ORIGINAL REPORT

Adult Acne in Middle-age: Effects on Mental Health in General Population of the Northern Finland Birth Cohort 1966

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The impact of adult acne on patients' mental health has not been widely studied, and most studies have been conducted within specific patient populations. The current study examines the association between adult acne and psychological symptoms in the Northern Finland Birth Cohort 1966 (NFBC1966) ($n = 1{,}907$). The cohort members attended a health study at the age of 46 years, which comprised a whole-body examination performed by dermatologists to identify acne, and answering the Beck Depression Inventory II (BDI-II), Athens Insomnia Scale (AIS), Generalized Anxiety Disorder (GAD-7), State-Trait Anxiety Inventory (STAI) and 15-dimensional measure of health-related quality of life (15D HRQoL) questionnaires. The prevalence of adult acne was 7.9% ($n = 150$) with no statistical differences between the sexes. Cases with acne presented more (18.9%) depressive symptoms (BDI-II > 14 points) compared with those without acne (9.7%) ($p < 0.001$). In adjusted logistic regression analyses, those with acne had a 2-fold risk (odds ratio (OR) 2.08, 95% confidence interval (95% CI) 1.23–3.38) of having depressive symptoms compared with controls. In conclusion, when treating adult acne patients, it is important to recognize the increased risk of mental health symptoms.

Key words: adult acne; mental health; depression; psychological; birth cohort.

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SIGNIFICANCE

Acne can appear for the first time in adult age or persist from adolescence. Previous studies have shown that acne can cause psychological burden. This study examined the association between adult acne and psychological symptoms in the general population among 1,907 subjects in the Northern Finland Birth Cohort 1966. The results showed that those with adult acne had a more than 2-fold risk of having depressive symptoms compared with those without acne. By acknowledging the risk of mental health challenges, it will be possible for physicians and other healthcare personnel to provide better quality care to patients with acne.

Acne vulgaris is a chronic, inflammatory skin disorder, which affects the majority of individuals going through puberty (1). Acne may also manifest for the first time in adulthood or persist from adolescence (2). In studies including clinical examination, the prevalence of adult acne varies between 1% and 8%, affecting both sexes (3, 4). Even though adult acne most often presents with mild disease (4, 5), there is evidence to support that acne has a greater impact on the quality of life in adult patients compared with adolescents (5, 6).

Albeit not a life-threatening disease, adult acne has been associated with serious psychosocial problems (6, 7), such as reduced quality of life, depression, anxiety, and poor self-image (6–10). Adult acne patients are also more likely to experience suicidal thoughts compared with the general population (7).

Previous studies concerning adult acne and psychological symptoms have been conducted mainly on patients from outpatient clinics (7, 10) and there has been a call for comprehensive, population-based studies on this issue (6). Thus, this study examined the association between these factors in the general population in the Northern Finland Birth Cohort 1966 Study (NFBC1966) (11, 12). More specifically, the aim of this cross-sectional study was to analyse the association between adult acne, diagnosed by dermatologists, and psychosocial symptoms.

METHODS

NFBC1966 is a longitudinal research programme that included all children whose expected dates of birth fell in the year 1966 in the 2 northernmost provinces in Finland (Oulu and Lapland) (11, 12). These cohort members have been evaluated regularly since birth by health questionnaires and clinical examinations. At the age of 46 years, cohort members living in the city of Oulu and within 100 km of the city, including rural areas, were asked to attend a health study, which included several health questionnaires and clinical examinations; for example, a whole-body skin examination performed by dermatologists (13).

Dermatological evaluation

During a total-body skin examination performed by dermatologists (SPS, LH) all typical skin findings and diseases, including adult acne, were observed and recorded in a pre-designed computerized database. The clinical skin examination has been described in

detail previously (14). Diagnosis of acne was based on evaluation by a dermatologist at the study visit and on internationally accepted criteria (2).

Psychosomatic or psychological questionnaires

The participants were asked to complete a Beck Depression Inventory II (BDI-II, cut-off < 14 and ≥ 14 points, mild/moderate/severe symptoms), Athens Insomnia Scale (AIS), Generalized Anxiety Disorder (GAD-7, cut-off ≤ 7 and ≥ 7 points), State-Trait Anxiety Inventory (STAI) and 15-dimensional measure of health-related quality of life (15D HRQoL) questionnaires to evaluate psychological symptoms in the study cases (15).

Confounding factors

Smoking, alcohol use, physical activity, body mass index (BMI), other facial dermatosis known to associate with psychological symptoms (rosacea), socioeconomic status (SES) (defined by education, which has been considered as the most judicious SES measure (16)) were considered as possible confounders because of their known association with psychological symptoms (17–22).

Ethical aspects

The ethics committee of the Northern Ostrobothnia Hospital District approved the study (§94/2011), which was performed according to the principles of the Declaration of Helsinki 1983. The participants took part on a voluntary basis and signed an informed consent. The data were handled on group level only, with personal information being replaced by identification codes, resulting in complete anonymity.

