Evaluation of the association between acne and smoking: systematic review and meta-analysis of cross-sectional studies

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Abstract

Background: Acne vulgaris is one of the most common skin diseases with a multifactorial pathogenesis. Examination of the literature regarding the contribution of smoking to acne shows contradictory results. The aim of this study was to undertake a systematic review of the literature and meta-analysis about the association between acne and smoking.

Methods: A systematic review and meta-analysis, when possible were performed. The literature review was based on Pubmed, Scopus and Google Scholar searches using the keywords "(smoking OR tobacco OR nicotine OR cigarettes) AND acne". Only cross-sectional studies were included. Meta-analyses were performed using the RevMan software version 5 for Windows. Four different meta-analyses were carried out: one evaluating the association between smoking habit and acne, one including data stratified by gender, one for studies with a quality score > 6, and one relating to acne classification.

Results: Six studies were selected. The first meta-analysis, including all studies, showed a non-significant role of smoke in the development of acne: OR 1.05 (95% CI: 0.66–1.67) with random effect estimate. The second meta-analyses, including data stratified by gender, showed a OR=0.99 (95% CI: 0.57–1.73) for males and a OR of 1.45 (95% CI: 0.08–24.64) for females, using random effect for the heterogeneity in both cases. The third meta-analysis, included studies with a quality score >6 resulted in an estimated OR= 0.69 (95% CI: 0.55–0.85): in this case it was possible to use the fixed effect estimate. The last meta-analysis, concerning the severity grading, showed a non-significant result: OR=1.09 (95% CI: 0.61–1.95) using the random effect approach.

Conclusions: The first two meta-analyses found no signification association between smoking and the development of acne. However, when we performed the analysis with only good quality studies, the protective significant effect was evident.

Key words: acne, smoke, tobacco, nicotine, cigarettes

Introduction

Acne vulgaris is an inflammatory disease involving the pilosebaceous follicles. It is considered to be the most common skin disorder in mid-adolescents, affecting over 80% of teenagers in westernized societies [1-3]. It is also the most common reason for consultation in dermatology practices.

Clinically acne is characterized by a typical lesional pleomorphism: the same patient may simultaneously manifest comedones, papules, pustules, nodules, cysts and scars, deeply impacting on their quality of life and social wellbeing [1-4].

Although the precise pathogenesis has not been fully elucidated, acne seems to be a multi-factorial and complex disease; with its development being attributable to genetic predisposition, hormonal influences and a large number of lifestyle risk factors such as stress or smoking habit [1-4].

Examination of the literature and epidemiological studies concerning the role of smoking in acne shows contradictory results.

It is well known that smoking is an important cause of morbidity and death. Moreover, it is also associated with a wide spectrum of cutaneous adverse effects such as skin carcinomas, premature skin aging, poor wound healing, hair loss, etc. Nonetheless, recent studies [4-6] have reported that smoking seems to have a protective role against some inflammatory diseases, due to the anti-inflammatory property of nicotine: in particular smoking is of benefit in pemphigus and

Behcet disease [1-4].
The aim of this study was to undertake a systematic review of the literature concerning the possible association between acne and smoking.

Methods

Identification of relevant studies

The selection of articles was performed according to the PRISMA statement [7] and is shown in Figure 1.

A literature review was based on Pubmed, Scopus and Google Scholar MEDLINE searches (1996-May, 2010) for English-language articles using the keywords "(smoking OR tobacco OR nicotine OR cigarettes) AND acne".

Using the Scopus and Google Scholar databases it was noted that the Medline outcomes overlapped, therefore all duplicate articles were removed. Only cross-sectional studies with available full text and with data about cases of acne in current smokers and no smokers were included in the meta-analysis.

Data extraction and quality assessment

ll publications were analyzed by two different researchers: in particular, both independently reviewed the papers to identify relevant information (gender, age, classification disease grading) and to extract data.

