# Cigarette Smoking Habits among Men and Women in Turkey: A Meta Regression Analysis

*F Sahin Mutlu [1], *U Ayranci [2], K Ozdamar [1]*

[1]*Biostatistics Dept of Medical Faculty, Osmangazi University, Turkey*
[2] *Medico-Social Center, Osmangazi University, Turkey*

## Abstract

Smoking has become more prevalent in Turkey than it has in those of western countries during the past decade. This study was conducted to make parameter estimations on gender related smoking habits with the minimum of variance. Of the ninety-two researches related to smoking habits conducted from 1981 to 2003 in Turkey, 60 were deemed appropriate for the application of Meta analysis and Meta regression analysis. The proportions of men and women smoking cigarettes were 0.51 and 0.35, respectively. The proportion of men smoking cigarette in 1996 and the years before it was 0.52, and for women as 0.35. However, the figures for the years following 1996 were 0.41 for men, and 0.32 for women. In the results of the Dersimonian and Laird random effect model, the Odds Ratio, which shows the tendency of men to smoke compared to women, was found 1.894 for the period of 1981-2003. A heterogeneous distribution between the researches was apparent (Q=1560.91, $P<0.001$) as well as for Tau-square test ($x^2=0.55$, z=6.29, $P<0.001$). We propose that effective precautions should be considered, especially with regard to the introduction of laws to minimize the smoking habit for both sexes, with particular attention to women.

**Keywords:** *Meta analysis, Meta regression analysis, Smoking habit, Turkey*

## Introduction

Smoking is a very important public health problem, urgently requiring immediate and effective measures, due to its harmful effect on health (1, 2). It is the single largest cause of preventable death worldwide. One in ten adults dies of tobacco-related diseases a day, a figure set to reach one in six (or 10 million deaths annually) by 2030. Seventy percent of these deaths will be in low- and middle-income countries, where smoking rates have risen by about 3.4% per annum in recent years (3).

In developed countries, tobacco is responsible for 24% of male and 7% of female deaths, rising to over 40% in some former socialist economies, and 17% of women in the USA (4). It has been estimated to cause two million deaths an-nually in developed countries (5, 6) and over 100,000 deaths in Turkey alone per year (7).

After the rapid spread of tobacco smoking among males in the United States and Northern Europe before the 1950s, the prevalence of cigarette smoking among females also started to rise. In the 1970s, the smoking prevalence among males and females began to decrease, with a stronger decline seen in males (8). However, tobacco consumption increased by 24% in the Middle East from 1990 to 1997.

Several studies have shown that smoking spreads through populations like an epidemic (9, 10). Although the smoking epidemic is decreasing steadily in other parts of the world, it continues to spread at an accelerated rate in underdeveloped and developing countries (3).

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**\*Corresponding author:** E-mail: unalayranci@yahoo.com, Tel: +90 222 2393750/1341, Tel GSM: +90 542 6600203

Turkey, among other developing countries, faces the increasing threat of tobacco use and tobacco-related diseases, particularly lung cancer, which is the leading cause of cancer death in both sexes (7, 11, 12).

Gender differences in tobacco use are probably inconsequential in societies where tobacco is grown for home consumption, but become increasingly substantial as manufactured cigarettes replace local tobacco products (13).

In Turkey, it has been estimated that there are about 17 millions cigarette users, constituting one fourth of the total population, and that this proportion is much higher amongst males (7).

In this study, the aim was to make estimations regarding the gender related smoking habits of the Turkish community, with the minimum of variance, through Meta analysis (MA) and Meta regression analysis (MRA). In order to achieve this aim, the combined research results published or appeared in press related to smoking cigarette conducted in different places and at different times in Turkey was investigated. A further aim of the study was to determine the effect of a societal factor impinging directly on smoking, such as the tobacco control legislation (the control of tobacco being smoked in closed and public places) that came into effect in 1996 (14). We also aimed to learn whether the time trend was significant in the prevalence of smoking.

## Materials and Methods

The means for the selection of relevant information was twofold. By both studying 92 smoking related studies (conducted at different times and in different places and centers) in Turkey, either published as such or appearing in press items on this subject from January 1981 to July 2003 in Turkey, we excluded 32 piece of research, taking our group down to 60. Researches not related to the correlation between cigarette smoking and gender nor compatible with MA procedures were deemed criteria for exclusion from our research (15, 16). The excluded research was related to specific subjects such as the effects of cigarette smoking on breast-feeding women, organs, respiratory system, or gastrointestinal system rather than gender, the topic of our research. Furthermore, some research, did not include the number of smoking cases, or were review papers. The remaining 60 articles were selected according to systematic review (17, 18).

