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Associations among Acne Vulgaris and Western Diet

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Abstract

➢ Acne vulgaris is one of the most common dermatologic conditions, especially among the adolescent population.

➢ The pathogenesis of acne is largely multifactorial, with heredity and hormones strongly contributing to one's risk of developing the chronic inflammatory skin condition.

➢ High prevalence rates of acne in the adolescent population cannot be attributed to heredity alone, but by the influence of Western diet (WD) that overstimulates insulin-like growth factors (IGFs).

➢ The purpose of this scholarly project is to determine if there is an association between the presence of acne vulgaris and the consumption of WD, and if a physiological link between the high glycemic food and dairy products that compose the typical WD exists.

➢ Includes current research that focuses on the pathophysiology of acne vulgaris, the breakdown of high glycemic foods and dairy products and their propensity to cause inflammatory acne, as well as hyperinsulinism

➢ Anticipated to be found that consuming a WD increases IGFs leading to hyperinsulinemia, and furthermore, acne presentation by increased sebum production

➢ More research is needed before universal associations can be established.

Introduction

➢ Acne vulgaris, the most common skin ailment in the United States, has become a growing concern in today's population; more than 14 million office visits a year are attributed to the diagnosis and treatment of acne vulgaris (Mancini, 2008).

➢ This inflammatory disease of the sebaceous follicle now affects around 85% of adolescents in Westernized nations (Melnik, 2018).

➢ Acne is thought to be a disease of wealthy nations, where an abundance of food, particularly processed food, is readily available.

➢ Researchers seem to believe two major cellular processes, regulation of steroid hormone metabolism and innate immune function of epidermal keratinocytes, are disrupted in patients with acne (Szabo & Kemeny, 2011).

➢ There have been numerous studies that have suggested a relationship between acne vulgaris and consumption of the high glycemic and dairy-rich WD.

➢ While not fully understood, it is hypothesized that with the increase in consumption of high glycemic-load and dairy rich foods composing the WD, concentrations of insulin, IGFs, as well as free-circulating androgens has increased, disrupting the endocrine cascade and promoting acne formation.

➢ The purpose of this scholarly project is to explore the pathophysiology of acne vulgaris, determine if there is an association between the presence of acne and the consumption of WD and to establish a link connecting high glycemic foods and dairy products and their propensity to cause acne.

Statement of the Problem

➢ Incidence rates of acne vulgaris have been substantially increasing in the United States over the last 25 years. Heredity and hormones alone cannot account for this increase. Possible associations among dietary glycemic load and dairy consumption seen in the Western diet, along with insulin resistance in relation to the pathogenesis of acne need to be further investigated.

Research Questions

➢ Is there an association between the presence of acne vulgaris and the consumption of Western diet?

➢ Is there a physiological link connecting high glycemic foods and dairy products and their propensity to cause inflammatory acne?

Literature Review

Pathophysiology of Acne Vulgaris

➢ Increase in the production of adrenal androgens during adolescence typically occurs, leading to increased production of sebum by sebaceous glands

➢ Increased sebum, along with the accumulation of epithelial cells and keratin, obstructs the hair follicle, causing swelling of the follicle and formation a keratin plug; this process forms the earliest acne lesion, known as a microcomedone (Feldman, Careccia, Barhma & Hancox).

➢ As a keratin plug enlarges, it causes greater follicular swelling and increases the likelihood that the follicle can become colonized with *Propionibacterium acnes,* a normal skin flora, progressing the microcomedone to a visible comedone (pimple)

➢ With the proliferation of *P. acnes*, infiltration of proinflammatory mediators are stimulated, causing a localized inflammatory response that results in a painful papule or pustule (DynamedPlus, 2018).

Associations between High Glycemic Load Diet and Acne Vulgaris

➢ A randomized controlled trial performed by Cerman, et al. (2016) found that diets with high-glycemic-loads were positively associated with acne vulgaris for participants with present acne. Glycemic index and glycemic load levels were found to be higher ($p = .022$) when compared to the control group ($p = 0.001$). There was a positive correlation between acne severity and glycemic index values ($p = .014$, $r = 0.345$).

➢ Kaymak, et al (2007) found that dietary glycemic index, glycemic load, and insulin levels did not play a role in the pathogenesis of acne in younger patients.

➢ Smith, Mann, Braue, Makelainen, and Varigos (2007) used a randomized, investigator-masked, controlled trial to compare the effects of a low glycemic-load (LGL) diet with a conventional Western diet. They found that nutrition-related lifestyle factors seem to play a role in the pathogenesis of acne vulgaris: mean change in fasting insulin levels ($p = .03$), HOMA-IR ($p = .02$) between the LGL group and control group, with the LGL group showing improvement in insulin sensitivity and the control group showing increased insulin resistance.

