



Relationship between Food Calories Intake and Lung Function in Pedicab Drivers in Surabaya City

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ARTICLE INFO

Article History:

Received Sept, 9th, 2022

Accepted Feb, 15th, 2023

Published online Mar, 31st, 2023

Keywords:

Calorie intake;
lung function;
pedicab;

ABSTRACT

The increasing number of motor vehicles will increase the exposure of air pollution. Air pollution can cause respiratory disorders, especially on pedicab drivers who are working. Respiratory disorders are one of the diseases that can reduce quality of life and one of the risk factors of respiratory disorders is malnutrition. The purpose of this study was to determine the calorie intake of pedicab drivers with and without lung function impairment. This study uses analytical cross-sectional study, correlational study by using purposive sampling. Variables include: food calorie intake with 24-hour recall method. Respondents in the study consisted of 112 respondents in lung function impairment group (60 people (53.57%) had a deficit level of food calorie intake) and 11 respondents without the impairment group (5 people (45.45%) had a deficit level of calorie intake). The average types of food that were consumed by lung function impairment group are rice, tofu, tempeh, eggs, and sambal. There was no significant difference ($p>0.05$) between each item consumed by respondents. There was no significant difference of the effect of calories between the two groups ($p>0.821$). Therefore, it can be concluded that low intake of calories can be related to lung function, although further research is still needed regarding the relationship.

INTRODUCTION

The second largest city in Indonesia is Surabaya. At present, air pollution in urban areas, including in Surabaya, has become a serious problem. The use of fuel which is used as a driving force for vehicles, engine ventilation systems, and most notably the exhaust from the combustion of fuel combustion is the mixing of hundreds of gases and aerosols and the main cause of the release of various pollutants.¹ The increasing use of motor vehicles and urban energy consumption are two factors that can contribute to a decline in air quality, if not controlled, it will worsen air pollution, congestion, and the effects of climate change which cause health, productivity, and economic harm to the country.² Air pollution is the cause and factor that causes many respiratory diseases such as Chronic Obstructive Pulmonary Disease (COPD), asthma, and lung cancer.³⁻⁵ This can affect the pulmonary physiology of people who are on the streets, especially on pedicab drivers who are working.^{6,7}

Several studies have been conducted regarding the relationship between socioeconomic status and respiratory disorders.^{8,9} Pedicab drivers have also been shown to tend to have Lead (Pb) blood levels that exceed the normal threshold because they often rest around the road,¹⁰ these Pb levels can also be exacerbated by smoking habits where Pd is one of the toxic components contained in a cigarette. Therefore, pedicab drivers are at high risk of experiencing chronic lung dysfunction, especially COPD.

Various dietary patterns have been linked to the risk of respiratory disease. A person's nutritional status is an important factor affecting the development of the disease course of lung function disorders. Diet and nutrition are modifiable factors in chronic disease development and progression.¹¹⁻¹³ Socioeconomic status is closely related to the fulfillment of nutrition of the community. Socioeconomic factors can affect various aspects of life, including daily eating habits.¹³⁻¹⁵ The relationship between malnutrition and chronic lung disease (including COPD) has long been known, where malnutrition has a negative influence on the structure, elasticity, and function of the lungs, strength and endurance of

respiratory muscles, defense mechanisms of lung immunity, and breathing regulation. Conversely, lung disease (including COPD) will increase energy requirements and can decrease dietary intake. Nutritional interventions in COPD patients are aimed to control anorexia, improve lung function, and control weight loss. The need for nutrients is calculated according to the results of the nutrition assessment.¹⁵⁻¹⁷

The condition of malnutrition can also be aggravated by the condition of decreased appetite which can occur among smokers because smoking can weaken and interfere the somatosensory function of the tongue. In addition to smoking that can affect appetite, cigarettes also constrict the heart blood vessels, and digestive tract so that it interferes with the process of absorption of nutrients. Hence, decreased appetite and impaired absorption of nutrients can cause nutritional disorders.¹⁸⁻²⁰

