


Acne and Food Relation: A Naturopathic Perspective

Dias Rima Sutiono, Ibdati Malika, Samirah, Nadita Putri Almira, Sheila Lestari
Indonesia International Institute for Life Sciences (i3L),
Jakarta Timur, 13210, Indonesia

ABSTRACT

Acne is a result of internal imbalance which appears in the form of inflammation, caused by the accumulation of oil, dirt and bacteria under the skin. Acne is the most prevalent skin disease and occurs in all ages, with the highest prevalence in adolescence. Naturopathy is the term for using prevention methods, based on the roots of the disease. This article is to review several scientific evidences on the association between acne and food. Thus, might support naturopathic perspective in acne prevention.

Keywords: Acne, hormonal regulation, naturopathy, sebum

ABSTRAK

Jerawat merupakan hasil ketidakseimbangan internal tubuh yang timbul dalam bentuk peradangan yang disebabkan oleh tumpukan minyak, kotoran, dan bakteri di bawah kulit. Jerawat merupakan penyakit kulit yang paling umum dan dapat menyerang segala usia, terutama remaja. Naturopati adalah istilah untuk penggunaan metode pencegahan penyakit berdasarkan akar penyebab. Artikel ini akan meninjau beberapa bukti ilmiah hubungan antara jerawat dan makanan. Hal ini dapat mendukung perspektif naturopati untuk mencegah jerawat. **Dias Rima Sutiono, Ibdati Malika, Samirah, Nadita Putri Almira, Sheila Lestari. Kaitan Akne dan Makanan: Perspektif Naturopatik**

Kata kunci: Jerawat, naturopati, regulasi hormon, sebum

INTRODUCTION

Acne is a ubiquitous skin disease that affects populations, mainly in urban areas. It is characterized with sebum blockage and accumulated hyper keratinization in the skin follicle opening.[1] This accumulation would attract acne bacteria to proliferate, triggering the immune system reaction in the form of inflammation.

Acne affects mostly adolescents in the age of 15-19 years old (women) and 17-21 years old (men).[2] A study from Indonesia's Cosmetic Dermatology group has reported that acne cases are found in 80% population especially in children, adolescents, and adults aged 11-30 years old.[3] Among the adolescents group, 85% are affected by minor acne which is a physiological process, while 15% are affected by major acne[4] which encourage them to go to the doctor or dermatologists.

Some studies tried to identify factors of acne susceptibility. The absence of hereditary factor indicates that environmental factors triggers the acne formation as well as daily urban diet.[5] In this review, this relation is then correlated with the naturopathic perspective in acne prevention.

Naturopathy is the term that applies for medical aspects of traditional knowledge, which focuses on mostly preventive function with vitalism and self-healing as focus points rather than evidence-based medication.[6] Because of these terms, naturopathy is considered as *pseudoscientific,*[6] which includes disease prevention by proper diet and control of nutrition intake. This method has been found to achieve homeostasis with the help of hormonal regulation as the body digests every nutritional intake.[6]

THE ORIGINS OF ACNE: INTERNAL IMBALANCES

In achieving homeostasis, sebaceous gland depends on hormonal regulation in producing an oily, waxy substance called sebum.[5] It is essential to lubricate the skin as well as protecting it from pathogenic microorganisms. Internal imbalances may occur and causes the sebaceous gland to secrete abundant production of sebum. This excessive and uncontrolled sebum production could block the follicle opening, preventing the sebum to spread on the skin surface (**Figure 1**).[5] Unhygienic skin conditions have a higher tendency for acne and pimple formation. The accumulation of dirt and dust particle clogs the skin follicle opening and prevents sebum to reach the epidermis. Sebum will accumulated inside the epithelial cells, expand and push the surroundings, producing amalgamation of epithelial cells and keratin flakes with the sebum.[8]

Inflammation as the Body Response towards Bacteria

The amalgamation formed a nutritious mixture thus attracts acne bacteria species: *Propionibacterium acnes* to mingle and proliferate.[9] Acne develops through specific stages:

The first one is the mild acne or non-inflammatory comedones which comprises of unexposed, small plugged follicles such as whiteheads and blackheads (**Figure 2**).[9]

Alamat Korespondensi *email: dias.sutiono@i3l.ac.id*

Comedones are the clog that blocks the follicle opening. Incomplete blockage will result in blackhead, known as open comedo. The blackheads usually appear in 1 mm to 5 mm in diameter.[5] Complete blockages would build whitehead known as closed comedo; the epidermis layer does not have any opening for the sebum onto the skin surface. The whiteheads may appear in different size: closed microcomedone is less than 1 mm in diameter; closed comedone is 1 mm – 2 mm in diameter and closed macrocomedone appear in up to 5 mm in diameter.[5]

The second stage of acne is moderate acne or superficial inflammatory lesions; consists of papule and pustule (**Figure 2**).[5] Papule is characterized by the presence of bacteria inside sebum mixture while pustule is characterized by the presence of white blood cells as immune response against bacteria in the sebum mixture.

