Original Article

Biological and environmental risk factors of children exposed or not to environmental tobacco pollution

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ABSTRACT

We aimed to investigate the biological and environmental risk facotrs of children exposed or not to environmental tobacco pollution (ETP). A cross-sectional study with 670 children of both sexes, aged between eight and 12 years, from schools located in Anápolis (GO). We used an adapted questionnaire directed to parents/guardians. The parents of children of the non-exposed to ETP group (NETP) were more educated. The group of children exposed to ETP (EETP) had a higher history of respiratory disease. The EETP resides with a smoker, commonly fathers, who smoke up to 20 cigarretes a day. The EETP lived in houses with fewer windows, less air circulation and more registries of mold. The EETP presents more respiratory diseases and unfavourable socioeconomic conditions. Therefore, there is a need for more care for the exposure and the environment where they live. Health professionals and educators should promote protection, education and stimulate the abandonment of parent smoking.

Descriptors: Tobacco Smoke Pollution; Child Development; Cross-Sectional Studies.

INTRODUCTION

The environmental tobacco pollution (ETP) can predispose or aggravate the development of diseases in active smokers, as well as, people exposed to it, as it contains three times more nicotine, carbon monoxide, and up to 50 times more carcinogenic substances in relation to the smoke inhaled by the smoker[(1)].

Children exposed to ETP present few symtoms as ocular and nasal irritation, headache, sorethroat, and cough. Therefore, in the long term, it can present: reducation of pulmonary growth and function, increase of cough frequency, increase in occurence of respiratory diseases, worsening of asthma, and sleep

disorders[2].

Factors should be taken into consideration, as the presence of mold, dust, animal hair and dry weather can reflect in the health of those involved. Meanwhile, there are no national and international studies documenting the existing relationship between the ones exposed to tobacco and their living conditions[3].

Some aspects can be related to higher predisposition to ETP, as low socioeconomic level, low income and parent's education level[4], therefore, more likely to be exposed to ETP [5].

There are few studies investigating the ETP effects in children aged eight to 12 years, as well as, the possible associations of passive smoking with parent's education, the hystory of symptoms and the most frequent respiratory diseases and, living conditions.

Considering passive smoking as a public health issue because of its consequences, it is necessary to investigate the effects of cigarette smoke in children exposed to TEP; and the objective of our study was to verify the biological and environmental risk factos of children exposed or not to ETP.

METHODS

A cross-sectional analytical study conducted between April and June of 2011 with children aged eight to 12 years (according to the Federal Law nº 8.069/90, 2nd article that considers a child to be a person up to 12 incomplete years of age), of municipal middle schools in Anápolis, Goiás. We identified 11 schools through the Municipal Education Secretary. However, eight schools agreed to participate in the study.

To define the study participants, we selected 670 voluntary children, of both sexes, between eight and 12 incomplete years and their respective parents/legal guardians, who participated in the study after signing the Free and Informed Consent Term (FICT). They fully answered the adapted epidemiological questionnaire[6]. The choice for this age group was justified by the fact that children older than six years, normally have a better comprehension ability needed to conduct the proposed assessment, when stimulated and guided by the examinator[7].

We excluded the children who did not complete the adpted epidemiological questionnaire, who missed class on the day when the study was explained and when the FICT was given to them, as well as, those who were absent in the physical exam day. We considered as variable exposition to ETP, those children who lived with smokers for at least six months. To characterize the study, we considered the history of respiratory diseases with reports of medical attention and diagnosis for asthma, bronchitis, pneumonia, and rhinitis[6].

The volunteers were classified into two groups: students exposed to environmental tobacco pollution (EETP) and students non-exposed to environmental tobacco pollution (NEETP).

We defined the sample size using a significance level of 0.5% and power of 80%, with an error margin of 4.6%. Therefore the minimum estimate for the sample size was 454 participants. We excluded 215 (32%) participants due to incomplete filling of the questionnaire (Figure 1).

