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Importance and health benefits of Cucurbita pepo (Pumpkin Seeds)

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Abstract

Pumpkin belongs to the genus *Cucurbita* and family *Cucurbitaceae* is grown all around the world for a variety of reasons. As the seeds are considered as byproduct of the pumpkin fruit, they are cheaper in cost and their utilization in different food products may lead to enhance their nutritional value at lower cost. Health promoting impacts of pumpkin seeds on a level of high antioxidant value along with anti-diabetic, anti-microbial and anti-cancer properties. This study deals with the review of research work reported on the importance and health benefits of pumpkin seeds, whose application can be considered as a good alternative for the nutritional enrichment of food products and could be consumed as food, having a rich source of nutrients.

Keywords: Cucurbita pepo, pumpkin, antioxidant, antidiabetic

Introduction

Pumpkin (*Cucurbita*) belongs to the family Cucurbitaceae generally grown in the regions of the globe as a vegetable. These are grown-up in the tropical and sub-tropical regions and including the cucumbers and squash. Worldwide there are three types of the pumpkins are present name as "*Cucurbita pepo*", "*Cucurbita maxima*" and "*Cucurbita moschata*" (Lee *et al.*, 2003) [12]. Pumpkin plant has large leaves, sprawling veins with coiled, modified leaves called tendrils. The leaves are simple, alternate and shallowly to deeply lobed. The root near the surface, stem would be square, flowers will be bright yellow and the fruit is more fibrous and less sweet than winter squash. Seed vary in size based on diversity and type (Silky and Bisla, 2024) [21]. Pumpkin seed have a real defensive skin called the hull. The pumpkin plant has been grown since the earliest history of mankind.

Importance of Pumpkin Seeds

Medicinal use

For the purpose of vegetable and medicinal pumpkins are grown throughout world. In many countries the pumpkin has been conventionally used as remedy like China, Pakistan, India, Yugoslavia, Argentina, Mexican regions, America and Brazil (Jia *et al.*, 2003) [9]. The pumpkin seeds are utilized for the cure of different diseases the herbal remedies separately or combine with medicines are used for the medical treatment. The pumpkin is the one of the famous edible plant that is utilized as the cure of many disorders due to the occurrence of many edible components and phytochemicals. Pumpkin seed oil has a strong anti – oxidant properties and has been recognized for several health benefits such as prevention of growth and reduction of size of bladder and urethral compliance, alleviation of diabetes by promoting hypo glycaemic activity, lowering the level of gastric, breast, lung and colorectal cancer (Yadav *et al.*, 2010) [24].

A healthy and well-nourished person depends on healthy food system. Nowadays, malnutrition imposes high cost on society. It comes in many forms and under nutrition is most prevalent form in developing countries. In 2017, the number of undernourished people is estimated to have increased to 821 million around one out of every nine people in the world. While some progress continues to be made in reducing child stunting, levels still remain unacceptably high. Nearly 151 million children under five are affected by stunting in 2017 (FAO, IFAD, UNICEF, WFP and WHO, 2018) [7]. Moreover, about 2 billion people in the world lack vitamins and minerals which are essential for healthy life (Kanwal *et al.*, 2015) [11].

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Use in a bakery products

In addition of benefit pumpkin is inexpensive and widely distributed. Pumpkin seed flour can be used to fortify soups, cookies, pancakes and breads. Moreover, it is also used to fortify wheat flour to produce bakery products like pastries with unique and nutty taste (Mamoun and Nada, 2019) [13]. Less money is spent on marketing, especially communicating the benefits of new products (Johi, 2010) [10]. All properties of pumpkin seed flour make it potentially valuable supplement to food products to offer high quality and nutritious products.

Bakery products in India are in common use. Items like breads, biscuits, buns, doughnuts, cookies etc. are very much popular among people and use them in their daily life, because they are cheaper and largely accepted. Attempts at popularizing bakery products among all has been successful because these products are considered easy, convenient and rather inexpensive means of taking food in hygienically prepared ready-to-eat form (Revathy and Sabitha, 2012) [18]. Biscuits are one of the oldest baked goods and consumed extensively worldwide by all age groups. The popularity of biscuits comes from their attributes, such as high palatable, nutritious, quickly released energy and available in convenient sizes, as well as in various forms. In addition, the biscuits formulation can be modified easily to meet the nutritional demands of the target consumers (Ashaye *et al.*, 2015) [3].

The seed content of pumpkin fruit varies from 3.52% to 4.27%. It has high nutritional value, provides good quality oil and excellent source of protein and has pharmacological activities such as antidiabetic, antifungal, antibacterial and anti-inflammation activities, and antioxidant effects. Pumpkin seeds have historically been used to produce oil, fortify breads, consumed as a snack or even for medicinal purposes (Dar *et al.*, 2017) [11].

Awareness of the health benefits of pumpkin seeds

The pumpkin seed has many health benefits and are considered as nutritional powerhouses, with a wide variety of nutrients ranging from magnesium and manganese to copper, protein and zinc. The pumpkin seeds have anti-parasitic activity due to the presence of cucurbitin (Devi *et al.*, 2018) [15]. Pumpkin seeds contain remarkably high proportions of essential amino acids along with various elements like K, Cr, Na, Mg, Zn, Cu, Mo and Se; etc. D-chiro-Inositol, isolated from pumpkin has been considered as an insulin action mediator (insulin sensitiser) and has been linked to its antidiabetic activity (Adolfo and Michael, 2005) [2].