The severe stage of acne is the deeper inflammatory lesions: module and cyst (**Figure 3**).[5] They have the appearance marked by an accumulation of white blood cells forming pus. Cyst has a softer trait than nodule. Deep-seated small nodule appears in 5 mm – 10 mm in diameter and deep-seated large nodule is more than 10 mm in diameter.[5]

ACNE, FOOD INTAKE, AND HORMONES

The production and secretion of hormones are affected by foods through the direct actions of digestive systems. As the gut digest food, nervous systems in the gut area are stimulated. The stimulation of nervous system changes the concentration of circulating metabolites in the blood, and it is secondary to circulating hormone level change.[11] An example of diet-dependent hormone is insulin, the well-known blood glucose regulator. The concentration of insulin hormone depends on peripheral insulin sensitivity, which is related to both total body fat stores and fat distribution.[12]

In relation with hormonal regulation, sebum is an acne formation precursor which is mainly controlled by hormones, including androgen. Based on clinical and experimental evidence, androgen is proven to affect sebaceous gland function, and is related to hyperinsulinemia which can trigger acne formation via androgenic effect.[13] Although the majority of androgen is produced by

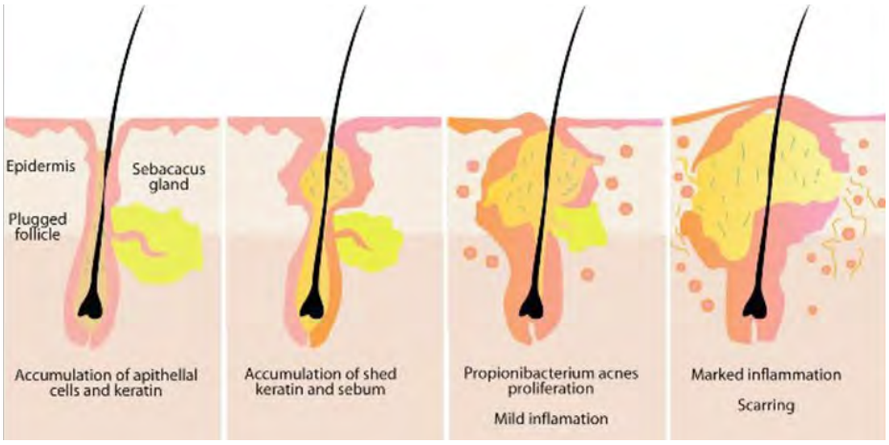

Figure 1. The visual chart of acne formation process. Acne formation is initiated by accumulation of epithelial cells and keratin often known as dead skin cells, an unhygienic condition of the skin. A certain condition of hormonal regulation promotes excessive sebum production by sebaceous gland. The accumulation of epithelial cells and keratin trapped the sebum under the skin, prevented to reach skin surface. The amalgamation of epithelial cells, keratin, and sebum attracts acne bacteria strain: *Propionibacterium acnes* to gather and proliferates. In response of the pathogenic presence, the body released white blood cells to engulf the microorganism (inflammation).[7]

Figure 2. Illustration of mild acne or non-inflammatory acnes: blackhead and whitehead comedones. The clog of blackhead has access to the skin surface, thus often called as open comedones. Whitehead comedones accumulated under the skin with no access to the skin surface, called closed comedones.[8]