Statistical analysis

The prevalence of adult acne was calculated. Distributions of categorical variables were presented as numbers and percentage of proportions. Categorical variables were tested by χ^2 test and continuous variables by Mann–Whitney *U* test. Logistic regression analyses were used to estimate the association between adult acne and self-reported psychological symptoms. The following variables were used in the adjusted multivariate model: sex, smoking, alcohol use, BMI, physical activity, SES and diagnosis of rosacea at the study visit. The statistical analyses were conducted using R software package version 4.0.2 (https://cran.rstudio.com) and $p < 0.05$ was considered statistically significant.

RESULTS

At the age of 46 years, 3,181 cohort members living in the city of Oulu and within 100 km of the city were asked to attend a health study. A total of 1,932 (60.7%) cohort members attended the skin examination, 1,036 (53.7%) of them were female. Afterwards, some study cases have denied the use of their data, and the final study population includes 1,907 cases.

Table I. Baseline characteristics of the study population

	No acne *N* = 1757	Acne *N* = 150	*p*-value overall
Sex, *n* (%)			0.405
Male	818 (46.6)	64 (42.7)	
Female	939 (53.4)	86 (57.3)	
Socioeconomic status[a], *n* (%)			0.851
Basic/secondary	1081 (61.5)	94 (62.7)	
Tertiary	676 (38.5)	56 (37.3)	
Physical activity, *n* (%)			0.623
Inactive	352 (20.8)	36 (24.5)	
Lightly active	654 (38.7)	59 (40.1)	
Active	628 (37.2)	48 (32.7)	
Very active	56 (3.31)	4 (2.72)	
Alcohol consumption (g/week), *n* (%)	11.3 (18.2)	11.2 (25.3)	0.955
Smoking status:			0.919
Non-smokers	889 (52.6)	78 (53.4)	
Former smoker (quit > 0.5 years ago)	425 (25.1)	34 (23.3)	
Former smoker (quit < 0.5 years ago)	29 (1.72)	3 (2.05)	
Current smoker	347 (20.5)	31 (21.2)	
Rosacea[b], *n* (%)			0.795
No	1489 (84.7)	128 (85.9)	
Yes	268 (15.3)	21 (14.1)	

[a]Defined by education. [b]Diagnosed by dermatologists during the dermatological evaluation.

The prevalence of adult acne according to the total-body skin examination was 7.9% ($n = 150$). There were slightly more females ($n = 86$) with adult acne compared with males ($n = 64$), but the difference was not statistically significant ($p = 0.45$) (4). Baseline characteristics of the study population are shown in **Table I**.

Those with adult acne had more answers referring to moderate/severe symptoms of depression (≥ 14 points in BDI-II) (18.9%) compared with those without acne (9.7%) ($p < 0.001$). Acne cases reported more symptoms of anxiety (defined by STAI and GAD-7) and insomnia (defined by AIS) than those without acne, but the difference was not statistically significant (**Table II**). There was no association between acne severity and psychological symptoms (data not shown).

In logistic regression analyses, those with adult acne had more than 2-fold risk of depressive symptoms (odds ratio (OR) 2.16, 95% confidence interval (95% CI) 1.36–3.34) (Table II). After adjusting for sex, SES, BMI, smoking, alcohol consumption and dermatologist-

Table II. Association between adult acne and psychological symptoms

	No acne *n = 1,757*	Acne *N = 150*	OR	*p*-value ratio	*p*-value overall
Athens Insomnia Scale (AIS), mean (SD)	2.78 (2.54)	2.81 (2.59)	1.01 [0.94;1.07]	0.870	0.873
State-Trait Anxiety Inventory (STAI), mean (SD)	10.4 (2.93)	10.9 (3.19)	1.05 [1.00;1.11]	0.060	0.082
15D HRQoL, mean (SD)	0.93 (0.07)	0.92 (0.08)	0.48 [0.04;5.28]	0.547	0.608
Generalized Anxiety Disorder Screener (GAD-7)					
< 7 points, *n* (%)	1383 (90.7)	114 (89.8)	Ref.	Ref.	0.853
≥ 7 points, *n* (%)	142 (9.31)	10 (10.2)	1.12 [0.59;1.97]	0.711	
Beck Depression Inventory–II (BDI-II), *n* (%)					
< 14 points	1505 (90.3)	116 (81.1)	Ref.		
≥ 14 points	162 (9.72)	27 (18.9)	2.16 [1.36–3.34]	0.002	0.001

OR: odds ratio; SD: standard deviation; 15D HRQoL: 15-dimensional measure of health-related quality of life.

diagnosed rosacea, the finding remained statistically significant (OR 2.08 95% CI 1.23–3.38, $p<0.001$).

DISCUSSION

Previous population-based studies related to acne have focused more on adolescents (6), while the effect of adult acne on mental health has not been as extensively studied. The current study focused on the association between adult acne and psychological problems in a general population. The results show that adult patients with acne had more than 2-fold risk of experiencing depressive symptoms compared with the general population.

