



DETERMINATION AND COMPARISON OF THE AMOUNT OF VITAMINS AND FLAVONOIDS OF WATERMELON SEEDS GROWN IN UZBEKISTAN AND CHINA

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ANNOTATION: Currently, many modern medical specialists are using folk medicine methods in the treatment of various diseases. The conditions created today serve as a great ground for the cooperation of modern medical workers and folk medicine specialists. If the modern doctor and healer work together, it will be possible to prevent and treat many diseases that are bothering humanity today.

We have analyzed the scientific literature, taking into account the importance of water-soluble vitamins, flavonoids and steroids in the diagnosis and treatment of kidney stone diseases. During the research, we have found that watermelon seeds are perfect in every way. In order to apply the results of this scientific research to a practical approach, we conducted practical experiments with watermelon seeds of the "Shirin" variety grown in Uzbekistan and China. The main goal of choosing watermelons grown in China is that China is the main producer and exporter of watermelons in the world.

In this article, we set out to determine and compare the amount of vitamins and flavonoids of "Shirin" watermelon seeds (*Citrullus lanatus* seed) grown in Uzbekistan and China. We determined the amount of vitamins B₁, B₃, B₆, B₁₂ and C, steroids and flavonoids from the water-soluble vitamins in watermelon using the high-performance liquid chromatography (HPLC) method. Results It was found that the watermelon grown in Uzbekistan contains more flavanoids and vitamins, which are important for the treatment and prevention of kidney stone diseases, compared to the watermelon grown in China.

KEY WORDS: Sweet watermelon, seed, vitamin, steroid, flavonoid, antioxidant, salidrazide, dehydroquercetin, rutin, lutein, thiamin, pyridoxine, pyridoxamine, cobalamin.

INTRODUCTION.

Kidney stone disease is now up to 12% in the world. If the stone is larger than 5 millimeters, it can cause blockage of the bladder and cause sharp and severe pain in the abdomen, resulting in increased risk of kidney disease. The main factors

causing the formation of calcium oxalate stones are hypercalciuria, hyperphosphatemia, hypocitraturia, hyperuricosuria, and hypomagnesuria [1,2].

Many studies have shown that watermelon is important for the treatment of urolithiasis [3]. Watermelon seeds are a natural diuretic and are an excellent natural remedy for treating the kidneys and cleaning urine. They play a protective role in the kidneys by reducing excess uric acid, and watermelon seed tea has been found to be an effective diuretic.

Pharmacological analysis revealed that *C. lanatus* has antioxidant, anti-inflammatory, hepatoprotective, antiplasmodial, antihycardial, antimicrobial, analgesic, antidiabetic, laxative and antiulcer activities [4].

The medical approach to kidney stone disease is mainly aimed at reducing the risk of stone recurrence. Water-soluble vitamins are very important for kidney stone disease. For example:

Conducted 13-17 years of research on vitamin C analysis in American countries. During this period, 6245 people with kidney stone diseases were examined. There was no incidence of kidney stones among those who received 90-249, 250-499, 500-999 and 1000 mg/d of vitamin C daily requirements.

Vitamin B₆ or (pyridoxine, pyridoxamine) is made up of water-soluble, colorless crystals. Taking vitamin B₆ with magnesium can prevent oxalate stone formation. Both magnesium and vitamin B₆ are used by the body to convert oxalate into other substances. Vitamin B₆ deficiency leads to an increase in kidney stones due to increased oxalate in the urine. 50mg of vitamin B₆ and 200-400mg of magnesium citrate per day prevent oxalate stone formation [5].

A high intake of vitamin B₁₂ has been shown to reduce the risk of kidney stones [6]. In animal experiments, Vitamin B₁ has been shown to reduce crystal formation and prevent kidney stone disease, and a deficiency of this vitamin has been shown to be associated with hyperoxaluria[7]. Also, due to the fact that vitamin B₃ has the healing properties of kidney damage, in this study, the amount of certain vitamins and flavonoids that have the properties of preventing and treating kidney stone disease in watermelons grown in Uzbekistan was compared with those grown in China.

