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The impact of chocolate consumption on acne vulgaris in college students: A randomized crossover study

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To the Editor: The effect of individual foods on dermatologic disease has received renewed attention.[1] Fulton et al[2] investigated the relationship between chocolate and acne pathogenesis in an often cited, but flawed study. The Chocolate Manufacturers Association of the USA sponsored the Fulton study and the study subjects were prisoners.[3] There were no baseline data or quantitative analysis, and no difference in the sugar and fat content between the chocolate bar and the control bar.[3] The link of chocolate to acne vulgaris was replaced by the theory that a high glycemic index may contribute to acne vulgaris.[4-6] In this study, we attempted to revisit the controversial topic by assessing the development of new acne lesions following ingestion of chocolate versus a nonchocolate candy with a similar glycemic load.

Our study was a single-blind randomized crossover study of 54 college students (Fig 1) with an average age of 21.4 (±3.9) years with participant written informed consent and approval from the Youngstown State University Institutional Review Board. Subjects agreed to abstain from all other chocolate ingestion for the study duration; exclusion criteria included diabetes mellitus, dietary restrictions, or allergies to chocolate or jellybeans. Participants completed dietary logs and demographic surveys. Participants were randomly assigned to receive a 1.55 oz (43g) Hershey's milk chocolate bar

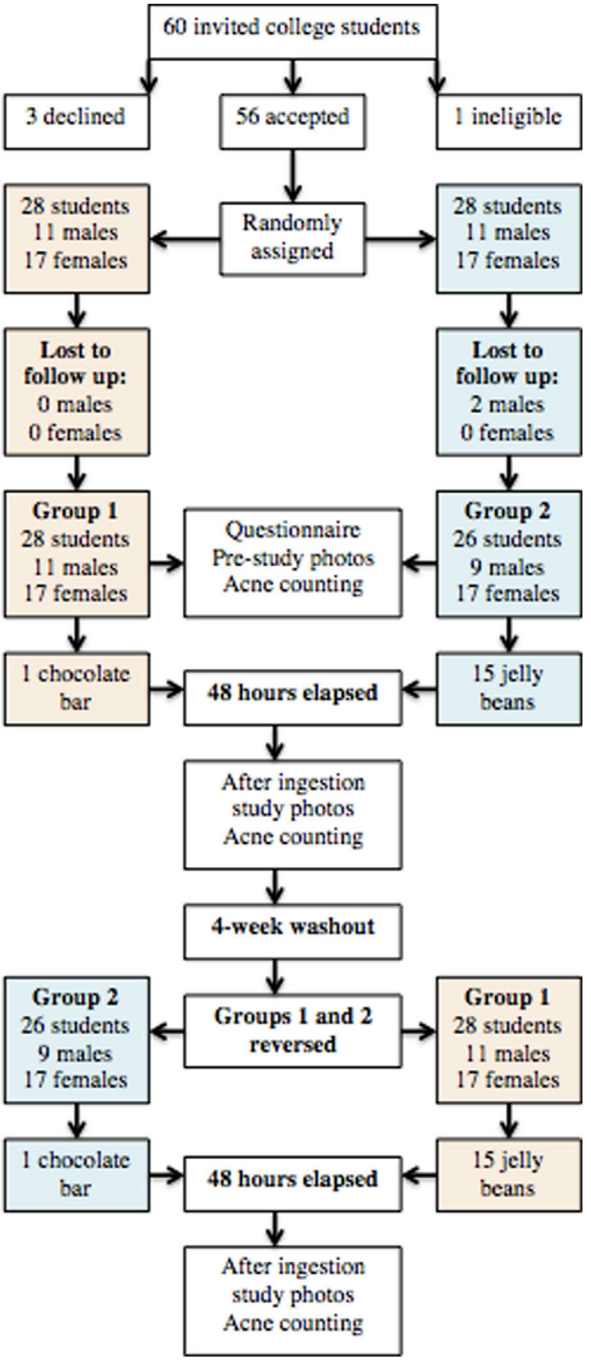

Fig 1. Study design flowchart: randomization, stratification, prestudy questionnaire, initial intervention, and crossover, subsequent intervention, and acne lesion assessment.

