



Exposure to Cigarette Smoke and Daily Physical Activity Associated with Asthma

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Abstract

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BACKGROUND: Asthmatic sufferers complain of sudden relapse when performing daily activities. Exposure to cigarette smoke makes asthmatics where the longer the exposure is experienced by the patient, the more frequent asthma exacerbations are experienced. For people with asthma, avoiding excessive physical activity and exposure to cigarette smoke are very necessary to prevent the recurrence of symptoms. Hence, it is necessary to control the level of asthma, which is influenced by factors that trigger asthma recurrence.

AIM: The purpose of the study was to determine the relationship between daily physical activity and exposure to cigarette smoke on asthma recurrence in asthmatic patients.

METHODS: This type of research uses observational analytics using a cross-sectional approach. Sampling in this study using purposive sampling obtained the number of respondents 358 with a vulnerable age of 18–45 years. This research was conducted for 6 months. The measuring instrument for exposure to cigarette smoke uses a questionnaire containing the categories of exposure to cigarette smoke for less than 1 h, exposure to cigarette smoke for 1–4 h, and exposure to cigarette smoke over 4 h. Physical activity measurement tool using the International Physical Activity Questionnaire. Asthma recurrence was measured using a questionnaire that refers to the asthma control test. The research procedure was carried out by researchers by ensuring that respondents were in good health and signed the informed consent provided. Data analysis using Chi-square test.

RESULTS: Asthma correlation with cigarette smoke exposure obtained data on controlled asthma respondents, most of the time span of exposure to cigarette smoke was 1–4 hours, a total of 107 respondents with a p value of 0.000. while the correlation between asthma and daily physical activity obtained controlled asthma, most of the daily physical activity was moderate, a number of 92 respondents with a p value of 0.000.

CONCLUSIONS: There is a relationship between exposure to cigarette smoke and daily physical activity on asthma relapse in asthmatic patients. It is expected that asthmatics should avoid triggering factors for asthma relapse to achieve controlled asthma level

Introduction

Chronic airway inflammation and bronchial hypersensitivity usually identify the pathogenesis of asthma. Asthma results in respiratory symptoms caused by episodic and reversible airflow limitation [1], [2]. Asthmatic patients complain of poor quality of life because their daily activities are limited by worsening respiratory symptoms on exertion. Exertion dyspnea is one symptoms of asthma in addition to various asthma symptoms such as coughing, wheezing or wheezing, chest tightness, excessive sputum production, and shortness of breath, whose intensity and time vary [2], [3].

Asthma is a health problem in almost all countries in the world. Asthma affects children to adults with mild-to-severe disease degrees and some cases, causes death. Most of the deaths occur in low- and middle-income countries [4]. It is estimated

that 300 million people worldwide have asthma, and by 2025, it is estimated that the number of asthma patients will reach 400 million. This number could be further increased given that asthma is an underdiagnosed disease [5]. Asthma is ranked 16th in the world among the leading causes of death living with disability and 28th among the leading causes of disease burden as measured by disability-adjusted life years [6]. Epidemiological studies show the incidence of asthma ranges from 1% to 18% [7]. While in Indonesia, the prevalence of incidence is 4.5% [8]. The incidence of asthma with inpatients has the largest case (7942 cases) in East Java Province and the incidence of asthma with outpatients is ranked 3rd with the number of asthmatics of 36,271 [4]. Data obtained from the Pulmonary Polyclinic of the Surabaya Ahmad Yani Islamic Hospital showed that in 2015, there were 291 asthmatic patients, in 2016, there were 244 people, and in 2017, there were 347 people. The incidence of asthma continues to increase every year [9].

Asthma symptoms can be controlled but asthma cannot be cured [10]. Healing from an asthma attack does not guarantee that in shortly, it will be free from the threat of the next asthma attack, supported by where asthmatics work in an environment that contains indoor allergens such as a lot of cigarette smoke, dust, pollution, pet dander, and allergens from outside in the form of powders, juice, and mushrooms. Triggers for asthma symptoms include cold air, emotional states such as anger and fear, and physical activity. Even certain medications can trigger asthma such as aspirin and nonsteroidal anti-inflammatory drugs [4], [10]. People with asthma who cannot stand fatigued will very quickly show signs of asthma relapse. Under these conditions, asthmatics must be able to adjust to their work so that they have sufficient rest time and do not sacrifice their bodies [9].