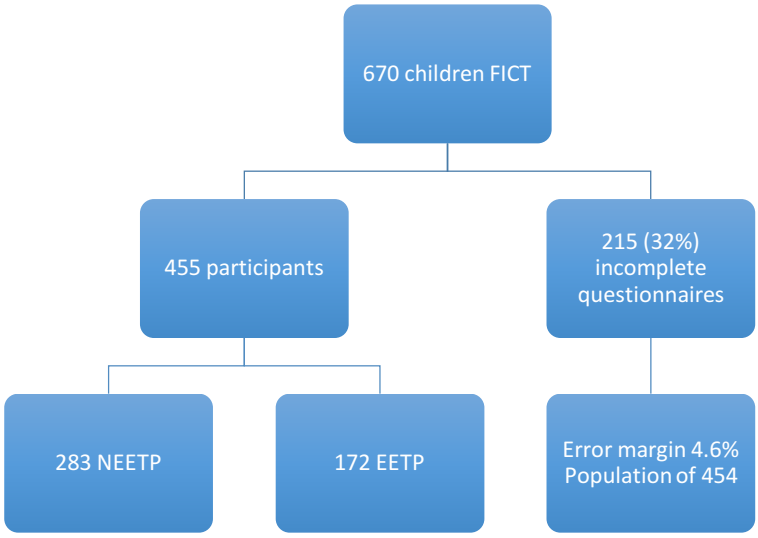

Figure 1: Flow-chart of the number of participants non-exposed to environmental tobacco pollution (NEETP), children exposed to ETP (EETP), excluded individuals and, an error margin of the study population. Anápolis, GO, Brazil, 2011.

To conduct the study, we requested authorization from the Municipal Education Secretary of Anápolis, to develop the study in the schools, as well as, also to request the authorization of all schools. In the schools, we contacted the legal person in charge representing the institution, as well as, parents or legal guardians, sending a note in the student's school agenda, where the Free and Informed Consent Term (FICT) and the adapted epidemiological questionnaire was presented[6].

The self-reported questionnaire for the parents/guardian contained the following data: indentification information; previous family history of respiratory diseases; maternal smoking during pregnancy; presence of mold in the house, number of people living and number of rooms in the house; parents' education; presence of respiratory disease or other symptoms;presence of smokers in the house; number of smokers; the conviviality time that the child had with smokers; for how long the person has a smoking habit; identidication of who are the smokers and the type of smoking used by smokers in the house[6].

We assessed the children at the school, an adequate place for researchers regarding the weighting with a digital scale (brand: Geratherm), where the child should be wearing light clothing (shorts and t-shirt) and barefoot.

We used a stadiometer fixed to the wall, in a place with a flad ground. The child must be barefooted and with the least possible amount of clothing so it would be possible to see the body position. We positioned the child standing erect, with the upper limbs hanging beside the body, the ankles united and the tips of the feet with a distance of approximately 60^{o} in between (the feet adjustment depends on the knees being in contact or not with each other), the body weight should be distributed equally on both feet and the head oriented in parallel with the groud.

After we calculated the body mass index (BMI) using the formula BMI = weight/height^2, and we verified the percentile value on the website: http://www.telessaudebrasil.org.br/apps/calculadoras/?page=7.

At the end of the study, the researchers gave lectures to students and their parents about smoking and its harms.

We organized all collected data in the assessments in an Excel® electronic spreadsheet. After preparing the whole data spreadsheet, we transfered the data to a spreadsheet in the Statistical Package for the Social Sciences (SPSS) version 15.0, and we processed the analyses.

Initially, we tested the normality of variables using the Kolmogorov-Smirnov test, to verify the use of parametric or non-parametric statistics. For the descriptive analysis, we calculated the mean, median, standard deviation (SD), minimum and maximum values for continuous variables and the absolute and relative frequencies for discrete variables.

We used logistic regression method to evaluate the data, and we obtained the odds ratio (OR) and confidence intervals (CI) of all variables for all analyzes, using a significance level of 0.05.

Our study was approved by the Ethics and Reseach Committee from the Centro Universitário de Anápolis, Goiás, internal protocol number from CONEP/SISNEP CAAE: 0153/2009, Approval Document 051/2010.

RESULTS

According to the obtained results, there were no statistical differences between the group NETEP when compared to the EETP group in relation to sex, age, weight, height and BMI (Table 1).

Table 1: Anthropometric characteristics of children non-exposed to environmental tobacco pollution (NEETP=283) and exposed to environmental tobacco pollution (EETP=172) from public schools in Anápolis, GO, Brazil, 2011.

