

# Symptom prevalence and risk factors for asthma at the rural regions of Denizli, Turkey

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**Objective:** This study was conducted using a standardised method (ECRHS) to identify the prevalence of asthma symptoms and risk factors in adults who lives in the rural regions of Denizli province.

**Methods:** This study was designed as a cross-sectional study to investigate the prevalence of asthma and asthma symptoms in adults older than 18 years old, around the rural regions of Denizli. Data were collected by personal interview and filling in questionnaires between July 2009 and September 2009.

**Results:** A total of 1,343 individuals were enrolled. Prevalence of current asthma was 5.9%, having an asthma-like symptom was 34.0% and allergic rhinitis was 2.5%. Most common asthma symptoms were woken by an attack of breathlessness (20.5%, n=275), woken by attack of cough (19.9%, n=267) and wheezing (12.7%, n=171).

**Conclusions:** Asthma is an important disease that may occur not only in cities but also at country sides. In rural areas risk factors for asthma and asthma-like symptoms compared to urban areas may show some differences.

**Keywords:** Asthma; wheezing; dyspnea

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## Introduction

Asthma is a heterogenous disorder that is characterized by variable airflow obstruction, airway inflammation and hyperresponsiveness, and reversibility either spontaneously or as a result of treatment (1). Chronic inflammation is related with airway hyperresponsiveness leading to wheezing, shortness of breath, chest tightness and coughing, particularly during night or early in the morning (2,3). Asthma is a global problem estimated to affect 300 million people around the world (4,5). Prevalence of asthma is variable around the world. According to some relatively standardised and comparable studies, prevalence rates of asthma varied between 1% and 18% for children and adults (4,5). Studies from Turkey conducted relying on European Community Respiratory Health Survey (ECRHS) methodology reported the prevalence of asthma between 0.3% and 7.6% and which are similar with most of the European countries (6).

Prevalence of asthma varies among the regions of Turkey. It is more prevalent in seaside regions, city centers, big cities and among lower socioeconomic communities (2). Asthma prevalence studies from Turkey relying on standardized methods like ECHRS are usually conducted in city centers. Whereas prevalence and risk factors of asthma vary between city centers and rural regions due to variations in socio-demographic, geographic and economic conditions. Risk factors of asthma can be outlined under personal and environmental factors. Heredity, atopy, gender and obesity are the main subtitles of personal factors. Environmental factors comprise of allergens, infections (especially viruses), occupational sensitizers, smoking (active and also passive), air pollution (inner and outer) and lifestyle (rural life, diet, consumption of antibiotics etc.) (1,7). Symptoms of asthma are described as wheezing, shortness of breath and coughing. This study was conducted using a standardised method (ECRHS) to identify the prevalence of asthma

symptoms and risk factors in adults who lives in the rural regions of Denizli province.

## Methods

### *Characteristics of the study region*

Denizli is located in the southwest of Anadolu peninsula to the northeast of Ege Region, standing on a corridor among Ege-Central Anadolu and Akdeniz regions. Climate of Denizli is not uniformly resemble seaside climate of Ege and terrestrial climate of the central Anadolu contributes to climate around Denizli. Province of Denizli has 19 dependent towns with 81 big villages with municipality and 369 small villages. According to 2008 Residential Population Registry Database Denizli has an overall population of 917,836. City center and dependent towns and villages has an overall population of 508,870 while the other provincial towns and villages' population is 408,966. Gender distribution is 457,787 males to 459,049 females (8). Textile industry is the main industrial sector in Denizli. Semi-professional individual workplaces distributed around the town and villages which are sometimes settled at the backyard of houses, has significant contribution to this industrial sector.

### *Study space and sample size*

This study was designed as a cross-sectional study to investigate the prevalence of asthma and asthma symptoms in adults older than 18 years old, around the rural regions of Denizli. Sample size was calculated as 1,063 cases with a 95% confidential interval and 0.03 error margin, and 1,343 individuals were enrolled in the study.

