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Tobacco smoking and hand eczema – a population-based study

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B Meding¹, M Alderling², K Wrangsjö¹

¹Unit of Occupational and Environmental Dermatology, Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden.

²Division of Occupational and Environmental Medicine, Department of Public Health, Karolinska Institutet, Stockholm, Sweden

Corresponding author: Birgitta Meding, Occupational and Environmental Dermatology, Karolinska Institutet, Norrbacka 3rd floor, SE-171 76 Stockholm, Sweden. Tel. +46 8 52480037, fax. +46 8 344445, e-mail birgitta.meding@ki.se

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Abstract

Background. Tobacco smoking has been proposed to promote hand eczema.

Objectives. To examine the association between tobacco smoking and hand eczema and to investigate a possible dose-response relation.

Subjects and Methods. In 2007 a national environmental health survey was performed. A questionnaire was mailed to 43,905 individuals and responses were obtained from 25,851 (59%). Questions on 1-year prevalence of hand eczema and on previous and current smoking were included. Respondents were asked to report number of cigarettes/day and provide information on history of atopy and frequency of hand exposure to water.

Results. In total, answers regarding smoking and hand eczema were obtained from 25,428 individuals. Of regular daily smokers, 10.0% reported hand eczema versus 9.1% of non-smokers ($p=0.0951$). Atopy history showed the strongest influence on the occurrence of hand eczema: prevalence proportion ratio (PPR) 3.46. The PPR for hand eczema among individuals smoking >15 cigarettes/day was 1.25 and 1.40 in uni- and multivariate analysis, respectively. Age, history of atopy, sex and water exposure were found to be confounders but not effect modifiers. A dose-response relation between amount of smoking and 1-year prevalence of hand eczema was revealed with a PPR of 1.05 ($p < 0.001$) for the continuous variable of smoking habits, indicating a significantly increased prevalence of hand eczema among individuals with higher consumption of tobacco.

Conclusions. An association between heavy smoking and hand eczema was confirmed. It is important to consider the amount of exposure, since a dose-response relation was revealed, and to be aware of confounding factors.

Introduction

Tobacco smoking has been discussed in several studies as a possible factor promoting hand eczema, but the findings have not been consistent.¹⁻⁹ In a previous study we found that heavy smoking gave a slightly increased 1-year prevalence of hand eczema.⁷ Individual smoking habits may correlate with sex, age, atopy history and various lifestyle factors. These factors are also of importance for the development and course of hand eczema.

Questionnaire-based public health surveys are performed regularly in Sweden. This paper is based on a national environmental health survey performed in 2007. About 44,000 individuals were sent a questionnaire including detailed questions on health and environmental exposures. Questions on tobacco smoking and hand eczema were included. The aims of the present study were to examine the association between self-reported tobacco smoking and the occurrence of hand eczema and to investigate a possible dose-response relation.

Subjects and Methods

Data collection and study population

The National Board of Health and Welfare, the Institute of Environmental Medicine at Karolinska Institutet and the Department of Environmental Medicine at Stockholm County Council performed a national environmental health survey in 2007.^{10,11} A questionnaire together with an instruction letter was mailed to a total of 43,905 randomly selected individuals aged 18-80 years. Four reminders were sent out and data were ultimately obtained from 25,851 respondents, giving a response rate of 59 %. Non-responding was analysed through a telephone interview. 54% (671/1250) randomly selected non-responders participated. No differences were found between questionnaire responders and interview participants in terms of general health. Data collection was performed by Statistics Sweden.

Questionnaire

The questionnaire comprised items about environmental exposures, physical health and mental health. A previously validated question "Have you during the past 12 months had hand eczema on some occasion" was included.¹² Detailed questions on current and previous smoking habits were used and the number of cigarettes/day was reported by the current smokers. In the analyses the respondents were classified in six subgroups according to smoking habits, Table 1. The concept of "regular smokers" includes those categories reporting current daily smoking. "Non-smokers" represents never-smokers, ex-smokers and occasional smokers. Frequency of hand

exposure to water during a day and the occurrence of atopy were reported. The concept of “atopy” was based on a positive answer to questions on childhood eczema and/or hay fever and/or asthma.

