

ORIGINAL ARTICLE

The effect of cigarette smoking on allergic conditions in Maltese children (ISAAC)

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Abstract

Maltese children are frequently exposed to tobacco smoke through passive and personal smoking. In the Phase 3 ISAAC study questionnaire, we enquired about passive smoking to the parents of 3816 (80% response rate) 5- to 8-yr-old children and about passive and personal smoking to 4139 (90% response rate) 13- to 15-yr-old participating children. Thirty-one percent of 5- to 8-yr olds were passive smokers with their father more likely to be the smoker ($p < 0.0001$). Maternal smoking in the first year of the child's life resulted in the children having an increased chance of wheezing 'ever' ($p < 0.001$), exercise-induced wheezing ($p < 0.05$) and being diagnosed with asthma ($p < 0.0001$). Current smoking by the mother also led to the child having current rhinitis ($p < 0.001$). Fifty-one percent of 13- to 15-yr olds were passive smokers again with the father more likely to be the smoker ($p < 0.0001$). Maternal ($p < 0.0001$) and paternal smoking ($p < 0.05$) resulted in the children having an increased chance of wheezing sometime in their life, exercise-induced wheezing, nocturnal cough, and being diagnosed with asthma. Current smoking by the mother was more common in children having current rhinitis ($p < 0.05$), while current smoking by both mother and/or father led to itchy/watery eyes accompanying rhinitis ($p < 0.05$). Recurrent itchy rashes were also more likely in passive smokers ($p < 0.001$). Personal smoking by the 13- to 15-yr olds (8.15% boys vs. 8.8% girls ns) resulted in a higher cumulative prevalence of wheezing ($p < 0.0001$), rhinitis ($p < 0.05$), and recurrent itchy rash ($p < 0.001$) but only affected current prevalence of wheezing ($p < 0.0001$). These smokers were more likely to experience exercise-induced wheezing ($p < 0.0001$), nocturnal cough ($p < 0.0001$), and being diagnosed with asthma ($p < 0.05$) and eczema ($p < 0.001$). Children smoking more than 10 cigarettes/day persisted with wheezing ($p = 0.04$) had more frequent episodes of exercise-induced wheeze ($p = 0.04$), nocturnal cough ($p < 0.0001$), and rhinoconjunctivitis ($p = 0.02$) than milder smokers. Smoking seems to be affecting childhood allergies in Maltese children quite significantly.

Our past studies on the prevalence and severity of childhood allergies in the Maltese Islands based on the ISAAC studies have already shown that our children have among the highest prevalences of allergic conditions in Europe and in the case of rhinitis, in the world (1–7). However, we have also shown that over 7 yrs between 1994/1995 and 2001/2002, the two age-groups studied differed in the trends of prevalence change across these time periods. Whereas in the 5- to 8-yr

olds we demonstrated a significant increase in the prevalence of wheezing and rhinitis but not eczema (3), the older age-group showed a plateau in the prevalence of wheezing and an actual decrease in the prevalence of rhinitis and eczema (4). A common factor across the two age-groups was an improvement in the control of symptomatology of the allergic conditions studied, a decrease in potentially life-threatening asthmatic episodes, and a significant increase in specific

diagnosis of asthma, rhinitis, and eczema in children with suggestive symptoms (3, 4). Various factors might explain all these changes across time, but the one that seemed to be very promising was the effect of passive and personal smoking as seen from the results in our studies associated with ISAAC phase 1 (1, 2). Various meta-analyses and studies have been carried out to try and study the effect of smoking on respiratory health (8–12) and these have been suggestive of a link between passive smoking and wheezing. On the other hand, there is a lack of information on the effect of environmental tobacco smoke on allergic rhinitis and eczema.

Thus, we opted to study more deeply the various aspects of the effects of cigarette smoking on childhood allergies in children in our island including maternal smoking in first year of life in the 5- to 8-yr olds and the effect of personal smoking on allergies in the teenage group. A comparison between the effects of maternal, paternal or of both parents smoking on the children's allergies was also investigated.

The Maltese Islands are an archipelago in the middle of the Mediterranean (14° east latitude and 35° north latitude) with two main populated islands – Malta and Gozo. Malta has an area of 246 square kilometers and a population of around 400,000, while Gozo is even smaller with an area of 67 square kilometers and a population of approximately 35,000. At the time of data collection, these densely populated islands were almost solely inhabited by Maltese people and thus there were no other ethnic groups of note. The Maltese population encompasses all socioeconomic strata, and all these were equally represented in the vast sampling methods used in our study and described below.