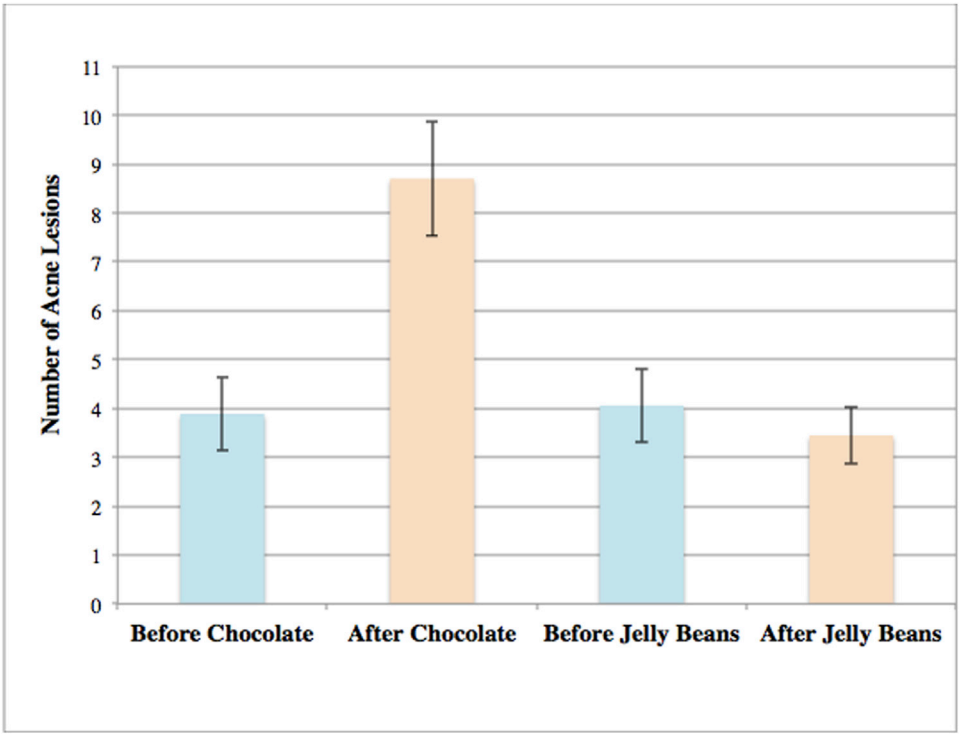

Fig 2. Overall change in acne lesions. Mean number of acne lesions (x-axis) for all study participants (n = 54) for each of the phases of the study (y-axis), before chocolate, after chocolate, before jellybeans, and after jellybeans. Error bars represent standard error of the mean.

or 15 Jelly Belly jellybeans which provided the same glycemic load. Acne changes were blindly assessed after 48 hours by a dermatologist who counted the number of acne lesions from photographs. Crossover analysis was done 4 weeks later. There was no statistically significant difference in the number of acne lesions between the 2 groups when the crossover occurred ($P = .322$), which demonstrates adequate washout from the first part of the study.

Fig 2 demonstrates that the chocolate consumption group had a statistically significant ($P < .0001$) increase in acne lesions (+4.8 lesions) compared with the jellybean consumption group (−0.7 lesions). The increase in acne lesions was present across gender, age, frequency, and severity classifications. To assess the effects of covariates on the number of lesions, linear regression analysis (SPSS Software, Chicago) was performed. None of the covariates (age, $P = .424$; stress, $P = .901$; gender, $P = .843$) showed statistical significance for the number of acne lesions. Furthermore, mixed model analysis assessing all combinations of the covariates did not show statistical significance with regard to outcome.

Chocolate flavonoid consumption modulates cytokine production, which may account for these observations. Netea et al[7] demonstrated that chocolate consumption primed human blood mononuclear cells to release more proinflammatory cytokines, interleukin-1β, and TNFα, upon stimulation with *Propionibacterium acnes*. Because overinflammation is an important contributor to acne pathogenesis and the antiinflammatory dose effect of antibiotics has been demonstrated to be most effective in treating acne, it is plausible that altered cytokine profiles can contribute to worsening acne.

Future studies with a larger study group using dark chocolate as well as specific components of chocolate, such as the flavonoids coupled with more diligent documentation of the participants' diets and menstrual cycles may provide valuable and comprehensive dermatology guidance to acne patients.

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Subungual debris cytopathology increases sensitivity of fungus detection in onychomycosis

To the Editor: Onychodystrophy has a variety of etiologies, including onychomycosis, psoriasis, lichen planus, eczema, trauma, peripheral vascular disease, systemic diseases, aging, and neoplasms. Onychomycosis, which accounts for half of cases, remains difficult to identify by standard mycologic techniques. A confirmed diagnosis is imperative to avoid unnecessary systemic antifungal treatments and potential toxicity.[1,2] Periodic acid—Schiff (PAS) staining of nail plate fragments is generally considered to be more sensitive than potassium hydroxide (KOH) preparation[3] and culture, although less sensitive, and remains an important method for the identification of challenging or treatment-resistant cases. Reported sensitivities and specificities are listed in Table I.

Even though fungal forms can be easily identified in the subungual hyperkeratotic debris,[4,5] the highly friable subungual material is easily dislodged and is not compatible with histologic processing.[6] One report describes the microscopic examination of PAS-stained subungual debris but requires abundant material.[4]

We describe the novel of application liquid-based cytopathology systems (eg, ThinPrep Pap Test used in cervical cancer screening) for the analysis of subungual debris in the diagnosis of onychomycosis. This study was exempt from approval by the institutional review board of the Legacy Research Institute, Portland, OR. We reviewed all nail plate clipping specimens submitted between January and March 2009 to 1 dermatopathology laboratory for histologic evaluation for onychomycosis. Specimens were processed using a standard processing protocol and paraffin embedding, from which both hematoxylin and eosin (H&E) and PAS slides were prepared. If a sample was negative on the initial histologic examination, the formalin in which the specimen was submitted was processed in a standard thin-layer cell preparation system (Thermo Cytofunnel and Cytospin) for adjuvant cytologic identification of fungal forms in the subungual debris. The pathologists reading the cytopathology of subungual debris

Table I. Sensitivities of PAS, KOH, and culture methods for the diagnosis of onychomycosis

Method (Reference)	Sensitivity
Culture*	49.5%
Culture*	29.4%
Culture†	62.1%
Culture‡	79.3%
Culture§	59.0%
KOH*	55.9%
KOH§	80.0%
KOH + Culture*	72.1%
KOH-A†	96.7%
KOH-A‡	90.9%
KOH-R†	83.3%
PAS*	93.1%
PAS*	88.2%
PAS†	93.3%
PAS‡	98.8%
PAS§	92.0%
PAS‖	85.0%
PAS (present study)	88.0%
PAS + Culture*	94.1%

KOH-A, Potassium hydroxide and light microscopy prepared and read by an attending dermatologist; *KOH-R*, potassium hydroxide and light microscopy prepared and read by a resident dermatologist.

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