</sup> It can be concluded that the instrument most widely used in measuring clinical output in

stroke patients who receive support and care from the caregiver is the Barthel Index on the fulfillment of ADL and is supported by other Berg Balance instruments. The results of a meta-analysis suggest that the Barthel Index Scale is a good instrument used in assessing the ability of stroke patients.<sup>24</sup>

### 3. Changes in cognitive abilities in stroke patients

From all the articles reviewed, there are two articles that report on the results of cognitive changes in stroke sufferers. The instrument used in measuring cognitive change is the Minimum Mental State Examination (MMSE) score.<sup>15,19</sup> Other instruments use the Montreal Cognitive Assessment (MOCA) score.<sup>19</sup> Stroke sufferers are very susceptible to changes in cognitive function, therefore a measurement of cognitive function is very important to do at the beginning of the examination so that interventions involving caregivers or family empowerment can continue between the intervention plan and the expected clinical output. At least stroke sufferers are still able to understand every instruction or direction from the caregiver when doing care interventions or recovery.

### 4. Anxiety in stroke patients

One of the six articles reviewed measured other clinical outputs namely anxiety, as for the instruments used in measuring the level of anxiety and depression in stroke sufferers using the Chinese version of the Hospital Anxiety and Depression Scale (HADS).<sup>19</sup> The findings say that involving caregivers in care can reduce anxiety levels and depression in the incidence of stroke compared to those who do not involve caregivers in the care of stroke sufferers (Huang et al., 2017; & Yu et al., 2019). From the results of the review found that other clinical outputs such as anxiety and depression are very important to note, stroke is one of the conditions of the disease that the recovery process requires a lot of time, even most stroke sufferers can not recover 100% as before illness that can be compounded with age which is getting older. Sometimes stroke sufferers who have high anxiety and depression find it difficult to be more cooperative when an intervention is carried out.

### 5. Quality of life of stroke sufferers

One of the six articles reviewed, measures the quality of life of stroke sufferers, while the

instrument used to measure the quality of life of stroke sufferers uses the Stroke-specific quality of life (SSQoL) 12 item-scale (short version).<sup>18</sup> Quality of life in patients with chronic diseases such as stroke tends to decrease so that by empowering caregivers (families) in each treatment intervention can help stroke patients to be more motivated to improve their health status.<sup>11</sup> The support obtained from the caregiver will be very helpful in achieving the expected short-term and long-term goals.

## 6. Caregiver burden and satisfaction

Of the six articles reviewed there is one article that measures these two factors, where the instruments used to measure caregiver burden are the Family burden scale and Caregiver burnout scale and caregiver satisfaction measurements using Canadian occupational performance measures (COPM).<sup>15,19</sup> In addition, other outputs that are very important to consider and even apply to all interventions that involve the role of a caregiver or family empowerment are the caregiver's burden and satisfaction while caring for stroke sufferers.<sup>11,25</sup> Avoiding burnout or burnout in caregivers, it is recommended to assess it, because the success of an intervention that involves caregivers greatly affects the mood or the feeling of burnout felt during caring for stroke sufferers, not a few caregivers complain about patience in caring for stroke sufferers. In addition, assessing the satisfaction of caregivers is also important, with the aim that caregivers who are satisfied with the interventions implemented will have a good impact on the success of the recovery process and of course with stroke patients who are more active and cooperative.

In conclusion, the results of a review of six articles, we can see that caregivers can be involved in treating stroke patients to improve physical, mental recovery and reduce mortality. However, to achieve these goals, nurses must first prepare a caregiver, by increasing the caregiver's knowledge and skills in post-stroke care.

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## A case-control study related to vitamin and mineral intake in female adolescents with iron deficiency anemia

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### Abstrak

**Latar belakang:** Anemia defisiensi besi (ADB) merupakan salah satu masalah nutrisi pada remaja putri di seluruh dunia. Penyerapan zat besi di usus halus dipengaruhi oleh adanya vitamin C, kalsium, dan zink pada makanan. Penelitian ini bertujuan untuk mengetahui hubungan pola konsumsi vitamin A, vitamin C, kalsium dan zink terhadap kejadian ADB pada remaja putri.