### *Data collection*

Data were collected by personal interview and filling in questionnaires between July 2009 and September 2009. The questionnaire had two parts. In the first part of the questionnaire age, gender, marital status, occupation, education level, socioeconomic status, residence location (must be residing more than three years), population of the residence, conditions of the residence (in terms of humidity, exposure to sunlight), heating system of the residence (central heating or independent with solid fuel), presence and species of pets in the house, presence of cockroach, presence of carpets in the bedroom, proximity of the residence to motorways, status and frequency (packs/year)

of smoking in the residence, smoking status of the parents, familial history of atopy and history of mumps were sought as predisposing factors of asthma. In the second part ECRHS questionnaire was utilized to investigate asthma and asthma symptoms. In ECHRS, asthma symptoms of wheezing, wheezing with shortness of breath, wheezing in the absence of a cold, waking with tightness in the chest, woken by an attack of breathlessness and by attack of cough, attack of asthma, treatment for asthma and history of allergic rhinitis were sought for the last year.

After completion of questionnaire pulmonary function test (PFT) was applied according to American Thoracic Society definitions with Spirobank No.A23643 device of MIR Srl Company with the patient in sitting position and every patient had undergone three repeated cycles of PFT (9). Best values for each patient enrolled and data of non-cooperative patients were excluded from the study.

According to ERCHS questionnaires, 'current asthma' was established if one had an attack of asthma and/or treatment for asthma in the last year. The ones who had at least one of the following symptoms were defined as 'the ones who has asthma-like symptoms'; wheezing, waking with tightness in the chest, woken by an attack of breathlessness and by attack of cough.

### *Statistical analysis*

Statistical analyses were carried out using Statistical Program For Social Sciences (SPSS) for Windows (10.0 version) software. Besides definitive statistical methods, Pearson  $\chi^2$  test was applied for comparing the categorical variables and a parametric Pearson *t* test was applied for comparing the quantitative data. The effect of independent variables were evaluated with Binary logistic regression analysis.  $P < 0.05$  was accepted to be statistically significant.

### *Ethics committee approval*

Ethics committee approval was obtained from the local ethics committee of Pamukkale University in accordance with the Declaration of Helsinki. Participants were informed about the study, and those who gave written consent were included.

## Results

Gender distribution was 764 females (56.9%) to 579 males (43.1%) among the study group. Mean age of the group

|  | n     | %    |
|--|-------|------|
| <b>Smoking</b>                                 |       |      |
| Smoker   | 264   | 19.7 |
| Ex-smoker                                      | 190   | 14.1 |
| Never  | 888   | 66.2 |
| <b>Smoking inside the house</b>                |       |      |
| Yes  | 364   | 27.2 |
| No   | 974   | 72.8 |
| <b>Family history of atopy</b>                 |       |      |
| Yes  | 129   | 9.6  |
| No   | 1,214 | 90.4 |
| <b>History of mumps</b>                        |       |      |
| Yes  | 200   | 14.9 |
| No   | 1,143 | 85.1 |
| <b>Conditions of the residence</b>             |       |      |
| Good   | 607   | 45.3 |
| Moderate                                       | 694   | 51.7 |
| Bad  | 40    | 3.0  |
| <b>Heating system of the residence</b>         |       |      |
| Coal-fired stove                               | 1,304 | 97.1 |
| Gas stove                                      | 1     | 0.1  |
| Central heating                                | 38    | 2.8  |
| <b>Presence of pets in the house</b>           |       |      |
| Yes  | 91    | 6.8  |
| No   | 1,252 | 93.2 |
| <b>Presence of cockroach</b>                   |       |      |
| Yes  | 137   | 10.2 |
| No   | 1,206 | 89.8 |
| <b>Presence of carpet in the bedroom</b>       |       |      |
| Yes  | 1,334 | 99.3 |
| No   | 9     | 0.7  |
| <b>Proximity of the residence to motorways</b> |       |      |
| Near   | 698   | 52.1 |
| Less near                                      | 537   | 40.0 |
| Far  | 106   | 7.9  |

was 52.45±16.13 years (18-89 years) with 51.51±16.15 years (18-88 years) for females and 53.70±16.04 years (18-89 years) for males. Sociodemographics were as follows: 4.1% were single (n=55), 83.3% married (n=1,117), 12.6% were widow or widower (n=169), 17.9% had no education (n=240), 6.0% is only capable of reading or writing (n=80), 58.8% had a primary school degree (n=790), 6.5% had a

