American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 04 ISSUE 10 PAGES: 36-44
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY

Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

DETERMINATION OF SOME BIOLOGICALLY ACTIVE COMPOUNDS IN CORN SILK (ZEA MAYS L)

Submission Date: October 25, 2024, **Accepted Date:** October 20, 2024,
Published Date: October 30, 2024
Crossref doi: https://doi.org/10.37547/ajbspi/Volume04Issue10-04

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ABSTRACT

For centuries, medicinal plants have been integral to treating ailments, with both traditional and modern medicine benefiting from their biologically active compounds. These plant-based remedies continue to be essential in healthcare, and interest in studying them has only grown. Corn silk (Zea mays L.) is one such valuable natural resource. This study focuses on quantifying the total flavonoid and β-carotene content in corn silk, alongside evaluating its antioxidant properties using phytochemical methods. Our findings contribute to the broader understanding of corn silk's potential therapeutic benefits and its relevance in natural medicine.

KEYWORDS

Corn silk, carotenoids, flavonoids, macro- and microelements.

INTRODUCTION

It is known that preparations obtained based on medicinal plants are widely used in medicine in many countries around the world today. The reason for this is explained by the fact that drugs of natural origin

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have less toxic properties and do not have side effects compared to synthetic drugs. Also, preparing ointments, tinctures, aerosols, and various powders made from medicinal plants is relatively easy and does not require complex technological devices and methods. This means that many of the above-mentioned remedies can be prepared at home..

Many countries around the world are currently conducting extensive research to isolate biologically active compounds from medicinal plants, develop food additives based on these compounds, and implement them in practice. Corn silk (Zea mays L.) is regarded as a valuable natural medicinal source, commonly used in both traditional and modern medicine for its choleretic, diuretic, and hemostatic properties. Its rich chemical composition has made corn silk the focus of research at various scientific centers worldwide. This growing interest is driven by the historically proven effectiveness of corn silk and the absence of side effects that are often associated with toxic and synthetic drugs [1].

For many years, in folk medicine, a tincture made from corn silk has been used as a choleretic agent in inflammatory diseases of the liver, gallbladder, and bile ducts, and as an effective diuretic in internal bleeding, kidney and bladder stones [3,4]. Corn silk contains as biologically active substances - taraxerol, taraxisterol, androsterol, taraxacin, sterol, choline, nicotinic acid, nicotinamide, rubber, tars, inulin, fatty acids, essential oils and protein substances, additives, oleanolic acid, linolenic acid, palmitic acid, malic acid, mineral salts, alcohols, flavonoids, vitamin C, group B vitamins, vitamin P, provitamin A, choline, asparagine, iron salts, potassium and phosphorus salts [2]. Recent analysis of modern scientific literature has shown that flavonoids, which are biologically active compounds found in corn silk, have been extensively studied. In addition to these flavonoids, other groups of biologically active compounds from this raw material are also receiving significant attention in research.

Table 1. Some biological active compounds are present in corn silk

class of biological active compounds	Compounds
Flavonoids	Maizin, methoxymaizin, chrysoeryl, 6-S-β-fucopyranoside, 4"-ON-3'-methoxymaizin molludistin, isomolludistin, vitexin, isovitexin, orientin, isoorientin, isoscoparin, isoquercetrin, quercetrin-3,7-diglucoside
Phenolcarboxylic acids	Chlorogenic acid, ferulic acid, caffeic acid, hydroxodolchinic acid

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Nutrient	Gallic acid, ellagic acid, gallocatechin, epicatechin, catechin, epigallocatechin, catechin gallate, epicatechin gallate
Vitamins	Phylloquinone, tamin, riboflavin, tocopherol, nicotinamide, ascorbic acid
Polysaccharides	Rhamnose, arabinose, xylose, mannose, galactose, glucose Oleanolinic acid, ursolic acid B-sitosterol, stigmasterol Alcohols: 2.3-butanediol, ethanol, 1.2-propanediol, 2-furanmethanol. Ketones 2.3-butanedione, 3-hydroxy-2-butanone, 3-methyl-2,5-furandio, 2-heptanone, 3-octanone, 2,4-pentanedione Aldehydes: benzeneacetaldehyde, heptanal, hexanal, proparal, pentanal, furfurol
Saponins	Rhamnose, arabinose, xylose, mannose, galactose, glucose Oleanolinic acid, ursolic acid B-sitosterol, stigmasterol Alcohols: 2.3-butanediol, ethanol, 1.2-propanediol, 2-furanmethanol. Ketones 2.3-butanedione, 3-hydroxy-2-butanone, 3-methyl-2,5-furandio, 2-heptanone, 3-octanone, 2,4-pentanedione Aldehydes: benzeneacetaldehyde, heptanal, hexanal, proparal, pentanal, furfurol
Phytosterols	Rhamnose, arabinose, xylose, mannose, galactose, glucose Oleanolinic acid, ursolic acid B-sitosterol, stigmasterol Alcohols: 2.3-butanediol, ethanol, 1.2-propanediol, 2-furanmethanol. Ketones 2.3-butanedione, 3-hydroxy-2-butanone, 3-methyl-2,5-furandio, 2-heptanone, 3-octanone, 2,4-pentanedione