Methods

Questionnaire

The ISAAC standard questionnaire consisted of three main sections, each involving questions relating to the prevalence and severity of wheezing, rhinitis, and eczema, respectively. The questions on asthma concentrated mainly on past and current wheezing episodes, frequency of wheezing attacks, sleep disturbance, acute severe wheezing episodes, exercise-induced wheezing, nocturnal cough which was unrelated to infection, and finally a diagnosis of asthma. The core questionnaire for rhinitis and eczema followed a similar format. These questionnaires were validated in previous studies (13–15). In Phase 3 of the ISAAC study, a number of questions were added in an additional 'ecological' questionnaire (16) and the various participating centers were invited to choose questions, which would be of particular interest to their center. From our studies associated with Phase 1 of the study, we noted that smoking seemed to be a significant problem affecting Maltese schoolchildren suffering from allergic conditions (1, 2), so we opted to concentrate on this aspect of passive and personal smoking and their effect on childhood allergy. In the older age-group, we added a question regarding how many cigarettes personal smokers smoked per day, which was not included in the original ISAAC questionnaire. The questions we chose are listed in Appendix 1 and 2. As

the great majority of Maltese parents of the 5- to 8-yr olds and most of the 13- to 15-yr-old schoolchildren themselves speak English fluently, they were given a choice of answering either a Maltese or an English version of the questionnaire. The Maltese version had been back-translated and used in a small pilot study before the questionnaires were printed.

Sampling and data collection

All state primary schools in Malta and Gozo were randomly chosen. We opted to use the state schools as our sampling frame, as we were most interested in the local geographical representation of allergic conditions in Maltese and Gozitan children. In the Maltese education system in this age-group, these were the only schools in which children attending a specific primary school lived in the towns or villages close to it and thus they fitted our needs exactly. All secondary schools in Malta and Gozo were chosen to participate for the 13- to 15-yr olds part of the study as in this age-group, there was no geographical catchment area specific to the school as in the case of the younger age-group. The schools were then randomly chosen by lot till more than 4500 students were available for the participation so as to make sure that we would have more than the minimum 3000 required by ISAAC study for each participating center. We ended up sampling 44 schools in the younger age-group where 4761 students were asked to participate and 18 schools in the older age-group where 4594 children were selected to take part in the study. The schools were situated all over the two islands, and the total number of children within the two chosen school years in which the majority of pupils were within the required age-groups and who were given their parents' consent to participate were 3816 (80% response rate) 5- to 8-yr olds (51.6% boys) and 4139 (90% response rate) 13- to 15-yr olds (54.6% girls). The sampling frame from each school ranged from 24 to 450 in the younger age-group and from 85 to 595 in the teenagers.

The data for the 5- to 8-yr olds were collected between March and June 2001 when the questionnaires were distributed to the parents or guardians of the children, while the older students were given the questionnaires to answer themselves between October 2001 and June 2002.

Consent

Whereas no consent was required in the younger age-group as the parents were answering the questionnaire themselves, the parents of the teenage children were sent an information sheet about the study and were asked to sign a special section of this sheet if they refused to allow their children to participate, and return the sheet to the school headmaster. A contact telephone number was available to the parents to contact in case of any queries they might have about the study.

Ethical approval

The study was approved by the Ethics committee of the Malta Medical Council.

Statistical analysis

The data from the questionnaires were double-entered by data input clerks into Epi-Info (CDC, Atlanta, GA, USA and WHO, Geneva, Switzerland), a computer program for the capture and processing of epidemiological data. The datasets were then validated and consolidated by a single data manager. Results were analyzed and tested for statistical significance using the chi-squared test and the z-test for differences between two proportions as appropriate. The analysis was univariate, and the results were expressed as odds ratios with 95% confidence intervals.

Results

5- to 8-yr olds

31% of 5- to 8-yr-old participating children were passive smokers. This was a significant decrease from the 49.6% ($p < 0.00001$) passive smokers noted in a similar study in Phase 1 ISAAC in 1994 (1). The father was the smoker in the majority of cases (40% vs. 25.2% of mothers) ($p < 0.00001$), while both parents were smokers in the case

of 16.5% the children. 17.5% of mothers smoked in the first year of the child's life.

The effects of passive smoking by either the mother (currently and in the first year of the child's life), father (currently) or both on the allergic symptoms of wheezing, rhinitis, and eczema of 5- to 8-yr-old Maltese children can be seen in Table 1. Maternal current smoking increased the prevalence of current rhinitis, while paternal current smoking influenced exercise-induced wheezing. The latter was also increased in the presence of maternal smoking in the first year of the child's life as was cumulative prevalence of wheezing. These factors did not influence 'itchy rash' at all. However, when both parents were smokers, this affected the cumulative prevalence of wheeze, nocturnal cough, current, and cumulative prevalence of rhinitis and current prevalence of 'itchy rash' together with an increased likelihood of a diagnosis of eczema. These children were more likely to be diagnosed as asthmatic with all types of passive smoking analyzed.