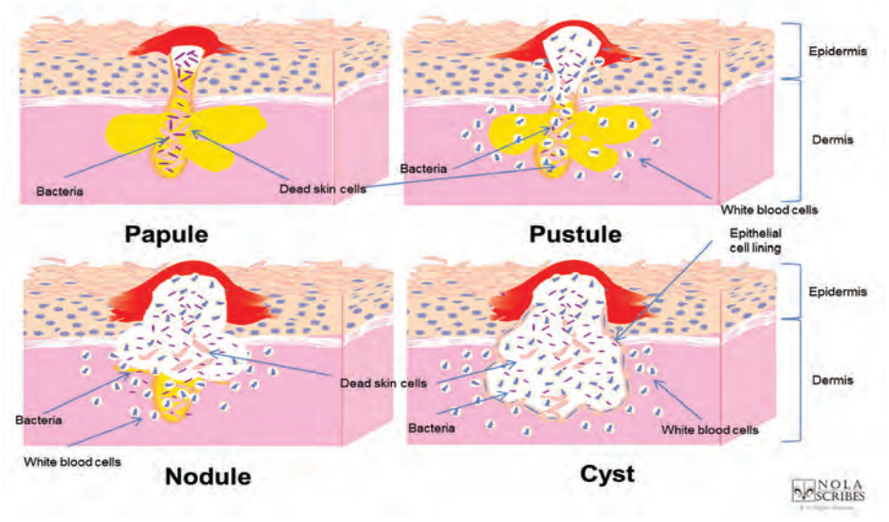

Figure 3. Illustration of inflammatory acnes; comprises of moderate acne and severe acne. Moderate acne includes papule and pustule, while severe acne includes nodule and cyst. These acnes are called inflammatory because acne bacteria occur in this stage. White blood cells engulf the pathogenic microorganisms as the bodily defense.[10]

	Glycemic Index
Grain Product	
Corn flakes	80±6
Wheat flake biscuits	69±2
Porridge, rolled oats	55±2
Instant oat porridge	79±3
Rice porridge/congee	78±9
Millet porridge	67±5
White rice	73±4
Brown rice	68±4
Sweet corn	52±5
Spaghetti, white	49±2
Rice noodles	53±7
Udon noodles	55±7
Doughnuts	74±2
Sugar, sweets	
Fructose	15±4
Sucrose	65±4
Glucose	103±3
Honey	61±3
Vegetables	
Baked potato	87±3
Sweet potato	63±5
Beets	60±3
Carrot	40±4
Raw Fruit	
Banana	51±3
Grapes	44±2
Watermelon	76±4
Dates	42±4
Orange	43±3
Snack product	
Chocolate	40±3
Popcorn	65±5
Potato crisps	56±3
Soft drink/soda	59±3
Rice crackers/crisps	87±2
Dairy Product	
Milk, full fat	39±3
Milk, skim	37±4
Ice cream	51±3
Yogurt, low fat	23±5
Soy milk	34±4
Rice milk	86±7

Table. Glycemic index of several foods. The average GI of common food is derived from multiple study, including various types of grain product, sugar, vegetables, fruit, snack product, and dairy product.[14]

the gonads and adrenal gland, androgen is also produced within the sebaceous gland from an adrenal precursor hormone called dehydroepiandrosterone sulfate. Androgen receptors are also known to be expressed in the basal layer of the sebaceous gland and in the outer root sheath keratinocytes of the hair follicle.[13]

NUTRITIONAL INFLUENCE ON ACNE FORMATION

High Glycemic Index Influence on Acne Formation

Glycemic index (GI) is defined as a relative comparison of the potential of various foods or combination of foods to raise blood glucose, based on equal amounts of carbohydrate.[5,14] It refers to the concept of Glycemic Load (GL) that was introduced to assess the potential of a food to raise blood glucose, based on both the quality and quantity of dietary carbohydrate.[5] The GI of food is based on the glucose content; the highest number is 100. Foods that have the GI of 55 or below is considered low, 55 to 69 is considered medium, and 70 or above is considered a high GI foods.[14] Glycemic load is the result of the division of glycemic index by 100, and multiplied by its available carbohydrate, excluding the fiber content (measured in grams).[5,14] For one serving of a food, a GL greater than 20 is considered high, 11–19 is considered medium, and 10 or less is considered low.[14] The calculation of glycemic load should follow its rule[14]. For instance, the glycemic index of corn flakes is 80, which is quite high. If a serving containing 30 grams of corn flakes have 25 grams of available carbohydrate, its glycemic load is 80/100*25 = 20[5,14]. From endocrine perspective, the importance of the glycemic index and load is that they are closely related to the insulin response.[5]

