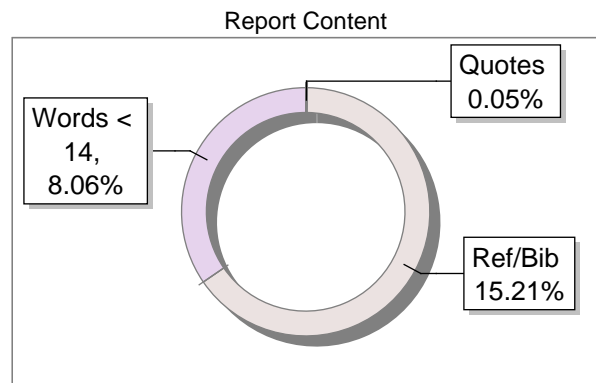
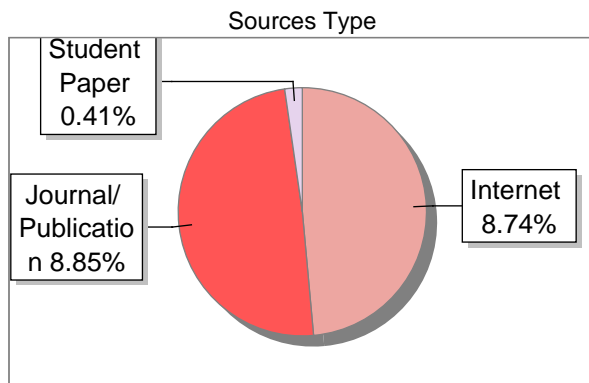
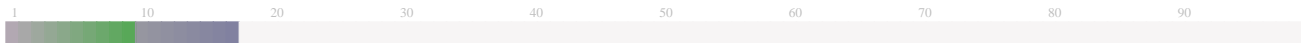


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Jamu Reduce Oxidative Stress from Active Smokers in a Rural Area of Yogyakarta

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Abstract. One cigarette contains 4,000 chemicals with nicotine as the main component. Nicotine is an oxidant compound that can cause lipid peroxidation. The product of lipid peroxidation is malondialdehyde. MDA is toxic to cell membranes. Jamu (Indonesian traditional herbal medicine) is one of the endogenous antioxidants made from natural ingredients. Thus, this study aimed to determine the level of MDA based on demographic and lifestyle data of female volunteers in Indonesia. Design. Cross-Sectional Study. Methods. A total of 127 female volunteers qualified according to inclusion and exclusion criteria filled the informed consent. Blood plasma samples obtained were analyzed for the MDA profile using a high-performance liquid chromatography technique. Results. The average plasma MDA level in female volunteers are exposed to cigarette smoke and consume jamu of $5,23 \pm 3,57 \mu\text{mo} / \text{L}$. There was not any significant relationship between MDA levels with the demographic data (age, education, and occupation) and lifestyle (habits of consuming jamu, vegetables, supplements, and doing exercises) ($p > 0.05$). Conclusion. Demographic and lifestyle data do not have any significant relationship with MDA levels, cigarette smoke exposure, and a habit of drinking jamu

Keywords: jamu, cigarette smoke, nicotine, MDA, secondhand smoking, female

1. Introduction

Xenobiotic tobacco agent is more toxic that inhaled by passive smokers or secondary smoker than that inhaled by active smokers.[1] One of the sources of free radicals is cigarette smoke. In general, the production of free radicals in our bodies takes a long time. [1,2]. Oxidative stress contributes to the production of malondialdehyde. Malondialdehyde is formed by the peroxidation of lipids, which are abundant in cell membranes. The MDA level calculation is an indirect indicator of oxidative stress. [3,4]

Antioxidants can donate an electron to a free radical, thus making the free radical a stable form. [5]. One of the sources of natural antioxidants is jamu[6]. The main ingredients of traditional-herbal remedies in Yogyakarta, called “jamu”, are Kaempferia galanga, rice, tamarind, papaya leaves, brown sugar, Curcuma xanthorrhiza, and lime. Some antioxidant compounds in the jamu are flavonoids, and polyphenol [7,8], curcumin[9], carotenoids[10], tannins, vitamin C, and vitamin E[6,11] are rich. These compounds play an active role in blocking the reaction of free radicals.[12,13] Herbal consumption was suggested to increase antioxidant activity, reduce reactive radicals in the body, and



lower malondialdehyde levels. In the Bantul regency special region of Yogyakarta, Indonesia, we investigate MDA's level on healthy female volunteers.

2. Methods

We used a cross-sectional study design with 127 volunteers. The study was conducted in the Yogyakarta Special Region, Indonesia. We comply with the Helsinki Declaration in involving human subjects with respect for the Subject's human rights and safety and the principle of justice. This research protocol has been reviewed and declared eligible ethics by the research ethics committee of Ahmad Dahlan University (no: 011610141). The Indonesian government established a regulation that the local government should license epidemiological research. This research has also received permission from the local government of Bantul (no: 070 / reg / 1065 / S2 / 2017).

2.1. Criteria for inclusion and exclusion

Inclusion criteria are healthy female passive smoker, declared fit by a doctor at a community health center, consuming traditional herbal drink of at least three glasses in 1 week, and aged 15- <65. Criteria for exclusion are participants who are not cooperative, are pregnant, and are afraid of needles.

2.2. Instruments and research materials

We used several instruments and materials in this study, including micro-centrifugation tube, 3 mL syringe, tourniquet, vortex, autoinjector type 20i Shimadzu (Kyoto, Japan), 250x4,6 mm column of high-performance liquid chromatography (HPLC), five µm microcentrifugation, thiobarbituric acid (TBA), malondialdehyde (MDA), ethylenediaminetetraacetic acid (EDTA), and n-Butanol.

