

DAHLIA FLOWERS AND TUBERS – A HEALTHY AND NOURISHING FOOD FROM MEXICO

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The Dahlia is a plant (*Dahlia spp.*) from the *Asteraceae* family, native to Mexico, where it grows in the wild primarily in temperate climates and altitudes over 1000 MASL. The Dahlia genus has 43 species, all of them with a morphology characterized by tuberous roots or tubers, a hollow stem and capitulum inflorescence. *Dahlia coccinea* is the most geographically distributed species in Mexico, since it is found in almost every single Mexican state, excluding the peninsulas. This led to a great knowledge and consumption of the plant by the Mexico inhabitants of the past.

Dahlia was brought to Europe in 1789 as a medicinal and nourishing plant. The Spaniards later found out that the past inhabitants of “New Spain” would use it to quench their thirst, given that their hollow stems and base are normally full of water. Also, their tubers were consumed as food and herbal remedies to fight external skin, eye and ear infections. In both Spain and France, the Dahlia was consumed as food for a few years; however, with the arrival of crops, such as the potato, consumption of Dahlia tubers decreased. In Mexico, Dahlia was consumed as food by various human groups, from the Tarahumara group in the North, to the Purépecha and Nahuatl groups in the center of the country, all the way to the Mixteco, Zapoteco and Mayan groups in the south of Mexico.

In 1963, the Mexican president Adolfo López Mateos declared all of Dahlia’s species the Mexican National Flower, which consequently meant a boost to the Dahlia’s value. The genetic improvement process conducted in Europe, particularly in Germany, allowed the development of over 50,000 plant varieties. These are divided in 22 types of striking flowers varying in shape, size and color. The flowers are cultivated all over the world for cut flowers, potted plants and gardening.

Nowadays, particular attention has been paid to this plant, since it has been acknowledged that its tubers are not just a source of nourishment, but they also have properties as a functional food. In farming conditions it can generate from 3,000 up to more than 80,000 kg/ha.; given this, its nutritional content and its addition to the regular diet of different male and female groups are analyzed in this document.

Dahlia characteristics.

One of the most important characteristics of Dahlias is its tuberous roots; each species produces a different amount of tubers, and thus, a different nutritional content, which makes it a significant source of nourishment and medicinal compounds. Similarly, its flowers have great functional properties as a source of beneficial antioxidants and pigments for the eyes and skin.

The most distinguishable species due to their beauty and distribution in the wild, common in the Mexico Valley are: *Dahlia coccinea*, most well-known species in Mexico, famous for its eye-catching orange, red or yellow flowers and its plentiful, tasty tuberous roots. Until recently, farmers would consume this plant and use it to treat external skin infections; *Dahlia pinnata* (sin. *Dahlia sorensenii*), similarly to *D. coccinea*, it has a plentiful production of tuberous roots, and its flowers are lilac and medium size from 31.5” to 59” high; *Dahlia merckii*, it grows in colder regions and has long, thin stems; its tubers are short and bulky, and tend to be yellowish in their insides; *Dahlia campanulata*, shrub type, with strong stems with a height over 7 ft. tall; its roots are long and fragile; their insides are light colored; this species contains the most amounts of inulin and tends to be low on fiber; *Dahlia brevis*, it grows in the State of Mexico with a low amount of tuberous roots, which are small and rounded; its capitulum is small as well.

Pre-hispanic use.

The medicinal usage of the Dahlia, also known as *acocoxochitl* (*flor de tallo hueco* [hollow stem flower]), is documented in the Códice Florentino for conditions such as cough and gastrointestinal problems. Groups of people who inhabited the Lake of Texcoco in the Mexico Valley knew this plant and made sure to immortalize it in the multiple petroglyphs we can admire today in various Xochimilcan built churches from the XVI century. Some of these petroglyphs can be admired in the Museo de Arqueología (Archeology Museum) of Xochimilco and in the baptismal fonts of the San Bernardino and Zumpango churches in downtown Xochimilco and State of Mexico, respectively.

Dahlia today.

The Secretaría de Agricultura y Desarrollo Rural formerly known as SAGARPA promoted the creation of the “Red de Dalias” (Dahlia Network), a collegiate body for investigators, academics and individuals who are dedicated to the study, conservation and utilization of the Dahlia species. With the support of the “Sistema Nacional de Recursos Fitogenéticos para la Alimentación y la Agricultura” (SINAREFI), 30 Dahlia species, protected by the SNICS-SADER, were collected. For 20 years now, the Universidad Autónoma Chapingo has been conducting many studies about the growth, breeding and utilization of Dahlia species. Results are widespread and publicized in rural communities of several states, hoping that people from those places will establish small Dahlia production plots. These plots would make for beautiful landscapes full of flowers, which, in addition to contributing to its surroundings, would produce flowers and tubers that could be consumed as food in many dishes. These could also be used for their medicinal benefits in people with diabetes, gastrointestinal problems, high cholesterol or triglyceride blood levels and obesity. In addition to promoting its usage as an ornate flower, with the creation of different varieties, its flowers are now promoted as a gourmet, functional food. A bilingual recipe book is now available to spread the elaboration of dishes with Dahlia flowers and tubers (Martínez-Montes et al., 2008).

