Chapter

Cosmetic, Culinary and Therapeutic Uses of Cucumber (*Cucumis sativus* L.)

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Abstract

Cucumber (*Cucumis sativus* L.) is cultivated throughout the world as an important vegetable. This review offers an insight on the versatile use of cucumbers for cosmetic, culinary and therapeutic purposes. Epidemiological and nutritional studies have shown various benefits associated with the use of cucumber. As cosmetic, cucumber is popularly used for natural beautification and for skin treatments. As a vegetable, cucumber is the quintessential materials and indispensable for salads, soups and smoothie with diverse health benefits including weight loss, remedy for chronic constipation, anti-inflammatory, cardiovascular and cancerous diseases among others. The use including weight loss, cosmetic, culinary and therapeutic purposes.

Keywords: cucumber, culinary, cosmetics, therapeutic, uses, health, benefits

1. Introduction

Cucumber (*Cucumis sativus* L.) is cultivated throughout the world because of its ability to thrive in both temperate and tropical conditions. As a result, fresh cucumbers are available throughout the year [1]. Historically, cucumber is one of the oldest cultivated crops and believed to be a native of the Asia continent [2]; parts of China with temperate climates and parts of southern regions of India with tropical climates. At present, cucumber is the fourth most widely cultivated vegetable crop in the world (after tomatoes, onions and cabbage) and China is by far the world's largest producer of it [1].

C. sativus belongs to the gourd family of Cucurbitaceous, which also includes cantaloupes, squash, pumpkins, melon and water melon [3, 4]. *C. sativus*is a tender creeping vine and hairy leaves with 3 to 5 pointed lobes. In general, it bears roughly cylindrical fruits and may be as large as 60 cm long and 10 cm in diameter with dark-green skin, crispy moisture rich flesh, and small edible seeds concentrated at its core [5]. There are close to 100 varieties, but common ones include the English, garden, Persian, mini, and lemon. Cucumbers are mainly eaten in the unripe green form when they taste sweet, have crunchy texture, and unique flavor. Thus, they are best-harvested young, tender and just short of reaching maturity. On getting to full maturity, the cucumber skin becomes tougher and turns yellow-white with an accompanied bitter and sour [1, 5].

Relative to other vegetables that have been widely researched and reported on, cucumber seems to have received little interest probably because of seemingly lack of concentrated levels of well-known bioactive compounds presents in garlic, onion, tomatoes and the likes. Generally, cucumbers are consumed because of their refreshing quality, in part due to their very high water content and crunchy texture. Studies have shown that cucumbers contain lignans, vitamin K, cucurbitacins and their derivatives (triterpenoids), flavonoids (apigenin, luteolin, quercetin, and kaempferol), antioxidants (beta carotene and vitamin C) and B vitamins among other trace elements and minerals [6–8]. With a 95% level of water content saturated with naturally-occurring nutrients and trace elements meshed in high dietary fiber, cucumbers are beginning to gain attention in therapeutic, culinary and cosmetic uses.

2. Cosmetic uses of cucumber

Cucumber has various benefits associated with skin treatments and natural beautification. As a cosmetic, cucumber is excellent for rubbing over the skin to keep it soft and white [9]. Because of its nutritious and an extremely cooling property, cucumbers are used by women to bringing cooling relief to the eyes in summertime [10]. Cucumber slices offer many topical benefits to the eyes and surrounding tissues through their hydrating properties, which work to reduce dehydration and their high levels of vitamin K that help reduce cutaneous eruption such as puffiness (eye bags) and dark shadows [9]. Cucumbers contain lignans that help to soothe down irritation and inflammation associated with sun burns and insect bites [11].

Cucumber fruit extracts are often incorporated as a primary ingredient in many topical skin preparations. Such preparations have been used as a moisturizer and skin toner by inhibiting tyrosinase [12]. Additionally, such preparations have been used to treat wrinkles and cleanse the skin. The deep cleansing action of cucumbers emanates from its naturally occurring organic acids such as glycolic, lactic and salicylic acids [9].

Glycolic and lactic acids are alpha hydroxyl acids used as chemical exfoliants that promote the natural removal of dead cells and to keep the protective surface layers healthy by dissolving the glue-like substance in the epidermal layer. The glue-like substance causes a buildup of dead skin cell layer; leaving skin dehydrated, dull and coarse. Histologically, alpha hydroxy acids have been shown to increase the thickness of the epidermis as well as cause increased collagen density, improved elastic fiber quality, increased papillary dermal thickness and increased dermal acid mucopolysacharide translating into thicker, healthier skin with fewer rhytids [13–15]. Alpha hydroxyl acids have been effective in the treatment of many skin conditions such as ache, psoriasis, bumps, pustules, eczema, dry skin, age spots, seborrheic keratosis, precancerous growths, hyperkeratosis, actinic keratosis and also black heads and whiteheads [16].