Nutritional status can be measured with quantitative methods to find out the amount of food consumed so that consumption of nutrients can be calculated by using the Food Consumption List (*Daftar Konsumsi Bahan Makanan/DKBM*) or other required lists such as the Household Size List (*Ukuran Rumah Tangga/URT*), the Raw-Cook Conversion List (*Daftar Konversi Mentah-Masak/DKMM*) and list of oil absorption. Currently, the 24-hour recall method is still used to acquire data on food consumption. with the consideration that it does not require a large amount of time and cost but has a lower level of accuracy.²¹ Calories as part of nutrition have a very important role, where it is converted into energy in the body. Without energy, the cells in the body would die and the lungs would stop. Over-consumption of calories causes overweight which causes the lungs to work harder causing breathing difficulties.¹⁵

Figure 1 showed the conceptual framework of the research. In an earlier study by Suryadinata, et al from November 2015 to January 2016 at a private university in South Surabaya, 110 respondents examined were divided into 2 groups, smokers and non-smokers. Based on BMI measurements, there were 6 respondents experiencing malnutrition among smokers and 2 respondents among non-smoker respondents.²² In conclusion, the purpose of this study was to know the calorie intake of pedicab drivers with and without lung function impairment.

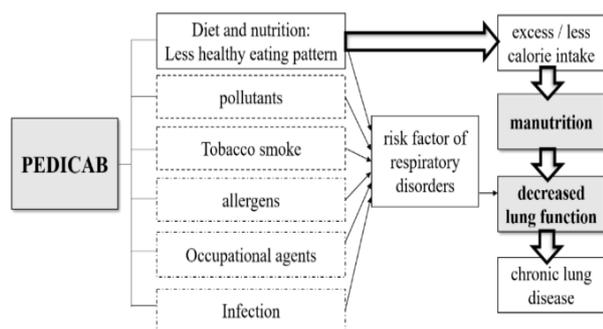


Figure 1. Conceptual Framework the Research^{15-17,22}

MATERIAL AND METHOD

This research method is an analytical cross-sectional study with direct interviews, located around Surabaya area. The research period started from April 2019 to September 2019 and No. 011/KE/III/2018 had been issued by the University of Surabaya as a certificate of ethics for the study. The lung function test of the respondents used the spirometry method (CONTEC SP10®) with instructions given by the physician, where the respondent would be divided into two groups (lung function impairment group and without lung function impairment group). The research variable to be measured in this study was the calorie intake consumed by respondents by 24-hour recall method, where the data obtained were ordinal scale, namely deficit (<80% of the minimum size measurement of calorie intake) and non-deficit ($\geq 80\%$ of the minimum calorie intake).

The population in this study was the pedicab drivers in Surabaya, East Java. The sample of this study were from populations that have met the criteria, including becoming a pedicab driver for >10 years; active smoker (a person who had smoked more than 100 cigarettes during his life and still smoked the last 28 days); and had no appetite problem or eating patterns. The sampling technique used purposive and consecutive sampling methods. The sample size used in this study was at least 70 people. The method for calculating the sample was used a formula for which the population was known. In 2016, the population size was known based on research into Surabaya's pedicab transportation policies from 1970 to 1980.²³ This study stated that pedicab provisions that were operated during the daytime were 2/3 of the total number of pedicabs, at 400, so that a large population can be 2/3 of 400 which was 266. The sample size in this study (n) was at least 100.

Then, this study used the 24-hour recall method to measure food consumption as an interview guide in the preparation of interview questions. The 24-hour recall method was carried out three times but not consecutively. Because the scheme illustrates the variation in calorie and nutrient intake, it is applied three times on weekdays and once on weekends. In this study, respondents received questions about food and beverages consumed in the previous 24 hours, including portion sizes, using a picture of a spoon, a plate, a glass, or another measurement commonly used daily as stated.²⁴ The results are then synchronized with the daily average intake. The data acquired in this study are primary data collected directly from research participants via direct dialogue (interviews). Then the data were presented descriptively. Data analysis used to determine the relationship of food calorie intake with pulmonary function (FEV1/FVC) with an ordinal scale was chi-square test.

