Differences in Dietary Glycemic Load and Hormones in New York City Adults with No and Moderate/Severe Acne

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ARTICLE INFORMATION

Article history:
Submitted 16 June 2016
Accepted 27 March 2017
Available online 9 June 2017

Keywords:
Acne vulgaris
Diet
Glycemic index
Glycemic load
Insulin-like growth factor-1

http://dx.doi.org/10.1016/j.jand.2017.03.024

ABSTRACT

Background Glycemic index (GI) and glycemic load (GL) may be implicated in acne pathogenesis.

Objective This cross-sectional study examined differences between GI/GL and biological factors associated with acne among adults with and without moderate/severe acne. Secondary objectives included examining differences between food-aggravated acne beliefs and acne-specific quality of life among adults with and without moderate/severe acne.

Design As part of a cross-sectional study, participants completed a 5-day food record; blood draw to measure biological factors associated with acne (ie, glucose, insulin, insulin-like growth factor-1, insulin-like growth factor binding protein-3, and sex hormone-binding globulin concentrations); body composition assessment; and questionnaire to evaluate food-aggravated acne beliefs and acne-specific quality of life. Food records were analyzed using Nutrition Data Services for Research.

Participants Sixty-four participants (no acne, n=32; moderate/severe acne, n=32) from New York City, NY, were included in this study.

Statistical analysis Independent sample *t* tests and Mann-Whitney tests examined differences in anthropometric measurements, dietary intakes, biological factors associated with acne, insulin resistance, and acne-specific quality of life between acne groups. A χ^2 test for independence assessed differences in food-aggravated acne beliefs between acne groups.

Results Participants with moderate/severe acne consumed greater total carbohydrate (P=0.003), available carbohydrate (P<0.001), percent energy from carbohydrate (P<0.001), and GL (P<0.001) compared to participants without acne. Participants with moderate/severe acne had greater insulin (P=0.002) and insulin-like growth factor-1 (P=0.009) concentrations, greater insulin resistance (P=0.001), and lower sex hormone–binding globulin (P=0.015) concentrations compared to participants without acne. Although there were no differences between groups, 61% of participants reported food-influenced acne. Participants with moderate/severe acne reported a lower quality of life compared to participants without acne (P<0.001).

Conclusions The results from this cross-sectional study suggest a relationship between dietary carbohydrate, including GL, and acne. Future research is necessary to determine the effect of medical nutrition therapy on biological factors associated with acne and acne severity.
J Acad Nutr Diet. 2017;117:1375-1383.

ACNE VULGARIS IS A COMMON SKIN DISEASE, afflicting approximately 50 million Americans.[1] Although acne incidence peaks during adolescence, the prevalence of adult acne is increasing in developed nations,[2,3] and acne may appear, persist, or reoccur into the third and fourth decades of life.[3-7] Individuals with acne may experience a variety of physical findings and symptoms, predominantly affecting visible skin.[7] Consequently, acne is associated with considerable psychological distress, including poor self-esteem, body dysmorphic disorder symptoms, suicidal ideation, and depression.[8-13]

Acne is attributed to inflammation of hair follicles and sebaceous glands, as well as excess oil production and obstruction.[7,14] Androgen hormones and various other hormonal mediators, including insulin and insulin-like growth factor (IGF)-1, stimulate sebum (oil) production in the sebaceous glands, increasing tissue growth and augmenting the signaling pathways of insulin receptors.[15] Similarly, insulin-like growth factor binding protein (IGFBP)-3 and sex hormone–binding globulin (SHBG) can play roles in acne development by promoting the growth of keratinocytes and sebaceous glands.[16-18]

Epidemiologic studies typically report a low incidence of acne in non-developed nations, suggesting that environmental factors, such as diet, can play a role in acne pathogenesis.[19-22] While researchers and clinicians have theorized that a variety of foods and dietary patterns can influence acne, the evidence examining the potential relationship between glycemic index (GI) and glycemic load (GL) is especially intriguing and requires additional consideration.[13]

The GI is a system of ranking the potential of dietary carbohydrates to raise blood glucose and insulin concentrations.[23,24] The GL is a related concept that takes into consideration the type, as well as the amount, of carbohydrates consumed and is interpreted as an evaluation of diet-induced insulin demand.[25] GI and GL are implicated in the etiology of acne due to acute and chronic diet-induced hyperinsulinemia and the subsequent cascade of hormonal responses.[26,27] Insulin resistance and increased IGF-1 concentrations lead to changes in concentrations of circulating hormones, binding proteins, and receptors. These changes increase unregulated tissue growth, available androgens, and sebum production, amplifying acne-promoting pathways.[28]

