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Short Communication

A Healthy Gut Means Clearer Skin

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Abstract

The desire to look beautiful and youthful is complete only with a healthy you from within! Skin health is influenced by environmental and lifestyle-related factors like nutrition, exercise, personal habits, and stress. A healthy lifestyle can postpone the visible signs of skin aging and favorably influence the longevity of the skin. The 'beauty attributes' including radiance, glow, softness, suppleness, and youthfulness are achievable if and only our skin is healthy and well-nourished. How much our skin is well-nourished depends upon the health of our gut.

Keywords: Skin; Gut; Lifestyle; Gut Microflora/ Microbiota; Inflammation; Homocysteine; Gene; Polymorphism; B Vitamins; Cobalamin; Methylene Synthase (MS); Methylene Synthase Reductase (MTRR); Atopic Dermatitis; Acne; Indole-3-Propionic Acid (IPA); Aryl Hydrocarbon Receptor (AHR); Indole-3-aldehyde (IAId); Tryptophan

What we see externally on the skin is a result of internal processes

In this competitive world everybody is tied up with their schedule, may it be at an office or your own sweet home. We hardly spare any time to relax, after all, we deserve it and no one can take better care of ourselves than us! Any overt sign seen on the face, may it be acne, pimple, blackheads, wrinkle, fine line, age spot or pigmentation is a resultant of vital internal processes that happen at the cellular level. The onset and severity of these external signs is decided by the cell's in-built capacity to cope up with the damage provoked by various external and internal stressors including heat, radiation, pollution, excess glucose, lack of exercise, stress, inadequate sleep, genetic variations, free radicals, collagen breakdown, and most importantly a poor gut health.

A healthy gut and a flawless appearance go hand-in-hand

Normally skin cells are replenished once in 30 days. If they aren't replenished at the right time, old and worn-out cells dominate causing skin health disturbances. Food and its components influence our skin health. Our skin cells are constructed with the nutrition derived from the foods that we consume. When we eat a balanced diet with a lot of fruits and veggies, and plenty of fluids we assume that we have done everything possible for glowing skin. But wait; there is something that we are overlooking. And it is simply making sure that the nutrients from our food are made usable by our skin. Now, who helps us in this? It is our gut or the digestive tract.

What is gut health? Why is it important for skincare?

Our digestive tract is the controller of our health, so it is also called the 'second brain'. It is responsible for breaking down our

food components into simpler units which the cells can use for energy production, growth, maintenance, and immunity or defence against harmful invaders. Apart from this, the gut also takes up the duty of clearing waste & toxic substances from our body. To keep the other organs healthy and functional, our gut needs to be in good health. Our gut health is primarily influenced by certain friendly microorganisms that habituate our lower digestive tract. The gut microflora or microbiome refers to nearly one trillion microorganisms (Bacteroidetes and Firmicutes as the dominant phyla and Actinobacteria, Proteobacteria, and Verrucomicrobia as minority members), of which ideally about 85% should be friendly to our health. An overgrowth of unfriendly, disease-causing microorganisms can result from unhealthy foods like the processed varieties and this can lead to undue inflammation in the body, showing up on the skin as acne or pimple. Simple sugar or refined sugar is also unhealthy for the skin as it disrupts the balance between unhealthy and healthy microbes, unfavourably moving the pendulum towards the unhealthy ones which erode the mucosal layer of the intestine. This causes poor absorption of skin-friendly nutrients like B vitamins, making the skin look dull, and delayed in its natural healing process [1,2].

How to improve gut health?

The best way to improve our gut health is by increasing the gut-friendly or good microbiome count. The growth of gut-friendly microbes is favoured by dietary fiber and fermented foods. They help our gut in the following ways-

- They maintain the integrity of the intestinal wall preventing episodes of diarrhoea. This can reflect on skin health as dehydration increases the chances of wrinkles.
- They improve the mucosal lining of the intestine which favours better absorption of nutrients and acts as the barrier against harmful microbes.
- They produce short-chain fatty acids (acetate, propionate, butyrate) which improve our immunity. Improved immunity makes our skin less prone to infectious acne [3].
- The level of sex hormones is also positively regulated by gut microflora. This is important for skin health as a hormonal imbalance can cause excess sebum, acne, and pimples.

Dietary fiber

Dietary fiber present in fruits (such as guava, papaya, strawberries, apple, banana, figs, and pears), vegetables (like cluster beans, black beans, brussels sprouts, broccoli, lady's finger, onion, and garlic, to name a few), flaxseeds, and whole grains like oats and barley is very good for gut health. Dietary fiber forms a gel when consumed along with plenty of fluids and is the favourite food for gut-friendly microorganisms.