In Sudan, the awareness of the health benefits of pumpkin seeds start to grow day by day. Nowadays, pumpkin seeds are eaten side by side with water melon seeds named (Tsaly) after roasting, which is presented for hospitality purpose in different felicitous occasions especially marriage. Although, Sudanese pumpkin seeds are directly consumed but large quantities are considered as by products (Toan and Thuy, 2018) [22]. Recently, several research projects have been conducted to endorse the nutritional and health aspects of pumpkin seeds and vouch for their use in dietary intervention. Supplementary foods are used to reduce the malnutrition; and supplementation could be applied in ready to eat bakery products and drinks (Onabanjo and Dickson, 2014) [16].

There has been considerable attention toward the pumpkin seeds recently due to its nutritional value and the health benefits. Pumpkin seeds are generally considered as waste product and it is rich in bioactive compounds with nutraceutical properties (Montesano *et al.* 2018) [14]. *In vivo*

experiments have been proved that natural bioactive compounds in pumpkin seeds such as carotenoids, tocopherols and sterols have wide range of biological activity on prevention of hypertension, diabetes and cancers (Dyshlyk *et al.* 2017) [6]. In addition, pumpkin seed flour is gluten-free ingredient, therefore it can be recommended to the patients suffering from gluten intolerance or celiac disease (Patel, 2013) [17].

Anti-cancer activity

High phenolic content and vitamin E levels have been linked to its potent antioxidant activity which significantly increases the serous and hepatic activities of superoxide dismutase and glutathione peroxidase *In vivo* and reduces the concentration of malonaldehyde (Chang *et al.*, 2004) [5]. Remarkable anti-cancer actives have been isolated from pumpkin extracts which include; MAP2 (MW 2249 Da) and MAP4 (MW 4650 Da); which inhibited the growth of leukemia K-562 cells. A novel ribosome inactivating protein (RIP) called moschatin isolated from mature pumpkin seed was used in the fabrication of moschatin-Ng76 immunotoxin which inhibits the growth of targeted melanoma cells M21 effectively (Xie, 2004) [23].

Anti-hyperglycemic

Diabetes is a metabolic disease which is a serious problem of modern society due to the severe health complications associated with it. Pancreatic β -cells release insulin which is the hormone responsible for glucose homeostasis. The inappropriate utilization of insulin leads to insulin resistance, which is characterized by the inability of cells to respond to normal levels of circulating insulin, thus leading to glucose metabolism disturbances are main factors leading to diabetes. For this reason therapeutic targets should lead a durable maintenance of glycemic control in the diabetic. Therefore, numerous herbal medicines, found to be effective in the long-term management of type 2 diabetes mellitus. (Bharti *et al.*, 2013) [4].

Tocopherol isomers (α , β , γ , and δ) from raw pumpkin seeds has been reported to be effective in the alleviation of diabetes through its antioxidant activities. Tocopherol was extracted and quantified of the seeds oil of *C. pepo* producing α -tocopherol ranged from 75 $\mu\text{g/g}$, 75 $\mu\text{g/g}$ to 493 $\mu\text{g/g}$ for γ -tocopherol, and from 35 $\mu\text{g/g}$ to 1110 $\mu\text{g/g}$ for δ -tocopherol. Tocopherol fraction of pumpkin seed oil was studied in hyperglycemia Wistar rats induced with nonionic copolymer PX-407 with impaired response and loss of β -cell sensitivity to glucose, which is considered as an appropriate model to study the activity of hypoglycemic drug (Perez Gutierrez, 2016) [19]. Results indicated a decreased of insulinemic, lipid profiles and glycemic levels. In addition, *in silico* constrained an unconstrained docking studies was performed using FRED and HYBRID programs to understand the mechanism of action with respect to three hypoglycemic proteins, PTP1 B, PPAR- γ , and DPP-IV with respect to 10 botanicals. In nonconstraint docking, all the tocopherols showed interaction in the active sites of the proteins. A significantly reduction in oxidative markers and enhanced cecal and pancreatic characteristics were also observed (Sesti, 2006) [20].

Antimicrobial activity

Antimicrobial chemotherapy has revolutionized modern medicine and has significantly reduced death and ailments from infectious diseases. Nevertheless, microorganisms have progressively diminished the effectiveness of previously

successful antibiotics by developing resistance. Certain bacteria's can secrete an extracellular polymer layer (biofilm) that accumulates and surrounds bacterial cells to resist to antibiotics. Bacteria in a biofilm present more resistance to multiple antibiotics those planktonic bacteria. In intracellular infections most antibiotic have poor cellular penetration and limited intracellular retention. Therefore develop of novel bioactive are of a high interest. The infection caused by multidrug-resistant and pandrug-resistant strains are often hard to treat due therapeutic options. Currently there is a great interest on natural antimicrobial molecules in hope that they may provide useful leads into anti-infective drug candidates. (Gutierrez, 2016)^[8].

Conclusion

With increased public awareness in sustainable agriculture, clean and efficient energy and waste management technologies, pumpkin seeds have the opportunity to capture a new and emerging market share in the snack food industry. These reports from several studies suggested that pumpkin seeds have the potential to be developed as novel value added product, which are rich in nutrients and to combat wastages of pumpkin seed. The application of these seeds can be considered as a good alternative for the nutritional enrichment of food products and could be consumed as food, having a rich source of oil and nutrients. The use of these by-products adds value to the production, besides contributing to the formulation of new food products and minimizing losses. So, it gives new opportunity to explore the possibilities for the production technologies for the different value added products from pumpkins seeds.

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