Recent observational research supports a relationship between dietary GI/GL and acne.[29-39] Despite this, several questions and concerns remain. For example, many researchers have assessed dietary GI/GL using nonvalidated questionnaires[31,35,37,38]; measured the GI/GL of some, but not all, foods consumed in the study[30]; or used self-reported acne to categorize acne severity.[29,31,33] Other studies included participants with mild acne in the control group,[35,37] which may not accurately represent differences among participants with and without acne. In addition, few observational studies have evaluated the diet and biological factors associated with acne among participants with and without acne.[30,34,40] This oversight is a substantial shortcoming, given that the measurement of some biological factors associated with acne may provide important preliminary data to design future interventions, ultimately helping researchers understand the potential mechanisms linking diet and acne.

To address these concerns and limitations, a cross-sectional study was conducted to examine the differences in GI and GL and biological factors associated with acne (ie, insulin, glucose, IGF-1, IGFBP-3, and SHBG concentrations) among adults with and without moderate/severe acne. Secondary objectives included examining the differences in food-aggravated acne beliefs and acne-specific quality of life among adults with and without moderate/severe acne.

METHODS

Study Design and Sample

Participants were recruited for this cross-sectional study between September 2013 and September 2014 in New York City, NY, through flyers posted at local universities, community boards, and dermatology offices, and information distributed on university listservs and Craigslist. Participants were eligible for inclusion in the study if they had a history of no acne or moderate or severe acne for $\geq$6 months, were between 18 and 40 years old, had a body mass index (BMI; calculated as kg/m^2) between 18.5 and 30.0, were nonsmoking, and could read the English language. Participants were excluded from participation in the study if they reported a history of mild acne or acne for $<$6 months; reported any pre-existing condition that might alter dietary, laboratory, or acne assessments; reported recent weight changes ($>$10% weight change over the past 6 months); were pregnant; had a self-reported history of polycystic ovarian syndrome, prediabetes, type 1 diabetes, or type 2 diabetes; reported following a low-carbohydrate, low-GI, low-GL, or hypocaloric diet; reported taking medications known to alter glucose metabolism; or had pacemaker or other battery-operated implantable device. The University Committee on Activities Involving Human Subjects at New York University approved this study and written informed consent was obtained from all participants before data collection.

Participation involved a total of two visits (an initial and final study visit). Interested participants contacted study investigators and eligibility was determined over the telephone using the study inclusion and exclusion criteria. Potential participants were invited to schedule a study visit.

During the initial visit, the study investigators reviewed the study methods, answered any study questions, and measured height and weight. Participants were interviewed regarding prescription and over-the-counter medications, given a questionnaire that collected information on demographic characteristics, food beliefs, and acne-specific quality of life, and asked to complete a 5-day food and beverage record.

At the final study visit (approximately 2 weeks after the initial study visit), body composition and blood biochemical factors associated with acne were measured and digital photographs were taken of the front and side views of the face.

Anthropometric Measurements

The anthropometric measurements recorded during the initial study visit were used to confirm eligibility, whereas the anthropometric measurements completed during the final study visit were used for all statistical analyses. Weight and height were measured and BMI was calculated during both study visits. Weight was measured without shoes using a digital scale (Seca Corporation). Height was measured without shoes using a wall-mounted stadiometer (Seca Corporation). Waist circumference and body composition were measured during the final study visit. Waist circumference was measured three times at the iliac crest using the Gulick II constant-tension measuring tape (Country Technology, Inc) and mean waist circumference was calculated. Waist-to-height ratio was also assessed. Body composition was measured via bioelectrical impedance analysis using the QuadScan 4000 multi-frequency analyzer (Bodystat). Anthropometric measurements were recorded to the nearest tenth of a centimeter and kilogram.

Dietary Intake

A registered dietitian nutritionist provided comprehensive instructions on techniques to record food and beverage intake (ie, food description, portion sizes, food preparation, brand names, and times consumed) for 5 days, including 1 weekend day, using food models, measuring cups, and Gourmet Weigh food scales (Metrokane Inc) at the initial study visit. Participants were provided with handouts summarizing the food and beverage recording instructions. Participants were asked to return the completed food and beverage record at the final study visit. Participants were