Watermelon (*Citrullus lanatus*) is an annual flowering plant belonging to the Cucurbitaceae family. His homeland is the desert regions of South Africa (Egypt). It has been cultivated in India for 3000 years[8,9].

Watermelon can be found in temperate to tropical temperate regions such as India, America, Europe, China, Turkey, Iran, Japan and Australia. Watermelon is the second largest fruit in Central Asia after melon. Watermelon is a very heat-loving plant and starts to develop when the temperature rises above 15 °C. There are approximately 800 species and more than 1,200 varieties of watermelon worldwide[9].

Watermelon is an annual plant, creeping and branching, producing a stem 2-3m long. The fruit is round egg-shaped, sometimes cylindrical. Its weight is 20 kg, in some cases even up to 40-50 kg [8].

Cultivated watermelons have *S. colocynthoides* Pand. and *khoraki S. aedulis* Pand. species. There are 4 bitter types of wild watermelon. All varieties of watermelon around the world are divided into 10 ecological geographical groups. More than 15 varieties of watermelon are grown in Uzbekistan: Guliston, Dilnoz, Korol, Kuba 92, Khait Kara, Orinboy, Uzbekistan, Surkhan Tong, Almas, Manzur, Marmar, Koziboy and other varieties. Since 2000, early ripening varieties such as Krisby, Trofi and Granit have been planted in the Netherlands[10].

So far, 47 varieties of watermelon have been cultivated in Uzbekistan. Of these, 15 are local, and the rest are foreign varieties. Among them, "Dilnoz", "Manzur", "Shirin", "Koziboy-30", "Hait Kara", "Shirin Sharq Nemati" are local varieties [9] .

The sweet variety is considered an early-mid-season variety. The fruit is spherical, with dark or light green skin. The flowers are wide and spiky. The weight is 3-4 kg. This watermelon ripens in 86-89 days. The content of sugar is 11.0-11.4%. Productivity reaches 30-35 tons per hectare. Has resistance to storage and transportation [9,1 0] .



Figure 1. Internal and external appearance of the sweet variety of watermelon grown in Uzbekistan

Watermelon cultivation in the world is estimated at 101.6 million tons, of which China - 60.1 million tons, Turkey - 3.49 million tons, India - 2.79 million tons, Iran - 2.74 million tons, Uzbekistan - 20-60 tons (according to 2020 data) [11,12] .

Red watermelon is widely consumed all over the world and in Uzbekistan. According to statistics, its early-mid-season variety "Shirin" is widely consumed and cultivated more in Uzbekistan. Its external and internal appearance is presented in Figure 2 [13] .

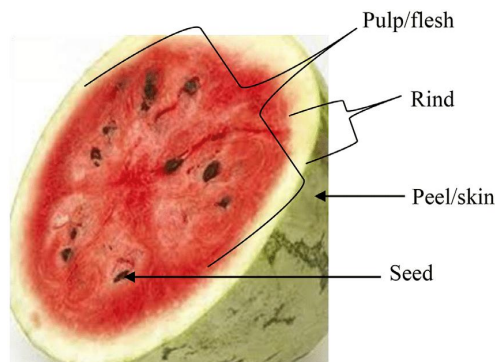


Figure 2. Components of "Shirin" watermelon

The stem of the red watermelon is creeping and branching, reaching 2-3 m in length. The fruit is oval, sometimes cylindrical. The weight is 20 kg, in some cases even up to 40-50 kg. Watermelon skin is thick (1.5cm), medium (1.15cm), thin and hard. The flesh of the red fruit is soft, juicy, sandy and fibrous. The color of the fleshy part between the fruit can be red, raspberry and yellow. The seeds are white, yellow, red, gray and black. The weight of 1000 seeds is 40-120 g, depending on the size [14].