Asthma has increased morbidity and mortality rates in children and adults caused by exposure to cigarette smoke [11]. Exposure to cigarette smoke makes asthma sufferers where the longer the exposure is experienced by the patient, the more frequent asthma exacerbations are experienced [12]. The rest of the cigarette smoke on the surface will evaporate into the air. However, there is nicotine residue that sticks to dust and surrounding objects such as clothes, carpets, walls, and furniture. Nicotine dust will not disappear in a short time, so it will be inhaled by others even though the smoker is not there [13], [14]. The chemical components found in cigarette smoke are more than 5200 components in the form of particles and vapors [15]. The effect of exposure to cigarette smoke on sufferers worsens symptoms [16], [17], [18], [19], [20]. Epidemiological studies have shown that exposure to secondhand smoke causes the severity of asthma [21], [22], [23]. Experimental studies show that exposure to cigarette smoke has a contribution or role to the severity of asthma exacerbations [14], [16], [24]. Asthma sufferers with exposure to cigarette smoke have a lower quality of life than asthmatics who are not exposed to cigarette smoke [16]. In addition to exposure to cigarette smoke, asthma symptoms can occur due to physical activity [10].

Physical activity is the cause of poor asthma control and has made the rate of asthma exacerbation with hospitalization increase over the last four decades [25], [26]. Decreased physical activity is contributor to the increased prevalence and severity of asthma [25]. Experimental studies have shown a relationship between physical activity and asthma control [27]. Decreased physical activity is contributor to the increased prevalence and severity of asthma. Experimental studies have shown a relationship between physical activity and asthma control. Decreased rates of asthma exacerbations and hospital stays in individuals with higher levels of physical activity [25], [27], [28]. Another experimental study showed that moderate-intensity routine activity was able to

control asthma in men and rigorous-intensity routine activity could increase the risk of uncontrolled asthma in women [29]. Moderate physical activity has a positive effect on asthma control [30]. From the explanation above, the purpose of this study was to determine the effect of physical activity and exposure to cigarette smoke on asthma control.

Methods

This type of research uses observational analytics using a cross-sectional approach. This research was conducted in Surabaya, East Java. Sampling in this study using purposive sampling obtained the number of respondents 358 with a vulnerable age of 18–45 years. This research was conducted for 6 months (August 2020–February 2021). The measuring instrument for exposure to cigarette smoke uses a questionnaire containing the categories of exposure to cigarette smoke <1 h, exposure to cigarette smoke 1–4 h, and exposure to cigarette smoke more than 4 h referring to research by Lima *et al.* (2020) [31]. The physical activity measurement tool uses the International Physical Activity Questionnaire (IPAQ) questionnaire which is designed to measure a person's physical activity based on metabolic equivalent of tasks (METs) by categorizing light activity with <600 METs-min/week, moderate physical activity with ≥600 METs-min/week and vigorous physical activity 1500–3000 METs-min/week. Asthma recurrence was measured using a questionnaire that refers to the asthma control test (ACT) a screening test that contains a clinical assessment of an asthmatic patient to determine whether the asthma sufferer is controlled or not. The measuring instrument in this study used the IPAQ which has been translated into Indonesian and retested the validity and reliability with the results of validity (r count = 0.890) and reliability with Cronbach's alpha 0.826–0.901. The METs questionnaires have been translated into Indonesian and tested for validity and reliability with the results of validity (r count = 0.745) and reliability results with Cronbach's alpha of 0.778–0.843. Moreover, the ACT questionnaire that has been translated into Indonesian is valid (r count = 0.45) and reliable with Cronbach's alpha 0.83 > 0.6.

The research procedure was carried out by researchers by ensuring that respondents were in good health and signed the provided informed consent.

Results

The following are the results of this study which are presented in tabular form.