When a person regularly consumes high glycemic load foods, it will lead to hyperinsulinemia, a condition of a high circulating insulin. Hyperinsulinemia is known to stimulate sebocyte proliferation and sebum production, and raising androgen concentrations, which eventually contribute to acne formation.[15] The condition of hyperinsulinemia also elevates free IGF-1 (insulin like growth factor I) which directly stimulates basal keratinocyte proliferation.[5] Further, basal keratinocytes proliferation will be inhibited by the simultaneous reduction of IGFBP-3 (insulin like growth factor binding protein 3) irrespective of its IGF-1 receptor activity.[5] In normal condition, insulin influences the circulating concentrations of IGF-1 and IGFBP-3. IGFBP-3 is a potent proapoptotic factor in epithelial cells, including keratinocytes.[5] Normally, to prevent the acne formation, corneocytes (keratinocytes-derived cell) should undergo apoptotic process to avoid the blockage of pilosebaceous duct. While in the condition of IGF-1 activation, corneocytes obstructs the pilosebaceous duct, resulting in the formation of closed microcomedones, known as the precursor lesion of acne.[5,15] Additionally, increased proliferation of basal keratinocytes (which ultimately may become overly cohesive corneocytes) fuels the obstruction of the pilosebaceous duct.[5]

Acne, Dairy Product, and Fatty Food Components

Dairy products and fatty food derived acne are exception from the rule of high glycemic index foods, which is considered as the main precursor of acne. Dairy product exhibit low glycemic indexes and loads but paradoxically elicit high insulin responses.[5] Some authors have reported that the hormones in milk, such as IGF-1, 5α-reduced steroids, and α-lactalbumin, may survive milk processing.[1,5,9,15] Milk consumption has been reported to increase IGF-1 production in the body, which has been associated with ovarian androgen production in premenarchal girls and acne in adult women.[5,9]

Both insulin and IGF-1 are proven to stimulate the synthesis of androgen in ovarian and testicular tissues.[5] Androgen normally stimulates sebum production, but at an excessive amount, it will be pathogenetically involved in the development of acne. Some studies have shown that insulin and IGF-1 suppress the hepatic synthesis of sex hormone-binding globulin (SHBG), results in the increasing bioavailability of circulating androgens to tissues, which triggers an excessive sebum production.[5,9,15]

In addition, diets high in saturated fat increases the concentration of IGF-1, while low-fat, high-fiber diets tend to decrease the concentrations of IGF-1 and androgens, increasing the concentration of SHBG.[9]

Fatty Acid Influence on Inflammation

The presence of fatty acid components in food are believed to trigger inflammatory response, which results in acne formation. Regular intake of omega-6 and omega-3 polyunsaturated fatty acids (PUFAs) elevates the expression of pro-inflammatory cytokines.[5,9,15] Studies have suggested that inflammatory markers increase as the ratio of omega-6 PUFAs increases. Omega-6 PUFAs are precursors to pro-inflammatory mediators present in most vegetable oils and processed foods made with these oils.[5] While high levels of omega-3 PUFAs have been shown to decrease inflammatory factors, and may reduce the risk of acne formation by decreasing IGF-1 levels and preventing hyper keratinization of sebaceous follicles.[5,9]

To reduce the effect of omega-6 PUFAs, increased consumption of dietary omega-3 PUFAs may be beneficial because of their ability to suppress inflammatory cytokine production. Based on a study on omega-3 supplementary intake, it has shown that omega-3 PUFAs frequently suppress IL-1β,IL-1α, tumor necrosis factor-α, Il-6, and IL-8 in peripheral blood monocytes (PBMs).[5] The suppression of IL-1α by dietary omega-3 PUFAs may also positively influence corneocyte differentiation by preventing or attenuating the hyper cornification and scaling that occurs during microcomedogenesis.[5]

FUTURE DEVELOPMENTS FOR VALID CONFIRMATION

Naturopathy has the potential to be an alternative method in preventing acne formation, especially in adolescents. Food intake that contains high glycemic index, dairy product, and fatty acid is systematically proven to induce acne, but additional evidences and references are needed.

Glycemic index and fat contents in certain foods are reported to trigger acne prevalence. However, some other papers reported that these foods do not trigger acne. More research regarding acne prevalence caused by chocolate and fast food are needed.

Specific type of chocolate along with the dosage and concentration should also be studied deeper in clinical trial. Precise explanation about sugar content in chocolate types such as: dark chocolate, white chocolate and milk chocolate and its effect to acne formation are essential for valid result; since previous studies did not state the correlation clearly. Also the effect of chocolate consumption on acne lesion.

CONCLUSION

The formation of acne, pimple and inflammation depends on sebum secretion regulated by hormonal factors and the activation of inflammatory cytokines. Consumption of high glycemic index food, dairy and fatty products are also proved to trigger the secretion of androgen, which has a primary role in sebum production. While fatty acid components are responsible for the work of inflammatory reaction of acne formation.

The role of naturopathic medicine in preventing acne is through the association between acne and food intake.

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