**Metode:** Penelitian ini merupakan penelitian case control yang melibatkan 60 remaja putri dengan ADB dan 58 remaja putri tanpa ADB. Diagnosis ADB berdasarkan kadar Hb dan indeks eritrosit, dan semikuantitatif FFQ digunakan untuk menentukan asupan vitamin dan mineral. Semua data dianalisis menggunakan test chi square dan tes regresi logistik ganda dengan  $p < 0.05$ .

**Hasil:** Semua subjek penelitian mempunyai asupan vitamin A dan C harian yang cukup tetapi asupan kalsium dan zinknya tergolong kurang (dalam mg). Namun, mereka semua memiliki frekuensi harian yang berbeda dalam mengkonsumsi mikronutrien tersebut. Remaja putri dengan asupan vitamin A yang jarang (OR=2.67; CI95%=1.10-6.50;  $p=0.03$ ) dan asupan kalsium yang sering (OR=2.27; CI95%=0.85-6.03;  $p=0.10$ ) lebih berisiko terkena ADB dibandingkan dengan remaja putri dengan asupan vitamin A yang sering dan asupan kalsium yang jarang. Akan tetapi hanya asupan vitamin A yang memiliki efek signifikan secara statistik.

**Kesimpulan:** Hasil penelitian ini menunjukkan bahwa tingginya risiko ADB pada remaja putri berkaitan dengan asupan vitamin A yang jarang. (*Health Science Journal of Indonesia 2020;11(1):52-6*)

**Kata kunci:** anemia defisiensi besi, asupan mikronutrien, remaja putri

### Abstract

**Background:** Iron deficiency anemia (IDA) is a nutritional problem that occurs in female adolescents around the world. Iron absorption in the small intestine is influenced by the presence of vitamin C, calcium, and zinc in ingested foods. This study aimed to investigate the relationship of vitamin A, vitamin C, calcium, and zinc intake with IDA in female adolescents.

**Methods:** This case-control study was conducted in 60 anemic and 58 normal female adolescents. IDA diagnosis was determined using Hb levels and erythrocyte indexes and the semiquantitative food frequency questionnaire was used to determine vitamin and mineral intake. All collected data were analyzed using chi-square and multiple logistic regression tests with  $p < 0.05$ .

**Results:** All groups had an adequate intake of vitamin A and C but they had inadequate intake of calcium and zinc (in mg). However, they all had different frequencies in consuming those micronutrients. Rare intake of vitamin A (OR=2.67; CI95%=1.10-6.50;  $p=0.03$ ) and frequent intake of calcium (OR=2.27; CI95%=0.85-6.03;  $p=0.10$ ) increased IDA, compared with frequent intake of vitamin A and rare intake of calcium but only vitamin A intake had a significant effect.

**Conclusion:** Our findings suggest that a higher risk of IDA in female adolescents is related to a rare intake of vitamin A. (*Health Science Journal of Indonesia 2020;11(1):52-6*)

**Keywords:** Iron deficiency anemia; micronutrient intake; female adolescents

Anemia is a major public health problem that around 1.62 billion people worldwide and iron deficiency is the most common cause of anemia.<sup>1</sup> Meanwhile, the prevalence of anemia in Indonesia is 48% in pregnant women<sup>2</sup>, 18% in female adolescents, and 28% in children.<sup>3</sup> Therefore, prolonged iron deficiency anemia (IDA) in the vulnerable age-groups will increase maternal morbidity and mortality rates<sup>4</sup>, lower adolescents learning achievement<sup>5,6</sup>, and disturb children cognitive and motor development.<sup>7</sup>

Multifactor contribute to IDA pathogenesis such as nutrition, infection, and genetics. The most common etiology of anemia in developing countries is the nutrition factor.<sup>8</sup> Inadequate intake of vitamins such as vitamin A, B12, C and folic acid is also found in people with anemia. A number of studies reported that calcium and zinc can decrease iron absorption by inhibition of Iron-DMT1 binding complexes in the small intestine.<sup>9,10</sup> Based on the background above, this study aimed to investigate the relationship between vitamin A, vitamin C, calcium and zinc intake and IDA in female adolescents.