Table 1: Characteristics of respondents

Characteristics	f	%
Age		
18–25 years	48	13.4
26–35 years	132	36.9
36–45 years	178	49.7
Gender		
Male	68	19
Female	290	81
Employment		
Work	127	35.5
Does not work	231	64.5
Education		
Primary school	83	23.1
Junior high school	59	16.5
Senior high school	164	45.8
Colleges	41	11.4
No school	11	3.2
Smoking status		
Yes	74	20.7
No	284	79.3

Table 2: Frequency distribution of respondents based on daily physical activity

No.	Physical activity daily	f	%
1.	Light activity	146	40.8
2.	Moderate activity	135	37.7
3.	Strenuous activity	77	21.5
	Total	358	100

Table 3: Frequency distribution of respondents based on the incidence of asthma

No.	Asthma incident	f	%
1.	Controlled	45	12.5
2.	Partially controlled	171	47.8
3.	Not controlled	142	39.7
	Total	358	100

Table 4: Asthma correlation with cigarette smoke exposure

Exposure	<1 h	1–4 h	>4 h	Total
Controlled	6	26	13	45
Partially controlled	7	107	57	171
Not controlled	0	81	61	142
Total	13	214	131	358
p value Chi-square			0.000	

Table 5: Correlation of asthma with daily physical activity

Exposure	Light	Currently	Heavy	Total
Controlled	29	10	6	45
Partially controlled	57	92	22	171
Not controlled	60	33	49	142
Total	146	135	77	358
p value Chi-square	= 0.000.			

Discussion

Characteristics of respondents

(Table 1) The results show that of the 358 respondents aged 18–25 years, 48 (13.4%), 132 (36.9%) in the 26–35 age range and 178 (49.7%) in the 36–45 age range. The incidence of asthma occurred in children aged 14 years, with 11 respondents (57.9%) compared to 13 years of age, with 8 respondents (42.1%) [32], [33], [34], [35], [36], [37], [38], [39]. In other studies that are in line based on the percentage of respondents in the age group, the majority are 10–19 years old (24.3%), respondents aged 40–49 years (16.0%) and age >60 years (10.4%) [40], [41], [42], [43], [44], [45], [46]. The age group diagnosed with asthma was mostly 45–54 years

(17.58%), 35–44 years (16.30%), 55–64 years (14.14%), 25–34 years (13.60%), 65–74 years (11.97%), 15–24 years (11.81%), 10–14 years (7.93%), and >75 years (6.68%). Most children who have asthma will survive into adulthood but there is also asthma that has disappeared for years but will reappear according to a person's age where there is a tendency that the increasing age of a person has a greater chance of having asthma [47].

The results of the research on gender characteristics showed that most respondents were female 290 respondents (81%). This study is inversely proportional to the research of Husniyya *et al.* (2018) where most of the respondents who experienced asthma due to exposure to cigarette smoke were male compared to 68.4% of female. Men are more sensitive to asthma attacks when compared to women because in terms of the diameter of the male respiratory tract, it is smaller, so it is more sensitive if there is a blockage in the airway. Most respondents who experience asthma are women by 56%, because women live at home with active smokers and are exposed to cigarette smoke so that the environment becomes smoky and is inhaled continuously by a woman [48].

The results of the study stated that from 45 respondents, most parents were female, 35 respondents (77.8%) [41]. Another similar study showed that the majority of respondents diagnosed with asthma were women (52.49%) while men (47.51%) [44]. At puberty, girls have a higher number of alternatively active macrophages (AAM) than boys. The AAM serves to stimulate Th2 production indirectly, it will affect the balance of Th1 and Th2, which is the basis of asthma pathogenesis [40].

The results of the research related to the characteristics of employment status showed that the majority did not work 231 respondents (64.5%). The proportion of respondents who were diagnosed with asthma was 47.02% of respondents who did not work, followed by those who worked as farmers, fisher, laborers 37.42%, entrepreneurs 9.22%, and employees 6.10% [47]. Another similar study belonging to Sihombing *et al.* (2010) said that the respondents' occupations were known as laborers or farmers (29.0%), not working (28.7%), still in school (18.5%), and self-employed (11.7%). Most asthmatics have other jobs, namely, 15 respondents (36.58%) and the minority as private employees and civil servants with 4 respondents (9.76%) [45].