Fermented foods

Fermented foods like kimchi, sauerkraut, kefir, yoghurt contain gut-friendly microbes or probiotics, notably lactobacillus, bifidobacterium, and Saccharomyces boulardii. Such foods are also called as prebiotics as they feed the healthy microbes. Probiotic supplements are also available in the market.

Can gut health be improved through genes?

Do we all have the same type of skin? Or do visible signs like acne, pimples, wrinkles or blackheads show up equally on us? Of course not! We have innate tendencies, based on our genetic expression, to decide our skin health. Our genes, in interaction with lifestyle factors (diet, activity, sleep, stress, pollution/radiation exposure, amongst others) have a huge role to play in deciding which visible sign and at what severity it will show up. Thus understanding why and how certain genetic changes are causing a visible sign is important, so that we can plan effective coping strategies through gene-specific nutrients.

Let's explore the gene-nutrient interplay in skin health…

B vitamins have significance in shaping the diversity and richness of our gut microbiota. Certain gut microbes are capable of producing B vitamins (thiamin, riboflavin, niacin, pantothenic acid, pyridoxine, biotin, folate and cobalamin), in limited amounts. While there are certain species of gut microbiome, the auxotrophic bacteria, which fulfill their vitamin requirements from the host. To handle this systematic competition, we should ensure optimal physiological levels of B vitamins, as their deficiency can impair normal cellular metabolism and instigate ageing signs on skin [3]. Dry skin with an uneven tone, cracked or chapped lips and angular stomatitis are some of the common skin health issues which root out from B vitamin deficiencies. A dietary supply of B vitamins

is essential to meet the host's daily requirements. Nevertheless, innate tendencies as determined through genetic variations are also crucial in influencing the bioavailability of a nutrient.

Undue or excess inflammation is unpleasant for the skin as inflammatory conditions like acne, rosacea and psoriasis can emerge. Higher levels of inflammatory markers like homocystine, correlate with inflammatory skin conditions [4]. Being a toxic by-product of cellular one-carbon metabolism, homocysteine doesn't stay in the blood for longer, and it is promptly disposed. Homocysteine is remethylated to methionine through the activity of Methionine synthase (MS/MTR). However the cofactor for this conversion, methylcobalamin, cycles through various oxidation states and is prone to oxidative inactivation. Hence, methylene synthase reductase (MTRR) reactivates MS by reductive remethylation of cob(II)alamin to methylcob(III)alamin. Hence the enzyme, methionine synthase reductase (encoded by the MTRR gene) has a vital role in the remethylation of homocysteine to methionine and the concurrent demethylation of 5-methyltetrahydrofolate to tetrahydrofolate. The enzyme function or its efficiency in reductive activation is influenced by variations in MTRR gene [5]. For instance, a polymorphism MTRR A66G or rs1801394 (66A --> G) results in a replacement of isoleucine with methionine at residue 22 in its encoding gene. The risk 'G' allele of A66G in the MTRR gene may reduce methionine synthase activity, causing homocysteine build-up and limitation in methionine availability. Supplementation with L-methionine can ensure that an appropriate supply of methionine is available for cells and tissues [5].

The MTRR enzyme depends on riboflavin and cobalamin for its catalytic activity. In a representative-sample study of 771 healthy adults (age range-18 to 75), total homocysteine level (tHcy) correlated significantly with MTRR gene polymorphism. The 'G' allele carriers of rs1801394 had 6.6% higher tHcy level compared to the AA genotypes when riboflavin status was optimal or marginally deficient. In the lowest cobalamin quartile (≤273 pmol/L), riboflavin status modifies the relationship between the MTRR 66 A>G polymorphism and tHcy (p for interaction: 0.034). The outcome of MTRR 66A>G polymorphism on the level of total homocysteine/tHcy is dependent on cobalamin and riboflavin status [6].

Alcoholism is yet another modifiable lifestyle factor which correlates with 'pale skin' due to macrocytic anaemia. Ingested alcohol is metabolized/oxidized to acetaldehyde through an enzymatic process by ADH/alcohol dehydrogenase. This is quickly followed-up by acetaldehyde conversion to acetate by aldehyde dehydrogenase (ALDH). Acetate gets metabolized to carbon dioxide, fatty acids, and water in peripheral tissues. Excessive alcohol intake increases the expression and activity of cytochrome P450 2E1 (CYP2E1), which promotes acetaldehyde production by formation of reactive oxygen species (ROS) [7]. Acetaldehyde induces its toxicity by inhibiting the enzyme methionine synthase. A reduced methionine synthase activity is seen in carriers of 'G' allele at A66G or rs1801394 in the MTRR gene. Additionally, due to alcohol consumption, acetaldehyde inhibited methionine synthase activity apparently by IC50 of 2 mM. Acetaldehyde-induced inhibition of methionine synthase was found to become irreversible over time. Hence, carriers may benefit from avoidance of alcohol overuse [8]. As methionine synthase enzyme is cobalamin-dependent, dietary sources of vitamin B12 are proven beneficial in averting macrocytic anaemia. Additionally, vitamin D deficiency is known to cause alcohol overuse [9]. And hence ensuring vitamin D adequacy through dietary sources as well as exposure to sunlight (without sunscreen) for 30 minutes, between 11 am and 2 pm, thrice a week are considered ideal to mitigate excess acetaldehyde generation.