Watermelon roots go deep with arrow roots. The leaves are pale green in color with several lobes, covered with white and long hairs, and curls are located in the leaf axils. Pollen and seed flowers are located separately. Watermelons are mainly pollinated from outside[15].

MATERIALS AND METHODS

Plant materials. The composition of watermelon fruit is 8-13.5% dry matter, 5.8-11% sugar (fructose), 3% sugar, more than 90% water and various vitamins. Germination begins in 5-6 days at a soil temperature of 14-16 °C. It has early, medium and late ripening varieties. The early variety ripens in 80-90 days, the mid-ripening variety in 90-100 days, and the late-ripening variety in 110-120 days[16].

Quantification of water-soluble vitamins by high-performance liquid chromatography.

The amount of water-soluble vitamins from the "Shirin" variety of watermelon seeds (*Citrullus lanatus* seed) grown in Uzbekistan and China was studied by the method of high-performance liquid chromatography.

Water-soluble vitamins in the sample were determined using high-performance liquid chromatography. 5-10 g is taken from the drawer on an analytical balance and placed in a 300 ml flat flask. 50 ml of 40% ethanol solution is added to it. The mixture was heated under vigorous stirring for 1 h, equipped with a magnetic stirrer, reflux condenser, and then stirred at room temperature for 2 h. The mixture is cooled and filtered. 25 ml of 40 percent ethanol was added to the remaining part and re-extracted 2 times. The filtrates were combined and filled to the mark with 40% ethanol (5-10%) in a 100 ml volumetric flask. The resulting solution is centrifuged at 7000 rpm for 10 minutes. The resulting solution was taken from the top for analysis.

Working solutions of water-soluble vitamins with a concentration of 1 mg/ml were prepared. For this purpose, 50.0 mg of each vitamin standard is accurately drawn on an analytical balance and dissolved in 40 percent ethanol in a 50 mL volumetric flask and filled to the mark.

Phosphorous, acetate buffer systems and acetonitrile were used as eluents in the literature for the determination of water-soluble vitamins by high-performance liquid chromatography (HPLC). We used an acetate buffer system and acetonitrile [19-21].

Quantification of steroids and flavonoids using liquid chromatography oat .

Steroids and flavonoids in the sample were determined by liquid chromatography. 5-10 g of the sample is taken on an analytical scale and placed in a 300 ml flat flask. 50 ml of 70% ethanol solution is added to it. The mixture was heated at 70-80 °C with intensive stirring for 1 hour, equipped with a magnetic stirrer, reflux condenser, and then stirred at room temperature for 2 hours. The mixture is cooled and filtered. 25 ml of 70% ethanol is added to the remaining part and re-extracted 2 times. The filtrates were combined and filled to the mark with 70% ethanol in a 100 ml volumetric flask. The resulting solution is spun in a centrifuge at a speed of 6000-8000 rpm for 20-30 minutes. The resulting solution was taken from the top for analysis.

Phosphorous, acetate buffer systems and acetonitrile were used as eluents in the literature for the determination of Steroids and Flavonoids with HPLC. We used a phosphate buffer system and acetonitrile [22-24].

RESULTS AND DISCUSSION.

The mass composition of a sweet watermelon is given in Table 1, according to which the pulp is 30%, the fruit is 68%, and the seed is 2%.

Table 1. Mass composition of sweet watermelon

Watermelon 1 kg		
Pod 30%	Fruit 68%	Seed 2%
300 g	680 g	20 g
30% moisture	80-90% moisture	10-15% moisture
210 g of dry mass	136-68 g of dry mass	18-17 g of dry mass

The appearance and size of watermelon seeds of the "Shirin" variety grown in Uzbekistan are shown in Fig. 1.



Figure 3. Appearance and size of "Shirin" watermelon seeds grown in Uzbekistan.