## METHODS

This study was an analytic study with a case-control approach, which conducted from June to August 2017. Research subjects of this study were 60 adolescent females with IDA, who had hemoglobin level of <12 g/dL, mean corpuscular volume (MCV) of <80 fL and mean corpuscular hemoglobin (MCH) of <30 pg/cell as the case group while 58 female adolescents with Hb $\geq$ 12 g/dL, MCV  $\geq$ 80fl, and MCH  $\geq$ 30pg/cell as the control group.<sup>11</sup> The selected subjects aged 15-19 years came from 4 senior high schools at Sukoharjo regency. From anamnesis, research subjects were excluded from this study if were menstruating and had chronic diseases such as pulmonary tuberculosis, blood disorders, and metabolic diseases. All research subjects agreed to participate in this study by signing the informed consent.

Venous blood was taken from lower arms of research subjects and Hb level was measured using the standard method of hemoglobin measurement.<sup>12</sup> The semiquantitative food frequency questionnaire (SFFQ) was used to determine vitamin A, vitamin C, calcium, and zinc intake. Calculated values of nutrient intake were compared with nutrient intake values from the Indonesian recommended dietary allowance (RDA).<sup>13</sup> The consumption frequency

of micronutrients used the average frequency of daily intake in both groups. All collected data were then analyzed using chi-square and multiple logistic regression tests with  $p < 0.05$ . This research protocol was approved by the Human Research Ethics Committee at the Public Hospital Moewardi, Surakarta number 585/VI/HREC/2017.

## RESULTS

Table 1 showed that there were no mean differences between case and control groups in terms of age, menarche, and menstrual duration except BMI. A lower mean of menarche age, menstrual duration, and BMI was observed in the case group, compared with the control group but only the mean BMI reached a statistical significance ( $p = 0.005$ ). This study showed that the case groups had a higher risk of IDA compared to the control group, eventhough both groups had a normal BMI. This condition happened because subject who had lower BMI probably had a low intake of nutrient. In contrast, the case group had a higher mean age than the control group.

Table 1. Basic characteristics of female adolescents with or without IDA.

	Case (n=60)	Control (n=58)	p
Age (y.o.)	16.38 $\pm$ 0.82	16.29 $\pm$ 0.72	0.374*
Menarche (years old)	12.76 $\pm$ 1.30	12.86 $\pm$ 1.43	0.755*
Menstrual duration (days)	6.46 $\pm$ 0.99	6.67 $\pm$ 1.06	0.151*
BMI (kg/m <sup>2</sup> )	19.74 $\pm$ 2.34	21.30 $\pm$ 3.41	0.005

Data presented as mean $\pm$ SD and \*used the Mann-Whitney test

We determined energy and macronutrients intakes in both groups using the SFFQ and converted it into daily intake using the Nutrisurvey software. As presented in Table 2, the mean daily intake of energy, iron, calcium and zinc in both groups was below the RDA, while the case group had a lower intake of energy, vitamin C and zinc compared to those intakes in the control group. Additionally, excessive intake of vitamin A and C was found in both groups. Overall the difference mean of daily intake in both groups was not statistically significant.

The chi-square and multiple logistic regression tests were used to analyze the relationship between vitamin and mineral dietary pattern and the risk of IDA. According to Table 3, vitamin A was the only nutrient that had a significant relationship to the risk of IDA in which decline the risk of IDA. While, the dietary pattern of vitamin C and calcium was positively related to the risk of IDA and the dietary pattern of zinc decreased the risk of IDA, although those data were not statistically significant.

Table 2. Energy and micronutrients intake in female adolescents with or without IDA.

Nutrient intake	RDA	Case (n=60)	Control (n=58)	P
Energy (kcal)	2125	1665.31±594.12 (78.35)	1947.02±1687.17 (91.62)	0.22
Protein (gr)	59	75.59±34.21 (127.11)	75.59±31.54 (127.11)	0.99
Iron (mg)	26	21.42±16.90 (82.34)	20.39±13.50 (78.42)	0.83
Vitamin A (mcg)	600	1981.50±1646.47 (330.25)	1868.26±1583.88 (311.37)	0.59*
Vitamin C (mg)	75	154.26±139.97 (205.68)	175.26±119.18 (233.68)	0.09*
Calcium (mg)	1200	755.80±535.99 (62.98)	747.57±441.24 (62.29)	0.61*
Zinc (mg)	14	8.54±3.43 (61.00)	8.71±3.42 (62.21)	0.78

Data presented as mean±SD and \*used the Mann-Whitney test

Table 3. The relationship between dietary pattern of vitamin A, vitamin C, calcium and zinc in female adolescents with or without IDA.

