

Tobacco, Vaporizers, and Cannabis in Asthmatic Adolescents

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Abstract

Adolescents with asthma use traditional tobacco, electronic cigarettes, and cannabis at a higher rate than the general population of the same age. The consumption of these products in this age group can increase the prevalence of asthma. Adolescents with asthma are a population potentially susceptible to these products with increased symptoms and alterations in quality of life. Some prevention and cessation strategies used in the general population of adolescents could be applied to those who suffer from asthma.

Keywords: adolescents, asthma, traditional tobacco, electronic cigarettes, cannabis.

Introduction

The prevalence of asthma in adolescents has changed in recent decades. The phase 1 study of the Global Asthma Network Phase carried out in 74,361 adolescents aged 13 and 14 years, reported an average prevalence of 10.4% and an increase in asthma cases in the last 27 years (1993-2020), especially in low-to-middle income countries [1]. The global prevalence of traditional tobacco in adolescents has had a slight decrease in recent years. However, it is still very important, reporting 11.3% for males and 6.1% for females aged 13 to 15 years [2]. The global prevalence of exposure to secondhand tobacco in adolescents aged 12 to 16 has decreased in recent years, however, there are still alarming reports such as 12.3% exposure in homes and 23.5% in public places daily for the last 7 days [3]. The overall prevalence of heated tobacco products (e.g., electronic cigarettes or vaporizers) is higher in adolescents than in adults (5.25% vs. 2.45%, respectively) [4]. The global prevalence of electronic cigarettes (e-cigarettes) among adolescents aged 12 to 16 years is 9.2% and is associated with greater parental smoking, personal traditional smoking, second-hand smoking, youth smoking, and consumption of other forms of tobacco [5]. In adolescents aged 12 to 17 years from low-to-middle income countries, a prevalence of cannabis consumption has been reported at 4.2%, whose consumption increases in males and tobacco users

[6]. Adults who smoke traditional or electronic cigarettes have a higher prevalence of asthma and worse clinical outcomes have been reported than those who do not smoke [7,8]. It has also been reported that adults who consume cannabis have a higher risk of asthma, exacerbations, and a greater need for anti-asthmatic medications [9]. However, the evidence on the health effects of tobacco, e-cigarettes, and cannabis in asthmatic adolescents is quite minor. The objective of this review was to measure the impact of tobacco and cannabis products on adolescents with asthma, and whether there are cessation or prevention strategies that can be implemented in this group.

Methods

A review of the evidence was carried out in a scientific study on adolescent asthma, tobacco, vaporizers or electronic cigarettes, and cannabis. The search for articles was carried out between April and May 2024 in the databases Medline (PubMed), Web of Science (WOS), EBSCO Host, Science Direct, and SCOPUS. The review considers cross-sectional, controlled studies, systematic reviews, and meta-analyses. MeSH terms and free terms in their English version were used. The terms were grouped into four dimensions: i) adolescent asthma ii) tobacco or smoke cigarette iii) vaporizers or e-cigarettes iv) marijuana or cannabis. The boolean operator was used "and" to integrate the four dimensions. The articles found were grouped into four questions: 1) Do

adolescents with asthma consume more tobacco or cannabis products than those without asthma? 2) Does the use of tobacco or cannabis products increase the risk of asthma in adolescents? 3) Does the use of tobacco or cannabis products increase asthma symptoms in adolescents? 4) Are there strategies for preventing or stopping the use of tobacco or cannabis products in asthmatic adolescents?

Do asthmatic adolescents consume more tobacco or cannabis products?