RESULTS

Characteristics of the Respondents

The number of pedicab drivers involved in the study was 123 people, with 112 people in the lung function impairment group and only 11 people without the lung function impairment group. Most of Body Mass Index (BMI) in both groups were normal, while respondents with a disease history of most frequently encountered in the lung function impairment group, with 11 respondents, and none from the other group (Table 1). All values of the P value showed the value of $p > 0.05$ which mean there was no difference between the two groups so that the distribution of characteristics does not affect the two groups.

24-Hours Recall Frequency Analysis

The average calories in the group with impaired lung function and without impaired lung function can be seen in Table 2. The calorie intake of group without lung function disorders (2124.07 kcal) was greater than those with lung function disorders (1722.19 kcal). In both groups, the composition of calorie intake on holidays was greater than on weekdays (Table 2). Classification of food calorie intake was divided into 5, namely: deficit (<70% of the value of the minimum measure of calorie intake); less (70-80% of the value of a minimum

measure of calorie intake); sufficient (80-100% of the value of a minimum measure of calorie intake); good (100-110% of the minimum size measure of calorie intake); and more (> 110% of the minimum caloric intake measure value).²⁵

The average types of food that were consumed by the lung function impairment group are rice, tofu, tempeh, eggs, and sambal and the drinks that are most often drunk are coffee and tea, while the average types of food consumed by respondents without lung function impairment group are rice, tofu, tempeh, eggs, and sambal and the most frequent drinks are also coffee and tea (Table 3). In addition, there was no significant difference ($p>0.05$) between each item consumed by respondents.

In Table 4, it was shown that the respondents who had deficit calorie intake were clearly higher in Lung Function Impairment group (60 of 112) compared to respondents in the group without the most significant lung function disorders (5 of 11). Based on the different tests, it showed the real difference in calorie intake and lung function values ($p>0.821$). The minimum number of respondents that exists between the two different groups was very different, the minimum number varies between respondents. The limitation of this study was that the number of respondents from the two groups is not balanced so the statistical test results may not be appropriate given the disparity of numbers.

Table 1. Characteristics of Respondents

Characteristic	Lung Function				<i>p-value</i>
	Lung Function Impairment Group		Without Lung Function Impairment Group		
	n = 112	(%)	n = 11	(%)	
Age (Years)					
Early-late adults (≥ 45)	26	23.21	2	18.18	0.818
Early-late elderly (46-65)	86	76.79	9	81.81	
BMI (kg/m²)					
Thin	8	7.14	1	9.09	0.941
Normal	81	72.32	9	81.81	
At risk - obese	23	20.54	1	9.09	
Disease History					
Have Disease History					
Diabetes	5	4.46	0	0	1.000
Hyperuricemia	2	1.79	0	0	
Hypertension	3	2.68	0	0	
Lung disease	1	0.89	0	0	
Don't Know/ None	101	90.18	11	100	
Allergy					
Have Allergy					
Egg	1	0.89	0	0	1.000
Fish	1	0.89	0	0	
Don't Know/ None	110	98.21	11	100	
FEV₁ Value (%)					
Average	49.13786		73.56727		
SD	7.181966		4.208715		

Source: Primary Data, 2019

Table 2. Food Intake Profile of Respondents That Contain Calories

Food Calories Intake (kcal)		Lung Function Impairment Group	Without Lung Function Impairment Group
Recall 1 st (kcal)	Recalls held on holidays	1886.76	2281.43
Recall 2 nd (kcal)	Recalls held on weekdays	1646.95	2142.32
Recall 3 rd (kcal)	Recalls held on weekdays	1636.99	1931.69
Average Recall 1st, 2nd, and 3rd (kcal)		1722.19	2124.07