|                                      | n   | %    |
|--------------------------------------|-----|------|
| <b>Current asthma</b>                | 79  | 5.9  |
| Attack of asthma                     | 31  | 2.3  |
| Treatment for asthma                 | 76  | 5.7  |
| <b>Asthma-like symptoms</b>          | 457 | 34.0 |
| Wheezing                             | 171 | 12.7 |
| Wheezing with shortness of breath    | 138 | 10.3 |
| Wheezing in the absence of a cold    | 130 | 9.7  |
| Waking with tightness in the chest   | 252 | 18.8 |
| Woken by an attack of breathlessness | 275 | 20.5 |
| Woken by attack of cough             | 267 | 19.9 |
| <b>History of allergic rhinitis</b>  | 33  | 2.5  |

junior high school degree (n=87), 8.0% had a high school degree (n=107), and 2.8 % had a postgraduate degree (n=38). Socioeconomic level distribution in the study group was high in 21.7% (n=292), fair in 71.8% (n=963) and poor in 6.5% (n=87). Some individual and environmental risk factors for asthma were evaluated and shown in *Table 1*. In the study group the prevalence of current asthma was 5.9%, having an asthma-like symptom was 34.0% and allergic rhinitis was 2.5%. Most common asthma symptoms were woken by an attack of breathlessness (20.5%, n=275), woken by attack of cough (19.9%, n=267) and wheezing (12.7%, n=171) (*Table 2*). Waking with tightness in the chest, woken by an attack of breathlessness and by attack of cough and asthma-like symptoms were more prevalent in women than in men (P=0.013, P=0.003, P=0.005 and P=0.002 respectively) (*Table 3*). According to PFT results, mean FEV1/FVC values were significantly lower in patients with wheezing, wheezing with shortness of breath, wheezing in the absence of a cold findings, treatment for asthma and with current asthma (*Table 4*). When risk factors attributable to asthma development were evaluated against multiple variables with logistic regression analysis, family history of atopy was found to increase the risk for all symptoms in varying degrees and age was found to increase the risk one fold for all parameters except asthma-like symptoms. Presence of cockroach in the house increased the risk two to three times for many parameters. Female gender and pets inside the house also increased the risk one to two times for some parameters. Presence of carpet in the bedroom was related with a slightly increased risk for 'wheezing in the absence of a cold' (*Table 5*).

**Table 3** Comparison of asthma and asthma-like symptoms for gender

|                                      | Female |      | Male |      | P*    |
|--------------------------------------|--------|------|------|------|-------|
|                                      | n      | %    | n    | %    |       |
| Current asthma                       | 53     | 6.9  | 26   | 4.5  | 0.059 |
| Attack of asthma                     | 21     | 2.7  | 10   | 1.7  | 0.217 |
| Treatment for asthma                 | 51     | 6.7  | 25   | 4.3  | 0.064 |
| Asthma-like symptoms                 | 287    | 37.6 | 170  | 29.4 | 0.002 |
| Wheezing                             | 97     | 12.7 | 74   | 12.8 | 0.963 |
| Wheezing with shortness of breath    | 82     | 10.7 | 56   | 9.7  | 0.526 |
| Wheezing in the absence of a cold    | 73     | 9.6  | 57   | 9.8  | 0.859 |
| Waking with tightness in the chest   | 161    | 21.1 | 91   | 15.7 | 0.013 |
| Woken by an attack of breathlessness | 178    | 23.3 | 97   | 16.8 | 0.003 |
| Woken by attack of cough             | 172    | 22.5 | 95   | 16.4 | 0.005 |
| History of allergic rhinitis         | 26     | 3.4  | 7    | 1.2  | 0.010 |

\*, Pearson  $\chi^2$ .