Glycolic acid is the most active and beneficial of the alphahydroxyl acids in skin care, because of its ability to penetrate through the cell wall by virtue of its small molecular size [17]. Once inside the cell, it triggers new formation of collagen and turns on the synthesis of dermal glycosaminoglycans to plump up the cell and the ground substance in the skin to reduce wrinkles on the skin's surface [18]. Lactic acid improves the appearance of photodamage and surface pigmentation [19].

Unlike glycolic and lactic acids, salicylic acid is a beta hydroxyl acid that exhibits a keratolytic, antiseptic and fungicidal properties [20]. It can be used for the treatment of hyperkeratotic and scaling conditions such as dandruff, ichthyosis and

psoriaisis [21]. The fungicidal properties of salicylic acid may partly explain the topical use of cucumber preparation in the treatment of fungal skin infections such as tinea [22].

Cucumber soap is used by many women, and a cucumber wash applied to the skin after exposure to keen winds is extremely beneficial. It is used in preparation of glycerin and cucumber cream. Cucumber has use in perfume production [9]. Overall, cucumber and its preparations have become part of daily beauty product into face packs, facials, juice and many other things which can affect your skin [1].

3. Culinary uses of cucumber

Cucumber is the quintessential fruit that can be added to a variety of dishes. Typically, they are indispensable for salads or used for pickling, soups and smoothie especially in warm season or summer. Cucumber wedges tossed in a garden salad (consumed with fried and barbequed foods), slices on a sandwich, or used as an appetizer for parties have become the mainstay of many of today's lunches [1].

There are basically three separate uses for cucumbers: fresh whole, fresh sliced, and pickled. Regardless of variety, fresh whole cucumbers are grown for consumer retail sales. On the other hand, fresh sliced cucumbers are typically garden variety and are grown for the foodservice sector, which requires uniform sized slices for packaged salads and restaurant chain salad bars.

Pickling cucumbers tend to be smaller and thicker. The best known variety is the bumpy-skinned gherkin. Not all pickled forms of cucumbers are fermented. Fermented pickled cucumbers are made by combining cucumbers with water, salt, and bacteria and giving the bacteria the right amount of time to convert various substances in the cucumbers into different bioactive compounds that can elicit health benefits especially in the gastrointestinal tract. However, the unfermented pickled cucumbers, though labeled as pickles and usually sold in grocery, are made by submerging cucumbers in a very acidic liquid (usually vinegar).

The consumption of fresh whole cucumbers has become a common trend among middle-class households in some African cultures. The fresh whole cucumbers are eaten alone as a snack or in conjunction with peanuts or peanut butter as an appetizer during folkloric/traditional display of hospitality.

In recent times, the cucumber diet have become increasingly popular and included among many sought-after choices because of its availability throughout the season, low calorific value and high dietary fiber as well as stress-free procedure associated with the conventional short-term weight reduction therapies [1]. In principle, there are no standard rules to this diet other than replacing most foods with cucumbers, along with a few protein-rich foods, such as eggs, chicken, lean meat, fish, cottage cheese and nuts. Since the diet lacks variety, it is considered extremely restrictive and unsustainable for a long-term with an attendant health risk.

4. Therapeutic uses of cucumber

Traditionally, cucumber has been used in folk medicine to treat diseases such as diarrhea, diabetes, and hypertension. Consisting mostly water in which numerous electrolytes and phytochemicals are saturated, the unique chemical profile of cucumbers is thought to elicit a number of possible health benefits Notwithstanding, that some of these claims are still undergoing investigation, there is proven evidence that the phytoconstituents in cucumber possess chemopreventive and anticancer properties, antioxidant and anti-inflammatory properties [23–26].

Cucumber has also been reported to modify plasma lipid and act as an analgesic [27]. Cucumbers are good sources of more than 73 different phenolic compounds known to elicit health benefits.

4.1 Hydration

On a daily basis, adequate hydration is crucial for healthy living and prevention of diseases especially the likes of constipation and kidney stones. Cucumber is a good source of superior hydration due to high content of water (95%) saturated with naturally-occurring electrolytes. Consumption of cucumbers offers the cells the much-needed hydration and vital nutrients required for optimal cellular functioning, repair and maintenance of membrane integrity [28, 29]. Thus cucumbers can help prevent dehydration during summer time or during and after exercises. Cucumber extract when pharmacologically refined has been reported to have the potential in the treatment of corneal acid burn through its hydrating properties [9].

4.2 Body weight management

Cucumbers have high content of dietary fiber and very low calorific value resulting from low carbohydrates and very low amount of protein and fat contents. Consumption of cucumbers can help to heighten satiety and naturally curb appetite, which make it easier to cut down on food intake. Cucumbers also improve digestion because of their high fiber content, and adequate digestion has been linked with easier weight loss. In view of the aforementioned, the cucumber diet has emerged and has been included among many sought-after choices in short-term weight loss therapeutic regimens [1]. However, it should be noted that cucumber diet are usually restrictive in variety and as such must be complemented with some protein-rich foods.

