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Fast Food Consumption and Asthma-Related Emergency Room Visits, California Health Interview Survey, 2011-2016

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UNIVERSITY OF CALIFORNIA, MERCED

Fast Food Consumption and Asthma-Related Emergency Room Visits, California Health
Interview Survey, 2011-2016

A thesis submitted in partial satisfaction of the requirements for the degree of Master of
Science

in

Public Health

by

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Table of Contents

	Page
I. Abstract	6
II. Introduction	7
III. Methods	8
IV. Results	9
V. Discussion	13
VI. Strengths and limitations	14
VII. Conclusion	14
VIII. References	16

List of Tables

	Page
I. Table 1.	10
Characteristics of adults with asthma from the 2011-2016 California Health Interview Survey.	
II. Table 2.	12
Association between fast food consumption and an emergency room visit due to asthma among adults with asthma in California.	

Abstract

Introduction: Asthma is a chronic inflammatory lung disease that causes airway constriction resulting in long-term impacts on respiratory health of individuals. This condition is common affecting up to 8% of adults in the United States. Factors such as air pollution, pollen, mold, tobacco smoke, secondhand smoke, other environmental exposures, and diet have been associated with asthma and the exacerbations of asthma symptoms. Several studies have shown an association with poorer diet and asthma. Despite the prevalence of fast food consumption in the Western diet, research examining fast food consumption and asthma is very limited.

Objective: The objective of this study was to examine the association between fast food consumption and asthma-related emergency room visits among adults with asthma in California from 2011-2016.

Methods: This cross-sectional study focused on 11,561 adults with asthma in California. Publicly available data from the California Health Interview Survey was used. The independent variable included fast food consumption and the dependent variable was an emergency room visits due to asthma. This study used logistic regression models and controlled for sex, race, self-reported overall health, BMI, and current smoking status. Additionally, the survey weights were applied to ensure the analysis was representative of the general population.

Results: Consumption of fast food ≥ 3 times per week was associated with increased odds of emergency room visits for asthma among adults with asthma in California (unadjusted model: OR = 1.64 CI: 1.13-2.40, $p = 0.01$; adjusted model: OR_{adj} = 1.53, CI: 1.03-2.26, $p = 0.03$).

Conclusion: Our findings suggest that among adults with asthma, a high consumption of fast food may result in higher odds of asthma related emergency room visits. Thus, decreasing fast food consumption may benefit adults with asthma by reducing emergency room visits. Additionally, the reduction of fast food consumption may be beneficial for asthma management. Further studies need to be conducted to assume causality from the results of this study.

Keywords: Asthma, fast food, logistic regression, adults with asthma, California

Introduction

Asthma is a chronic disease that compromises the respiratory health of individuals, this inflammatory disease constricts and narrows the airways.¹ Asthma is a common condition affecting up to 8% of adults in the United States. As of 2019, approximately 20 million adults suffered from asthma and 862,074 adults reported visiting the emergency room due to asthma exacerbation in the United States.² In California, approximately 400,000 individuals currently suffer from asthma.² Common symptoms of asthma include wheezing, coughing, shortness of breath, or chest tightness, however severity of these common symptoms can vary.³ Factors such as air pollution⁴, pollen⁵, mold⁶, tobacco smoke⁷, secondhand smoke⁸, other environmental exposures^{9,10} and diet^{11,12} have been associated with the worsening of asthma and exacerbations of asthma symptoms.

Fast food can be defined as food purchased conveniently in self-service or carry-out method with little to no waiting time for the consumer.¹³ Typically, fast food options tend to contain ingredients that are high in calories, saturated fats, and refined carbohydrates and low in essential micronutrients.^{14,15} Due to its accessibility, convenience, and availability, fast food has become common in the Western diet.¹⁶⁻¹⁹

Recent studies have examined the association of different diets, such as fast food consumption, with asthma. For example, a cross-sectional study in New Zealand examined the consumption of fast food and its relationship to the prevalence of asthma and allergy.²⁰ The study found that frequent consumption of hamburgers was associated with increased asthma symptoms. Similarly, Wang et al. (2018) found that the consumption of hamburgers was correlated with severe asthma.²¹ A high fat and low nutrition diet, such as the increased consumption of hamburgers, may lead to obesity and increased metabolic disease that may aggravate asthma symptoms. Scott et al. (2011) suggested that a plausible explanation for the association between obesity and aggravation of asthma symptoms is that adipose tissue may increase systemic inflammation that subsequently increases airway inflammation, leading to asthma exacerbation.^{22,23} Consistent with this hypothesis, a high-fat or fast food diet can result in increased fatty acids in circulation, leading to systemic inflammation.^{21,22} Thus, higher intake of fast food may lead to obesity which then results in the aggravation of asthma. Conversely, studies conducted by Alwarith et al. (2020) and Barros et al. (2015) indicate that a plant-based diet has been demonstrated as a treatment and prevention strategy for asthma.^{24,25} In summary, the association between a poor diet and the aggravation of asthma, or a between a healthier diet and treatment of asthma, is well supported in the literature. However, data gaps remain concerning the relationship between different types of fast food and asthma among adults with asthma.