**Table 4** Comparison of mean values of FEV1/FVC for asthma and asthma-like symptoms

|                                      | n     | Mean  | SD    | t      | P*      |
|--------------------------------------|-------|-------|-------|--------|---------|
| Wheezing                             |       |       |       |        |         |
| Yes                                  | 167   | 82.69 | 12.89 | -3.791 | <0.0001 |
| No                                   | 1,159 | 86.26 | 11.16 |        |         |
| Wheezing with shortness of breath    |       |       |       |        |         |
| Yes                                  | 135   | 82.37 | 13.04 | -3.701 | <0.0001 |
| No                                   | 1,191 | 86.20 | 11.20 |        |         |
| Wheezing in the absence of a cold    |       |       |       |        |         |
| Yes                                  | 127   | 82.34 | 12.46 | -3.613 | <0.0001 |
| No                                   | 1,199 | 86.18 | 11.28 |        |         |
| Waking with tightness in the chest   |       |       |       |        |         |
| Yes                                  | 245   | 85.65 | 12.38 | -0.238 | 0.812   |
| No                                   | 1,081 | 85.85 | 11.23 |        |         |
| Woken by an attack of breathlessness |       |       |       |        |         |
| Yes                                  | 268   | 85.46 | 12.80 | -0.511 | 0.610   |
| No                                   | 1,058 | 85.90 | 11.09 |        |         |
| Woken by attack of cough             |       |       |       |        |         |
| Yes                                  | 262   | 85.07 | 12.20 | -1.168 | 0.243   |
| No                                   | 1,064 | 85.99 | 11.25 |        |         |
| Attack of asthma                     |       |       |       |        |         |
| Yes                                  | 30    | 83.34 | 9.63  | -1.196 | 0.232   |
| No                                   | 1,296 | 85.87 | 11.49 |        |         |
| Treatment for asthma                 |       |       |       |        |         |
| Yes                                  | 74    | 82.12 | 11.17 | -2.864 | 0.004   |
| No                                   | 1,252 | 86.03 | 11.43 |        |         |
| Current asthma                       |       |       |       |        |         |
| Yes                                  | 77    | 82.33 | 11.12 | -2.753 | 0.006   |
| No                                   | 1,249 | 86.03 | 11.44 |        |         |
| Asthma-like symptoms                 |       |       |       |        |         |
| Yes                                  | 448   | 85.31 | 12.29 | -1.091 | 0.276   |
| No                                   | 878   | 86.07 | 10.99 |        |         |

SD, standard deviation; \*, Pearson *t* test.