It has been reported that adolescents aged 15 to 18 years with asthma are 1.5 times more likely to smoke than non-asthmatics [10]. A prospective follow-up cohort with a group of adolescents with an average age of 12.9 years demonstrated that when there is a history of asthma, there is a greater risk of regular traditional tobacco consumption than experimental tobacco (OR 1.91; 95% CI, 1.1 to 1.34), risk that increased in asthmatic women with a smoking mother [11]. A study of 9th and 12th-grade adolescents demonstrated that those who had a history of asthma throughout their lives had greater consumption of Hookah Smoking (9.8% vs. 7.2%, respectively, $p < 0.01$) and a lower perception of risk of said consumption (16.1% vs. 14.4%, respectively, $p=0.014$), than those who did not have a lifetime history of asthma [12]. Another study of adolescents from 9th to 12th grade showed that those with asthma consume more smoking hookah or e-cigarettes than those without asthma. Furthermore, adolescents with asthma reported more often that smoking hookah or e-cigarettes makes them look cooler than adolescents who did not have asthma [13]. A cross-sectional study conducted with adolescents aged 13 to 19 years reported that asthmatics were more likely to smoke traditional cigarettes (21.6% vs. 11.8%). In addition, asthmatics who reported smoking started the habit at age 11 out of curiosity and maintained it because it reduced their anxiety and stress [14]. A cross-sectional study carried out in adolescents aged 13 to 18 years showed that asthmatics had a higher proportion of e-cigarette consumption than non-asthmatics (9.9% vs 8.2%, $p < 0.001$ respectively), and the factors with a greater association with e-cigarette consumption were: alcohol consumption, caffeine energy drink more than 5 times a week, violent experiences and having smoking friends [15]. Finally, a study carried out on adolescents from 9th to 12th grade showed that those who have asthma report greater cannabis consumption than those who do not have asthma (23.4% vs. 18.5%; respectively; $p < 0.05$). Adolescents with asthma reported a greater

proportion of days of cannabis use in the past month than those without asthma: 20 to 39 days (2.7% vs. 1.5%; respectively $p < 0.05$) and 40 or more times (5.2% vs. 3.5%; respectively $p < 0.05$). Furthermore, women with asthma had greater cannabis consumption than non-asthmatic women (24.7% vs. 18.0%; $p < 0.05$) [16]. In summary, there is evidence that supports that adolescents with asthma have greater consumption of traditional tobacco, hookah, e-cigarettes, or cannabis than adolescents without asthma.

Do tobacco or cannabis products increase the prevalence of adolescent asthma?

In a prospective cohort with healthy adolescents followed for 6 years, it was reported that those who smoked in the last year had twice as many asthma symptoms (OR 2.1; 95% CI, 1.2 to 3.8), compared to those who did not [17]. In another prospective cohort with healthy children recruited between 4th and 7th grade, it was reported that when they reached adolescence, those who smoked 300 cigarettes per year had almost 4 times the risk of asthma (RR 3.9; 95% CI, 1.7 to 8.5), and those who smoked at least 7 cigarettes in the last week with a history of maternal smoking during pregnancy had a higher risk (RR 8.8; 95% CI, 3.2 to 24) [18]. In a cross-sectional study carried out in 3000 adolescents between 13 and 14 years of age, it was reported that active smoking was associated with a higher risk of asthma symptoms (OR 1.83; 95% CI, 1.42 to 2.35) than those who did not smoke [19]. An annual follow-up cohort from 7-8 years of age to 16-17 years of age demonstrated that both maternal smoking during childhood and adolescence and the adolescent's own active smoking were associated with a higher prevalence of asthma, than those who did not have this history. This study also demonstrated that asthma diagnosed by a doctor increased linearly (X^2 -test for trend, $p=0.02$) with the number of cigarettes consumed daily, especially when consuming more than 11 per day [20]. A cross-sectional study conducted in adolescents from 7th to 12th grade reported that active smoking greater than or equal to 20 days per month (OR 1.57; 95% CI 1.38 to 1.77) or passive smoking greater than or equal to 5 days per month week (OR 1.4; 95% CI, 1.28 to 1.53) were associated with a higher prevalence of asthma than those who did not smoke or were not exposed to passive smoking [21]. Another cross-sectional study with adolescents who had an average age of 16.8 years demonstrated that active smokers had a higher risk of asthma (adjusted PR = 1.82; 95% CI, 1.30 to 2.56) and passive smokers (PR adjusted 1.64; 95% CI,