The purpose of this study was to investigate the association between fast food consumption and emergency room (ER) visits due to asthma in California. Using cross-sectional survey data from the California Health Interview Survey (CHIS) we examined whether an increase in fast food intake was associated with an increase in ER visits due to asthma among adults with asthma. We hypothesized that higher fast food consumption is

associated with an increase in ER visits due to asthma among California adults with asthma.

Methods

Data and participants

Information on fast food consumption and ER visits was obtained from the 2011-2016 publicly available CHIS database. The CHIS is a cross-sectional survey conducted in collaboration with the UCLA Center for Health Policy Research (UCLA-CHPR), California Department of Public Health, and the California Department of Health Care Services.²⁶ Extensive information regarding the health, health conditions, health-related behaviors, and other health topics are collected by the CHIS. The publicly available data files contain no identifiable information from participants therefore it is exempt from Institutional Review Board (IRB) approval. From 2011 through 2016, the CHIS adult sample consisted of 125,264 adults, of which 11,561 individuals were diagnosed with asthma by a doctor and still had asthma or experienced an asthma episode in the past 12 months.

Variables

We used an ER visit due to asthma as the outcome (dependent) variable. Participants were asked, “during the past 12 months, have you had a visit to the hospital emergency room because of your asthma?”. A “no” response was coded as “0” and a “yes” response was coded as “1”.

The main exposure (independent) variable was fast food consumption. Participants were asked “now think about the past week. In the past 7 days, how many times did you eat fast food? Include fast food meals eaten at work, at home, or at fast food restaurants, carryout or drive through.” Respondents reported the number of times they ate fast food in the past week. Respondents reported “0 times”, “1 time -2 times” or “3 or more times” coded as 0, 1, 2, 3 respectively. In our sample, 23.51% of individuals reported consuming fast food three or more times per week and we used this cut-point to define high fast food consumption. Other variables that we included in our study were age (18-25, 26-44, 45-64, 65 or older), sex (male and female), education (less than high school, high school or GED, some college or Associates degree, Bachelor’s degree or higher), race (Non-Hispanic (NH) White, Hispanic, NH African American/ Black, Other), self-reported overall health (excellent, very good, good, fair, poor), Body Mass Index (BMI kg/m²) (underweight (0-18.49), normal weight (18.5-24.99), overweight (25.0-29.99), obese (30+)), and current smoking status (non-smoker and smoker).

Statistical analysis

We first computed descriptive statistics for the dependent and independent variable. We used logistic regression models to evaluate the association between fast food consumption and an ER visit due to asthma among adults with asthma. Logistic regression models are commonly used to examine the relationship between a

dichotomous dependent variable and categorical independent variable.²⁷ We conducted a binary analysis examining the association between our independent variable (fast food consumption) and our dependent variable (ER visit due to asthma among adults with asthma). We then adjusted the model for confounders by controlling for sex, race, and self-reported overall health. Final confounders included in the adjusted logistics model were identified by Chi-squared tests. We examined the association between each variable in the analysis and the outcome variable, see Appendix A (Table A.1).²⁸ Additionally, we used the Cramér's V test to measure the correlation between each of the variables and to evaluate multicollinearity among the variables in our study. The results from the Cramér's V test range from 0 to 1, 1 being perfect association²⁸. A result of 1 was a consider a multicollinear result, see Appendix B (Table B.1).

