

TURMERIC – CHEMICAL COMPOSITION AND MEDICAL APPLICATIONS

***Parizoda Jafarovna Amirova,
Bekhzod Gofurovich Kodirov***

Samarkand State Medical University,

Faculty of Pediatrics, Group 104

Abstract: This article explores the pharmacological properties of turmeric (*Curcuma longa*) and its active compound, curcumin. The main biological effects are described, including anti-inflammatory, antioxidant, hepatoprotective, and neuroprotective actions. Special attention is given to the mechanisms of curcumin's action in various diseases such as type 2 diabetes, cancer, cardiovascular, gastrointestinal, and neurodegenerative disorders. The article provides data on the chemical composition of turmeric, its nutritional value, and its applications in both traditional and official medicine.

Keywords: Turmeric, curcumin, anti-inflammatory effect, antioxidants, metabolic syndrome, cardiovascular diseases, type 2 diabetes, cancer diseases, digestive system, neuroprotective effect.

Introduction:

Family: Ginger family (*Zingiberaceae*).

Part of the plant used in food and medicine: Rhizome (underground stem).

Color: Bright yellow or orange.

Origin: South Asia, especially India and Indonesia.

The root of this plant is the main component of the famous curry spice, which gives dishes not only a pungent taste and distinctive aroma but also a pleasant yellow color.

Even in ancient times, turmeric was noted for its ability to extend the shelf life of prepared foods. Additionally, it was used as a natural dye for gloves, metal, and wood, giving them a golden hue. Wafi and his colleagues discovered one of turmeric's beneficial properties and uncovered the molecular mechanisms behind its effects on the body. They observed how the main active compound in turmeric influenced the heart function of several mice.

To do this, a special pump was implanted under the mice's skin, which continuously delivered small doses of curcumin into their bodies. The researchers monitored the animals' endurance over a five-month period. The results showed that this Indian spice significantly improved the heart performance of the rodents. The mice ran about 1.5 times farther on a treadmill compared to their counterparts who received placebo injections, and their running speed increased by approximately 20–30%.

Genetic activity analysis of their muscle cells revealed that curcumin molecules enhanced the

activity of the Nrf2 gene, which is responsible for combating inflammation and oxidative stress. It also activated two other related DNA regions, HO-1 and SOD2.

Curcuminoids (Main Active Compounds)

The primary bioactive compound in turmeric is curcumin, which makes up 3–5% of the root's total mass.

100 grams of turmeric contains approximately 13% of the daily requirement of protein, 4% fat, and 22% carbohydrates.

In addition to proteins and carbohydrates, turmeric rhizomes also contain organic acids, essential oils, fat-soluble vitamins (E and K), water-soluble vitamins (C, B1, B2, B3 (PP), B4, B5, B6, and B9), and trace elements such as iron, copper, manganese, magnesium, phosphorus, zinc, and potassium.

Turmeric helps eliminate toxins and harmful substances from the body due to its rich antioxidant content. These antioxidants protect the body from the damaging effects of free radicals, which destroy healthy cells. Scientists believe that turmeric may assist in the prevention and treatment of Alzheimer's disease. This spice also helps remove excess water from the body and reduces swelling in conditions such as arthritis.

Moreover, turmeric has been shown to block the development of cancer cells. It also has a positive effect on the immune system thanks to its anti-inflammatory properties and the stimulation of macrophage activity, a type of immune cell.

Medical Applications of Turmeric:

Turmeric is used in dietary supplements and pharmaceutical products for the treatment and prevention of:

- Arthritis
- Gastrointestinal disorders
- Diabetes
- Cancer (as part of combination therapy)
- Skin diseases
- Depression and anxiety disorders

Forms of Use and Administration

- Powder (most commonly used as a spice)
- Capsules and tablets (as a dietary supplement)

- Infusions and decoctions
- Ointments and pastes (for topical application)
- Golden milk – a drink made from milk, turmeric, and spices

Mechanisms of Action in Diseases

- Curcumin inhibits tumor cell proliferation and induces apoptosis.
- It disrupts angiogenesis (formation of new blood vessels in tumors).
- It modulates the expression of oncogenes and related proteins.
- Result: Slows tumor growth and metastasis (especially in early stages).

Type 2 Diabetes and Metabolic Syndrome

- Enhances insulin sensitivity in tissues.
- Reduces inflammation in the pancreas.
- Decreases free radicals that damage pancreatic beta-cells.
- Result: Normalization of glucose levels and improved metabolic functions.

Liver Diseases (Hepatitis, Fatty Liver Disease)

- Stimulates detoxification enzyme production in the liver (e.g., glutathione-S-transferase).
- Protects liver cells (hepatocytes) from toxins and oxidative stress.
- Promotes bile flow (cholagogue effect).
- Result: Reduced inflammation and improved liver function.

Cardiovascular Diseases (Atherosclerosis, Hypertension)

- Lowers LDL (“bad cholesterol”) levels.
- Prevents lipid oxidation, slowing plaque development.
- Improves vascular endothelial function.
- Reduces platelet aggregation.
- Result: Decreased risk of thrombosis, heart attacks, and strokes.

Depression and Neurodegenerative Disorders

- Increases BDNF (Brain-Derived Neurotrophic Factor) levels.
- Protects neurons from inflammation and oxidative damage.
- Modulates dopamine and serotonin receptors.
- Result: Improved memory and mood, slowed neurodegeneration.