Associations between Dairy-rich Diet and Acne Vulgaris

➢ A prospective cohort study of youth and lifestyle factors, titled, Growing Up Today Study (GUTS) was used by Adebamowo et al. (2008) to examine the association between acne presentation and dietary dairy intake among teenaged boys. They concluded that a positive association between the intake of milk and acne exists, and more specifically, skim/nonfat milk intake was associated with incidence of acne in adolescent boys.

➢ LaRosa et al. (2016) conducted a case-control study to investigate the possible association between dairy consumption and acne in the teenage population. It was found that the total dairy consumption in the acne group was significantly higher ($p = .02$) than the control group.

➢ A European, longitudinal, questionnaire-based population study designed by Ulvestad, Bjertness, Dalgard, and Halvorsen (2017) found that high-fat dairy products (two or more servings a day) were associated with moderate to severe acne appearance (18.5%, OR 1.55) in Norwegian adolescents. No associations were found with semi-skimmed or skimmed dairy products, nor with moderate intakes of any variety of dairy products.

Associations between Hyperinsulinemia and Acne Vulgaris

➢ Cordain et al. (2002) sought to investigate the prevalence of acne vulgaris in non-westernized societies, where individuals consume Paleolithic diets that constrain hyperglycemic carbohydrates, milk, and dairy products; these diets lack the dietary components that yield high glycemic loads that elevate insulin levels, therefore leading to hyperinsulinemia. Through their meta-analysis, it was found that not a single case of acne vulgaris was observed in the Kitavan subjects, nor the Ache Hunter-Gatherer group, during the observation periods and acne presentation is likely a result of the environmental factor, diet.

➢ Cordain, Eades and Eades (2003) conducted research examining the pathophysiology of hyperinsulinemia and insulin resistance in relation to acne vulgaris, and the biochemical breakdown of consumption of high-glycemic load carbohydrates was examined. They explained:

■ How consuming high-glycemic-load meals acutely increases hepatic secretion of very low density lipoproteins (VLDL), in turn increasing endocrine and homeostatic changes

■ How hyperinsulinemia can cause a shift in the endocrine pathways related to growth, and therefore cause upregulation of insulin growth factors, more specifically IGF-1, which reduces insulin-like growth factor-binding protein 3 (IGFBP-3)

■ How hyperinsulinemia can cause overexpression of the epidermal growth factor receptor (EGF-R) by elevating fatty acids in the plasma, which induces production of transforming growth factor-beta (TGF-beta1), and in turn, increased concentrations of both EGF and TGF-beta1 can depress localized keratinocyte synthesis of IGFBP-3, which leads to decreased availability of free IGF-1 to keratinocyte receptor and therefore promotes proliferation of keratinocytes

➢ Another biochemical study, published by Melnik (2018), found that intake of hyperglycemic carbohydrates and milk products both have the propensity to induce postprandial rises of serum insulin levels, which then in turn, signal the activation of mTORC1. Increased expression of mTORC1 kinases in the skin promotes cell growth and proliferation of keratinocytes.

Discussion

➢ Recent studies have suggested that as diets begin to Westernize, prevalence rates of acne vulgaris have increased.

➢ High-glycemic-load carbohydrates and dairy products now comprise nearly 40% of the daily energy in the typical Western diet in the United States, which is a secular increase in the glycemic load that has been occurring in the last few decades.

➢ With the increase in consumption of high glycemic-load and dairy rich diets, the concentrations of insulin and IGF-1, as well as free-circulating androgens, has increased, leading to hyperinsulinemia.

➢ Taken together, these data suggest that the endocrine cascade induced by hyperinsulinemia enhances sebum synthesis; with sebum production being essential to the development of acne vulgaris, this increase is paramount.

➢ All in all, more current studies are warranted to thoroughly examine the link of insulin resistance among the high glycemic load and dairy-rich foods that make up Western diet.

Applicability to Clinical Practice

➢ Not only can the presence of acne cause physical discomfort and scarring to an individual, but it can also cause life-long psychological and emotional scarring, increasing one's risk of depression and in some instances, suicidal ideation. Approximately 7% of patients with acne exhibit depression or suicidal ideation (Mancini, 2008).

➢ With acne vulgaris accounting for 35.0% of family medicine office visits in adolescent males and 66.9% of family medicine office visits in adolescent females, trying to determine a likely cause that is relatively modifiable, such as diet, is extremely applicable to primary care clinic providers (Verhoeven et al., 2008)

➢ The hyperinsulinemia that is linked with Western diet, can cause a number of diseases, such as hypertension, type II diabetes, dyslipidemia, coronary artery disease, obesity, and abnormal glucose tolerance.

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