We calculated crude odds ratios (OR), based on the logistic regression model without confounders, and adjusted odds ratios (OR_{adj}), based on the logistic regression model with confounders, with 95% confidence intervals (CIs). Statistical significance was considered for p-values < 0.05 (two-sided tests). All statistical analyses were conducted using STATA 14.²⁹

Results

Characteristics of study group

Table 1 presents the selected characteristics of respondents in the study population. The sample of this study consisted of 11,561 California adults with asthma. Respondents aged 45 - 64 years were the largest group (35.6%). More than half of the respondents were female (64.1%); 34.5% of participants held a Bachelor's degree or higher followed by 30.1% of participants completing some college or an associate degree. Overall, most of the participants were NH White (50.4%). Furthermore, most of the participants self-reported good overall health (30.5%). Regarding BMI, 37.1% of respondents were considered obese, 31.3% were considered overweight, followed by 30.1% respondents within the normal range. Less than 2% of respondents were underweight (1.6%). Most respondents were non-smokers (85.3%). Many (41%) reported consuming fast food 1 to 2 times per week, and 35.5% reported not fast food consumption. Lastly, 24.5% of respondents reported consuming fast food 3 or more times per week.

Table 1. Characteristics of adults with asthma from the 2011-2016 California Health Interview Survey.

	N= 11561	Unweighted % = 100	Weighted % (95% CI)
<i>Age</i>			
18-25 Years	884	7.7%	16.7% (15.1-18.5)
26-44 Years	1867	16.2%	29.7% (27.8-31.7)
45-64 Years	4660	40.3%	35.6% (33.9-37.4)
65+ Years	4150	35.9%	17.8% (16.8-19.2)
<i>Sex</i>			
Male	3431	29.7%	35.9% (33.7-38.2)
Female	8130	70.3%	64.1% (61.8-66.3)
<i>Education</i>			
Less than high school	1263	10.9%	12.2% (10.9-13.7)
High school or GED	2566	22.2%	23.1% (21.6-24.7)
Some college or associate degree	3531	30.5%	30.1% (28.3-32)
Bachelor's degree or higher	4201	36.3%	34.5% (32.7-36.4)
<i>Race/Ethnicity</i>			
NH White	7253	62.7%	50.4% (48.5-52.4)
Hispanic	2108	18.2%	26.2% (24.4-28)
NH African American/ Black	813	7%	8.8% (7.8-9.9)
Other	1387	12%	14.7% (13.1-16.4)
<i>Self-reported overall health</i>			
Excellent	912	7.9%	9.4% (8.3-10.6)
Very good	2701	23.4%	26.6% (25-28.3)
Good	3616	31.3%	30.5% (28.6-32.4)
Fair	2769	24%	22.6% (21.2-24)
Poor	1563	13.5%	11% (9.7-12.3)
<i>BMI categories</i>			
Underweight (0-18.49)	200	1.7%	1.6% (1.2-2.1)
Normal (18.5-24.99)	3354	29%	30.1% (28.4-31.7)
Overweight (25.0-29.99)	3617	31.3%	31.3% (29.3-33.2)
Obese (30.0+)	4390	38%	37.1% (35.3-38.9)
<i>Current smoking status</i>			
Non-Smoker	9984	86.4%	85.3% (83.8-86.7)
Smoker	1577	13.6%	14.7% (13.3-16.2)
<i>Fast food consumption (per week)</i>			
0 times	5164	44.7%	35.5% (33.6-37.5)
1 -2 times	4488	38.8%	41% (38.7-43.3)
3 times or more times	1909	16.5%	23.51% (21.4-25.7)

BMI: body mass index (kg/m²)

Unadjusted model

Table 2 presents the unadjusted OR fast food consumption and the odds for an ER visit for asthma. In the unadjusted model, adults with asthma that reported consuming fast food 3 or more times per week had higher odds of an ER visit due to asthma exacerbation (OR = 1.64 CI: 1.13-2.40, $p = 0.01$).

Adjusted model for confounders

After adjusting the model for sex, race, self-reported overall health, BMI, and current smoking status the odds remained statistically significant (OR_{adj} = 1.53, CI: 1.03-2.26, $p = 0.03$).

Additionally, in our adjusted model, sex also demonstrated statistical significance. Females had higher odds of an ER visit due to asthma compared to males (OR_{adj} = 1.53, CI: 1.09-2.16, $p = 0.02$). Race also demonstrated statistically significant results, Hispanic respondents had higher odds of an ER visit due to asthma compared to NH Whites (OR_{adj} = 1.85, CI: 1.35-2.53, $p = <0.01$). NH African American/ Black respondents had higher odds of an ER visit due to asthma compared to NH Whites (OR_{adj} = 3.47, CI: 2.41-5.01, $p = <0.01$). Self-reported overall health is another variable that reported statistically significant results. Participants with the self-reported overall health of fair had higher odds of an ER visit due to asthma compared to participants with a good self-reported overall health (OR_{adj} = 2.08, CI: 1.34-3.23, $p = <0.01$). Also, respondents that reported their health as poor had higher odds of an ER visit due to asthma compared to respondents that reported their health as good (OR_{adj} = 3.33, CI: 2.05-5.43, $p = <0.001$).