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	Aldehydes: benzeneacetaldehyde, heptanal, hexanal, proparal, pentanal, furfurol
Volatile compounds	Rhamnose, arabinose, xylose, mannose, galactose, glucose Oleanolinic acid, ursolic acid B-sitosterol, stigmasterol Alcohols: 2.3-butanediol, ethanol, 1.2-propanediol, 2-furanmethanol. Ketones 2.3-butanedione, 3-hydroxy-2-butanone, 3-methyl-2,5-furandio, 2-heptanone, 3-octanone, 2,4-pentanedione Aldehydes: benzeneacetaldehyde, heptanal, hexanal, proparal, pentanal, furfurol
Amino acids	Asparagine, glutamine, glycine, alanine, lysine, proline. serine, threonine, cysteine, valine, methionine, leucine, isoleucine, tyrosine, phenylalanine, histidine, arginine, cystine

Flavonoids found in corn silk have garnered significant attention from researchers due to their unique physicochemical structure. In addition to flavonoids, corn silk also contain phenolic-carboxylic acids, vitamin K, phytosterols, volatile compounds, polysaccharides, amino acids, and saponins.

The pharmacological properties of corn silk are of considerable importance in practical medicine. Current research highlights their various pharmacological effects, including antioxidant, anti-inflammatory, antidiabetic, hypotensive, neuroprotective, and photoprotective activities. Scientific literature provides evidence supporting the effectiveness of corn silk in the complex treatment of tumor diseases.

This research focuses on the spectroscopic determination of flavonoid and β-carotenoid levels in corn silk.

Experimental part:The amounts of β-carotenoids and total flavonoids in dried and ground corn silk were measured using an EMC-30PC spectrophotometer (Germany) by assessing the optical densities of the solutions. The determination of flavonoid content was carried out following the method outlined in reference [5].

To conduct the analysis, we utilized the GOST 55312-2012 method. The research object was corn silk, which was crushed to a particle size that passed through a 1 mm sieve. An analytical sample consisting of 1 g of dried corn silk was placed in a 100 ml conical flask, to

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which 25 ml of a 1% hydrochloric acid solution was added along with 30%, 45%, and 80% ethanol solutions. The mixture was continuously stirred using a magnetic stirrer at room temperature.

The resulting solution was then filtered to obtain solution A. From this filtrate, 1 ml was transferred into a 25 ml volumetric flask, and the volume was brought to the mark with ethyl alcohol. Each mixture was heated in a water bath for 30, 60, and 90 minutes, respectively. The optical density of the solutions was measured using a spectrophotometer at a wavelength of 430 nm, and the total flavonoid content in the product was determined using the following formula.

Here D is the optical density of the substance under investigation;

m - product weight, g

W-Mass loss during drying of raw materials, % = 14%

The method recommended in GF XIV was used to determine the amount of β-carotenoid and the amount was calculated by the following formula [4].

$$x = \frac{D \cdot 30 \cdot 25 \cdot 100 \cdot 1000}{2773 \cdot m \cdot 2 \cdot (100 - W)}$$

Here, D is the optical density of the substance under investigation; 2773 - 450 nm β-carotenoid relative absorption index; 2- the volume of the hexane separation to obtain the test solution, 30- the volume of the extract (ml), 25- the volume of the test solution (ml), m is the mass of the product, g; W-product moisture.

Table 2. Amount of β-carotenoid in 100 g of corn silk

Extractant	Product-Extractant Ratio	Fineness, mm	Extraction time, min	β-carotene quantity, mg
Hexane	1:5	1,0	30	0,28

From the above data, it can be seen that the β-carotenoid contained in the corn silk is isolated in high yield (0.28 mg) when extracted with hexane.

Table 3. Metrological characteristics of determination of β-carotenoid content in corn silk

n	X,%	S2	Sx	P,%	T (p,f)	±Δ	E,%

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12	9.54	0.0662	0.2573	95	2.18	±0.1619	±0.027

The results of statistical analysis of the obtained data indicate that the error in determining the amount of β-carotenoids in corn silk, within a 95% confidence interval, is ± 0.027%. Flavonoids are biologically active compounds that belong to the class of polyphenols and are found in various parts of plants. They play a significant role in biological processes in the body, helping to strengthen the immune system and enhancing the body's response to allergens, viruses, and carcinogens. Research shows that flavonoids exhibit greater antioxidant activity than vitamins C and E, as well as carotenoids. Plant materials rich in flavonoids are valuable for their applications as natural dyes, food antioxidants, and tannins. Some flavonoids also possess antibacterial properties.

Quercetin, an important flavonoid, is known for its anti-inflammatory, antihistamine, antispasmodic, antioxidant, and diuretic effects. Rutin and quercetin, components of vitamin R, are used to reduce the permeability and fragility of capillaries, improve the quality of red blood cells, and prevent blood clotting.

