A Population-Based Study of Acne and Body Mass Index in Adolescents

Moderate to severe acne has a prevalence of 10% to 20% in adolescent populations and is associated with psychosocial problems.[1-3] There is a growing interest in possible links between diet, lifestyle, and acne.[4,5] However, possible relationships remain controversial. On the other hand, the number of overweight children and adolescents is increasing.[6] The aim of the present study was to demonstrate a possible relationship between body mass index (BMI) and acne in adolescents.

Methods. The study population consisted of adolescents aged 18 or 19 years in Oslo, Norway, who were not seeking health care. The survey was cross-sectional and questionnaire-based. Informed consent was obtained from all participants. The Regional Committee for Medical Research Ethics in Norway approved the study. Further information about the study, its population, and its variables are available in an open-access journal.[5] A total of 4744 adolescents were invited and the participation rate was 80%.

Data were collected on acne from 3655 adolescents and on BMI from 3584 adolescents. The data regarding acne were collected through the following question: "In the last week, have you had pimples?" Response options included (1) No; (2) Yes, a little; (3) Yes, a lot; and (4) Yes, very much. Because the goal was to explore moderate and severe acne, responses 3 and 4 were considered positive for acne for the purpose of this study.[7]

Body mass index was calculated as weight in kilograms divided by height in meters squared and was based on participants' self-reported answer to the following question: "What was your weight and height when last measured?" A BMI of 25 or higher is considered overweight, and 30 or higher, obese in adolescent boys and girls aged 18 years or older.[8] We pooled the overweight and obese categories because there were only 32 obese girls and 37 obese boys in our population. Body mass index was divided into 4 categories: lower than 18.50; 18.50 to 22.99; 23.00 to 24.99; and 25 or higher.[9]

To calculate the adjusted odds ratios (ORs), the following variables were included in the model: mental distress; cigarette smoking; alcohol intake; ethnicity; family income; and dietary intake of soft drinks with sugar, raw vegetables, fatty fish, chocolate and/or sweets, and potato chips. The adjustment variables used were the same as previously described in the same population.[5] SPSS software for Windows, version 16.0, was used for the statistical analyses (IBM), and ORs were calculated with 95% confidence intervals (CIs).

Results. The prevalence of overweight was 9.5% in girls and 15.4% in boys. The prevalence of acne was 13.1% in girls and 14.0% in boys. Among those who were overweight or obese (BMI ≥25), the prevalence of acne was 18.5% in girls and 13.6% in boys (**Table 1**).

In girls, there was an unadjusted OR of 2.1 (95% CI, 1.4-3.3) between acne and overweight, and an adjusted OR of 2.0 (95% CI 1.3-3.2). In boys, no significant associations were found between acne and BMI (**Table 2**).

By regression analysis, we found that in the sample of adolescent girls for whom we also had data on age at menarche (n=1215), the odds ratio for having acne with a BMI of 25 or higher was 2.1 (95% CI, 1.3-3.4). Here, we controlled for age at the time of menarche in addition to the variables used previously in the adjusted analyses.

Comments. This study demonstrates that overweight and obesity are associated with acne in girls aged 18 and 19, but the same association was not observed in boys.

It has previously been shown that boys and girls (age 6-11 years) in Taiwan with lower BMI have a lower prevalence of acne.[10] In adult women, however, no difference in BMI was found across acne severity.[11] In British male soldiers older than 20 years, those with acne tended to be heavier.[12] We are not aware of any other

Table 1. Reports of Moderate to Severe Acne Across 4 Categories of BMI for Adolescent Boys and Girls[a]

	BMI				
Sex	<18.50	18.50-22.99	23.00-24.99	≥25.00	Sample
Boys	10/56 (18)	135/946 (14.3)	44/337 (13.1)	33/244 (13.6)	222/1583 (14.0)
Girls	28/217 (12.9)	151/1277 (11.8)	40/266 (15.0)	34/184 (18.5)	253/1944 (13.1)

Abbreviation: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared).
[a] Data are reported as number of adolescents in the category/overall number (percentage).

Table 2. Adjusted[a] ORs (95% CIs) for Association Between Moderate to Severe Acne and BMI in Adolescent Boys and Girls

	BMI				
Sex	<18.50	18.50-22.99	23.00-24.99	≥25.00	Sample
Boys	1.3 (0.6-2.7)	1 [Reference]	0.9 (0.6-1.4)	0.8 (0.5-1.3)	1302
Girls	0.9 (0.5-1.5)	1 [Reference]	1.3 (0.9-2.0)	2.0 (1.3-3.2)	1576

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); OR, odd ratio.
[a] Adjusted for mental distress, ethnicity, family income, cigarette smoking, alcohol intake, and 5 different dietary factors (soft drinks with sugar, raw vegetables, fatty fish, chocolate and/or sweets, and potato chips). For additional information see Halvorsen et al[5] (2009).

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studies that have investigated the relationship between acne and BMI.

Strengths of this study are the many participants and the high participation rate, and thus its representativeness. An additional strength is the inclusion of relevant variables in the adjusted analyses, especially mental distress, which reflects symptoms of depression and anxiety, and dietary parameters. In addition; the results in both girls and boys were the same when overweight and obesity were defined as being above the 85th percentile.