Table 2. Association between fast food consumption and an emergency room visit due to asthma among adults with asthma in California.

	Model 1			Model 2		
	Unadjusted Model			Adjusted Model		
	OR	<i>p</i>	(95% CI)	OR _{adj}	<i>p</i>	(95% CI)
<i>Fast food consumption (per week)</i>						
0 times	1.00			1.00		
1 - 2 times	1.05	0.77	(0.76-1.44)	1.04	0.83	(0.73-1.45)
3 times or more times	1.64	0.01**	(1.13-2.40)	1.53	0.03**	(1.03-2.26)
<i>Sex</i>						
Male				1.00		
Female				1.53	0.02**	(1.09-2.16)
<i>Race/Ethnicity</i>						
NH White				1.00		
Hispanic				1.85	0.00***	(1.35-2.53)
NH African American/ Black				3.47	0.00***	(2.41-5.01)
Other				1.04	0.86	(0.65-1.67)
<i>Self-reported overall health</i>						
Good				1.00		
Excellent				0.83	0.62	(0.39-1.75)
Very good				0.65	0.17	(0.35-1.20)
Fair				2.08	0.00***	(1.34-3.23)
Poor				3.33	0.00***	(2.05-5.43)
<i>BMI categories</i>						
Normal (18.5-24.99)				1.00		
Underweight (0-18.49)				1.00	1.00	(0.17-5.74)
Overweight (25.0-29.99)				1.00	1.00	(0.67-1.49)
Obese (30.0+)				1.082	0.70	(0.72-1.62)
<i>Current smoking status</i>						
Non-Smoker				1.00		
Smoker				0.991	0.96	(0.66-1.48)
<i>Constant</i>	0.10	0.00***	(0.08-0.13)	0.04	0.00***	(0.02-0.07)
N	11561			11561		

*** $p < .01$, ** $p < .05$

OR: odds ratio, OR_{adj}: adjusted odds ratio

BMI: body mass index (kg/m²)

Model 1 logistic regression model between fast food intake and asthma an emergency room visit due to asthma. **Model 2** adjusted model for sex, race/ethnicity, self-reported overall health, BMI, and current smoking status.

Discussion

This study expands on the literature examining asthma outcomes and fast food consumption. In our study, we examined the association between fast food consumption and ER visits for asthma among 11,561 adults with asthma in California. This association was observed even after controlling for several health-related factors. We observed a positive association between fast food consumption and asthma-related ER visits, consistent with the hypothesis that fast food may exacerbate systemic and airway inflammation. The results of this study indicate that fast food consumption may be a modifiable risk factor for the prevention of ER visits related to asthma.

Our findings are consistent with previous studies. For example, an international study conducted by Ellwood et al. (2013) found that the consumption of fast food ≥ 3 times per week resulted in an increased risk of severe asthma in adolescents and children.³⁰ Importantly, in our study, this association was also observed in the adult population. Based on the work from Ellwood et al. (2013) the present study, the association between increased fast food consumption and the aggravation of asthma or related symptoms has now been observed in children, adolescents, and adults.³⁰ It should be noted that although a review found no association between the consumption of Western dietary patterns and asthma,³¹ the results from our study provide additional empirical evidence that increased fast food consumption, which is common in many Western diets, can result in increased odds of asthma-related ER visits.

Moreover, based on our findings and previous studies, limiting fast food consumption among people with asthma may provide benefits for the management of asthma.^{24,25} For example, increasing fruit and vegetable consumption demonstrates a protective effect for individuals with a compromised respiratory system.^{12,32-38} This outcome may be due to the increased intake of antioxidants, which have numerous benefits for individuals with asthma,^{33-35,38,39} in contrast to a high-fat diet, which may result in airway inflammation and hinder the health of individuals with asthma.⁴⁰⁻⁴² Additionally the Mediterranean diet, which has been shown to be useful for asthma management⁴³ demonstrates the importance of diet in respiratory health. The Mediterranean diet is rich in plant foods, olive oil, moderate intake of fish, seafood, and dairy products and a low consumption of red meat and a moderate intake of alcohol.⁴⁴ Therefore, individuals with asthma should aim to follow a nutritious diet such as the Mediterranean diet to benefit their respiratory system.