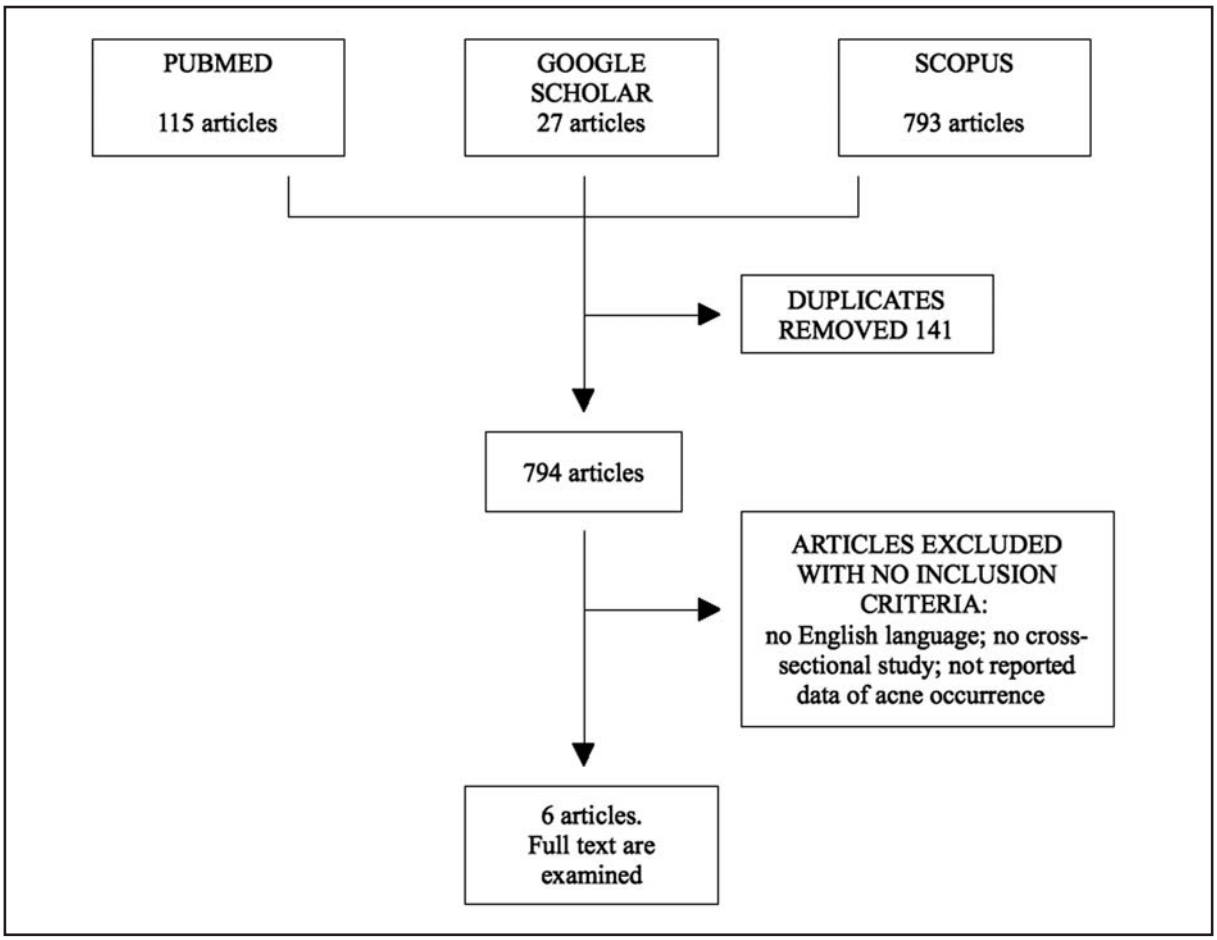
The quality of the studies was assessed using a quality scoring tool for observational studies [8]. Disagreements between the two researches were solved with discussion or with help of a third researcher.

Statistical analysis

We carried out four different meta-analysis: the first one, including all of the selected cross sectional studies, that evaluated the association between smoking habit and acne; the second one included only studies that reported data stratified by gender (two different analyses were conducted for male and female); the third included cross sectional studies with a quality score > 6; and the final meta-analysis considered acne classification.

In order to assess the association between smoking habit and acne, we used the Odds Ratio (OR) measure with relative CI 95%. The Chi-square test was computed to evaluate the studies heterogeneity, thus using the random effect

Figure 1. Selection of the studies.



model when the test highlighted differences between studies and the fixed effect model when no significant differences were shown [9]. The level of significance was set p<0.05.

The meta-analysis was performed using RevMan software version 5 for Windows [10].

Results

Identification of relevant studies

Using the inclusion criteria we identified a total of 935 articles, 27 articles from Google Scholar, 115 from PubMed and 793 from Scopus, however, 929 articles were later excluded.