Source: Primary Data, 2019

Table 3. Food Intake Profile of Respondents That Contain Calories

Respondents Consumed	Lung Function								<i>p-value</i>
	Lung Function Impairment Group				Without Lung Function Impairment Group				
	n	Mean (kcal)	Minimum (kcal)	Maximum (kcal)	n	Mean (kcal)	Minimum (kcal)	Maximum (kcal)	
Rice	112	737.70	780.1	975.1	11	762.37	520.1	975.1	*
Tofu	94	237.28	247.2	494.5	11	184.77	164.8	247.2	0.205
Tempeh	94	420.97	483.77	530.93	11	348.55	306.68	412.97	0.205
Chili	90	27.01	20.4	35.7	11	24.70	22.1	45.7	0.205
Egg	89	263.03	229.17	286.45	11	264.66	239.71	294.17	0.204
Tea	70	31.64	28.9	38.5	11	47.78	38.5	56.23	0.205
Coffee	65	1652.31	1891.33	2026.4	9	1925.48	1656.8	2563.8	0.288
Chicken Meat	59	106.77	64.2	149.73	7	77.93	64.2	96.25	0.379
Instant Noodle	59	685.43	559.9	839.9	6	621.19	439.45	739.45	0.430
Vegetable Soup	57	358.93	249.5	499	5	452.38	374.5	543.25	0.482
Spinach Soup	48	40.65	28.7	57.4	5	50.5	38.7	67.3	0.488
Tamarind Vegetable Soup	47	197.66	117.6	235.2	3	189.5	135.3	256.6	0.605
Sauteed Vegetables	39	160.43	138	184.05	4	170.02	118.2	198.16	0.573
Vegetable Lodeh	33	195.24	134.2	268.5	8	210.37	128.71	542.21	0.348

*No statistics are computed because rice was a constant

Source: Primary Data, 2019

Table 4. Relationship Food Calories Intake to Lung Function

Calorie Intake Level Classification	Lung Function Impairment Group (n = 112)	Without Lung Function Impairment Group (n = 11)	<i>p-value</i>
Deficit	60	3	0.821
Less	33	1	
Sufficient	16	5	
Good	1	1	
More	2	1	

Source: Primary Data, 2019

DISCUSSION

In the pulmonary function disorder group, the most calorie intake level classification was deficit in the group with normal BMI levels of 43 subjects, while the lowest calorie intake level classification was the group with normal BMI level, as many as .1 subject (Table 1). The close relationship between calorie intake and lung function is also strengthened by the analysis (Table 2), proving low fat and high carbohydrate intake reduces lung function only in women. Lung function is positively related to high protein and fat intake, but negatively related to high carbohydrate intake, which can be affected by age and obesity.²⁶ Most Asians, including Indonesians, consume relatively large amounts of carbohydrates (e.g., rice) as a staple food compared to Western countries, but consume low amounts of animal protein sources.²⁶

The most age group was the elderly with normal BMI levels of as many as 48 subjects, most of the elderly respondents have normal BMI. Even in theory, older people are more at risk experiencing an increase in BMI. Elderly with BMI <25 and >35 kg/m² are at higher risk of experiencing decreased functional capacity, as well as experiencing gait and balance problems, risk of falling, decreased muscle strength, and malnutrition. Obesity among older adults is most likely caused by consuming more calories than energy expenditure. Decreased basal metabolic rate and physical activity level in older adults are important contributors to obesity. Often, in older adults, common changes are in body composition, such as increased fat mass and decreased muscle mass.²⁷

Lower BMI was associated with increased mortality at 1 year, but dependent on first-year

survival. Lower BMI resulted in a similar or lower risk of death compared to reference. Patients with lower BMI, who have limited comorbidities and better physical function, have a better survival.²⁸