Furthermore, previous studies have analyzed and established the relationship between asthma and obesity; such that obesity is a risk factor for asthma.⁴⁵⁻⁴⁷ However, in our study, we have controlled for obesity and the association between fast food consumption and the aggravation of asthma persisted. Thus, individuals should decrease their fast food intake regardless of their BMI category. Based on our findings, decreasing fast food intake may decrease visits to the ER for asthma among adults with asthma in California.

Several studies have reported sex difference as a predictor of asthma and asthma symptoms.⁴⁸⁻⁵⁰ For example, the prevalence of asthma is higher among females compared with males. Plausible explanations for this difference have been linked to increased genetic susceptibility to asthma⁵¹, bronchial hyper-responsiveness⁴⁸, and hormonal differences⁴⁹. Our study also found an association between fast food intake and ER visits by sex. Females had higher odds of ER visits for asthma compared to males. The mechanism behind the way fast food affects women differently than men is unknown. Based on our findings, women may be at greater risk of worsening of asthma when there is increased fast food consumption. Further research should aim to investigate the mechanism behind the sex-difference in fast food consumption and asthma.

The consumption of sugary drinks was not assessed in this study; however, sugary drink consumption is often associated with fast food consumption.⁵² Increased consumption of sugary drinks has been associated with the worsening of asthma symptoms.⁵³ This may be due to the low nutritional value of sugary drinks and their association with metabolic disease, potentially resulting in airway inflammation in the same way as fast food consumption, which in general is associated with poorer respiratory health for individuals with asthma. Future research should investigate the association between sugary drink intake, fast food consumption, and asthma.

Strengths and limitations

A strength of this study is the large sample size and the quality of information from the CHIS database that collected over multiple years. Research examining diet and asthma is very limited, particularly in the adult population.

Limitations of the study include the potential for recall bias when respondents answer questions during the CHIS survey. Participants may not accurately remember the number of times they ate fast food in the past week, potentially biasing our results. Additionally, participants did not report the serving size of their fast food meal/s, therefore we are unable to assess the serving size that affects individuals with asthma the most. Lastly, the consumption of sugary drinks is typically a component of fast food consumption which may independently contribute to the worsening of asthma via airway inflammation. Future studies should investigate whether sugary drink consumption is a confounder in the association between fast food consumption and the worsening of asthma.

Conclusion

We observed that the consumption of fast food ≥ 3 times per week is associated with increased odds of ER visits related to asthma among adults with asthma in California. Our findings suggest that consuming fast food worsens asthma outcomes which may result in an increased number of ER visits compared to people with asthma who eat fast food less than 3 times a week. Health education efforts should encourage healthy and nutritious eating habits for individuals who suffer from asthma. Future studies are needed

to increase understanding on the association between fast food consumption, asthma and the benefits of interventions to improve diet. However, existing data strongly suggests that individuals with asthma would benefit from removing fast food from their diet and increasing their fruit and vegetable intake.

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Appendix A

Table A.1 Chi-square test results for each variable and in the analysis and the outcome variable, emergency room visit for asthma, in our study.

Emergency room visit for asthma	Pearson Chi ²	<i>p</i>
Age	19.53	0.00***
Sex	15.00	0.00***
Education	134.05	0.00***
Race	161.19	0.00***
Overall health	455.37	0.00***
BMI	47.77	0.00***
Current smoking status	26.90	0.00***
Fast food consumption	13.83	0.00***

*** $p < .01$

BMI: body mass index (kg/m²)

Appendix B

Table B.1 Cramér's V test results. Correlation analysis of the variables selected in our analysis (California Health Interview Survey, 2011- 2016).

	Emergency room visit for asthma	Age	Sex	Education	Race	Overall health	BMI	Current smoking status
Age	0.0411	1.00						
Sex	0.0360	0.0734	1.00					
Education	0.1077	0.1001	0.0464	1.00				
Race	0.1181	0.1351	0.0445	0.1824	1.00			
Overall health	0.1985	0.0936	0.0481	0.1978	0.0881	1.00		
BMI	0.0643	0.0889	0.0982	0.0951	0.0913	0.1472	1.00	
Current smoking status	0.0482	0.1429	-0.0132	0.1837	0.0813	0.1528	0.0618	1.00
Fast food consumption	0.0349	0.1591	0.0959	0.0712	0.0969	0.0642	0.1075	0.0643

BMI: body mass index (kg/m^2)

Correlation between 0 to 1, 1 being perfect association. All variables in our study demonstrated a relatively low association.