1.21 to 2.23) had a higher risk of having asthma [22]. Adolescents aged 15 to 18 years who are exposed to passive smoking have more physician-diagnosed asthma (OR 1.11; 95% CI, 0.91-1.31) and wheezing in the last 12 months (OR 1.35; 95% CI, 1.2 to 1.47) than those not exposed [23]. A study with adolescents aged 12 to 17 years showed that those who smoked at least 11 traditional cigarettes in the last month had a higher risk of asthma (adjusted Hazard Ratio 1.68; 95% CI, 1.21 to 2.32) in the 5-year follow-up when compared to those who did not smoke [24]. A cohort of asthmatic adolescents aged 12 to 17 years found that current consumption of traditional cigarettes was associated with a higher prevalence of wheezing in the last 12 months (OR 1.88; $p < 0.01$) than those who did not consume [25]. The increased risk of asthma due to the consumption of e-cigarettes has also been studied. A meta-analysis that grouped 10 studies measured the association between e-cigarette consumption and the risk of asthma in adolescents. The authors found that every use of e-cigarettes was associated with asthma (OR 1.20; 95% CI; 1.12 to 1.28), as was the current use of e-cigarettes (OR 1.36; 95% CI, 1.26 to 1.48) when compared to those who did not consume them [26]. A recent cross-sectional study carried out with adolescents aged 13 to 17 years showed that the consumption of e-cigarettes in the last month was associated with a higher risk of asthma in Texas (OR 1.32; 95% CI, 1.06 to 1.66) and throughout the United States (OR 1.18; 95% CI, 1.02 to 1.37) than those who did not consume them [27]. A study with adolescents from 10th to 12th grade reported that dual consumption of e-cigarettes/marijuana (OR 1.17; 95% CI, 1.12 to 1.23) and consumption of only marijuana (OR 1.17; 95% CI, 1.11 to 1.23) was associated with asthma compared to those who did not consume [28]. Finally, a recent study measured cannabis use in adolescents from 9th grade to 12th grade. An elevated risk of asthma was found in those who reported cannabis use in the last month (OR 1.25; 95% CI, 1 to 1.3) compared to those who did not use cannabis. The risk of asthma was further increased when monthly cannabis use was reported to be 40 or more in the past month [29]. In summary, there is evidence to indicate that active or passive consumption of traditional tobacco, e-cigarettes, and cannabis increases the risk of asthma in adolescence.

Do tobacco or cannabis products increase adolescent asthma symptoms?

A study in adolescents aged 13 to 14 years showed that those who actively smoked tobacco had a higher risk of wheezing in the last year (OR 1.98; 95% CI,