13- to 15-yr olds

Of 51% of 13- to 15-yr-old participating children were passive smokers. This was a significant decrease from the 57.1%

Table 1 Effect of passive smoking on the allergic conditions of 5–8 yr olds

	Mother current smoker	Father current smoker	Maternal smoking first year of child's life	Both parents smoking
Responses for asthma				
Ever had whistling/wheezing of the chest at any time in the past?	ns	ns	1.38 (1.15–1.66)**	1.22 (1–1.49)*
Had whistling/wheezing of the chest in the past 12 months	ns	ns	ns	ns
In the past 12 months, how often has sleep been disturbed	ns	ns	ns	ns
In the past 12 months, has wheezing ever been severe enough to limit speech	ns	ns	ns	ns
In the past 12 months, has the chest sounded wheezy during/after exercise	ns	1.35 (1.02–1.80)*	1.42 (1.19–1.99)*	ns
In the past 12 months, had nocturnal cough not associated with URTI/LRTI	ns	ns	ns	1.27 (1.03–1.56)*
Ever had asthma	1.26 (1.03–1.55)**	1.31 (1.09–1.58)**	1.63 (1.3–2.05)***	1.42 (1.1–1.82)**
Responses for rhinitis				
Ever had a problem with sneezing/runny/ blocked nose not assd. cold/flu?	ns	ns	ns	0.82 (0.66–1)*
In the past 12 months, had problem with nose not associated with cold/flu	1.42 (1.12–1.79)**	ns	ns	0.66 (0.5–0.88)**
In the past 12 months, was this nose problem assd. with itchy/watery eyes	ns	ns	ns	ns
Ever had hayfever	ns	ns	ns	ns
Responses for eczema				
Ever had itchy, intermittent rash for at least 6 months	ns	ns	ns	ns
Ever had this rash in the past 12 months	ns	ns	ns	0.64 (0.4–1)*
Ever had eczema	ns	ns	ns	0.63 (0.45–0.87)*

* $p < 0.01$, ** $p < 0.001$, *** $p < 0.0001$.

($p < 0.00001$) passive smokers noted in a similar study in Phase 1 ISAAC in 1995 (2). The father was the smoker in the majority of cases (37% vs. 24.4% of mothers) ($p < 0.00001$), while both parents were smokers in the case of 14.9% of the children. 8.5% of the participating 13- to 15-yr olds were active smokers themselves with no differences between both genders 8.15% boys vs. 8.8% girls (ns). Again there was a significant decrease in personal smoking from 1995 (2), 12% vs. 8.15% boys ($p = 0.0004$); 14.7% vs. 8.8% girls ($p < 0.0001$), and when taken together, the difference was 13.4% vs. 8.5% ($p < 0.0001$). 36% ($p < 0.00001$) of these smokers had a mother who smoked, while 54% ($p < 0.00001$) had a father who was a smoker.

The effects of passive smoking by either the mother, father or both on the allergic symptoms of wheezing, rhinitis, and eczema of 13- to 15-yr-old Maltese children can be seen in Table 2. Paternal and to a greater extent maternal and both parents smoking increased the cumulative prevalence of wheezing, exercise-induced wheezing, nocturnal cough, and diagnosis of asthma significantly in this age-group. Current rhinoconjunctivitis was affected by passive smoking from the mother, father, or both parents as was the cumulative prevalence of an 'itchy rash'.

Table 3 shows the effect of personal smoking on the allergic symptoms of wheezing, rhinitis, and eczema of 13- to

15-yr-old Maltese children and also whether there was any difference if the teenager smoked more or < 10 cigarettes daily. Personal smokers were more likely to have wheezed and had rhinitis or an 'itchy rash' sometime in their life. They were also more likely to have current wheezing, exercise-induced asthma, and nocturnal cough than non-smokers. A diagnosis of asthma or eczema is also more common in these smokers. Smokers who smoke more than 10 cigarettes a day persist in wheezing, exercise-induced wheeze, and coughing at night and suffer from rhinoconjunctivitis more than smokers who smoke < 10 cigarettes per day.

Discussion

This study confirms that cigarette smoking seems to play a major role in the significant problem Maltese schoolchildren have with allergic conditions. This effect seems to be present both when the child is a passive smoker in both age-groups studied and when he/she is a personal smoker in the case of the older age-group.