Nutritional properties.

Studies conducted by students and investigators of Universidad Autónoma Chapingo, have permitted the promotion of the crop and the utilization of Dahlia species in communities with high or very high levels of marginalization as a source of food and nourishment (Table 1), and for its herbal medicinal benefits to treat severe obesity, high cholesterol or diabetes mellitus.

Table 1. Nutritional content in tubers from different wild and cultivated *Dahlia* species

Nutrient	<i>D. hortorum</i>	Grams/ 100 g raw weight	<i>D. coccinea</i>	Grams/ 100 g raw weight	<i>D. campanulata</i>	Grams/ 100 g raw weight
Raw fiber	6%	0.92 g	4.7%	0.70 g	4.9%	0.73 g
Dietary fiber (Soluble fiber)	60	9.1	70	10.52	72	11.30
Protein	11%	1.66 g	8%	1.20 g	6%	0.90 g
Carbohydrates (sugars)	5	0.775 g	5	0.775 g	5	0.775 g
Fat	1%	0.15 g	0.7%	0.105 g	1%	0.15 g
Inulin	60	9.1 g	70	10.52	72	11.30
Calories	180		186		193	
Output of tuberous roots gr/plant	300 g		870 g		1170 g	
Humidity (%)	84.9	12.81	79.6	16.23	78.8	16.7
Dry weight %	15.1		20.4		21.2	

Source: (data taken from multiple postgraduate studies thesis documents from the Instituto de Horticultura, Universidad Autónoma Chapingo [Horticulture Institute])

Calories.

Dahlia tubers has a low caloric value, varying between 180-193 kcal per 100 g of dry materials, which in terms of a low calorie diet, represents a very low intake; this makes it healthy to consume very big portions of this food. This is beneficial for people who are used to eating large amounts of food in their regular diet, and it is a very healthy snack for children as well.

Fiber.

Tubers of the Dahlia are a rich source of fiber, since they are 4.8 to 11.1% of the dry weight of the total dry weight of the tuber, which compared to other foods, is a very high fiber percentage. Fiber is a natural compound that works as a prebiotic, which means it is used by the gut micro biota to achieve better digestive mobility and food digestion. This helps achieve good gastrointestinal health that prevents health issues like colon cancer. Fiber intake should be continuous. The recommended fiber intake varies between 20-35 g a day, depending on a person's gender, age and clinical condition.

The fiber intake requirement in children from ages 5-8 is 8 g a day, and from ages 9-10, 22 g a day. For young adults from ages 18-59 according to the World Health Organization (WHO), the intake must be between 25-30 g a day according to the Academy of Nutrition and Dietetics (AND). Adults (Mahan y Raymond, 2017) from age 60 on should have a fiber intake of 30 g a day for males and 21 g a day for females (Palafox y Ledesma, 2015). The American Diabetes Association (ADA) recommends that people with diabetes should mind their fiber intake (10-13 g of fiber per 1000 kcal) to maintain good health. This makes the Dahlia a great option to include in every diet.

Functional food.

It is highlighted that the Dahlia is one of the species with a highest dietary fiber content or soluble fiber (40-80%), constituted by inulin. Inulin is a fructose long-chained compound with extraordinary functional properties, as asserted by Roberfroid (2007), highlighting, amongst others: lipid metabolism decrease, colon cancer risk reduction, body mass decrease, blood sugar levels decrease, gut flora increase and immune system activity increase.

Protein.

Dahlia has a relatively low protein level, between 6.5-15.1%. Proteins are part of different body functions and structures. Daily consumption of an adequate amount of protein is necessary, ranging between 15-20% of the total energy requirements of an average healthy individual.

In other compounds, Dahlia tubers do not have significant soluble carbohydrates, so they do not supply energy in that particular way. Lipids are also not found in Dahlia tubers. On the other hand, they have important quantities of potassium, magnesium, phosphorus, calcium and iron. These elements combined with Vitamin B are a major source of minerals for bone health, especially in women, since they help absorb calcium more efficiently than other foods. The body needs potassium for almost all of its processes, even the correct functioning of kidneys and the heart, muscle contraction and nerve transmission.

Furthermore, Dahlia tubers also contain adequate amounts of benzoic acid, which is considered the predecessor of salicylic acid and an antibiotic agent for external and internal use to fight pathogen issues and infectious microorganisms. Stem and tubers juice is common in rural communities when treating skin, eye and ear infections.

Usage in people with diabetes.