**Table 5** Logistic regression analysis of risk factors for asthma and asthma-like symptoms

|                                      | OR, 95% CI                         |                                    |                                    |                          |                                    |                           |                                    |                                    |
|--------------------------------------|------------------------------------|------------------------------------|------------------------------------|--------------------------|------------------------------------|---------------------------|------------------------------------|------------------------------------|
|                                      | Age                                | Gender                             | Smoking                            | Smoking inside the house | Cockroach                          | Familiy history of atopy  | Carpet in the bedroom              | Pets in the house                  |
| Wheezing                             | 1.032,<br>1.020-1.045*             | 1.105,<br>0.682-1.789              | 1.321,<br>0.803-2.172              | 1.140,<br>0.762-1.706    | 2.932,<br>1.861-4.620*             | 4.993,<br>3.223-7.736*    | 0.264,<br>0.060-1.157              | 1.574,<br>0.852-2.907              |
| Wheezing with shortness of breath    | 1.038,<br>1.024-1.052*             | 1.310,<br>0.766-2.242              | 1.398,<br>0.802-2.435              | 1.050,<br>0.670-1.647    | 2.969,<br>1.809-4.873*             | 5.922,<br>3.725-9.416*    | 0.399,<br>0.075-2.141              | 1.969,<br>1.036-3.741 <sup>‡</sup> |
| Wheezing in the absence of a cold    | 1.035,<br>1.022-1.049*             | 0.938,<br>0.551-1.597              | 1.093,<br>0.628-1.902              | 0.978,<br>0.613-1.562    | 2.898,<br>1.745-4.811*             | 5.736,<br>3.568-9.223*    | 0.191,<br>0.043-0.851 <sup>#</sup> | 2.174,<br>1.145-4.130 <sup>#</sup> |
| Waking with tightness in the chest   | 1.019,<br>1.009-1.028*             | 1.800,<br>1.185-2.734 <sup>‡</sup> | 1.418,<br>0.920-2.186              | 1.138,<br>0.819-1.583    | 1.277,<br>0.822-1.985              | 2.277,<br>1.511-3.431*    | 0.917,<br>0.185-4.545              | 1.592,<br>0.958-2.643              |
| Woken by an attack of breathlessness | 1.031,<br>1.021-1.041*             | 2.148,<br>1.417-3.256*             | 1.608,<br>1.046-2.473 <sup>#</sup> | 1.127,<br>0.812-1.565    | 0.864,<br>0.537-1.392              | 2.454,<br>1.630-3.696*    | 0.634,<br>0.150-2.675              | 1.731,<br>1.048-2.858 <sup>#</sup> |
| Woken by attack of cough             | 1.025,<br>1.016-1.035*             | 1.864,<br>1.234-2.816 <sup>‡</sup> | 1.394,<br>0.909-2.140              | 1.270,<br>0.918-1.755    | 0.731,<br>0.446-1.201              | 2.162,<br>1.432-3.263*    | 0.592,<br>0.143-2.461              | 1.520,<br>0.914-2.528              |
| Attack of asthma                     | 1.026,<br>1.001-1.052 <sup>#</sup> | 1.042,<br>0.373-2.910              | 0.685,<br>0.221-2.125              | 0.523,<br>0.189-1.451    | 3.107,<br>1.248-7.737 <sup>#</sup> | 8.871,<br>4.049-19.437*   | 0.186,<br>0.019-1.803              | 2.532,<br>0.816-7.859              |
| Treatment for asthma                 | 1.062,<br>1.040-1.083*             | 0.954,<br>0.471-1.932              | 0.515,<br>0.231-1.149              | 0.785,<br>0.396-1.554    | 2.131,<br>1.003-4.530 <sup>#</sup> | 24.856,<br>13.685-45.144* | 0.654,<br>0.058-7.384              | 0.950,<br>0.298-3.032              |
| Current asthma                       | 1.054,<br>1.034-1.074*             | 1.046,<br>0.523-2.094              | 0.621,<br>0.287-1.343              | 0.781,<br>0.406-1.502    | 2.181,<br>1.062-4.479 <sup>#</sup> | 20.543,<br>11.629-36.292* | 0.655,<br>0.060-7.118              | 1.173,<br>0.414-3.325              |
| Asthma-like symptoms                 | 1.018,<br>1.011-1.026              | 1.717,<br>1.226-2.405 <sup>‡</sup> | 1.294,<br>0.911-1.840              | 1.245,<br>0.947-1.636    | 1.282,<br>0.883-1.862              | 2.246,<br>1.544-3.265*    | 1.159,<br>0.281-4.775              | 1.153,<br>0.731-1.818              |

\*, P<0.0001; #, P<0.05; ‡, P<0.01; CI, confidential interval.

## Discussion

Results of our study which was designed to evaluate prevalence of asthma symptoms and determine the risk factors of asthma among adults in rural regions of Denizli province were as follows; prevalence of asthma was 5.9%, asthma-like symptom was 34.0%. Prevalence of attack of asthma in the last year was 2.5% and treatment for asthma (spray, inhaler, pills) was 5.7%. In a study of Daloğlu *et al.* conducted among adults between 20 and 49 years in Denizli, the prevalence of attack of asthma in the last year and treatment for asthma were 1.5% and 2.3%, respectively (10). In another study of Bozkurt *et al.* conducted among patients 15 years old and older in Denizli, the prevalence of attack of asthma during the last year and treatment for asthma were 2.1% and 3.8%, respectively (11). Higher prevalence found in our study can be attributed to older population and higher allergen