Students	n	M	SD	MCI 95%		p*	OR (CI 95%)	p**
				Min	Max			
Age								
NEETP	283	9.83	1.22	9.69	9.98			
EETP	172	9.95	1.31	9.76	10.15	0.323	1.08 (0.93-1.26)	
Weight								
NEETP	283	37.48	10.33	36.28	38.69			
EETP	172	36.40	9.00	35.05	37.76	0.256	0.99 (0.97-1.01)	0.597
Height								
NEETP	283	141.76	9.16	140.69	142.84			
EETP	172	142.06	9.38	140.65	143.47	0.741	1.00 (0.98-1.02)	0.759
BMI								
NEETP	283	58.71	30.80	55.11	62.32			
EETP	172	53.12	31.13	48.43	57.80	0.062	0.99 (0.99-1.00)	0.084

Footnotes: n: total number; M: mean; SD: standard deviation; MCI: mean confidence interval; p*: Logistic Regression Analysis test; OR: odds ratio; CI: confidence interval; p** Kolmogorov-Smirnov.

The parents of the NEETP group had higher education levels (p=0.005) than the EETP. The maternal smoking during pregnancy (p<0.001) was higher among EETP when compared to NEETP (Table 2).

Table 2: Family history of children non-exposed (NEETP=283) and from the exposed to environmental tobacco pollution (EETP=172) from public schools in Anápolis, GO, Brazil, 2011.

Variables	NEETP (N=283)	EETP (N=172)	OR (CI95%)	p*
	n (%)	n (%)		
Parental Education				
Incomplete middle school	77 (27.2)	70 (40.7)		
Complete middle school	152 (53.7)	78 (45.3)		
Incomplete high school	54 (19.1)	24 (14.0)	0.67 (0.50-0.89)	0.005
Maternal smoking during pregnancy				
Yes	13 (4.6)	36 (20.9)		
No	270 (95.4)	136 (79.1)	5.50 (2.82-10.71)	< 0.001
Family history of respiratory disease				
Yes	84 (29.7)	72 (41.9)		
No	199 (70.3)	100 (58.1)	1.71 (1.15-2.53)	0.008
Child history of respiratory disease				
Yes	56 (19.8)	106 (61.6)	6.51 (4.26-9.95)	< 0.001
No	227 (80.2)	66 (38.4)		
Hospitalization				
Yes	5 (1.8)	12 (7.0)		
No	278 (98.2)	160 (93.0)	4.17 (1.44-12.05)	0.008
Child history of respiratory disease with need of medical attention				
No	227 (80.2)	66 (38.4)		
Rhinitis	17 (6.0)	26 (15.1)	5.26 (2.69-10.28)	< 0.001
Asthma	1 (0.4)	14 (8.1)	48.15 (6.22-372.99)	< 0.001
Bronchitis	20 (7.1)	38 (22.1)	6.53 (3.56-11.99)	< 0.001
Pneumonia	4 (1.4)	9 (5.2)	7.74 (2.31-25.93)	0.001
Others	5 (1.8)	3 (1.7)	2.06 (0.48-8.86)	0.330
Total	**56 (19.8)**	**106 (61.6)**	**6.51 (4.26-9.95)**	**< 0,001**

Footnotes: p*: Binary Logistic Regression Test; OR: odds ratio; CI: confidence interval.

The group EETP had more family history of respiratory disease (p=0.008) in comparison to NEETP, as well as, children from EETP had more history of respiratory disease (p<0.001) in comparison to the NEETP group. Additionally, we found that the EETP group had more hospitalizations (p=0.008) when compared to NEETP (Table 2).

Regarding the smoking habits of family members of the EETP group, we verified that most people lived with only one smoker (77.3%), normally the father (53.4%), who smoked up to 20 conventional cigarretes per day (83.6%) and exposed the kids up to six hours a day (50.6%). Also, a minority smoked when they took the children to school (13.5%).

Regarding living conditions, EETP children lived in houses with fewer windows (p=0.007) when compared to NEETP group. The presence of mold was higher (p=0.002) in houses of EETP children than NEETP group. And the EETP group presented fewer reports of good air circulation (p=0.042) when compared to NEETP group (Table 3).

Table 3: Distribution of living conditions of children non-exposed (NEETP=283) and exposed to environmental tobacco pollution (EETP=172) of public schools in Anápolis, GO, Brazil, 2011.