To find the relationship between the number of years and habit of cigarette smoking, trend analysis was conducted (19). Since there was heterogeneous distribution among the research, MRA was applied to obtain homogeneous distribution. The number of years was treated as an independent variable, or Odds Ratio (OR). This showed men's tendency to smoke, when compared to women, according to research results homogenized as dependent variable (17). Furthermore, according to years, gender and sample size, weighed cigarette smoking prevalences were estimated. After cigarette smoking prevalence was treated as a dependent variable, models were formed though both MA and MRA methods. Furthermore, a trend analysis of cigarette smoking prevalence was done according to years. Standard errors of cigarette smoking prevalences were estimated according to the Wolf method and binomial approach (20).

These 60 researches included data taken from 44,048 men and 24,966 women, and were appropriate for the application of MA. They included information on the relationship between cigarette smoking and gender necessary for the true estimation of smoking habits in Turkey when MA is applied. However, since the research was conducted in a heterogeneous manner, parameter estimations were both erroneous and inconsistent. Thus, we further performed MRA to adjust the differences between the researches from a heterogeneous approach to a homogeneous one (21). Analyses were prepared using Stata v8.2 (20).

In the second phase, the research was divided into two groups, to better understand whether smoking habit had changed, and any effect the introduction of the 1996 'tobacco control' leg-

islation had had on the smoking of cigarettes: representing 50 articles in the year 1996 and prior to this, and 10 in 1997 and after. MA was again applied to this research.

Habitual male smokers were allocated into the test group, and habitual female smokers into the control group. This was performed by assuming that the proportion of male smokers would be higher than that of females.

Statistical analysis consistent with the following literature information was performed: In each study (n= 60), an OR, which showed men' inclination to smoke compared to women, formed through MA (OR $_{D+L \text{ (Dersimonian and Laird random effect model)}}$) and OR formed by MRA (OR$_{MRA}$), which showed men's inclination to smoke in comparison to women according to homogenized research results, were used for illustration of the notations, with further 95% Confidence Interval (CI) by gender. In addition, according to the sample size, weighted prevalence values were analyzed by the years 1996 and before and 1997 and after taking into consideration the total number of years and gender.

Since the study was case control, we wanted to determine the relationship of cigarette smoking between men and women. We banded the men the study group and women as the control group, and the addition weight of each study alongside the individuals' smoking habits were extracted using a Random Effect Model(17,22).

When selecting studies to be included in the MA, it is necessary to assess the quality of individual articles. The selection of scales or checklists for use in quality assessment is performed with great care. Decisions to include or weight studies based on quality in a MA can be quite different depending on the quality rating system that is selected (23). Once studies have been identified for inclusion in the MA, data related to the question of interest should be extracted from the studies (24). A Tau chi-square ($x^2$) test is commonly used to test the homogeneity of the individual study results (25, 26).

Potential sources of heterogeneity were examined through graphic methods such as the forest plot. A more formal examination of heterogeneity was accomplished using MRA, which involves an application of linear regression to MA (27).

For significance, *P*<0.05 was used. In order to correct the 'year', which was thought to cause heterogeneity as the independent variable and lnOR$_{MRA,}$ which showed the 'ln' of men's inclination to smoke compared to women according to homogenized research results as the dependent variable, MRA investigation was introduced to form heterogeneity patterns in the research.

Statistical results were given as OR and 95% CI, and prevalence values as prevalence ± standard error (s.e.) and 95% CI.

## Results

In 60 case-control studies conducted from 1981 to 2003, data were taken from 44,048 men and 24,966 women. The proportion of men and women smoking cigarettes was found 0.51 (the number of male smokers/ total number of men; 22,570/44,048), and 0.35 (the number of female smokers/total number of women; 8,741/24,966), respectively. The proportion of men smoking cigarettes in 1996 and the years before this was 0.52 (20,901/39,981), and that of women 0.35 (7,965/22,545). However, the figures for the years following 1996 were 0.41 (1,669/4, 067) for men, and 0.32 (776/2,421) for women.