Of the 115 articles located using Medline, 5 met the selection cirteria [11-15]. The same process was carried out using Scopus, resulting in the identification of 793 articles. However, from these there were no new studies identified that met the inclusion criteria. The Google Scholar search identified 27 articles which met the inclusion criteria, of which one was included [16].

Finally, the review was performed using 6 articles concerning cross-sectional studies (Table 1): five from Medline and one from the Google search.

The first meta-analysis (Figure 2), including the all studies selected, reported a pooled analysis with a non significant increase in the risk of having acne for tobacco smokers: OR=1.05 and 95%CI=(0.66;1.67), using effect random estimate as suggested by the heterogeneity test's level of significance (p<0.001).

The second meta-analysis, regarding the data stratified by gender, showed the following global estimate: OR=0.99 with 95%CI=(0.57;1.73) for males; OR =1.45 with 95%CI=(0.08;24.64) for females (Figure 3). In both models the random effect estimate (heterogeneity test p=0.01 and p=0.001 respectively) was used and there was a non significant increase in risk of having acne among current smokers.

The meta-analysis concerning studies with a quality score > 6 (Figure 4), produced an OR=0.69 and 95%CI=(0.55;0.85) estimated with fixed effect approach (heterogeneity test p=0.89). In this case the association showed a significant reduction (31%) of the risk of having acne among smokers.

The last meta-analysis, which includes the papers on acne severity grading, see Figure 5, demonstrates that there was not significant increase in risk associated with smoking in those persons with acne, OR=1.09 and 95%CI=(0.61–1.95), with random effect estimate (heterogeneity test p=0.005).

Discussion

Acne vulgaris is a chronic inflammatory skin disorder. Up to now, previous studies have produced contradictory results in terms of the association of acne with nicotine consumption.

Some authors support the theory that smoking exerts an anti-inflammatory effect in acne [6] and stated that smoking appeared to have a protective effect in the development of this disease [13].

Table 1. Description of the studies characteristics.

Author	Year of pubbl.	Population	Acne classification	Compared groups	Case of acne (smokers)	Tot smokers	Case of acne (no smokers)	Tot No smokers	Quality assesment
SZ Ghodsi	2009	12-20 ys female	moderate/severe acne	n.r.	3	6	61	471	6
		12-20 ys male			7	47	66	448	
		Tot 12-20 ys			10	53	127	919	
S Rombouts	2007	female	n.r.	ex smokers vs current smokers (*)	10	69	69	153	7
		male			29	60	108	136	
		Tot 14-18 ys			39	129	177	289	
I Klaz	2006	male 21-22 ys	severe acne	smoker vs ^	82	11718	155	15365	11
T Schafer	2001	male and female 1-87 ys	n.r.	smoker vs^	98	206	n.r.	645	6
GBE Jemec	2001	15-22 ys	n.r.	n.r.	14	59	44	127	6.50
I. Petrou	2009	male 23-24 ys	severe acne	n.r.	63	278	45.98	445.91	4.50

(*) at least 3 cigarette daily consumption for more than 6 months

n.r. not reported

^nonsmoker=neversmoker+exsmoker

vs=versus

Other authors, have not found any association between acne and smoking [14,15,17], while Petrou (2009) found a significant association between the duration of cigarette smoking and acne severity [16].

The meta-analysis of the studies included in our study did not demonstrate that smoking habits played a significant role in the pathogenesis of acne [OR 1.05 (95% CI= 0.66;1.67)].

Neither were we able to demonstrate that smoking played an important function when the data was stratified by gender, even though the crude OR=1.45 showed that for females smoking habit seemed to increase the risk slightly.

Chuh et al., (2004), also conducted a case-control study with data stratified by gender,

Figure 2. Forest-plots of acne events between current smokers versus no smokers, all studies included.