2.3. MDA level

We determined MDA levels by using HPLC as done by previous investigators. Blood samples are taken from cubital veins by professional personnel with a safe and healthy procedure.[14]

2.4. Data analysis

Statistically, the degree of MDA data was evaluated by univariates. The variations in MDA levels based on ethnic characteristics, herbal medicine drinking patterns, and cigarette smoke exposure were examined with a 95 percent confidence level with a mean difference test, One Way ANOVA, bivariate.

3. Result and discussion

3.1. Description of malondialdehyde Level in Participants

The results of measuring malondialdehyde levels in young healthy-female passive smoker in Bantul are presented in Table 1.

Table 1. MDA level profile of healthy-female passive smoker volunteers who consume traditional herbal medicine

	Mean ± S.D.	Minimum	Maximum
MDA level	5,23 ± 3,57 µmol /L	0,75 µmo /L	15,21 µmol /L

Note : MDA = malondealdehyde

Table 1 shows that the MDA level is $5,23 \pm 3,57 \mu\text{mol} / \text{L}$, it was known that the MDA levels in volunteers in Bantul were in the high category. Based on the reference, it is stated that MDA levels in healthy people for the age range between 16 years to 29 years and average body mass index (BMI) are $1.21 \mu\text{mol} / \text{L}$. Other researchers stated that plasma MDA levels in adolescents - adults were $3.134\text{-}3.185 \mu\text{mol} / \text{L}$. Radicals free of oxygen are highly reactive and dangerous. Via lipid peroxidation, free radicals injure biological membranes. Based on previous research results, it is known that

malondialdehyde (MDA) can be used as a marker of peroxidation of polyunsaturated fatty acids. We assessed serum MDA levels in this study as an indicator of lipid peroxidation levels in healthy volunteers of passive smoking women who were taking a traditional herbal medicine called jamu. [15, 16, 17]

3.2. Level of malondialdehyde based on subject characteristic and lifestyle

We described the MDA level based on the Participants' characteristics and their's lifestyle in Table 2. The low MDA levels were in volunteers with over 30 years, non-obese, education at university, a job, consumed traditional-herbal remedies, no smoke exposure, no consumed supplements, and consumed vegetables. The difference in MDA levels was not statistically significant ($P > 0.05$).

Table 2. MDA levels of healthy female passive smoking volunteers who have a habit of taking traditional herbal medicines

No.	Volunteer Characteristic	N	Mean \pm S.D. ($\mu\text{mol/L}$)	p-Value
1.	Age			
	16-30	64	4,71 \pm 2,94	0,90
	31-60	63	4,69 \pm 3,31	
2.	Educational status			
	elementary-High School	106	4,89 \pm 2,25	0,13
	Diploma-Master's degree	21	3,78 \pm 2,49	
3	Job-status			
	Yes	35	4,28 \pm 3,21	0,38
	No	92	4,86 \pm 3,02	
4.	Cigarette smoke exposure			
	Yes	65	5,12 \pm 3,29	0,11
	No	62	4,25 \pm 2,28	
5.	Jamu consumption			
	Yes	62	4,40 \pm 3,02	0,28
	No	65	4,91 \pm 3,851	
6	Exercise status			
	Yes	14	6,34 \pm 4,72	0,07
	No	113	4,51 \pm 2,92	
7.	Supplement consumption			
	Yes	11	5,33 \pm 3,37	0,42
	No	116	4,69 \pm 3,41	
8.	Vegetable and fruit consumption			
	Yes	113	4,67 \pm 3,50	0,73
	No	14	4,94 \pm 3,17	
9.	BMI			
	<25	101	4,67 \pm 3,19	0,82
	\geq 25	28	4,87 \pm 2,98	

It is established that MDA levels in healthy-female passive smoker volunteers are in the high range, based on table 1. Based on table II, it is understood that there is no meaningful relationship between the demographic and lifestyle data and the MDA level ($p > 0.05$). There is no significant association between the level of MDA from this study and age, job-status, BMI, and lifestyle ($p > 0.05$). The findings of this study are different from previous studies' results. Several previous studies have shown that age is related to levels of MDA. This implies that the older an individual is, the higher the MDA level will be. [16, 17].

Data from prior research shows that exposure to cigarette smoke will increase the amount of MDA in blood plasma. [18], likewise, with exercise. MDA levels in healthy-female passive smoker

volunteers were higher than the MDA levels who were not exposed to cigarette smoke or did not exercise; however, the differences in MDA levels were not statistically significant ($p > 0.05$). Consumption of herbal medicine is expected to reduce MDA levels. Jamu is proven to contain various natural antioxidant compounds, such as polyphenols, curcumin, curcuminoids, and flavonoids [19]. The research data showed that the housewives' MDA level who consumed herbal medicine was lower than the MDA level of the housewives who did not consume herbal medicine. Still, it was not statistically significant ($p > 0.05$). The difference in this study with previous studies is possible due to differences in the participants' characteristics. Most of the participants in this study were aged less than 40 years, with an ideal BMI (not obese), live in rural areas, have low education, do not have a job, do not have sports habits, and consume vegetables. The aging process, which is marked by an increase in reactive radicals, will begin at 45 years old, and the aging process will occur earlier in those who are obese and do not consume vegetables[20].

4. Conclusion

The study shows that the average MDA level of young housewives in rural Bantul is 5.23 ± 3.57 $\mu\text{m}/\text{L}$. Demographic factors, exposure to cigarette smoke, and drinking herbal medicine (jamu) affect MDA levels but not statistically significant.

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