Effectiveness Test from Various Types of Mask to Air Carbon Monoxide (CO) with Expiratory Carbon Monoxide Levels to People Around the University of Sumatera Utara

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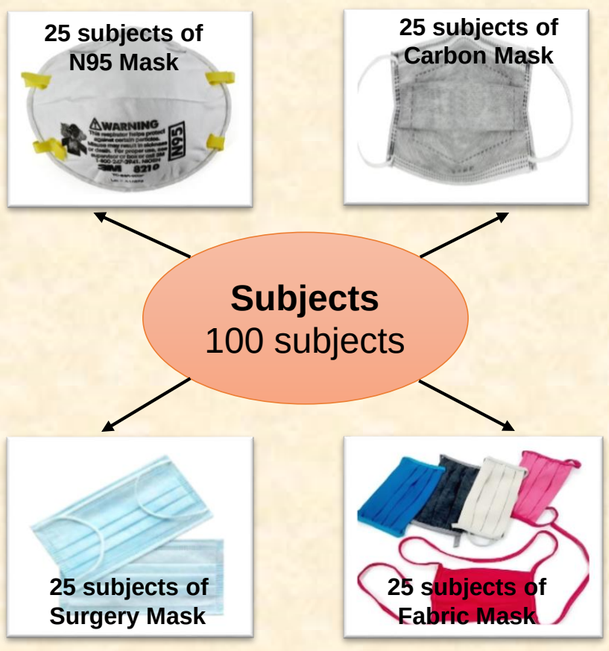
INTRODUCTION

Air pollution is known as the main cause of health problems. According to World Health Organization, air pollution has led to 800,000 mortality per year.[1] Epidemiology study explained that concentration of ambient particles in air affects health level, especially to cardiovascular and respiratory system.[2]

Carbon monoxide (CO) is one of the most common air pollutants and widely distributed.[3] The main pollutant source is resulted from transportation, particularly motorized vehicles. According to Central Bureau of Statistics in 2017 the number of motorized vehicles in Indonesia from 2000 to 2016 reached 7,109,082.[4] Every year, the number of various type of vehicles always increase at an average rate of 8.9% each year. The increasing number of motorized vehicles operation, will cause an increase of pollutant concentration, thus endanger human health and affect air quality if exceed the specified threshold.[5]

Aim of the study was to assesed the comparison of CO levels before and after the use of masks and air expiratory CO levels in people living around the Universitas Sumatera Utara (USU).

METHODS AND MATERIALS



Experimental study with consecutive sampling

The subjects were examined before and after wearing a mask

Using masks for 8 hours

Data collection and processing

The inclusion criterias :

- male and female
- aged between 17 and 60 years old, and
- non-smoker

The exclusion criterias :

- non-smokers, and
- not suffering from lung or respiratory disorder (COPD or TB).

Statistical Analysis

Data analysis using SPSS software with *Kruskal Wallis Test* (if the data is not normally distributed), and *Post Hoc Test* (multiple comparison).

RESULTS AND DISCUSSION

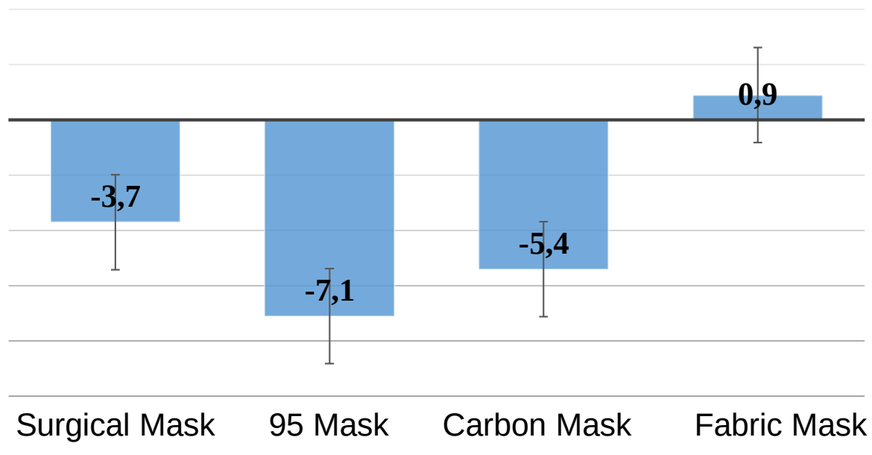
Table 1. Comparison of the effectiveness of various types of masks against decreasing carbon monoxide levels

Mask Types	CO Pretest	CO Posttest	Δ CO
	Mean ± SD	Mean ± SD	Mean ± SD
Surgical Mask	8,0 ± 7,04	4,3 ± 2,98	- 3,7 ± 5,72
N95 Mask	14,2 ± 17,05	7,0 ± 8,69	- 7,1 ± 12,06
Carbon Mask	12,0 ± 9,79	6,56 ± 5,38	- 5,4 ± 6,23
Fabric Mask	7,4 ± 4,05	8,3 ± 4,97	0,9 ± 3,48
p-value			< 0.001*

*) significant with the *Kruskal Wallis Test*

- There was a significant difference in the decrease on CO (Δ CO) levels after using various types of masks ($p<0.001$).
- Mask which provides the best CO level reduction is the N95 mask and carbon mask. While mask that provides the lowest CO level reduction is a fabric mask.
- Ludyaningrum (2016) → stated that N95 mask has 95% protection because it can filter particles up to 0.5 microns.[6]
- Rais *et al* study → showed that the addition of TiO2 (Titanium Dioxide) increased the adsorption ability of activated carbon.[7]

Figure 1. Comparison of the effectiveness of various types of masks



- The subjects using fabric masks, this is actually an increase the level of posttest CO, or in other words fabric masks are not effective enough to protect individuals from inhalation of CO particles.

Table 2. The result of Post Hoc Test from mask types group

	p - value
Surgical Mask vs N95 Mask	0.67
Surgical Mask vs Carbon Mask	1.00
Surgical Mask vs Fabric Mask	0.19
N95 Mask vs Carbon Mask	1.00
N95 Mask vs Fabric Mask	0.002*
Carbon Mask vs Fabric Mask	0.021*

*) significant with the *Post Hoc Test*

- The most significant difference was observed between the N95 mask group vs. the fabric mask, and between the carbon mask vs fabric mask groups ($p<0.05$).

CONCLUSIONS

- The N95 mask provides the highest protection, but principally, the three types of masks can still be use effectively to avoid inhalation of CO particles into the body except for fabric mask.
- Personal Protective Equipment such as masks and respirators can prevent the accumulation of pollutants in the lung, so it will reduce a decrease on lung function.

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