According to the sample size, weighted prevalence values were converted to normal distribution using 'arcsin' formula, and the means, s.e. and CIs of prevalence values, respectively were estimated as the following taking into consideration the cut off points as the periods of 1991-1996 and 1997-2003: Male and female smoking prevalences for 1981-1996 were 0.52±0.024 (0.23-0.88) and 0.39±0.029 (0.07-0.87), respectively. Male and female smoking prevalences for 1997-2003 were 0.48±0.055 (0.23-0.81) and 0.37±0.096 (0.10-0.68), respectively. In total, male and female smoking prevalences for 1981-2003 were 0.51±0.022 (0.23-0.88) and 0.39± 0.026 (0.07-0.87), respectively. For both sexes the smoking prevalence for the period 1997 and

the years following this had decreased significantly compared to the period 1981-1996.

The prevalence of cigarette smoking showed a decrease from 1981 to 2003. When the year 1996 was treated as cut off value, it was determined that the decrease after 1996 was more than that of the year 1997 and after.

It was found that global model was 'Smoking= 996.581-15.568* years' in the trend analysis of habitual cigarette smoking by years, for the years 1981-2003.Heterogeneous distribution existed in the first years, whereas there was homogeneous distribution in the following years. In the result of this research, MA was conducted for the random effect model (28). In the results of the random effect model, $OR_{D+L}$, which showed men' inclination to smoke compared to women's, was found to be 1.894, with a 95% CI of between 1.553 and 2.310 for the period 1981-2003. We found that research results had a heterogeneous structure by years and sexes in analyses conducted according to both OR and cigarette smoking prevalence values. The results for OR values were Q=1560.91, DF=59, $P<0.001$; $\chi^2=0.55$, OR=1, z=6.29, $P< 0.001$, for prevalence values Q=8314.69, DF=59, $P<0.001$, $\chi^2=0.028$, prevalence=0.46, z=21.03, $P<0.001$. Parameter estimation was performed through the MRA approach by means of statistical values obtained from heterogeneous research data. This is because it was thought that MRA should be applied for parameter estimation.

A heterogeneous distribution between the researches was apparent (Q=1560.91, DF= 59, $P<0.001$). Moreover, $x^2$ test was apparent ($x^2=0.55$, OR=1, z= 6.29, $P<0.001$). According to this, MRA was conducted to make homogeneous the data distribution determining that parameter estimations were not appropriate for the period of 20 years. In the results of MRA, the corrected OR values were determined.

The corrected OR values were assigned as the dependent variable, the 'year' as the independent variable, which yielded into heterogeneity, with the MRA model estimated as "$lnOR_{MRA}=$ 78.642-0.0391*startyr". In the MRA results, $OR_{MRA}$, which showed men's smoking inclination compared to women's, according to homogenized research results, was found to be 1.889, with 95% CI between 1.602 and 2.176. There was a homogeneous distribution between the pieces of research (Q=5.854, DF=59, $P>0.05$) with the $x^2$ test being apparent ($x^2=0.416$, $P>0.05$). The heterogeneous structure of the data was removed on a large scale by MRA.

In the light of these findings, habitual smoking in Turkey was seen to be 1.9 ($OR_{MRA}$: 1.9, which showed men's smoking inclination compared to women's, according to homogenized research results) fold more in men than in women. The $OR_{D+L}$ value, showing men's inclination to smoke compared to women's, obtained from the random effect model, and the $OR_{MRA}$ value obtained from MRA revealed no differences ($P>0.05$). It was observed that the heterogeneous distribution between the researches caused the power of the $OR_{MRA}$ parameter estimation values obtained from the random effect model to decrease. Homogeneous structures were obtained, removing heterogeneous structures by means of MRA.

The MRA results of the studies showed that it was possible to carry out parameter estimation with valid, inconsistent and minimum variance according to the community.

After parameter estimation (based on homogeneous structure) was provided for the research using MRA conducted from 1981 to 2003, the research was divided into two parts: 1996 and previous years, and 1997 and following years.

The $OR_{MRA}$ estimation value for smoking habits in the year 1996 and prior to this was 1.984, with 95% CI of between 1.673 and 2.295, while $OR_{MRA}$ estimation value of smoking habits in the year 1996 and prior to this years was estimated as "$lnOR_{MRA}=144.233-0.0720*startyr$". There was a homogeneous distribution between the research (Q=3.459, DF=49, $P>0.05$), and $x^2$ test was not apparent ($x^2=0.458$, $P>0.05$), whereas in 1997 and following years,an $OR_{MRA}$

estimation value of proportion of smokers was 1.351, with 95% CI of between 0.609 and 2.093. The $OR_{MRA}$ estimation value of smoking habits was estimated as "$lnOR_{MRA}$=-111.688+ 0.056* startyr". There was a homogeneous distribution between the research (Q=0.020, DF=9, $P$>0.05), and $x^2$ test was not apparent ($x^2$=0.167, $P$>0.05). It was found that habitual smoking

increased by 1.469 (1.984/1.351) less in 1997 and after, or after the 'tobacco control legislation' had been put into effect, than in the year 1996 and before this.