exposure in the rural regions. The finding that age is related with one fold increase in the risk of asthma and asthma like symptoms also supports this proposal. In a study conducted in the city center of Antalya province, prevalence of asthma was as 9.4% (12). The discrepancy between our results and this study can be attributed to the risk factors like higher humidity, crowded population and air pollution in Antalya province. Prevalence of current asthma in individuals 18 years and older in Manisa was reported as 1.2% by Şakar *et al.* (13). It is interesting that current asthma prevalence in rural regions of Denizli is higher than the city center of Manisa which has similar characteristics with Denizli. The same study reported the prevalence of asthma-like symptoms as 25.0%. This is lower than the prevalence found in our study. Also prevalence of attack of asthma during the last year and treatment for asthma (spray,

inhaler or pills) were 0.9% and 0.7%, respectively. These prevalences are also lower than our study. The fact that Şakar *et al.* evaluated current asthma, cumulative asthma and asthma-like symptoms on individuals between 20-44 years old, lower humidity and location of industrial structures outside the town in Manisa and difference of interview technique might be responsible for the discrepancies from our results. Older study population and higher exposure to allergens in our study might be potentially responsible for differences between results. In other reports outside Turkey which are conducted using ECRHS questionnaire method reported the prevalences of treatment for asthma and/or attack of asthma in the last year (diagnosed current asthma) as: 5.8-6.8% in Sweden, 2.1-4.4% in Germany, 3.5-5.5% in France, 7.5-8.4% in England, 2.9% in Greece, 3.3-4.5% in Italy, 2.1-6.3% in Spain (14). Similar prevalences with Spain may be attributed to geographic proximity and sociocultural resemblance. National Health Interview Survey (NHIS) study in United States of America between 2001 and 2010 years found the prevalence of current asthma 7.0% among the individuals 65 years and older (15). Again this higher prevalence might be attributed to the older study population.

In terms of asthma-like symptoms; the prevalences of waking with tightness in the chest, woken by an attack of breathlessness and by attack of cough in the last year were 18.8%, 20.5% and 19.9%, respectively. In a study conducted in central province of Denizli, prevalences of the most common symptoms of woken by attack of cough, wheezing and wheezing with shortness of breath were reported 17.4%, 16.8% and 11.1%, respectively (10). Again in another study conducted in central province of Denizli reported the prevalences of tightness in chest, shortness of breath and woken by attack of cough as 13.0%, 11.0% and 22.7%, respectively (11).

Our results indicated that mean FEV1/FVC values were lower in patients with wheezing, wheezing with shortness of breath, wheezing in the absence of a cold findings, current asthma and in patients who were on treatment for asthma. Decreased mean FEV1/FVC values are expected where air flow restriction is encountered.

Family history of atopy was related with increased risk for all symptoms in varying degrees. Cockroach presence in the house also was related with increased risk two or three fold for most of the symptoms. In a study conducted in rural and provincial regions of Nigeria, people with asthma had shown to have positive skin tests for many allergens including cockroach and total IgE levels were higher when compared

with people without asthma (16). Our study was not designed to utilize blood and skin tests but self-report of individuals were investigated and similar results were found. Among the atopic disorders, allergic rhinitis was most commonly associated with asthma (17,18). In our study, prevalence of allergic rhinitis was found 2.5% and 3.4% of women and 1.2% of men had allergic rhinitis. Daloğlu *et al.* found 16.1% prevalence of allergic rhinitis with a predominance of women in central province of Denizli (10). Our results are lower but this discrepancy might be a reflection of the socioeconomic differences among the two study groups as allergic rhinitis is thought to be more common in urban areas than rural areas. Female gender and presence of pets in the house was related with one or two fold risk increase for some of the symptoms. Presence of carpet in the bedroom was related with only mild decrease in risk for 'wheezing in the absence of a cold findings'. The fact that having carpet in the bedroom to protect against cold is more prevalent in rural regions where central heating is rare climate is colder, might have a contribution to this finding. Smoking inside the house is less prevalent in rural regions than urban areas due to sociocultural factors. Prevalence of smoking in the house was found 27.2% which means a passive exposure to smoke. This might be a reason why smoking inside the house was not found as a risk factor in the multivariate analysis.

In conclusion, asthma is an important disease that may occur not only in cities but also at country sides. In rural areas risk factors for asthma and asthma-like symptoms compared to urban areas may show some differences. In rural areas, more studies should be conducted to determine urban/rural differences.

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