Statistics

For statistical analysis, SAS, release 9.1, was used (SAS Institute Inc., Cary, NC, USA). Prevalences were compared using chi-square statistics. As the present study is cross-sectional, the association between current tobacco smoking and hand eczema was analysed by prevalence proportion ratios (PPR).^{13,14} This was done by using a generalised linear model with a logarithmic link function and a binomial distribution function. A confounder was defined as having an association with hand eczema itself and by significantly changing the association between smoking habits and hand eczema ($\geq 20\%$ change for at least one of the groups of smokers).

We investigated whether any of the factors were effect modifiers rather than confounders. This was done by including an interaction term defined as the specific confounder multiplied by the smoking variable. If the interaction was significant ($p < 0.05$) the specific confounder was an effect modifier instead, i.e. a PPR for a smoking habit group compared to never-smokers was modified at different levels of the effect modifier.

In order to verify a possible dose-response relation between smoking and hand eczema, the categorical smoking habit variable was exchanged with a continuous variable in the final model. If a dose-response relation is present, the PPR for this variable would be significantly different from 1, i.e. the 1-year prevalence of hand eczema would steadily either decrease or increase for subjects in groups with higher tobacco consumption.

The study was approved by the Ethics Committee of Karolinska Institutet, Stockholm.

Participants in the study gave their informed consent according to the Declaration of Helsinki Principles.

Results

In total, answers regarding smoking and hand eczema were obtained from 25,428 individuals. Descriptive data are presented in Table 1. The 1-year prevalence of hand eczema in relation to sex and age is presented in Fig. 1. Hand eczema was most common in females and the prevalence was highest at young age for both males and females. The proportion of regular smokers in relation to sex and age is shown in Fig. 2. More females reported smoking than males, and the highest prevalence was found in late middle age for both sexes.

Among regular smokers, 10.0% reported hand eczema versus 9.1% among non-smokers ($p=0.0951$). Corresponding figures for male regular smokers vs. non-smokers were 6.6% vs. 7.1% ($p=0.4993$) and for female regular smokers 12.5% vs. non-smokers 10.8% ($p=0.0337$). The relation between smoking habits (6 subgroups) and 1-year prevalence of hand eczema is presented in Table 2.

History of atopy was reported by 33.8% of the regular smokers and 37.2% of the non-smokers ($p=0.0002$). Frequent exposure to water (>20 times/day) was stated by 25.0% of the regular smokers and 20.5% of the non-smokers ($p<0.0001$).

Table 3 presents univariate analyses of smoking habits, age, atopy history, sex and water exposure in relation to 1-year prevalence of hand eczema. Atopy history showed the strongest influence on hand eczema, PPR 3.46. For heavy smoking, >15 cigarettes/day, the PPR was 1.25.

Age, atopy history, sex and water exposure were all found to be confounders (i.e. they significantly changed the association between smoking habits and 1-year prevalence of hand eczema). These variables were also tested as possible effect modifiers. None of the variables were shown to fulfil such criteria. Table 4 presents results from a multivariate analysis regarding the relation between smoking habits and 1-year prevalence of hand eczema, adjusted for age, atopy history, sex and hand exposure to water.

A dose-response relation between amount of smoking and 1-year prevalence of hand eczema was revealed with a PPR of 1.05 ($p<0.001$) for the continuous variable of smoking habits, indicating a significantly increased prevalence of hand eczema in groups with higher tobacco consumption.

Discussion

In this study an association between heavy smoking and 1-year prevalence of hand eczema was found, and a dose-response relation was indicated. Nonetheless, comparison of the prevalence of hand eczema in regular smokers vs. non-smokers in total revealed no statistically significant association.