HPLC analysis of water-soluble vitamins on an Agilent Technologies 1200 chromatograph on an Eclipse XDB C18 column (reverse phase), 3.5 micron, 4.6x150 mm. diode array detector (DAD), 254, 290 nm. Solution a: 0.5% acetic acid, ph 1.7:B: CH₃ CN (acetonitrile). The flow rate was 1 ml/min. Gradient %b/min: 0-5 min/96:4%, 6-8 min/90:30%, 9-15 min/80:20%, 15-17 min/96:4%. Thermostat 25 °C [26,27].

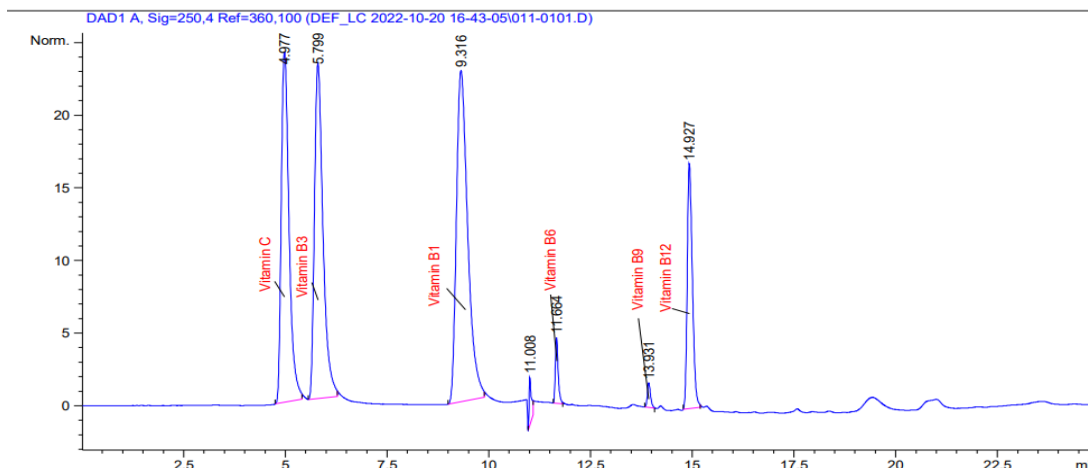


Figure 4. Standard chromatogram of vitamins.

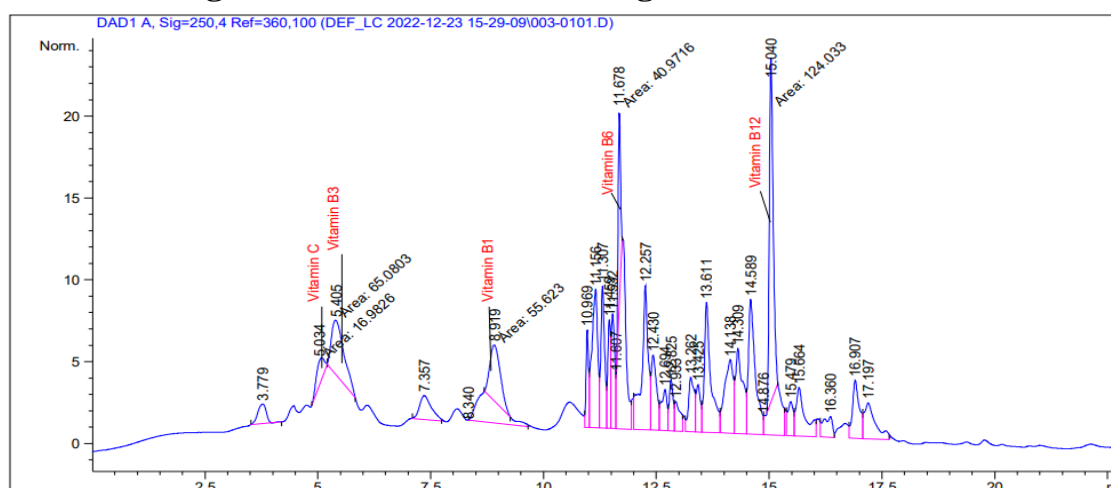


Figure 5. Vitamin chromatogram of sweet watermelon seeds

When studying the amount of vitamins in watermelon seeds of the " Shirin" variety grown in Uzbekistan and China, it was found that vitamins B₆ and B₁₂ are present in large quantities. Vitamins C and PP contained in them were found to be in small amounts. Compared to the watermelon grown in China, it was found that the amount of vitamins in the seeds of the sweet watermelon grown in the Andijan region of Uzbekistan is much higher (table 1).