Variables	NEETP(N=283)	EETP (N=172)	OR (CI95%)	p*
	n (%)	n (%)		
Rooms in the house				
Up to 3	10 (3.5)	13 (7.6)		
> 3	273 (96.5)	159 (92.4)	0.44 (0.19-1.04)	0.063
Windows in the house				
Up to 3	30 (10.6)	34 (19.8)		
> 3	253 (89.4)	138 (80.2)	0.48 (0.28-0.82)	0.007
Good air circulation				
Yes	250 (88.3)	140 (81.4)		
No	33 (11.7)	32 (18.6)	1.73 (1.02-2.93)	0.042
Mold in the house				
Yes	72 (25.4)	68 (39.5)		
No	211 (74.6)	104 (60.5)	0.52 (0.34-0.78)	0.002
People in the house				
Up to 2	176 (62.2)	95 (55.2)		
> 2	107 (37.8)	77 (44.8)	1.33 (0.90-1.95)	0.143
Possess animal				
Yes	114 (40.3)	62 (36.0)	0.83 (0.56-1.23)	0.369
No	169 (59.7)	110 (4.0)		

Footnote: p*: Logistic Regression Test; OR: odds ratio; CI: confidence interval.

DISCUSSION

The exposure to environmental tobacco pollution is a public health problem, and it has been associated with cultural and socioeconomic factors, as well as, behaviors risky to health[8]. In our study, the parents of children of the NEETP group had higher levels of education than the EETP (OR=0.67; CI95%= 0.50-0.89), which is a similar data than what was found in another study[9], where researchers found a higher likelihood for tobacco habits among family menbers of children with fewer education levels when compared to non-smokers.

On the other hand, there is a great socioeconomic variance between smokers in the world[4]. The highest smoking prevalance in individuals less educated is possible due to less access to information about the harms of tobacco use. During decades in Brazil, advertisements stimulated tobacoo consumption, imposing an image that those who smoked were more virile, stronger, more powerful, independent, free and self-affirmed[10].

In addition, we found that most mothers who smoked during their pregnancies had five times more chance to keep the tobacco habit (OR=5.50; CI95%=2.82-10.71), as it is already known in the literature[11]. Smoking is one of the hardest habits to give up, as the higher the nicotine dependence level, the higher is the difficulty to abandon cigarretes.

On the other hand, few investigators attribute the continuity of gestational smoking habit due to the stimulus of a companion to keep this habit[11]. The gestational smoking habit is directly related to newborn low-weight and overweight/obesity during infancy[12]. The continuity of this habit while breastfeeding and in the first years of life can result in the development of many diseases, like asthma, bronchitis, pneumonia, rhinitis, sleep disorders and, behavioral problems[2].

It is proven that smoking habit during pregnancy is harmful to the health of neonates. Therefore, more

concrete actions are needed during the prenatal phase, aimed to fight maternal smoking[13].

In our study, smokers' family members presented almost two times more chance to have a history of respiratory diseases (OR=1.71;CI95%=1.15-2.53) when compared to those not exposed to ETP.

It is indisputable that the exposition to cigarrete smoke cause diseases, but its mechanism still is unknown[2]. As well as the smoker, the passive smoker is also exposed to many tobacco-related diseases, and the main ones are the non-communicable chronic diseases (NCCD), like cancers, cardiovascular diseases, diabetes, chronic obstructive respiratory diseases (CORD) within others[14].

A study conducted in Spain[15] also observed that children exposed to ETP had six times more chance to have a history of respiratory diseases when compared to the non-exposed (OR=6.51;CI95%=4.26-9.95).

Children are more vulnerable to ETP exposition, as they more frequently subject to it in the domestic environment, at schools, in public places and in transportation vehicles[5]. It is evident that exposed children present a depressed immunologic system, and they are more likely to develop a series of diseases as colds, middle ear infections, respiratory diseases as pneumonia, bronchitis and worsening of asthma[16]. A recent study[17] found that children with respiratory diseases constitute a high risk group to develop low acute respiratory diseases and, this risk tends to increase with the continuous exposition to ETP.

In the present study, we verified that children exposed to ETP had a higher predisposition to develop respiratory diseases, having five times more chance to have rhinitis (OR=5.26;CI95%=2.69-10.28), 48 more chances to develop asthma (OR=48,15;CI95%=6.22-372.99), six times more chance to have bronchitis (OR=6.53;CI95%3.56-11.99) and, seven times more chance to have pneumonia (OR=7.74;CI95%=2.31-25.93).

Active and passive smokers have a 20 to 30 times higher risk to acquire the diseases mentioned above[9]. The active smoker consumes the smaller portion of the tobacco smoke, while the passive smoker consumes around 85% of the smoke released by the cigarrette and still, the smoke that comes out of the smoker's mouth[18].

The National Cancer Institute (INCA) refers that the environmental tobacco pollution has about 4,700 toxic substances to the body, as the carbon monoxide, ammonia, ketones, formaldehyde and, other 43 carcinogens such as arsenic, nickel, benzopyrene, cadmium, lead, residues of pesticides and radioactive substances[1].