The Universidad Autónoma Chapingo, based on laboratory data and bibliographies, as well as herbal studies, has demonstrated that the Dahlia is an important ally in the treatment against diabetes mellitus type II. Its consumption in tea can reduce blood sugar content in an efficient way in short treatment periods. Additionally, it reduces blood cholesterol and triglyceride levels, and helps the digestive system with problems such as ulcers and colitis. A non-confirmed event, but that has been observed as a side effect, indicates that it improves kidney and liver health. Recent results of Italian investigators confirm that the health benefits observed in people with diabetes are linked to the vegetal hormone, abscisic acid, present in high quantities in dormant plants (Zocchi et al., 2017).

Conclusions

The Dahlia crop is a development option for marginalized regional farmers of temperate weathers and moderate gale or available irrigation water. Its outdoors production system generates 4-80 tons of tuberous roots. Based on its nutritional and functional properties, it is recommended to include fresh or dried Dahlia tubers in a low caloric intake diet, with no cholesterol, low fat levels and moderate protein content. Additionally, Dahlia tubers are a rich source of fiber and minerals like potassium, calcium, phosphorus and magnesium. The functional properties of the Dahlia are primarily associated with the high content of inulin and abscisic acid.

Inclusion of Dahlia tubers in people's diets is extremely favorable as it regulates the digestive system, reduces body weight, stimulates calcium absorption, reduces blood cholesterol and triglycerides, and regulates blood levels, so it is helpful in treating type II diabetes. It is suggested to have a Dahlia tubers based diet at least two days a week.

Recommended bibliography

- De la Cruz, M., y J. Badiano. 1964. Libellus de Medicinalibus Indorum Herbis. Instituto Mexicano del Seguro Social, México, 394 pp.
- Hernández, F. 1959. Historia de las plantas de la Nueva España, en Obras completas, t. II y III. Universidad Nacional Autónoma de México, México.
- Kaufer-Horwitz, M., Pérez-Lizaur, A.B. 2015. Nutriología Médica. 4ª Ed. Editorial Panamericana. México, Pp 890.
- Martínez-Montes, M.T., J.M. Mejía-Muñoz, G.Treviño de Castro. 2008. Las dalias orgánicas en la gastronomía (Organic dahlias in gastronomy) 3ª Edición. Servicio Nacional de Inspección y Certificación de Semillas, Universidad Autónoma Chapingo. 39 pp.
- Mahan, K.L. y Raymond, J.L. 2017. Krause Dietoterapia, 14 a. ed., Ed. Elsevier, Barcelona, España, Pp 377.
- Mendoza-Castelán, G., Mejía-Muñoz, J.M., A. Espinosa-Flores, M. G. Treviño-Hernández. 2017. La Dalia (*Dahlia spp.*) química, terapéutica y gastronomía. Universidad Autónoma Chapingo, Chapingo, México. 139 pp.
- Moldovan., L., Z., Szekely,-V., M., CANTOR. 2017. DAHLIA AN UNFORGETTABLE FLOWER - A NEW PERSPECTIVE FOR THERAPEUTIC MEDICINE. Hop and Medicinal Plants. 25: 56-68
- Nsabimana C, Jiang B (2011). The chemical composition of some garden Dahlia tubers. British Food Journal 113(9):1081-1093.
- Roberfroid, M.B. 2007. Inulin-type fructans: functional food ingredients. [J Nutr.](#)137(11 Suppl):2493S-2502S. doi: 10.1093/jn/137.11.2493S
- Secretaría de Agricultura y Ganadería. 1963. Decreto Presidencial en Diario Oficial de la Federación, 13 de mayo, p. 8.
- Whitley, G.R. 1985. The medicinal and nutritional properties of *Dahlia spp.* J. Ethnopharmacol. 14: 75-82.

- Zocchi, E. Hontecillas, R., Leber, A. Einerhand, A., Carbo, A., Bruzzone, S., Nuria Tubau-Juni, N., Philipson, N., Zoccoli-Rodriguez, V., Sturla, L., Bassaganya-Riera, J. 2017. Absciscic Acid: A Novel Nutraceutical for Glycemic Control, Review. **Front. Nutr.**, 4: 1-13.

PHOTOGRAPHS

DAHLIA COCCINEA



DAHLIA TUBERS FOR FOOD AND MEDICINE



PLOTS OF DAHLIA AND CORN IN VERACRUZ, (FOR FLOWER AND TUBER PRODUCTION)



PLOTS OF DAHLIA CAMPANULATA AND DAHLIA X HORTORUM IN CHAPINGO,



SEEDLINGS OF DAHLIA X HORTORUM FOR GROWING IN RURAL AREAS OF VERACRUZ, MEXICO



DAHLIA FLOWER PETROGLYPH FROM THE XOCHIMILCA CULTURE IN MEXICAN VALLEY