In the younger age-group, one could see that the effect of passive smoking by either parent seems to be associated with allergic conditions in the bronchi and to a lesser extent in the nose but not the skin. This seems to be quite plausible seeing that environmental tobacco smoke is more likely to affect

Table 2 Effect of passive smoking on the allergic conditions of 13- to 15-yr olds

	Mother current smoker	Father current smoker	Both Parents smokers
Responses for asthma			
Ever had whistling/wheezing of the chest at any time in the past?	1.51 (1.29–1.76)***	1.24 (1.07–1.43)*	1.6 (1.31–1.94)***
Had whistling/wheezing of the chest in the past 12 months	ns	ns	ns
In the past 12 months, how often has sleep been disturbed	ns	ns	ns
In the past 12 months, has wheezing ever been severe enough to limit speech	ns	ns	ns
In the past 12 months, has the chest sounded wheezy during/after exercise	1.42 (1.19–1.70)***	1.18 (1.00–1.40)*	1.48 (1.18–1.86)**
In the past 12 months, had nocturnal cough not assd. URTI/LRTI	1.53 (1.32–1.79)***	1.28 (1.11–1.47)**	1.58 (1.3–1.92)***
Ever had asthma	1.48 (1.22–1.81)***	1.22 (1.01–1.47)*	1.53 (1.19–1.96)**
Responses for rhinitis			
Ever had a problem with sneezing/runny/ blocked nose not assd. cold/flu?	1.15 (1.00–1.34)*	ns	ns
In the past 12 months, had problem with nose not associated with cold/flu	ns	ns	ns
In the past 12 months, was this nose problem assd. with itchy/watery eyes	1.27 (1.03–1.56)*	1.20 (1.0–1.45)*	1.43 (1.1–1.87)*
Ever had hayfever	ns	ns	ns
Responses for eczema			
Ever had itchy, intermittent rash for at least 6 months	1.34 (1.08–1.64)**	1.28 (1.05–1.57)*	1.44 (1.09–1.8)*
Ever had this rash in the past 12 months	ns	1.53* (1.16–2.02)	1.45*(1–2.11)
Ever had eczema	ns	ns	ns

* $p < 0.01$, ** $p < 0.001$, *** $p < 0.0001$.

Table 3 Effect of personal smoking on the allergic conditions of 13- to 15-yr olds

	Personal smoking 13–15	Less vs. more 10 cig/dly n = 230 vs. 135
Responses for asthma		
Ever had whistling/wheezing of the chest at any time in the past?	1.95 (1.54–2.46)***	ns
Had whistling/wheezing of the chest in the past 12 months	1.85 (1.34–2.56)***	0.57 (0.3–1.07)*
In the past 12 months, how often has sleep been disturbed	ns	ns
In the past 12 months, has wheezing ever been severe enough to limit speech	ns	ns
In the past 12 months, has the chest sounded wheezy during/after exercise	2.09 (1.63–2.69)***	0.64 (0.39–1.04)*
In the past 12 months, had nocturnal cough not assd. URTI/LRTI	2.47 (1.97–3.11)***	0.41 (0.26–0.66)***
Ever had asthma	1.39 (1.03–1.86)*	ns
Responses for rhinitis		
Ever had a problem with sneezing/runny/ blocked nose not assd. cold/flu?	1.4 (1.11–1.76)*	ns
In the past 12 months, had problem with nose not associated with cold/flu	ns	ns
In the past 12 months, was this nose problem assd. with itchy/watery eyes	ns	0.59 (0.32–1.06)*
Ever had hayfever	ns	ns
Responses for eczema		
Ever had itchy, intermittent rash for at least 6 months	1.73 (1.27–2.35)**	ns
Ever had this rash in the past 12 months	ns	ns
Ever had eczema	1.63 (1.19–2.23)**	ns

*p < 0.01, **p < 0.001, ***p < 0.0001.

sites where it is inhaled rather than just external exposure, although smoking is thought to augment allergic reactions in any vulnerable site (17). This finding and the fact that in this younger age-group we had reported an increase in prevalence of wheezing and rhinitis but not eczema between 1994 and 2001 (3) seems to lead to the speculation that there might be a direct correlation between passive smoking and prevalence of upper and lower allergic respiratory conditions in young Maltese children. One must point out that in spite of this increase in airway allergies, which seems to be associated with environmental tobacco smoke, there was a also significant decrease in these 5- to 8-yr-old passive smokers across the time period between both studies, thus it is plausible to suggest that there are other important factors affecting the increased prevalence of asthma and rhinitis in this younger age-group of Maltese schoolchildren. Also, the differentiating effect between airway allergies and eczema noted previously seems to be nullified if both parents smoke as then, apart from a wider effect on the child's respiratory system, a current itchy rash in the child's skin becomes significantly more common.