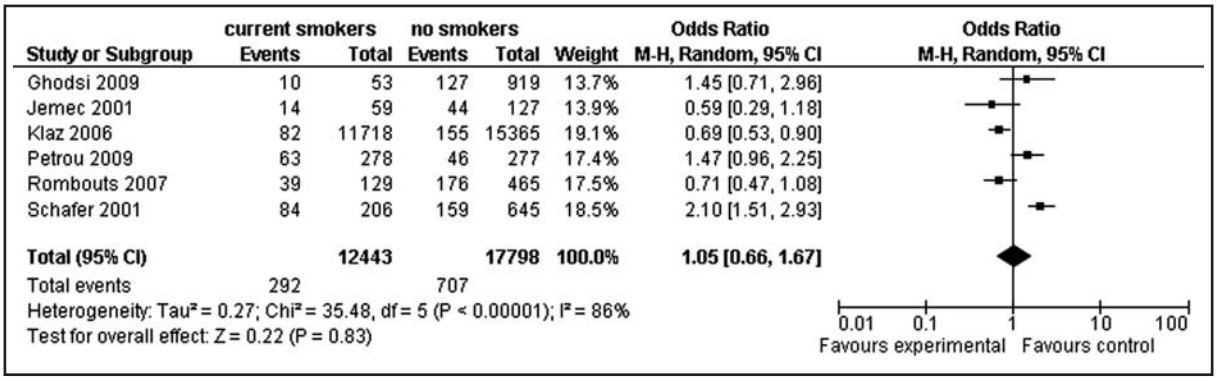


Figure 3. Forest-plots of acne events between current smokers versus no smokers, using only studies that stratified data by gender .

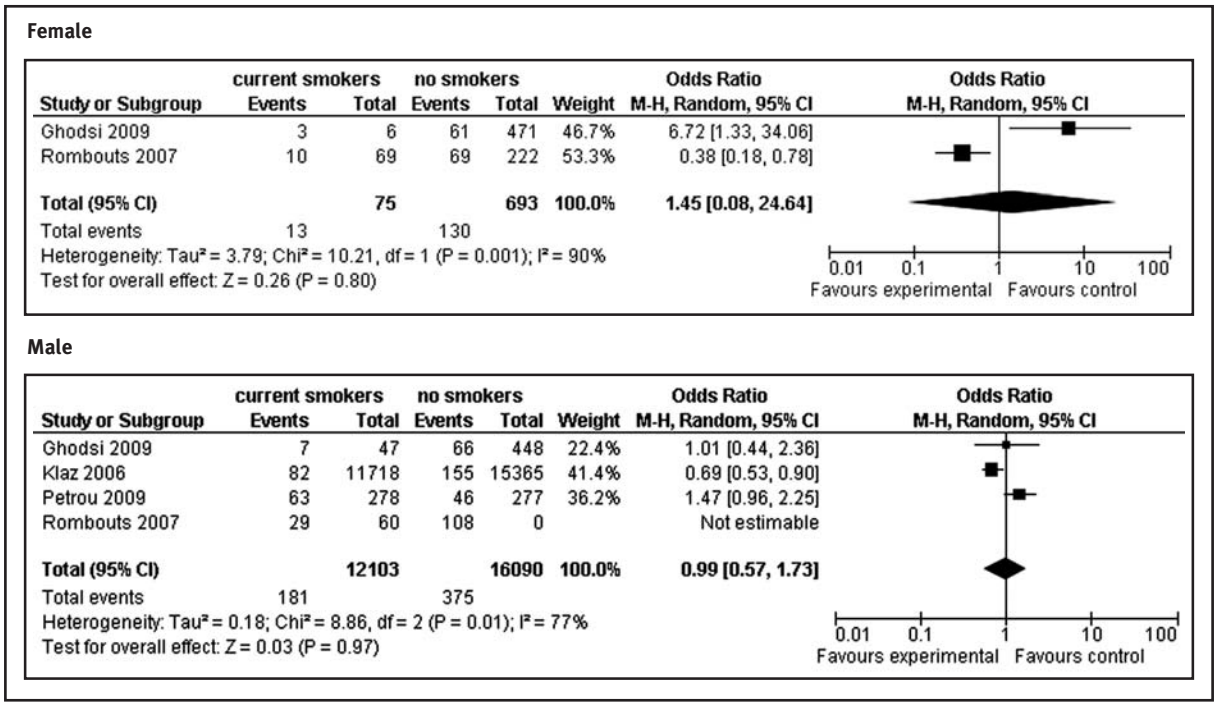


Figure 4. Forest-plots of acne events between current smokers versus no smokers, considering studies with quality score >6.