Over the years, several studies have been performed to evaluate a possible relation between tobacco smoking and hand eczema.¹⁻⁹ Some studies were performed without quantification of the

amount of smoking and with sparse information on other factors of importance for the occurrence of hand eczema. Well documented risk factors for hand eczema are a history of atopy, female sex, low age, and exposure to skin irritants. Other possible risk factors include contact allergies,^{15,16} stress,¹⁷ genetic vulnerability,^{16,18} and also tobacco smoking.^{1,2,4,7-9} There is reason to believe that several of these factors are related. If an association exists between smoking and hand eczema it may be dose-dependent and it may also be concealed or accentuated by several confounding factors.

The results from the present study demonstrate how the 1-year prevalence of hand eczema relates to age, with the highest figures seen below 40 years for both males and females (Fig. 1). In contrast the proportion of regular smokers was highest among individuals older than 40 years (Fig. 2). Regular smokers reported history of atopy significantly less often than did non-smokers, but a larger proportion of regular smokers reported frequent daily skin exposure to water. These facts must be considered in the analyses.

In the univariate analyses (Table 3) a history of atopy had the strongest influence on the 1-year prevalence of hand eczema, PPR 3.46. This is in accordance with previous knowledge.^{9,19} Young age, female sex and frequent exposure to water had all PPR values around 1.6, demonstrating that these factors have a statistically significant influence on the prevalence of hand eczema. The influence of tobacco smoking was less obvious. Only the group that smoked more than 15 cigarettes a day showed a statistically significant PPR of 1.25.

In the analyses we have taken into consideration factors that may be related to the occurrence of hand eczema and to smoking habits. Although we have probably not achieved complete coverage, we believe that main possible confounding factors were included. However, in the multivariate analysis, the PPRs for ex-smokers and heavy smokers (>15 cig/day) had increased compared to the univariate analysis from 1.02 to 1.14 and from 1.25 to 1.40 (Tables 3 and 4). Among ex-smokers and heavy smokers (>15 cig/day) the proportions of high risk individuals for hand eczema, females, younger individuals and those with a history of atopy, were smaller compared with among never-smokers (data not shown). This indicates that there could be further confounders not measured in this study. The only available information about skin exposure regards frequency of daily water exposure. More data on skin exposure, occupational and domestic, would have been desirable. Our results illustrate the importance of performing this type of analysis when studying hand eczema and smoking. A dose-response relation was

revealed with a PPR of 1.05 ($p < 0.001$) indicating a five percent increase of hand eczema among ex-smokers compared to never-smokers, occasional smokers compared to ex-smokers and so on.

The quantification of smoking used in this study is an inexact measure of the exposure. Moreover, it is probably not a totally accurate reflection of the degree of hazardous exposure. A moderately increased risk of hand eczema, PPR 1.40, was found among heavy smokers. Similar results were also found in our previous study.⁷ When the data were analysed in total for regular smokers vs. non-smokers, no increased risk for hand eczema was revealed. It is thus important that the amount of exposure which is used in the analysis is relevant. It appears that it requires more than just smoking a few cigarettes for the harmful effect to be detectable.

Precisely how tobacco smoking might exert an influence on the occurrence of hand eczema has not been explained and cannot be elucidated through this type of study. It might be that smoking promotes the onset of hand eczema or disturbs the healing process. Underlying mechanisms may be immunological or vascular.²⁰⁻²² There are also isolated reports of contact allergy to tobacco.^{23,24}

Sweden has a long tradition of performing environmental health surveys. Such studies afford an opportunity to study environmental factors that pose risks to the health of the general population. One strength of this study is the large study population but a drawback is the somewhat low response rate. In a cross-sectional study, it is not possible to draw conclusions about causal relations. The question concerning 1-year prevalence of hand eczema has previously been validated.¹² The sensitivity was found to be 53-59% and the specificity 96-99%, resulting in an underestimation of the true prevalence. The validity of questions on smoking habits similar to those used in this study has been evaluated elsewhere.²⁵

In conclusion the present study confirms an association between heavy smoking and hand eczema. In the analyses it is important to consider the amount of harmful exposure, since a dose-response relation was revealed, and to be aware of confounding factors.