The results of the study related to the characteristics of the latest education, the majority of respondents were in high school, the last was 164 respondents (45.8%), elementary school was 83 respondents (23.1%), junior high school was 59 respondents (16.5%), and universities were 41 respondents (11.4%). Sari's research (2013) showed that the majority of respondents with asthma had an elementary school education of 35 respondents

(85.36%) and a minority with a high school education of 2 respondents (4.88%). Respondents obtained from the case group are still relatively low educated, namely, elementary and junior high school, half of the family heads have elementary and junior high school education, this is very supportive of negative behavior, especially smoking behavior. A person with low education has relatively less knowledge about the content of cigarettes or the dangers of smoking compared to someone who has a higher education [35], [47].

Smoking status obtained data that the majority do not smoke as many as 284 respondents (79.3%) and 74 respondents (20.7%) smoke. Respondents know that they have asthma and it is caused by smoking (33.76%), respondents know that they have asthma but have never smoked (37.03%) [44]. Meanwhile, respondents do not know that they have asthma but still smoke (66.24%) and respondents do not know that they have asthma but have never smoked (62.24%). Based on research from Asta and Artana (2020) that has been carried out on asthma patients, it was found that 21.2% of respondents were active smokers [32]. Another similar study belonging to Putra, *et al.* (2012) found that the number of asthma patients who were active smokers was 22.4%. Asthmatic patients with smokers will be more at risk of developing asthma symptoms than asthmatic patients with non-smokers [42].

Daily physical activity

(Table 2) The results showed that the frequency distribution data based on daily physical activity obtained data for almost half of the light activity of 146 respondents (40.8%), the moderate activity of 135 respondents (37.7%), and heavy activity of 77 respondents (21.5%). Similar research related to daily physical activity in patients shows that respondents who have asthma and do moderate physical activity (3.03%) respondents and who know that they have asthma but do not do physical activity are as many as 2.47% of respondents, while respondents who do not know if they have asthma but do moderate physical activity (96.97%) respondents and respondents who do not know if they have asthma and have never done physical activity are as many as 97.53% of respondents. In respondents who have less activity, the incidence of asthma is 4.0% while those who have moderate activity are 3.5% [44], [46].

Asthma incident

(Table 3) The results of the study on the frequency distribution of respondents based on the incidence of asthma obtained data on the incidence of controlled asthma of 45 respondents (12.5%), partially controlled asthma of 171 respondents (47.8%), and uncontrolled asthma of 142 respondents (39.7%). Asthma controlled status in respondents showed that

controlled asthma was 19 respondents (57.6%) and uncontrolled asthma was 14 respondents (42.4%) [32]. Sixty-eight respondents with controlled asthma control status and had a disturbing quality of life were none (0.0%), while respondents with uncontrolled asthma control status and had disturbed quality of life were 41 respondents (93.2%) and respondents with asthma that is not controlled and has an uninterrupted quality of life as many as 3 respondents (6.8%) [43].

Another study by Daud *et al.* (2017) that in the working area of Pukesmas Kuin Raya Banjarmasin, the majority of respondents experienced uncontrolled asthma as many as [33] respondents (80.5%) where asthma patients tend to experience recurrent asthma attacks.

Asthma correlation with cigarette smoke exposure

(Table 4) The results of the study on the correlation of asthma with exposure to cigarette smoke showed that the majority of respondents had controlled asthma with a period of 1–4 h totaling 26 respondents, partially controlled asthma patients with the majority of the time spanning 1–4 h as many as 107 respondents, and patients with uncontrolled asthma with a majority of the period 1–4 h a total of 81 respondents. The results were 52 respondents (55.9%) were not exposed to cigarette smoke and 41 respondents (44.1%) were exposed to cigarette smoke [39]. Another study which showed that a child exposed to parental cigarette smoke had a significant relationship with the incidence of asthma in a child, it was found that 32.4% of asthma events that occurred were caused by cigarette smoke [34]. Another study stated that the proportion of cases of asthma respondents who were exposed to cigarette smoke was 62.4% while in the control group, it was 47%, this shows that the majority of respondents were exposed to cigarette smoke [38]. Cigarette smoke is a very dangerous indoor pollution because more than 90% of people will spend time indoors. Cigarette smoke itself consists of the main smoke which contains 25% hazardous levels and side smoke which contains 75% hazardous materials. Passive smokers themselves can inhale 75% levels of hazardous materials plus the smoke released by active smokers [37].