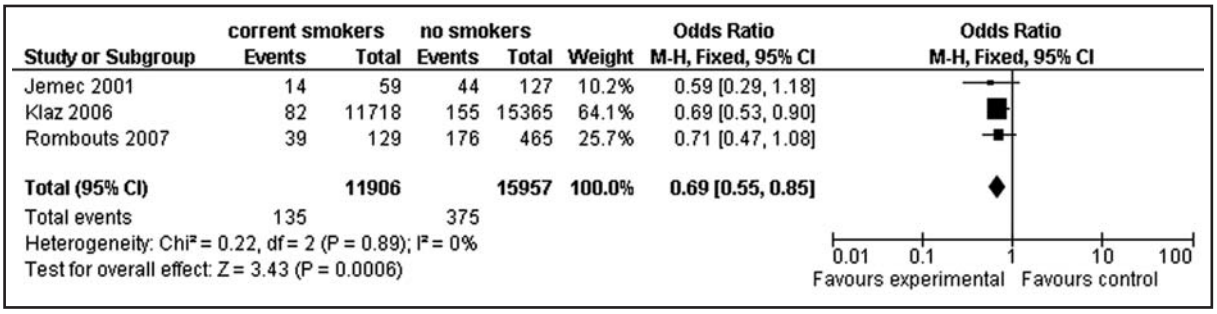
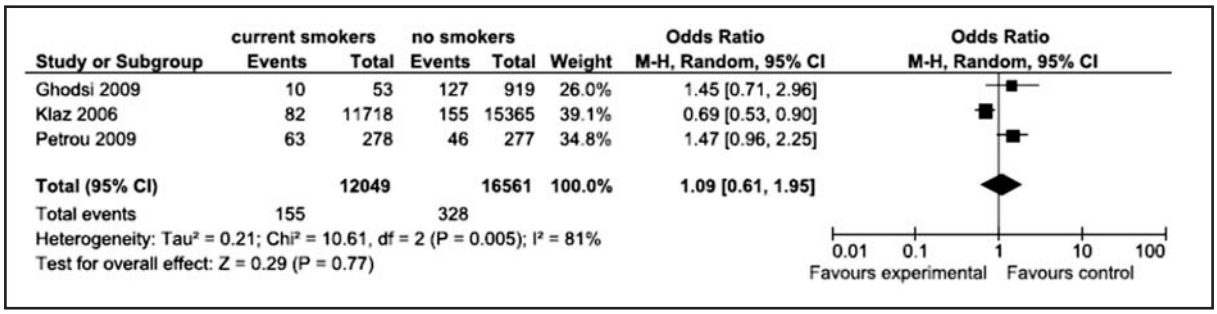


Figure 5. Forest-plots of acne events between current smokers versus no smokers, considering studies with related the acne classification.



however their study reported that smoking is likely to bear a positive correlation with acne for men, but not so for females [18]. This difference may be attributable to more males than females being selected.

In the third meta-analyses, the examination of three studies with a quality score > 6, showed that smokers were less likely (31% reduced risk) to develop acne than non-smokers, this protective effect maybe due to the presence of the large sample enrolled by Klatz (Table 1); only in this case the fixed effect approach was used, highlighting the heterogeneity of the investigations in terms of the definitions of acne, smoking attitude and of the main features of the samples.

It should be noted that there were some limitations in regards to the grading of the acne classification: in some paper acne was not defined, while others reported different classifications (mild, moderate, and severe or presence/absence). This difference makes comparison of the data difficult.

Another bias was that, in several studies, the distinction between ex-smokers and never smokers was not clearly explained or even reported: therefore it is difficult to determine if the cumulative dose of nicotine from previous years could still have played a role in pathogenesis of acne.

One further limitation was the age of persons enrolled in the different studies: some authors took into consideration patients across all ages, while others examined particle age groups. This makes it complicated to differentiate the effect of age from the role of smoking itself in the development of acne. Moreover, the data presented in some papers wasn't stratified by gender [14,15], this is an important obstacle, in the view of its possible confounding effect, to correcting the risk estimate.

Finally this analysis only considered cross-sectional studies. This kind of observational study often does not include data on other variables that affect the relationship between the putative cause and the effect. For example, data only on present smoking attitude and acne would not allow for the consideration of the role of past cigarette consumption, or for other causes to be explored. Future analyses examining case-control or cohort study designs could reach different conclusions.

Our meta-analysis underlines that there is no evidence to support an association between smoking habits and acne, although in three of the good quality papers a significant protection in the current smoker was found. It necessary to be cautious in declaring that smoking may provide a protective effect in the pathogenesis of acne because the analysis was based on only a small number of studies.

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