Tabe 4. The total amount of flavonoids present in corn silk.

Extractant	Product-Extractant Ratio	Fineness, mm	Extraction time, min	Amount of flavonoids
Ethanol 30%	1:5	1,0	30	0,0500
	1:5	1,0	60	0,0699
	1:5	1,0	90	0,0951
Ethanol 45%	1:5	1,0	30	0,1158
	1:5	1,0	60	0,1355
	1:5	1,0	90	0,1735
Ethanol 96%	1:5	1,0	30	0,1975
	1:5	1,0	60	0,3161
	1:5	1,0	90	0,2543

Table 5. Metrological characteristics of determining the amount of flavonoids in corn silk

Ethanol %	t, time	n	X	S2	S	P, %	T(p,f)	ΔX	E, %

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30	30	12	0,0500	0,03	0,1732	95	2,18	0,109	3.4673
30	60	12	0,0699	0,042	0,2049	95	2,18	0,129	2.9304
30	90	12	0,0951	0,0571	0,2389	95	2,18	0,1504	2.5135
45	30	12	0,1158	0,06954545	0,2637	95	2,18	0,166	2.2773
45	60	12	0,1355	0,0814	0,2852	95	2,18	0,1795	2.1054
45	90	12	0,1735	0,1042	0,3228	95	2,18	0,2031	1.8606
80	30	12	0,1975	0,1186	0,3444	95	2,18	0,216757825	1,7436
80	60	12	0,3161	0,1898	0,4357	95	2,18	0,27417937	1,3784
80	90	12	0,2543	0,1527	0,3908	95	2,18	0,2459	1,5367

Research indicates that the aqueous extract of corn silk has significant antioxidant properties, according to various scientific sources. In light of this, a study was conducted to assess the antioxidant activity of this extract in vitro.

There are several methods for determining antioxidant activity. One such method is based on the observation that adrenaline can inhibit auto oxidation reactions in vitro, thereby preventing the formation of reactive oxygen species (ROS). The antioxidant activity of the examined extract is measured by the percentage of active oxygen species formed and the autoxidation of adrenaline (AA%).

Here, Optical density of adrenaline hydrochloride solution added to D1-buffer; Optical density of aqueous extract and adrenaline hydrochloride added to D2-buffer.

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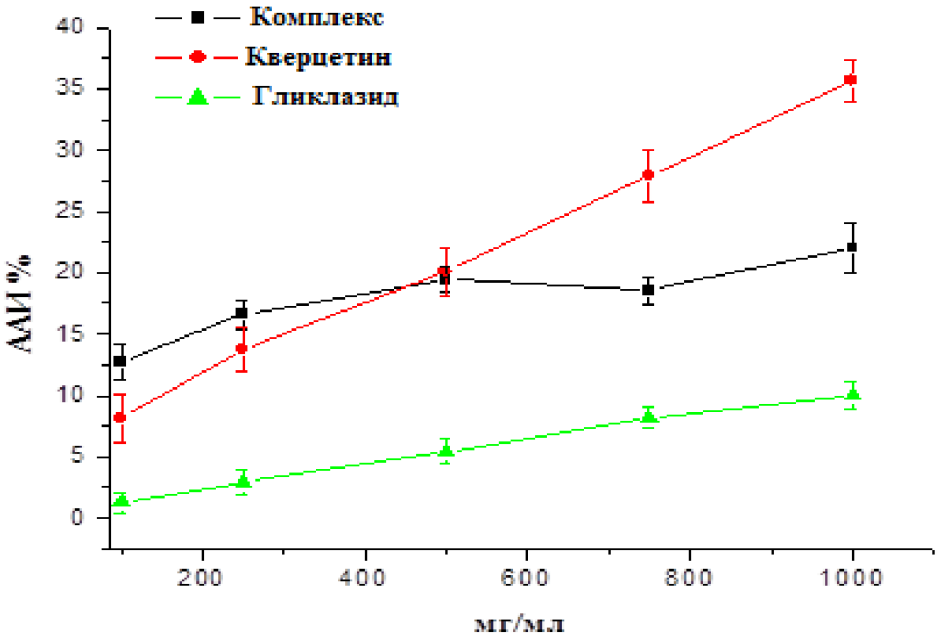

Figure 2. Antioxidant activity of corn silkaqueous extract

Antioxidant activity was determined by phytochemical tests of corn silk aqueous extract and evaluated using several methods. The aqueous extract was found to be 19.44% at 200 mg/ml.

CONCLUSION

When assessing the content of flavonoids and β-carotenoids in corn silk using a spectrophotometric method, it was determined that 100 grams of the product contains 0.28 mg of β-carotenoids and a total flavonoid content of 0.3161 grams.

The antioxidant activity of the corn silk aqueous extract was evaluated through various phytochemical assays. Results showed that the extract inhibited the active form of oxygen by 19.44% at a concentration of 200 mg/ml.

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