Exposure to cigarette smoke is one of the factors that play a role in the decline in lung function, which affects the level of asthma control in asthmatics. Cigarette smoke is tobacco burning as a source of irritant substances producing a complex mixture of gases and harmful particles [49]. Cigarette smoke is one of the trigger factors for asthma. Smoking can make things worse during an asthma attack, so avoiding secondhand smoke is an important recommendation. Cigarette smoke is a pollutant for humans and the surrounding environment [50]. Among all the particles in the air, cigarette smoke is the most capable of penetrating to

the last respiratory system, namely, the alveoli. This is equivalent to the diffusion ability of the virus. Cigarette smoke is also able to make airway epithelial cells produce more mucus. The movement of the lungs to clean themselves is also disrupted so that phlegm and other irritants cannot be expelled. This makes people with asthma more susceptible to respiratory infections. Asthma symptoms will also appear due to infection in the respiratory tract [51].

The duration of exposure to cigarette smoke is grouped into two categories, namely, moderate exposure to cigarette smoke (<3 h/day) and exposure to heavy cigarette smoke (>3 h/day). The longer the exposure experienced by asthmatics, the more frequent asthma exacerbations are experienced [12]. Active smokers can increase the risk of developing asthma. Passive smokers: The side stream of cigarette smoke that burns is hotter and more toxic than that inhaled by smokers. Exposure to passive tobacco smoke results in more dangerous symptoms of lower respiratory tract disease (cough, mucus, and wheezing) an increased risk of asthma and asthma attacks. In people with asthma, this condition will reduce the quality of life and cause death, especially in active smokers if a severe asthma exacerbation occurs, where the patient will experience chronic obstruction as a result of the body's need for oxygen is not fulfilled so that they experience shortness of breath or experience an ineffective breathing pattern. Cigarette smoke can damage the lungs and may stop certain asthma medications, such as inhaled corticosteroids (a type of preventer medication), from working properly. This is to help with full assistance in asthma patients to avoid secondhand smoke and it is recommended not to smoke. Asthma sufferers who have smoked are warned to stop the habit because it can aggravate the disease so that asthma attacks do not occur. It is found that there is a significant relationship between exposure to cigarette smoke and the level of asthma control [49].

Asthma correlation with daily physical activity

(Table 5) The results of the study on the correlation of asthma with daily physical activity obtained data on respondents with controlled asthma, the majority of light daily physical activity was 29 respondents and a severe minority was six respondents, asthma was controlled in part, the majority of moderate daily physical activity was 92 respondents and a severe minority was 22 respondents, asthma was not controlled. The majority of heavy daily physical activity are 49 respondents and the moderate minority are 33 respondents. The results of Dwimaswasti's research (2013) showed that uncontrolled asthma patients with high activity were 1 respondent (3.3%), moderate activity was 5 respondents (16.7%), and low activity was 24 respondents (80%), while the results in controlled

asthma patients with high activity 9 respondents (30%), moderate physical activity 10 respondents (33.3%), and low physical activity 11 respondents (36.7%).

Physical activity is the movement of limbs that cause energy expenditure, which is very important for maintaining physical and mental health, as well as maintaining the quality of life to stay healthy and fit throughout the day. The amount of energy needed depends on how many muscles are moving, for how long and how much work is done. Physical activity for asthmatics will get an attack if it is too long to do excessive and heavy physical activity. If the body is tired due to physical activity, the body will compensate by breathing faster, to get more oxygen for the sake of metabolism. Physical activity is one that often triggers asthma attacks. This then causes a tendency for asthmatics to reduce their physical activity [36].

Conclusions

There is a relationship between exposure to cigarette smoke and daily physical activity on asthma recurrence in asthmatic patients. It is hoped that asthmatics should avoid triggering factors for asthma recurrence to achieve controlled asthma levels.

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