A Forest plot graph of smoking and gender ORs for studies conducted between the years 1981-2003 according to the Random Effect Model is presented in Figure 1.
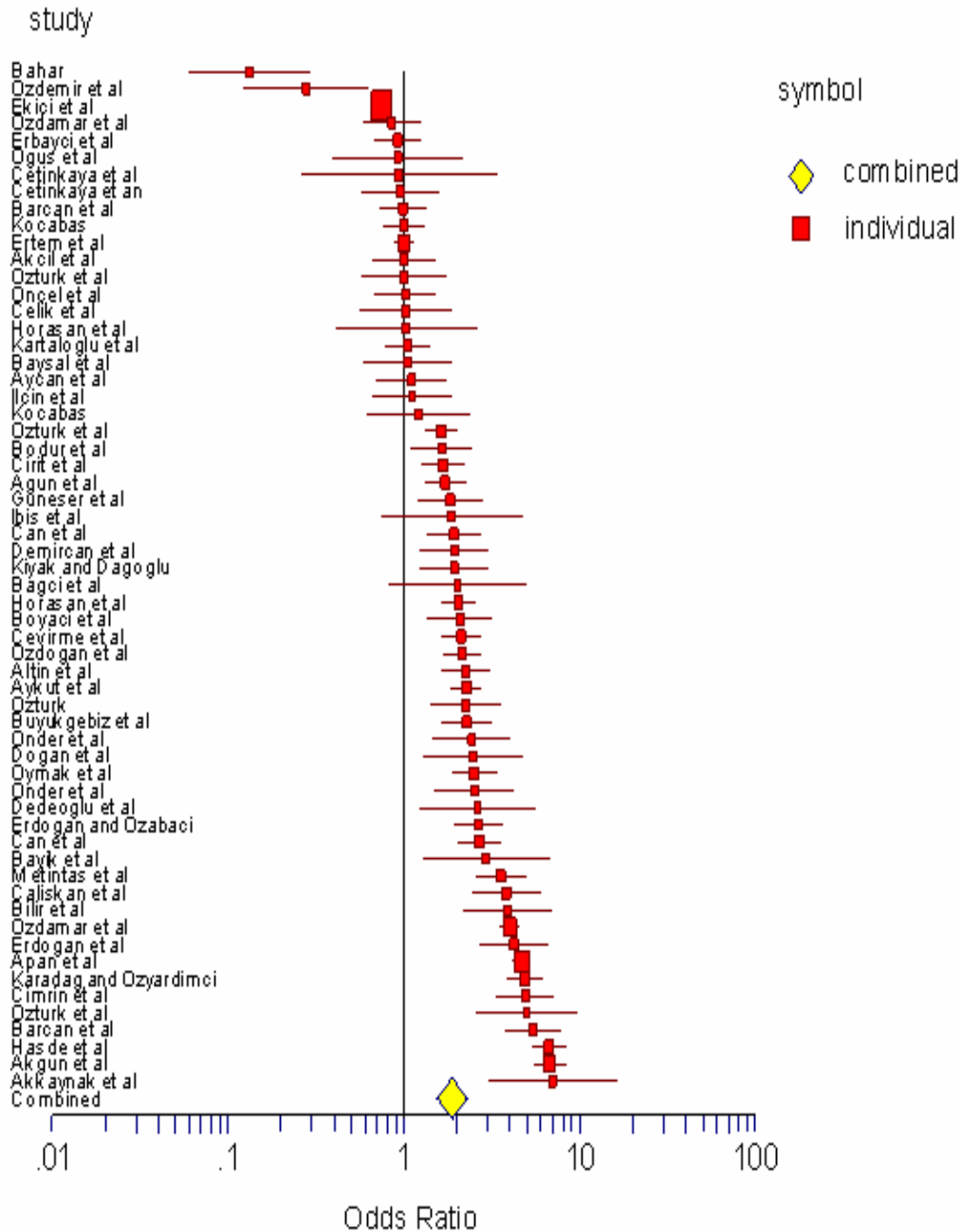


**Fig. 1:** A Forest plot graph of smoking and gender ORs for studies conducted between the years 1981-2003 according to the Random Effect Model

## Discussion

To our knowledge, this is the first case-control study of its kind conducted in Turkey. As of yet, we are unaware of any studies investigating smoking habits between the sexes in relation to Turkey and other countries established through these analysis methods.