Food intake	Case n(%)	Control n(%)	OR	C.I 95% (min-max)	P
Vitamin A (times/day)			2.28	1.09 – 4.77	0.04*
- < mean (3.44)	36 (61)	23 (39)			
- ≥ mean	24 (40.7)	35 (59.3)			
Vitamin C (times / day)			1.40	0.68 – 2.90	0.45
- < mean (3.30)	32 (55.2)	26 (44.8)			
- ≥ mean	28 (46.7)	32 (53.3)			
Calcium (times / day)			1.22	0.59 – 2.52	0.71
- < mean (5.00)	28 (48.3)	30 (51.7)			
- ≥ mean	32 (53.3)	28 (46.7)			
Zinc (times / day)			0.76	0.37 – 1.57	0.58
- < mean (2.83)	32 (54.2)	27 (45.8)			
- ≥ mean	28 (47.4)	31 (52.6)			

Chi-square test

Table 4. Multiple logistic regressions of dietary pattern of vitamin A, vitamin C, calcium and zinc with IDA.

	OR	C.I 95% (min-max)	p
Constant	0.51		0.15
Rare intake of vitamin A	2.67	1.10 - 6.50	0.03
Rare intake of vitamin C	1.00	0.41 - 2.41	0.99
Frequent intake of calcium	2.27	0.85 - 6.03	0.10
Frequent intake of zinc	0.64	0.25 - 6.03	0.36
Nagelkerke R Square		8.5%	

Table 4 showed a statistical analysis of all variables that influenced hemoglobin synthesis. Stronger associations were observed in a rare intake of vitamin A and a frequent intake of calcium but only the dietary pattern of vitamin A reached significantly. The protective effect of frequent intake of zinc was as same as the result of a bivariate analysis and it was not statistically significant.

## DISCUSSION

From our results about nutrients daily intake (in mg) seems not to contribute to IDA pathogenesis in female adolescents. Daily intake of protein, iron, vitamin A,

vitamin C, and zinc in female adolescents with IDA was similar to female adolescents without IDA. It is more likely that other factors are involved in the IDA pathogenesis. For example, hookworm infection is the most common cause of IDA in tropical countries like Indonesia.<sup>14</sup> This happens because the worm is associated with chronically mild bleeding, which leads to iron deficiency.<sup>15</sup>

Based on the daily pattern, our findings suggested that female adolescents who have infrequent intakes of vitamin A and frequent intakes of calcium are susceptible to suffer IDA. This study, however, only vitamin A intake that had a significant contribution in



decreasing in IDA. In normal conditions, vitamin A can increase blood iron concentration through direct and indirect actions. Vitamin A deficiency might inhibit the expression of ferroportin and mobilization of iron from the liver storage by direct pathway. This pathway results in a low iron concentration in the blood circulation. Meanwhile, the indirect effect of vitamin A deficiency affects the immune system by reduction of antibody production, lymphocyte proliferation, and epithelial integrity, leading to an increase of iron usage.<sup>16</sup> In addition, frequent intake of calcium will increase iron deficiency due to competitive inhibition in the active site of the DMT1 protein.<sup>9</sup> Supporting this study, a study involving 696 children in Brazil showed IDA were associated with low levels of serum retinol (low levels of retinol lead to vitamin A deficiency).<sup>16</sup> Moreover, several systematic reviews showed that the supplementation of vitamin A in children, adolescence, and pregnant women had a positive effect on hemoglobin and other parameters of iron, such as ferritin.<sup>17,18</sup> Otherwise, research in Greece, which involved more than 1000 female adolescents, explained that iron depletion was associated with high calcium intake.<sup>19</sup> However, quantitative measurements of food intake by SFFQ should be combined with another method like 24-hour food recall. Furthermore, a cohort study is required to confirm this case-control study in order to find out the specific roles of vitamin A and calcium in IDA pathogenesis.

In conclusion, the daily pattern of rare vitamin A intake increases the risk of IDA in female adolescents in Sukoharjo regency. However, these results cannot be generalized because we only used the daily pattern of vitamin and mineral intake, and we did not combine with other methods to obtain data of daily intake of vitamins and minerals.

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