Limitations of the study include the cross-sectional design, which makes interpretation of causality difficult, and the use of self-reported data on BMI and acne, which can allow for measurement errors. However, the acne question used has been previously validated, and the BMI prevalences were similar to findings among 18-year-old adolescents from the United Kingdom and the United States.[3,7,8] Another limitation is that there were no data available on total caloric intake in this population. Finally, despite the ability to control for age at menarche, which is known to be related to hormonal status and development of polycystic ovarian syndrome (PCOS),[13] it was not possible to directly control for serum hormone levels or for a diagnosis of PCOS, which has a known association with acne and obesity in adolescents.[13,14] Despite the findings demonstrating a relationship between acne and overweight and obesity in girls aged 18 and 19 years, the study limitations do not allow the straightforward interpretation that obesity causes acne.

To our knowledge, this is the first population-based study of acne and BMI in adolescents. Given the importance of this common skin problem, along with the increasing prevalence of both overweight and obesity in children and adolescents, further exploration is warranted into the association between BMI and acne in this age group.

Jon Anders Halvorsen, MD, PhD
Ruth Ann Vleugels, MD, MPH
Espen Bjertness, PhD
Lars Lien, MD, PhD

Author Affiliations: Department of Dermatology, Oslo University Hospitalet, Faculty of Medicine (Dr Halvorsen), Department of Community Medicine (Drs Halvorsen and Bjertness), and Department of Mental Health and Addiction (Dr Lien), University of Oslo, Oslo, Norway; Department of Dermatology, Brigham and Women's Hospital, and Division of Allergy and Immunology, Children's Hospital Boston, Harvard Medical School, Boston, Massachusetts (Dr Vleugels); Tibet University Medical College, Lhasa, Tibet (Dr Bjertness); and Department of Research, Hospital Innlandet Trust, Brumundal, Norway (Dr Lien).
Correspondence: Dr Halvorsen, Department of Dermatology, Oslo University Hospitalet, Faculty of Medicine, N-0027, Oslo, Norway (j.a.halvorsen@medisin.uio.no or jander-h@online.no).
Author Contributions: Drs Halvorsen, Bjertness, and Lien had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Halvorsen and Bjertness. *Acquisition of data:* Bjertness. *Analysis and interpretation of data:* Halvorsen, Vleugels, and Lien. *Drafting of the manuscript:* Halvorsen and Vleugels. *Critical revision of the manuscript for important intellectual content:* Vleugels, Bjertness, and Lien. *Statistical analysis:* Halvorsen. *Obtained funding:* Halvorsen and Bjertness. *Administrative, technical, and material support:* Halvorsen and Bjertness. *Study supervision:* Vleugels, Bjertness, and Lien.
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1. Burton JL, Cunliffe WJ, Stafford I, Shuster S. The prevalence of acne vulgaris in adolescence. *Br J Dermatol*. 1971;85(2):119-126.
2. Kilkenny M, Merlin K, Plunkett A, Marks R. The prevalence of common skin conditions in Australian school students: 3, acne vulgaris. *Br J Dermatol*. 1998;139(5):840-845.
3. Halvorsen JA, Stern RS, Dalgard F, Thoresen M, Bjertness E, Lien L. Suicidal ideation, mental health problems, and social impairment are increased in adolescents with acne: a population-based study. *J Invest Dermatol*. 2011;131(2):363-370.
4. Spencer EH, Ferdowsian HR, Barnard ND. Diet and acne: a review of the evidence. *Int J Dermatol*. 2009;48(4):339-347.
5. Halvorsen JA, Dalgard F, Thoresen M, Bjertness E, Lien L. Is the association between acne and mental distress influenced by diet? results from a cross-sectional population study among 3775 late adolescents in Oslo, Norway. *BMC Public Health*. 2009;9:340.
6. Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among US children and adolescents, 1999-2000. *JAMA*. 2002;288(14):1728-1732.
7. Halvorsen JA, Braae Olesen A, Thoresen M, Holm JO, Bjertness E, Dalgard F. Comparison of self-reported skin complaints with objective skin signs among adolescents. *Acta Derm Venereol*. 2008;88(6):573-577.
8. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ*. 2000;320(7244):1240-1243.
9. World Health Organization. BMI classification. http://apps.who.int/bmi/index.jsp?introPage=intro_3.html. Accessed February 8, 2010.
10. Tsai MC, Chen W, Cheng YW, Wang CY, Chen GY, Hsu TJ. Higher body mass index is a significant risk factor for acne formation in schoolchildren. *Eur J Dermatol*. 2006;16(3):251-253.
11. Borgia F, Cannavò S, Guarneri F, Cannavò SP, Vaccaro M, Guarneri B. Correlation between endocrinological parameters and acne severity in adult women. *Acta Derm Venereol*. 2004;84(3):201-204.
12. Bourne S, Jacobs A. Observations on acne, seborrhoea, and obesity. *Br Med J*. 1956;1(4978):1268-1270.
13. Rosenfield RL. Clinical review: Identifying children at risk for polycystic ovary syndrome. *J Clin Endocrinol Metab*. 2007;92(3):787-796.
14. Pfeifer SM, Kives S. Polycystic ovary syndrome in the adolescent. *Obstet Gynecol Clin North Am*. 2009;36(1):129-152.

COMMENTS AND OPINIONS

Narrowband UV-B Phototherapy During Pregnancy and Folic Acid Depletion

We read with interest Zeichner's[1] case report of acne vulgaris during pregnancy treated successfully with narrowband UV-B (NB-UV-B) therapy. Generally, UV-B is considered a safe form of psoriasis therapy during pregnancy, and this may ap-

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