In accordance with the results found by other authors in the literature[2,15-16] , passive smokers have four times more chance to be hospitalized due to respiratory diseases when compared to non-passive smokers (OR=4.1;CI95%=1.44-12.05). The cost of hospitalizations due to tobacco-related diseases comes up to 1.5 billion reals, being 11% of the documented registries[19]. Thus, it is indispensible that anti-tobacco campaigns promoted by the Health Ministry through the INCA in states, which articulated actions compose the National Program of Tobacco Control (PNCT), to take effective and concrete actions to control active smoking and to protect the exposed ones, especially in their homes.

The current anti-smoking laws in Brazil have been reaching sucess in changing social habits, in the reduction of the profits of the tobacco industry and, in the reduction of cigarette consumption, however, it

still does not effectively protect the ones exposed to environmental cigarette smoke.

In the present study, we found results similar to the literature[20-21] where the child exposed to ETP lives with a smoker, commonly the father, who consumes up to 20 conventional cigarretes per day[10-15]. According to the World Health Organiztion (WHO), this can be partialy explained, due to the higher prevalence of smoking habit among men[1].

A study conducted in Portugal[21] also reported a high number of cigarretes smoked per day. Despite the high number of consumed cigarretes, this percentage has been decreasing[10,15] when compared to other countries. This reduction can be explained due to anti-smoking campaign, the laws forbidding smoking in closed environments as the Law nº 5.658 of January 2nd of 2008 that promulgates the Framework Convention on Tobacco Control, the decrease of advertisement and effective inspection[9].

Regarding the time of exposure to ETP, it was high, about six hours daily. Similar data were found in another Portuguese study[20], therefore, demonstrating that passive smoking is very common in our society, consequently, a public health issue due to the consequences of exposure to ETP.

Regarding the living conditions, the findings in our study are similar to another study[7], that verified that children non-exposed to ETP have more chances to live in houses with more windows (OR=0.48; CI95%=0.28-0.82), consequently, less chance for houses to have mold (OR=0.52,CI95%=0.34-0.78). Contrary, children exposed to ETP have almost two times more chance do live in houses with less air circulation (OR=1.73;CI95%=1.02-2.94).

Studies investigating the living conditions of clhidren exposed to ETP are scarce. However, an Australian study[22] identified not only the ETP as the main cause of respiratory diseases. Other environmental factors were identified in a Brazilian study[3], as the presence of dust, animal hair, mite, apparent mold in the walls, drought, smoking from cane sugar burning and environmental pollutants, once they negatively alter the air quality and they favor the development of respiratory diseases. Possibly, this fact is related to low family income, which makes difficult to build aired houses, therefore impeding the air circulation and increasing the ETP.

Health professionals should receive specific training to know how to deal with this public, with the intention to stimulate cessation of maternal smoking during pregnancy and also smoking cessation to other family members[2], considering that one person's habit can influence others. A possible strategy would be the conduction of campaigns and the individualized accompaniment of those involved[23] by the Family Health Strategy (*Estratégia Saúde da Família)* – ESF. The ESF within the Primary Health Atttention is the entrance door to moviments, individual and collective actions englobing health promotion until rehabilitation.

Within this context, the National Program of Smoking Control offers support and treatment for smoking cessation with educational actions and the individual and collective accompaniment in Centers of Family Health Support (NASF), however, the reality is complex, therefore requiring teams to work with empathy with the smoker's population, aiming to treatment adherence and to offer guidance.

CONCLUSION

There are many studies about the ETP effects in children with diseases in the respiratory tract, but there are few targeting the living conditions of children exposed to ETP. In the present study, the children exposed to ETP presented more chronic respiratory diseases, the father was the main smoker to expose the child to ETP and, they lived in environments with little air circulation.

Therefore, the passive smoking is a public health problem with a particular impact on children's health. Not only the exposition should be taken into consideration, but the environment where they live needs more attention and care by the parents/guardians. The health professionals, with educators, should propitiate more information to parents about the harms of exposure to ETP by children, to instigate the adherence of programs for parents to abandon smoking and to promote health promotion and protection to all involved.

The results of our study contributed to comprehend better the context where children exposed to ETP live and, the associated diseases. But we found limitations conditioned to the questionnaire that did not evaluate the family income and data provided by parents/guardians subjects to memory bias and interpretation issues.

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