Table 2. Vitamin content of watermelon seeds grown in Uzbekistan and China

Vitamins name	Average daily intake for	Vitamin content of watermelon seeds grown in Uzbekistan	Vitamin content of watermelon seed kernel grown in China

	middle-aged people is mg	Concentration mg/g r	
C	90.54 _	0 . 4 7±0.05	0.17±0.05
B ₁	0.06	0 . 1 5±0.05	0.11±0.05
B ₃	1.6 2	0 . 25 ±0.05	0.17 ±0.05
B ₆	2.12 _	3 . 05 ±0.05	1.7±0.05
B ₁₂	2.54 _	1 . 1 6±0.05	1.12±0.05

It was found that, the seeds of the sweet watermelon grown in Andijan region contain 11.81 mg of dehydroquercetin, 7.13 mg of lutionine, 0.71 mg of rutin and 2.45 mg of salidrazide, while seeds of sweet watermelon grown in China contained 10.62 mg of dehydroquercetin, 6.03 mg of lutionine, 0.45 mg of rutin and 1.36 mg of salidrazide.

Dehydroquercetin is a polyphenol, a flavonoid in the quercetin group. The natural antioxidant is rich and is found mainly in the bark and seed material of plants. Studies by scientists have confirmed that quercetin has a specificity of thinning inflammatory and oxidative processes triggered by hyperoxaluria in kidney tissue [28].

Lutionin is a powerful antioxidant that has been found that calcium oxalate can effectively thin out the formation of urinary stones (the most common kidney stones). [28-30].