Respondents' nutritional intake was assessed using the 24-hour recall method. In the measurement, several factors that can affect a person's nutritional intake, including: Nutrition knowledge, which is an important component in health. Low knowledge is often associated with poor health outcomes and a lack of nutrition in adults.²⁹ The existence of bad habits or certain restrictions in fulfilling a person's nutritional intake, the existence of excessive food preferences will result in a lack of variety of food so that the body does not get nutritional intake from other sources. Economic status can affect one's nutritional status,³⁰ and alcohol consumption can contribute to nutritional deficiencies.³¹

Psychological factors also affect patterns of high-calorie food intake. Studies by Park showed the identification of eight genetic variants associated with sweet taste preference in genes involved in taste receptor signaling. Adults with an intense need for sweet flavor have a higher consumption of sucrose-containing foods and an increased glucose tolerance.³² The genetic impact is eliminated by high mental stress and absence of physical activity.³³ Foods that contain low fiber and low protein can trigger type 2 diabetes mellitus. The condition of this disease is exacerbated by high stress increases with high sugar-sweet food intake, because high anxiety can cause the release of sympathetic hormones which can increase cortisol and glucose levels. decrease insulin release, or affect insulin hormone sensitivity and resistance.^{34,35}

The 24-hour food recall method has both advantages and disadvantages. The difficulty in carrying out the 24-hour recall method is highly dependent on the respondent's memory. Therefore, respondents must have a good memory, so this method is not suitable for children under 7 years old, parents over 70 years old, and people who have memory loss or forgetful people.³⁶ But in practice, the 24-hour recall method is relatively cheap, easy to implement, and does not overburden respondents.^{21,36} This 24-hour food recall

method should be combined with the Food Frequency Questionnaire (FFQ) method so that the data obtained would also assess the frequency of various types of foods within a certain period time so that it can describe a person's daily food consumption patterns.^{21,36} Between these two methods, there is nothing superior because everything is seen from the initial purpose of each study.

Some limitations of this study include: This study does not look at other things that affect the respondent's nutritional intake such as education factors, gender differences, and environmental factors, so the results obtained only measure one parameter that can affect nutritional intake, which is only smoking. The parameter of calorie intake measurement in this study still cannot describe the actual condition of the respondent's calorie intake because to see someone's nutritional intake in the interview we have to weigh what is eaten by the respondent.^{6,7} From many types of food consumed by respondents, several calorie comparisons are available in each of these foods consisting of rice, chicken meat, and egg.

Rice is in the top of food pyramid, it is included in the food group that must be consumed by the body every day, which is grains. Because the body requires a lot of nutrients and all of the nutrients cannot be obtained from just one food source. White rice has lower fiber compared to cooked rice from mixed rice (whole grains). In mixed rice, the white rice is mixed with grains of other types, so that there is more fiber and fewer carbohydrates than many types of processed rice.³⁷ The type of processed chicken can affect the number of calories. For Eggs, how to process and the origin of eggs have different calories. The biggest calories come from duck eggs (salted eggs) compared to chicken eggs.³⁸

CONCLUSION AND RECOMMENDATION

Based on the results of research conducted on pedicab drivers in Surabaya, it can be concluded that the description of the calorie intake, the majority of people with respiratory distress status had deficit calorie intake (53.57%), and the level of calorie intake in the group without respiratory distress majority is sufficient (45.45%). However, there was no significant

difference in the effect of calories on food between the two groups ($p>0.821$).

Therefore, in elderly patients, to maintain healthy lung function, it is better to pay attention to food intake, by reducing calorie intake and increasing protein intake.

ACKNOWLEDGMENTS

This research was funded by Institute of Research and Community Service by Universitas Surabaya.

AUTHOR CONTRIBUTIONS

From the research process until the writing of this article, all authors played a role in this research. AL plays a role in compiling and designing the research, RVS acts as a data analyzer, and RDA and INYD act in data collection in the field. AL = Amelia Lorensia; RVS = Rivan Virlando Suryadinata; RDA = Reza Dwi Anggrealdi; INYD = I Nyoman Yoga Diputra.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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