In line with the results of the current study, prior research has shown that there is a connection between adult acne and mental health issues (6, 7, 10). In a recent cross-sectional study that examined the psychological burden of adult acne patients from 13 European countries ($n=213$ acne cases), researchers reported that patients with adult acne are more likely to express depression and anxiety than the general population (7). In that study, patients (recruited from dermatological outpatient clinics) completed questionnaires related to mental health, such as the Hospital Anxiety and Depression Scale (HADS) and the Dermatology Life Quality Index (DLQI) (7). They found that symptoms of depression (HADS scores ≥11) were seen in 5.7% of patients with acne, which is clearly less than in the current study (18.9%, BDI-II, score ≥14 including also mild cases) (7). However, that study differs from the current study, since the subjects were markedly younger (mean ± standard deviation (SD) age 24.4 ± 7.1 years), patients were selected from a dermatology clinic, and there were differences in methodology. A high risk of psychiatric symptoms in patients with acne has also been seen in meta-analytic review by Samuels et al. ($n=1,029,299$), which included both adolescents and adult patients (6). Interestingly, they showed that mental health burden was stronger in adult patients with acne than in adolescents, which strengthens the results of the current study.

The association between adult acne and psychological symptoms was shown to affect both sexes. Nevertheless, according to previous studies, there is disagreement as to whether there is a female predominance both in the prevalence of adult acne and its association with psychiatric burden (5, 23, 24). For example, an Italian study ($n=1,103$) reported that the quality of life in adult acne patients was decreased, especially in females (5). Furthermore, a review by Skroza et al. concluded that females with acne are more prone to develop psychiatric symptoms than males (25). However, many recent studies have not performed sex-specific analyses (6, 7). Females are thought to suffer more from stress-related depressive disorders, which may also be contributed to by hormonal factors (26). Stress, further, can increase the risk of acne (26). However, in the current study, there was no sex difference in the prevalence of adult acne or in the relationship with psychological symptoms. The difference between the current study and previous findings may result from the fact that, in general, females are more likely to seek consultation, especially for acne (27). This effect may not be so pronounced in our birth cohort setting, where the study subjects participated in a general health examination, not solely a dermatological consultation.

Adult acne as a visible, facial skin disease has a high impact on quality of life and on appearance. Thus, the relationship between acne and psychological symptoms is understandable. Acne may increase stress, reduce self-confidence, affect everyday life by diminishing relationships with other people, decrease sexual attractiveness, and even make it difficult to find employment opportunities (26). As adult acne is often persistent, it may also provoke fear. Despite the reported increased risk of mental health burden and suicidal risk, the psychological impression of adult acne is probably still underestimated (26). The current study especially found a risk of depressive symptoms among the study cases; however, there was also some tendency for increased risk of insomnia and anxiety.

The severity of acne did not correlate with the psychological symptoms. This has also been shown in other studies: a patient may report a high negative impact on quality of life, although the symptoms of acne are mild to moderate (28). Also, a study by Altunay et al. (7) found that HADS scores for anxiety and depression did not correlate with the severity of acne symptoms.

The major advantage of the current study was the coverage of a wide general population. Not all patients with adult acne seek help from physicians, which makes population studies important to reveal this kind of association. The participation rate was also relatively good (61%) and highly comparable with the participation rates in other cross-sectional European health examination surveys (13, 29). The current results are thus generalizable to other Caucasian populations in middle-age. In addition, the current study population was not limited to any population subgroups, such as employed persons, patients from dermatology clinics, or mental health patients. The psychological questionnaires were part of a large-scale cohort study, not just for mental health or adult acne patients. Another strength of the study was the clinical whole-body skin evaluation performed by a dermatologist who has the best ability to distinguish acne from other skin diseases affecting the face. One of the weaknesses of the study was that all the invited cohort members did not participate in the clinical examination. Participants were more often employed, from higher social class, and more likely married and with children compared with non-participants (13). In addition, the current study does not reveal if the symptoms of depression are a consequence of adult acne or vice versa.

In conclusion, this general population study found a 2-fold risk of depressive symptoms in middle-aged acne patients, affecting both sexes. In clinical practice, physicians treating adult acne patients are encouraged to not only evaluate patients' skin, but also to ask about psychological symptoms. By acknowledging the risk of mental health challenges, it will be possible for physicians and other healthcare personnel to provide better quality care to their patients. Adult acne should be treated effectively to in order diminish the risk of mental health burden.

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Data referral. https://etsin.fairdata.fi/dataset/716939c3-7a2a-4b6a-91f3-92aca09bc52d

NFBC data is available from the University of Oulu, Infrastructure for Population Studies. Permission to use the data can be applied for research purposes via electronic material request portal. In the use of data, this study follows the European Union (EU) general data protection regulation (679/2016) and Finnish Data Protection Act. The use of personal data is based on cohort participant's written informed consent at his/her latest follow-up study, which may result in limitations to its use. Contact the NFBC project centre (NFBCprojectcenter(at)oulu.fi) and visit the cohort website for more information.

The authors have no conflicts of interest to declare.

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