Maternal smoking seemed to be affecting wheezing 'ever' only if present in the child's first year of life as compared with paternal smoking or indeed current maternal smoking which have no significant effect. However, this current

smoking by the mother seemed to affect current rhinitis symptomatology. Another interesting finding was that passive smoking in this age-group seemed to affect exercise-induced symptoms more than nocturnal cough unless both parents were smokers when this seemed to have an additive effect on the child's other allergic symptoms. What was certainly universal for maternal (current or in first year of life) or paternal smoking was that these children were much more likely to be diagnosed with asthma than their counterparts who were not exposed to environmental tobacco smoke in their homes.

In the older age-group, passive smoking seems to have a greater effect on the participating schoolchildren's allergic conditions than in their younger counterparts. This is possibly due to a cumulative effect of a longer period of exposure to passive smoking on the allergic response of these students. One can also note that this exposure is seen to affect all allergic conditions studied but most significantly the lower respiratory symptoms, especially nocturnal cough and exercise-induced wheeze. Again, as in the case of the 5- to 8-yr olds, the effect of maternal smoking on the older age-group is much stronger than paternal smoking and this must be due to the longer time the child is in the company of his/her mother and thus exposed for longer to her smoking and the resultant side-stream cigarette smoke. This was also

demonstrated in the worldwide ISAAC analysis on the association between tobacco smoke and childhood allergies (18). One could also note that in the case of rhinoconjunctivitis, it was the eye symptoms that were most likely to be triggered off by environmental tobacco smoke in these teenagers. Again smoking by both parents seemed to amplify the effect of tobacco on the children's allergic symptoms at all sites studied because of a potential additive effect.

Personal smoking was on the decline in both sexes in the teenage group across the seven years between Phase 1 and phase 3 of the ISAAC (Malta) study (2). The importance of this decline is emphasized when one sees the strong effect personal smoking has, even when compared to passive smoking, on allergic conditions throughout the systems under study, especially on the bronchi. Wheezing, whether 'ever', current or exercise-induced and bronchial hyper-reactivity as evidenced by coughing are severely affected by personal smoking by the teenager him/herself. These deleterious effects of smoking on the bronchial tree are present even at the relatively small amount and short period of active cigarette smoking carried out by these 'novice' smokers. This fact continues to emphasize that there is no 'lower limit' where the adverse effects of smoking are concerned especially on a still-developing airway. Some of these effects seem to be dose-related as those children smoking more than 10 cigarettes a day were more likely to be currently wheezing at the time of

the study and experienced more severe exercise-induced symptoms and nocturnal cough. Rhinoconjunctivitis was also more prevalent in the heavier smokers insinuating a direct irritative effect of the cigarette smoke on the teenagers nasal mucosa and conjunctivae. Our study also revealed that these young Maltese personal smokers were more likely to have been passive smokers themselves. Apart from more extensive exposure to direct and second-hand smoke, one can confirm that these smoking parents impart a very bad example to their children and induce them to become cigarette smokers themselves.

In conclusion, the present study has demonstrated that passive smoking seems to lead to severe adverse effects on allergic conditions in Maltese children with quite a lot of differences between the two age-groups studied and also differences between children whose mother or father smoked vs. those unlucky enough to have both their parents smoking in their presence. This dose-related effect is further revealed when comparing personal teenage smokers who smoke more cigarettes per day. Malta was one of the first few countries to pass legislation banning cigarette smoking in public places. All these aforementioned data should further strengthen the Maltese health authorities' efforts to curb smoking in adults by publicizing the effect their smoking is having not only on themselves but on their children and educating children to desist from even ever starting to smoke cigarettes.

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Appendix 1

Questions on smoking to parents of 5- to 8-yr olds.

1 Does your child's mother [or female guardian] smoke cigarettes?

Yes

No

2 Does your child's father [or male guardian] smoke cigarettes?

Yes

No

3 Did your child's mother [or female guardian] smoke cigarettes during your child's first year of life?

Yes

No

Appendix 2

Questions on smoking 13- to 15-yr olds.

1 Does your mother smoke cigarettes?

Yes

No

2 Does your father smoke cigarettes?

Yes

No

3 Do you smoke cigarettes? YesNo

(a) If YES how many cigarettes do you smoke per day

1–10

more than 10