Recommended Daily Intake

There is no strict standardized dosage, but the average daily amount is:

- Fresh root: 1.5–3 grams
- Powder: 1–3 grams

Classic Use: Golden Milk

A spicy, refreshing drink with a mild bitterness – a choice you won't regret!

Preparation of Golden Milk or Turmeric Drink

The preparation is very simple:

1. Heat filtered or bottled water (200–250 ml) to a temperature of 40–50°C.
2. Add ½ teaspoon of turmeric powder into a glass (preferably using the freshest spice available).
3. Stir the mixture thoroughly until all the lumps of turmeric are completely dissolved.

Variation: With Honey

This version is slightly different from the previous ones.

Not only does honey add a sweeter, smoother taste, but it also helps turmeric dissolve faster, eliminating any remaining lumps.

Preparation Instructions:

1. Mix 1 tablespoon of natural honey with ½ teaspoon of turmeric powder.
2. Stir the ingredients until a smooth, thick paste is formed.
3. Heat one glass of filtered water to about 40°C (do not exceed this temperature, as excessive heat may destroy the healing properties of honey).
4. Add the honey-turmeric paste to the warm water and stir until fully dissolved.

Contraindications

Turmeric has blood-thinning properties. Therefore, it should not be added to the diet of people taking aspirin or anticoagulant medications (blood thinners), or those with vascular diseases. Patients suffering from hypotension (low blood pressure) are advised to avoid this spice, as it may further lower already low blood pressure and worsen their condition. Turmeric should also be avoided during acute exacerbations of gallstone disease and cholecystitis, since it stimulates bile production and gallbladder contraction. This can cause the movement of stones and lead to

blockage of the bile ducts.

During pregnancy and lactation, turmeric should be used cautiously. In cases of severe morning sickness in early pregnancy, it is best to avoid turmeric altogether because it stimulates saliva production and increases stomach acid, potentially worsening symptoms. For the same reason, turmeric is contraindicated for people with gastroesophageal reflux disease (chronic heartburn) and gastritis. It is also better to exclude turmeric from the diet in cases of kidney inflammation and urolithiasis (kidney stones), since turmeric extract contains oxalates (salts of oxalic acid), which may contribute to the formation of kidney stones.

Conclusion:

Turmeric is not only a popular spice but also a valuable medicinal substance with a wide range of biological effects. Thanks to its active compound, curcumin, it possesses anti-inflammatory, antioxidant, hepatoprotective, and other beneficial properties. Turmeric can be used both for the prevention and as part of the comprehensive treatment of various diseases, including diabetes, cardiovascular, and neurodegenerative disorders.

Although turmeric extract is generally safe for most people, it is important to consider possible contraindications and to adhere to the recommended dosages.

References:

1. Kovaleva J. S., Safronova E. A. Curcumin: properties, biodistribution and perspective application // Farmatsiya. – 2021. – No. 6. – S. 12-18.
2. Kozlovskaya L. V., Tarasenko L. V. Turmeric in medicine and pharmacology // Journal of clinical and experimental medicine. – 2020. – No. 3. – S. 45–50.
3. Aggarwal B. B., Sung B. Pharmacological basis for the role of curcumin in chronic diseases: an age-old spice with modern targets // Trends in Pharmacological Sciences. - 2009. - Vol. 30(2). - P. 85-94.
4. Hewlings S. J., Kalman D. S. Curcumin: A Review of Its Effects on Human Health // Foods. - 2017. - Vol. 6(10):92.
5. Gupta S. C., Patchva S., Aggarwal B. B. Therapeutic roles of curcumin: lessons learned from clinical trials // AAPS Journal. - 2013. - Vol. 15(1). – P. 195–218.
6. Singh S., Aggarwal B. B. Activation of transcription factor NF- κ B is suppressed by curcumin // Journal of Biological Chemistry. - 1995. - Vol. 270(42). – P. 24995–25000.
7. Prasad S., Tyagi A. K., Aggarwal B. B. Recent developments in delivery, bioavailability, absorption and metabolism of curcumin: the golden pigment from golden spice // Cancer Research and Treatment. - 2014. - Vol. 46(1). – P. 2–18.
8. Arutyunov S. D. Osnovy biokhimii rastitelnykh preparatov. — M.: Medicine, 2018.
9. Guide to phytotherapy / Pod editor. Korsun V. F. — Kyiv: Zdorove, 2020. — 432 p.
10. Markova N. Yu. Biologicheski active veshchestva lekarstvennykh plant. — SPb.: Lan, 2022. — 310 p.

11. Kodirov B. et al. Silicon carbide synthesis in a solar furnace from natural raw materials //E3S Web of Conferences. - EDP Sciences, 2024. - T. 508. - S. 01005.
 12. Suvanova L. S. et al. Studying the technological possibilities of the large sun face in the localization of imported jewelry stones //American Institute of Physics Conference Series. - 2022. - T. 2432. – no. 1. – S. 020016.
 13. Muratov I. M. i dr. SUPEROXIDNYY CATALYSIS METALLOCOMPLEKSAMI PORFIRINOV AND PHALOTSIANINOV //Universe: chemistry and biology. – 2022. – no. 6-2 (96). - S. 41-44.
- Turgunov D. E., Rakhmanova F. E., Karjavov A. R. Terapevticheskoe primenenie i toksichnost saffron //Universum: meditsina i farmakologiya. – 2023. – no. 4-5 (98). - S. 47-51.