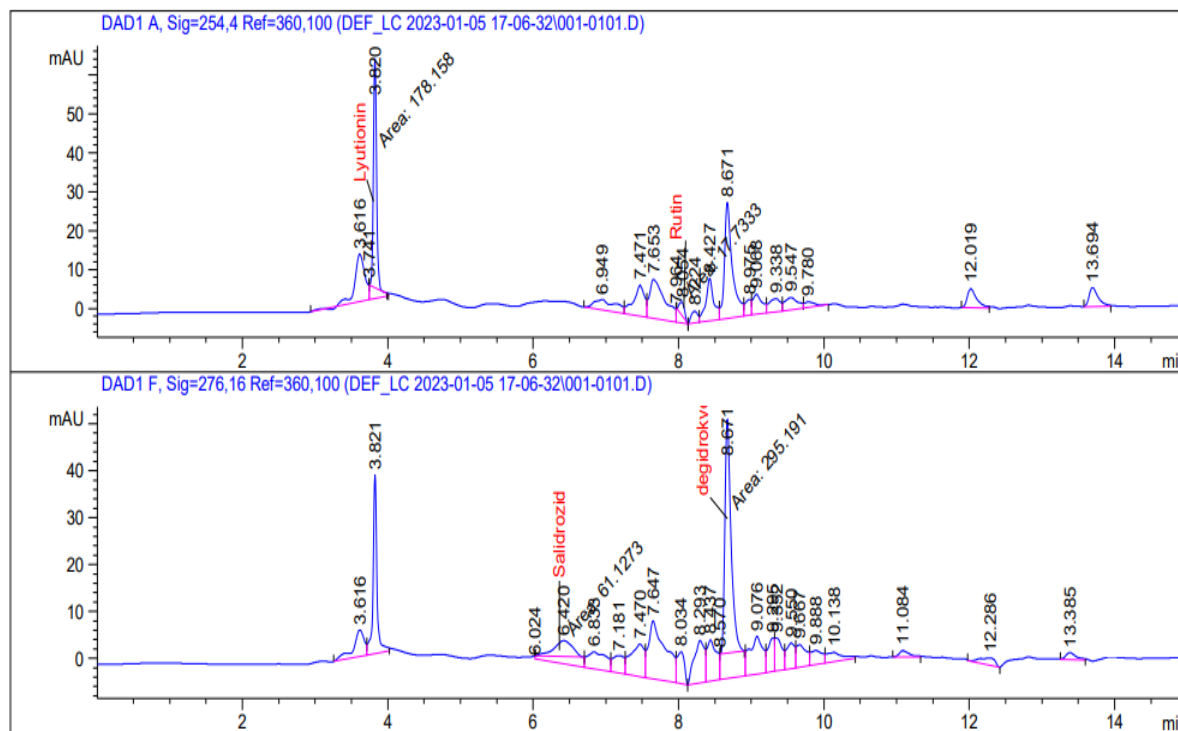


Figure 6. Chromatogram of steroids and flavonoids in sweet watermelon seeds

HPLC "Agilent-1200" brand column Agilent C18 5µm, 4.6x250mm. Elution was carried out in isocratic mode, using a mixture of 0.1% orthophosphoric acid and acetonitrile ratio (70:30) as the mobile phase. The volumetric flow rate of the eluent is 1.0 ml/min, and the volume of the prepared sample is 10 µcl. Length V. 254 nm [34-38].

Table 4. Amount of steroids and flavonoids in "Shirin" watermelon seeds grown in Uzbekistan and China

Steroids and flavonoids name	Watermelon seed kernel in Uzbekistan	Watermelon seed pulp in China
	Concentration mg / g	
Dehydroquercetin	11.81 ±0.05	10.62 ±0.05
Lutionine	7.13 ±0.05	6.03 ±0.05
Routine	0.71 ±0.05	0.45 ±0.05
Salidrazid	2.45 ±0.05	1.36 ±0.05

B₁₂ is a group of biologically active substances called cobalamins, which belong to corrinoids containing a cobalt atom and having chelate compounds. This vitamin refers to cyanocobalamin, which is freely converted into one of the coenzyme forms in the human body [34].

The amount of water-soluble vitamins was studied by the method of high-performance liquid chromatography. It was determined how many percent of the vitamin content of the "Shirin" variety of watermelon seeds grown in Uzbekistan and China meets the daily requirement of the human body. 1g of "Shirin"

watermelon seeds grown in Uzbekistan satisfies the daily requirement of vitamins B₁-9.73%, B₃-15.68%, B₆ - 152.7%, B₁₂ -57.94% and C - 0.52%. 1 g of "Shirin" watermelon seeds grown in China meets the daily requirement of vitamins B₁-7.33%, B₃-10.62%, B₆-85%, B₁₂ -56% and C - 0.19%.

When studying the amount of steroids and flavonoids in "Shirin" watermelon seeds grown in Uzbekistan, was found that 1 gram of sweet watermelon seeds grown in Andijan region contains 11.81 mg of dihydroxyquercetin, 7.13 mg of rutin, 7.13 mg of lutein and 0.71mg salidrazide. While 1 gram of watermelon seeds grown in China contains 10.62 mg of dehydroquercetin, 6.03 mg of lutionine, 0.45 mg of rutin and 1.36 mg of salidrazide.

It can be seen that the amount of vitamins, steroids and flavonoids in watermelon seeds grown in Uzbekistan is high. The reason for this is the higher climate and softer soil in Uzbekistan compared to China. As the climate rises, the production of antioxidants and vitamins accelerates and increases in quantity.

Conclusion

Summing up, the fact that watermelon grown in Uzbekistan has a high content of B₁, B₃, B₆, B₁₂ and C vitamins and flavonoids, which are actively involved in the treatment and prevention of diseases of urolithiasis, is of great importance for further study and use of watermelon seeds grown in Uzbekistan in the treatment of this disease using traditional medicine methods

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