This study found that the proportion of men reporting cigarette use was 0.51 and women was 0.35. In the light of this finding, it was determined that men smoke at a rate of 1.46 (051/0.35) more than women did. However, since the results were formed in a heterogeneous structure, it was concluded that MRA parameter estimations would be a better means of investigation than MA. According to this finding, $OR_{MRA}$, which showed men's inclination to smoking in comparison with women's, was 1.889 from 1981 to 2003. Our result, showing that smoking was more prevalent in men than in women, is compatible with results released from other countries during different years: In a Canadian study conducted from 1978 to 1996, it was found that men usually smoked more than women (29). Similarly, in a 1995 Australian study, the proportion of men smoking was 0.27, whereas the figure was found to be 0.23 for women (30). In a 2004 Italian study, this proportion was 0.38 for men and 0.26 for women (31), and in Brazil, in a study conducted in 2001; the proportion of men was 0.24, and women 0.18 (32). The following could be offered as an explanation for this trend: The general characteristics of traditional gender roles, including men's greater social power and in general greater restrictions on women's behavior, contributed to widespread social pressures against women's smoking (33). In the same way, the most significant reason to explain this could be that more social pressure to abstain from smoking has been placed on women than men by family, relatives and the social environment in Turkey (7, 12). However, given that there is conflicting evidence regarding gender differences, there is a need for better understanding of why gender differences exist. In Turkey, proportions for both men and women were higher than for those in other countries of the west. One reason for this may be that, due to its economic and social-cultural characteristics, Turkey is still a developing country and thus tobacco use therein is rather high (10, 29, 34).

In the current study, the proportion of men smoking cigarettes in the year 1996 and before was 0.52, and the proportion of women smoking cigarette 0.35. However, the figures for the 1997 and the following years were 0.41 for men, and 0.32 for women. That the prevalence of smoking for both men and women was higher in the years before the introduction of the 1996 'tobacco control' legislation proves the power of campaigns showing the increase in cancer rates in the 1990s. Furthermore, the success of restricting smoking in public areas as well as closed places (t=16.74, DF=44046, *P*<0.001; t=3.21, DF=24964, *P*<0.01, respectively) must have had some influence on the apparent decline. The scope for this legislation ranges from educational programs to legislation that has increased cigarette excise taxes, restricted smoking in public places, banned cigarette advertising and tobacco sales to young people under the age of 18, and introduced the placing of obligatory health warnings on all cigarette packaging.

In this study, the proportion of smoking in men after 1996 decreased quite significantly (from 0.52 to 0.41=0.11), whereas the proportion of women decreased only a little (from 0.35 to 0.32=0.03). This shows that for men, being more active in social life, the restriction placed on smoking in public places or workplaces by the 'tobacco control' laws has had a positive effect. Conversely, the small change observed in the women's smoking proportion shows that since women's social life and work conditions are limited and that the proportion of homemakers is rather high, women tend to stay at home more, and thus are freer to smoke than men. As one explanation of this, Osler et al

(1999) (35) has proposed that the less favorable trend in smoking prevalence in women with respect to men may be due to lower cessation rates in women. In addition, prices have an effect on men's use of tobacco. The dynamics of smoking in men and women would appear to differ concerning the effect of cost. Because of women's preoccupations with weight, stress and anxiety, women might thus continue to smoke even in the face of the highest tax increases (29). Similarly, Collins et al (1990) (36) presented several more reasons for this apparent difficulty in breaking the habit, including a greater tendency for women to perceive themselves as hooked on cigarettes, less confidence in their motivation and ability to quit, and the use of emotion-focused coping strategies, including smoking, to deal with stress. While the negative health effects of smoking (e.g., skin wrinkles, illness) may seem delayed or probabilistic, weight control is an immediate and frequently cited benefit of smoking for women and serves as an additional barrier to quitting (37, 38).

When considered from a different point of view, the number of women smoking per year has increased faster than that for men. One reason for this finding may be that changes in social life in Turkey, such as the adaptation of women to modern life, improvements in women's working conditions, the decrease in the rate of housewives when compared to rates in the past, and having contacts at work are seen as important sources of influence on the increase in women's smoking habits (39). Correspondingly, feelings of isolation and a lack of social support have been associated with high smoking prevalence rates. As a further explanation, it has been offered that women perceive smoking as a badge of autonomy and social power (26).

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