1.39 to 2.82) and asthma attacks (OR 4.15; 95% CI, 2.25 to 7.68) when compared to those who did not smoke [30]. Another study in adolescents with an average age of 15 years showed that heavy smokers (more than 100 cigarettes in the last week) had a higher risk of suffering from bronchoconstriction with exercise (OR 2.27; 95% CI, 1.30 to 3.97) and nocturnal cough (OR 3.45; 95% CI, 1.52 to 7.81) than those who did not smoke [31]. Severe asthma has been found more frequent in adolescents exposed to passive smoking (at least one smoker in the home), experimental smoking (at least once in their life), current smoking (at least 1 time in the last month), and smoking habitual (seven or more consecutive days in the last month), than those who do not report smoking [32]. A recent meta-analysis reported that adolescents exposed to environmental smoking have a higher risk of hospitalization in the following month (OR 1.94; 95% CI, 0.67 to 5.61) than those who were not exposed [33]. An association with hospitalizations for asthma has also been found in ex-smoking adolescents aged 12 to 17 (Incidence rate ratio 1.26; 95% CI, 1.05 to 1.53) compared to those who never smoked [34]. A prospective cohort of adolescents aged 12 to 17 years showed that those exposed to traditional tobacco had a greater risk of interference in their quality of life on most days of the last month (OR 8.49; $p < 0.01$) than those who were not exposed. Furthermore, those who had dual tobacco consumption (traditional cigarettes plus e-cigarettes) had more interferences in quality of life (OR 13.07; $p < 0.01$) than those who did not consume any form of tobacco [25]. A meta-analysis reported that adolescents who use e-cigarettes between 6 and 30 days in the last month report more bronchial symptoms (OR 1.55; 95% CI, 1.34 to 1.69) and more difficulty breathing (OR 1.87; 95% CI, 1.58 to 2.21) than those who did not consume them. Moreover, adolescents who consumed e-cigarettes with multiple devices had a higher risk of asthma attacks (OR 1.64; 95% CI, 1.21 to 2.21) than only pods [35]. Preliminary evidence suggests that cannabis use with an electronic nicotine delivery system (ENDS) could affect respiratory health in adolescents. A study with adolescents aged 12 to 17 years reported that those who used cannabis with ENDS had almost twice as much wheezing or whistling (OR 1.81; 95% CI, 1.47 to 2.22) than those who did not [36]. In brief, the evidence collected indicates that adolescents with asthma who smoke, who are exposed to environmental smoking, and who use e-cigarettes or combinations of electronic cigarettes with traditional cigarettes or cannabis have more asthma symptoms and alterations in quality of life than those who are not

exposed.

Are there strategies for preventing or stopping the use of tobacco or cannabis products in asthmatic adolescents?

Most prevention strategies for adolescent smoking are general and not specific for asthmatic adolescents. Individual behavioral counseling interventions have moderate benefits. These can be printed, in person, by telephone, or computer. In face-to-face or telephone interventions, it is recommended to use the 5A model (Ask, Advise, Assess, Assist, and Arrange), and they can be carried out in primary care, dental care, and non-medical settings: home, school, or community [39]. A meta-analysis measured the effect of programs with incentives (rewards) to avoid smoking in adolescents aged 11 to 14 without finding significant differences with those who did not participate in these programs [38]. A systematic review demonstrated that behavioral interventions carried out in primary care with adolescents reduce the possibility of starting smoking by up to 18% (Risk Ratio 0.82; 95% CI, 0.72 to 0.94) compared to controls who did not receive them [39]. A randomized controlled study in adolescents performed a cost-effectiveness analysis for a school intervention program to prevent the initiation of traditional tobacco. In this study, adolescents were recruited between 11 and 12 years of age who received at least 8 anti-tobacco educational interventions or placebo, up to 15-16 years old. The group that received anti-smoking interventions had a lower risk of ever smoking than the control group (RR 0.83; 95% CI, 0.71 to 0.97, $p=0.016$). The economic analysis of the incremental cost-effectiveness ratio (ICER) showed that 134 dollars should be spent for each smoker avoided between 15 and 16 years of age [40]. Family interventions to prevent adolescents have also been measured. A systematic review evaluated the effect of parenting practices and parental habits on the prevention of smoking in adolescents. In this analysis, it was proven that the complete prohibition of smoking at home, avoiding cigarettes inside the house, and respectful and constructive communication (rather than lecturing or preaching), were preventive factors for tobacco consumption in adolescents [41]. A meta-analysis showed that adolescents aged 11 to 14 years who receive family programs to prevent the initiation of traditional tobacco can reduce consumption or experimentation with tobacco between 16 and 32%, compared to those who do not receive these programs [42]. In a meta-analysis, it was also shown that interventions to achieve cessation of traditional tobacco consumption in