4.3 Bone health

Cucumber contains calcium, phosphorus and vitamin K. Vitamin K helps to improve calcium absorption. A sufficient intake of these elements has been associated with maintenance of healthy bones that are less likely to fracture especially among the elderly. Put together, these nutrients contribute to good bone health.

4.4 Management of blood glucose level

Cucumbers have a low score on glycemic index (GI), indicating that they provide important nutrients without or with minimal carbohydrates that can cause a spike in blood glucose level [30]. Besides, a recent report suggested that cucurbitans in cucumber can stimulate the release of insulin and regulate the metabolism of a key hormone in the processing of blood glucose and hepatic glycogen [31]. Put together, this may suggest that cucumbers may help in the control and prevention of diabetes, given credence to folkloric claim.

4.5 Potential anti-cancer health benefit

Cucumbers contain high levels of triterpen family of phytochemicals known as cucurbitacins. The consumption of cucumber avails us cucurbitacins A, B, C, D, and E, which may help prevent cancer by stopping cancer cells from proliferating and surviving. Cancer research studies have proved that the JAK–STAT and MAPK signaling pathways involved with cancer cell development and survival can be

blocked through the effects of cucurbitacins [24, 25]. While there are currently no current anti-cancer therapies that utilize cucurbitacins, experimental research has yielded promising results awaiting confirmation in human studies [31, 32].

The results of cancer studies have shown that cucumber lignans such as lariciresinol, pinoresinol and secoisolariciresinol are converted by intestinal bacteria into enterolignans. These enterolignans including enterodiol and enterolactone have been reported to bind to estrogen receptors thereby eliciting both pro-estrogenic and anti-estrogenic effects [33]. Some preliminary results have shown that consumption of plant derived lignans including cucumbers can reduce estrogen-related cancer risk of the ovary, prostate, breast and uterus [34].

4.6 Cardiovascular health benefits of cucumber

There are several processes through which cucumber consumption may elicit cardiovascular benefits. Cucumbers are good sources of dietary fiber, particularly in their skins. Dietary fibers are known to significantly reduce the absorption of dietary cholesterol thus positively modifying the blood lipid profile with an attendant reduction in cholesterol buildup in the arteries. More so, cucumbers provide potassium and magnesium that may contribute to preventing high blood pressure [9, 35, 36]. With 73 different phenolic constituents, cucumber provides protection against oxidative insults for the blood vessels and their vulnerable contents such as low density lipoproteins among others [26].

The cucurbitacins in cucumber may also help prevent atherosclerosis. There have been reports on Cucurbitacin B and E in glycosidic form to exhibit inhibitory effect on lipid oxidation products like malondialdehyde (MDA) and 4-hydroxynonenal (4-HNE) [37, 38]. These positive reports bolster the therapeutic role of cucurbitacins in artherosclerosis, which involves modification of lipoproteins by involvement of- MDA and 4-HNE [39].

4.7 Antioxidant and anti-inflammatory benefits of cucumber

A good number of phytochemicals present in cucumber have been reported to exhibit antioxidant and/or anti-inflammatory activities via sparing effect on other antioxidants and/or regulation of antioxidant enzymes in metabolic pathways involved. Small-scale human studies have been conducted using some of these identified phytochemicals in cucumber and found to provide some health benefits [29]. The cyclooxygenase 2 (COX 2), a pro-inflammatory enzyme, has been shown to be inhibited by cucumber extract [34]. In addition, antioxidant enzymes like superoxide dismutase, catalase and glutathione peroxidase showed increased activities in studied participants that consumed cucumber powder. Some studies have shown that cucumber can reduce the generation of reactive oxygen species (ROS) and reactive carbonyl species (RCS), which could be of help in individuals with type 2 diabetes. The high content of phenolic compounds (flavonoids and terpenoids) present in cucumbers may be involved in this probable health benefit by significantly lowering the levels of ROS and RCS. Its high content of fisetin flavonoid gives it the potential anticancer, antioxidant and anti-inflammatory benefits [40]. Since cucumbers are rich in phytonutrients, there could be logical theoretical link between their consumption and amelioration of some chronic diseases.

4.8 Other health benefits of cucumber

The peel and seeds are the nutrient dense parts of cucumber and contain beta-carotene that is good for the eyes [41]. Cucumber provides an alkaline diet,

and due to its triterpene content, works well in regulating diseases of the immune system [42]. Majority of alkaline fruits and vegetables like cucumber are also anti-inflammatory in nature [43] and thus neutralize the body's acid pH specifically in the kidneys [29].

5. Conclusions

The cosmetic and culinary uses of cucumber without any reported adverse effect are indicative of its versatility. Cucumbers are endowed with phytochemicals that have been reported to elicit positive health benefits ranging from hydration of body cells, body weight control and management of degenerative diseases. It is hoped that as more clinical researches are conducted on whole extracts and phytoconstituents, amazing health benefits shall be unfolded and folkloric claims shall be clarified for diverse but specific therapeutic uses.

Conflict of interest

The authors declare no conflict of interest.

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