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Table 1. Descriptive data on 25,428 individuals who responded to questions regarding smoking and hand eczema, in a Swedish national environmental health survey.

	n	%
<i>Sex</i>		
female	13798	54.3
male	11630	45.7
<i>Age (years)</i>		
18-29	3470	13.7
30-39	3863	15.2
40-49	4602	18.1
50-59	4788	18.8
60-69	5114	20.1
70-79	3591	14.1
<i>Smoking habits</i>		
never-smokers	12752	50.2
ex-smokers	8162	32.1
occasional smokers (not daily)	1131	4.5
smokers, 1-7 cig/day	1178	4.6
smokers, 8-15 cig/day	1421	5.6
smokers, >15 cig/day	784	3.1
<i>Hand eczema (1-year prevalence)</i>	2344	9.2
<i>Atopy history</i>	9039	36.7
<i>Frequent water exposure (>20 times/day)</i>	5352	21.1

Table 2. Self-reported 1-year prevalence of hand eczema in relation to smoking habits and sex.

	1-year prevalence of hand eczema		
	Total % (n)	Males % (n)	Females % (n)
Never-smokers	9.0 (1145)	7.1 (393)	10.4 (752)
Ex-smokers	9.2 (747)	7.0 (287)	11.3 (460)
Occasional smokers (not daily)	10.1 (114)	7.7 (43)	12.4 (71)
Smokers, 1-7 cig/day	9.3 (109)	7.0 (32)	10.7 (77)
Smokers, 8-15 cig/day	9.9 (141)	4.5 (24)	13.2 (117)
Smokers, >15 cig/day	11.2 (88)	8.8 (38)	14.2 (50)
Total	9.2 (2344)	7.0 (817)	11.1 (1527)

Table 3. Univariate analyses for smoking habits, age, atopy history, sex and water exposure separately in relation to self-reported 1-year prevalence of hand eczema.

	PPR (95%CI)
Never-smokers	1
Ex-smokers	1.02 (0.93-1.11)
Occasional smokers (not daily)	1.12 (0.94-1.35)
Smokers, 1-7 cig/day	1.03 (0.85-1.24)
Smokers, 8-15 cig/day	1.11 (0.94-1.30)
Smokers, >15 cig/day	1.25 (1.02-1.53)*
Age ¹	1.64 (1.52-1.77)***
Atopy history ²	3.46 (3.18-3.76)***
Sex ³	1.58 (1.45-1.71)***
Water exposure ⁴	1.60 (1.47-1.74)***

¹young (<45 years) vs. old ($\geq$ 45 years); ²pos. vs. neg.; ³females vs. males; ⁴>20 times/day vs. $\leq$ 20 times/day

*=p<0.05, ***=p<0.001

Table 4. Self-reported 1-year prevalence of hand eczema in relation to smoking habits in a multivariate analysis adjusted for age, atopy history, sex and water exposure.

	PPR (95% CI)
Never-smokers	1
Ex-smokers	1.14 (1.04-1.25)**
Occasional smokers (not daily)	1.01 (0.84-1.21)
Smokers, 1-7 cig/day	1.10 (0.92-1.32)
Smokers, 8-15 cig/day	1.18 (1.00-1.39)
Smokers, >15 cig/day	1.40 (1.15-1.71)**

**=p<0.01

Legends to Figures

Fig. 1 Self-reported 1-year prevalence of hand eczema in relation to sex and age (n=25,778).

Fig. 2 Regular daily smoking in relation to sex and age (n=25,566).