adolescents increased the probability of quitting smoking by 34% compared to those who did not receive it, requiring intervention in 13 adolescents so that 1 could quit smoking [39]. In asthmatic adults with moderate-severe dependence on traditional tobacco, there is evidence that demonstrates good results with drugs such as bupropion, varenicline, and nicotine replacement therapy, to reduce tobacco consumption [43]. Despite this, in adolescents under 18 years of age, there is no solid scientific evidence that allows us to recommend the use of bupropion or varenicline in the treatment of addiction to traditional tobacco [37]. Strategies or interventions in cessation of traditional smoking in adolescents have been measured. A meta-analysis measured the effect of interventions to quit smoking in children under 20 years of age, finding that although there is limited evidence, the best interventions were group interventions (RR 1.35; 95% CI, 1.03 to 1.77), but not in the individual ones. No significant evidence was found in pharmacological treatment such as nicotine replacement therapy or bupropion [44]. Nicotine replacement therapies have increasingly evolved and should continue to be evaluated in the future. To date, nicotine replacement therapy has not been approved by the Food and Drug Administration (FDA) for adolescents under age 18, but the American Academy of Pediatrics (AAP) has recommended it for adolescents with moderate to severe tobacco substance use disorder who are willing to eliminate smoking [45]. E-cigarette prevention strategies for adolescents recommend intervening in: a) policies (limit access and prohibit advertising) b) education (doctors, medical students, teachers, and students), and c) dual preventive approach to e-cigarettes and traditional cigarettes (community, public health, web or applications for mobile devices) [46]. A recent systematic review analyzed the strategies available to eliminate the e-cigarette habit or dual consumption (electronic and traditional cigarettes). The majority were studies in adolescents, finding little evidence in favor of cessation of the consumption of e-cigarettes with behavioral strategies, without finding evidence in the cessation of dual consumption [47]. Other reviews found preliminary positive evidence with some individual interventions that promote social-emotional skills. Some evidence was also found in interventions that promote the training of leaders in the prevention of e-cigarettes among peers, however, no evidence was found that community activities serve to prevent e-cigarettes in adolescents [48]. The methods to stop using e-cigarettes will be different according to the characteristics of each adolescent. A recent study

that analyzed strategies to stop using e-cigarettes in adolescents found that 63.7% did not request any help to stop using, 14.2% did so by asking their friends for help, 6.4% consulting on the internet, 5.9% through text message or mobile application and 5.8% sought help from their parents. In this study, it was also found that women requested less help from their parents than men, Hispanics requested more help from parents and friends than whites, and those who had dual consumption (e-cigarettes plus traditional cigarettes) received more help from a teacher, coach, doctors or health provider [49]. In the prevention of cannabis use in adolescents, it is recommended that health professionals ask about use in adolescents, however, they usually do not have the same motivation to find out as with smoking. What is recommended is to ask respectfully without prejudice, make a quantitative and qualitative evaluation of the consumption, and if it coexists with the consumption of alcohol or other drugs [50]. Preventive drug use interventions in adolescents are limited. The cannabis cessation interventions that have been successful in adolescents are those that have aimed to improve patients' relationships, their emotional regulation, and the treatment of psychiatric comorbidity. In this study, it was found that online interventions can have a success rate in eliminating cannabis use up to 89% [51]. Concisely, the available evidence on the prevention and cessation of traditional tobacco and e-cigarette consumption is not specific to adolescents with asthma. There are strategies with satisfactory results in the prevention and cessation of traditional cigarette and e-cigarette consumption in the general population of adolescents that could be applied to asthmatic adolescents. There is little evidence on the prevention or cessation of cannabis use in adolescents.

Conclusions

Adolescents with asthma have a greater consumption of traditional tobacco, e-cigarettes, or cannabis than adolescents without asthma. Active or passive consumption of traditional tobacco, e-cigarettes, and cannabis increases the risk of suffering from asthma in adolescence; they have more asthma symptoms and alterations in quality of life than those who are not exposed. There are strategies with satisfactory results in the prevention and abandonment of the consumption of traditional electronic cigarettes and cannabis in the general population of adolescents that could be applied to asthmatic adolescents.

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