The short-chain fatty acid, butyrate, produced by our gut microbiome is a prime source of energy source for colonocytes. It renders anti-inflammatory effects by modulating the host immunological processes. Additionally, the note-worthy metabolic interaction of host with gut microbiome transforms aromatic amino acids into various metabolites (indole-3-propionic acid and indole-3-acetic acid) constructively modulating the host immune system [10]. Indole-3-propionic acid or IPA is a gut microbiota-derived metabolite of tryptophan which has a potentially therapeutic role in skin disorders characterized by 'epidermal barrier dysfunction'. Gut microbiota, can thus modulate skin barrier formation and repair through tryptophan metabolism [11]. Commensal skin microbes synthesize metabolites (such as Indole-3-aldehyde/IAId) which activate the aryl hydrocarbon receptor/AHR and mediate several inflammatory responses. The AHR has a vital role in skin homeostasis and 'epidermal permeability barrier' development. It upregulates antimicrobial peptides and barrier genes to

favourable sculpt skin microbial communities. Atopic dermatitis/AD is a skin disorder which significantly alters skin microbiota's diversity, composition and functionality. A skin microbiota-derived tryptophan metabolite, namely IAId, diminishes skin inflammation in patients with AD, making known the role of skin microbiota in inflammatory disorders [12].

A compliment on appearance pleases anybody, and when we say appearance, the role of our skin is indispensable. Our skin stands first in the priority list of exclusivity and customized catering. Gut health is indispensable in a skincare regimen. Hence consider your gut health as a valid reason for your skin problems, and adapt a gut-friendly lifestyle to stay skin-healthy!

Bibliography

1. Hossain K S., *et al*. "B Vitamins and Their Roles in Gut Health". *Microorganisms* 10.6 (2022): 1168.

2. Nithyakalyani Mohan and Anusha Sunder. "Chapter 5 - From symbiosis to dysbiosis in gut- consequence includes metabolic syndrome; Microbial Biofilms". Academic Press (2023): 61-83.

3. Starke S., *et al*. "Amino acid auxotrophies in human gut bacteria are linked to higher microbiome diversity and long-term stability". *ISME Journal* 17 (2023): 2370-2380.

4. Chung B Y., *et al*. "Relationships of Serum Homocysteine, Vitamin B12, and Folic Acid Levels with Papulopustular Rosacea Severity: A Case-Control Study". *BioMed Research International* (2022): 5479626.

5. Kluijtmans L A., *et al*. "Genetic and nutritional factors contributing to hyperhomocysteinemia in young adults". *Blood* 101.7 (2003): 2483-2488.

6. García-Minguillán C J., *et al*. "Riboflavin status modifies the effects of methylenetetrahydrofolate reductase (MTHFR) and methionine synthase reductase (MTRR) polymorphisms on homocysteine". *Genes and Nutrition* 9.6 (2014): 435.

7. Hyun J., *et al*. "Pathophysiological Aspects of Alcohol Metabolism in the Liver". *International Journal of Molecular Sciences* 22.11 (2021): 5717.

8. Kenyon SH., *et al*. "The effect of ethanol and its metabolites upon methionine synthase activity in vitro". *Alcohol (Fayetteville, N.Y.)* 15.4 (1998): 305-309.

9. Galyuk TM and Loonen AJM. "Putative role of vitamin D in the mechanism of alcoholism and other addictions - a hypothesis". *Acta Neuropsychiatrica* 33.1 (2021): 1-8.

10. Konopelski P and Mogilnicka I. "Biological Effects of Indole-3-Propionic Acid, a Gut Microbiota-Derived Metabolite, and Its Precursor Tryptophan in Mammals' Health and Disease". *International Journal of Molecular Sciences* 23.3 (2022): 1222.

11. Uberoi A., *et al*. "Commensal microbiota regulates skin barrier function and repair via signaling through the aryl hydrocarbon receptor". *Cell Host and Microbe* 29.8 (2021): 1235-1248.e8.

12. Yu J., *et al*. "A tryptophan metabolite of the skin microbiota attenuates inflammation in patients with atopic dermatitis through the aryl hydrocarbon receptor". *The Journal of Allergy and Clinical Immunology* 143.6 (2019): 2108-2119.e12.