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Turmeric:

Benefits for athletes

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INTRODUCTION

TURMERIC

- Turmeric has become a **popular remedy** for the treatment of numerous conditions.
- Studies are now providing evidence that turmeric can be of **assistance to athletes**.
- Turmeric is sold as a spice and in a supplement form by many companies as a highly promoted **‘super-ingredient’.**

Turmeric – the Golden Spice

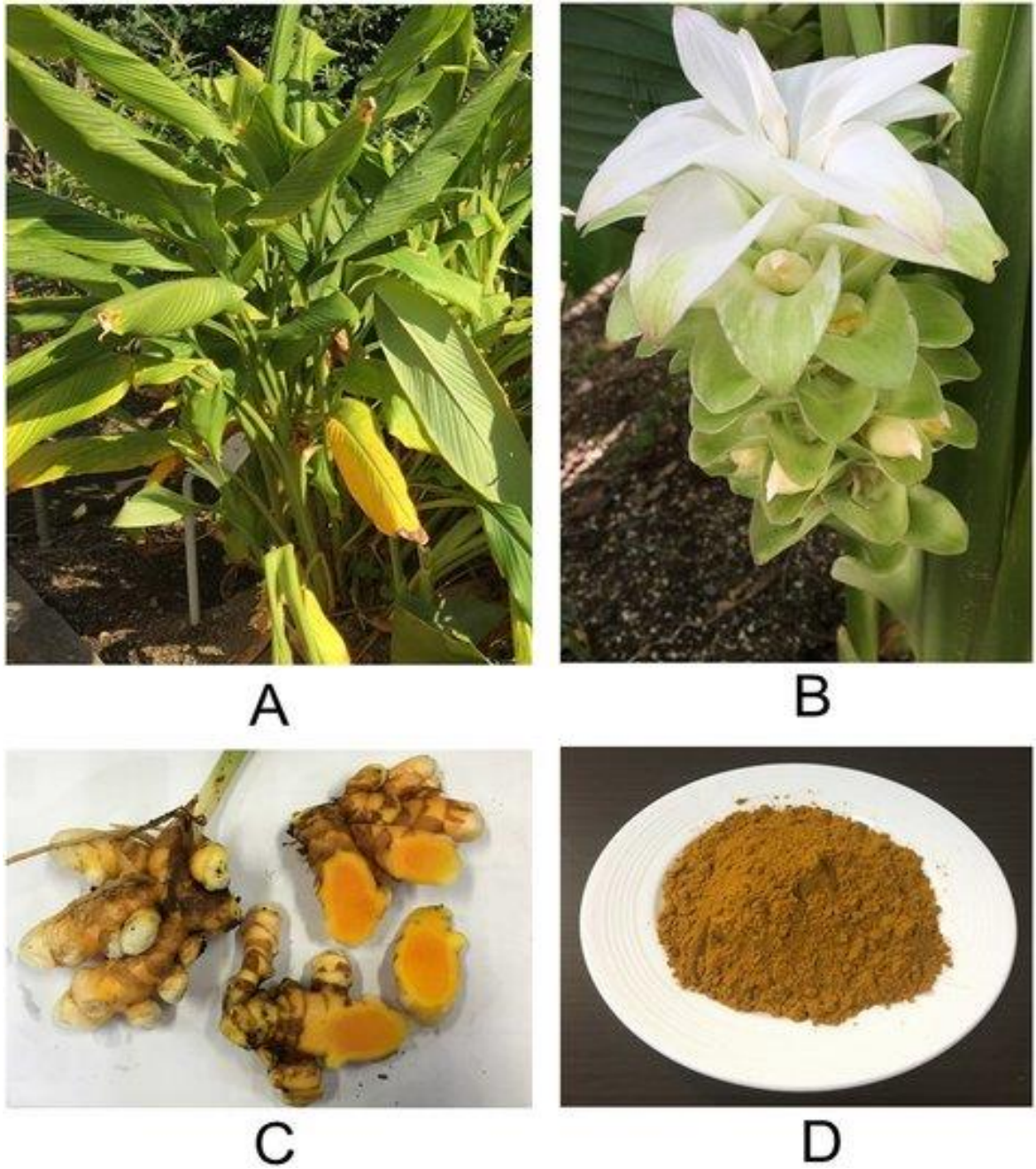
Turmeric is the dried root of the **Curcuma longa plant** (part of the ginger family Zingiberaceae)

It has different names throughout the world

- The name in Latin, English and Bulgarian: *Terra merita / Turmeric / Куркума*
- Turmeric is grown most extensively in **India**, but is also cultivated in Bangladesh, China, Thailand, Cambodia, Malaysia, Indonesia, and the Philippines.

PREPARATION AND USAGE

- Pictures of **Curcuma longa plant** (A), its flower (B), rhizomes (C) and rhizome powder (D) [Li 2019].
- **Turmeric** has been used as a spice, medicine and in many socio-religious practices for thousands of years.
- Turmeric is known for its yellow colour, which comes from the presence of compounds called curcuminoids. The curcuminoids (1-6% of the weight of turmeric) are a group of compounds, such as **CURCUMIN** - the most researched compound in turmeric.



Li, H., Sureda, A., Devkota, H.P., Pittala, V., Barreca, D., Silva, A.S., Tewari, D., Xu, S., and Nabavi, S.M.: 'Curcumin, the golden spice in treating cardiovascular diseases', Biotechnology advances, 2019

CURCUMIN (COMPOUND OF TURMERIC)

TURMERIC consists of more than 200 different compounds

- **Curcumin** was discovered in 1815, when Vogel and Pelletier isolated a yellow substance from turmeric and named it curcumin.
- Although curcumin is believed to account for most of the benefits accruing from turmeric, a recent review on **curcumin-free turmeric (CFT)** showed that CFT is **as effective as, or even more effective than**, curcumin containing turmeric (Aggarwal et al., 2013)

Curcuminoids
(1-6% of the weight of turmeric)

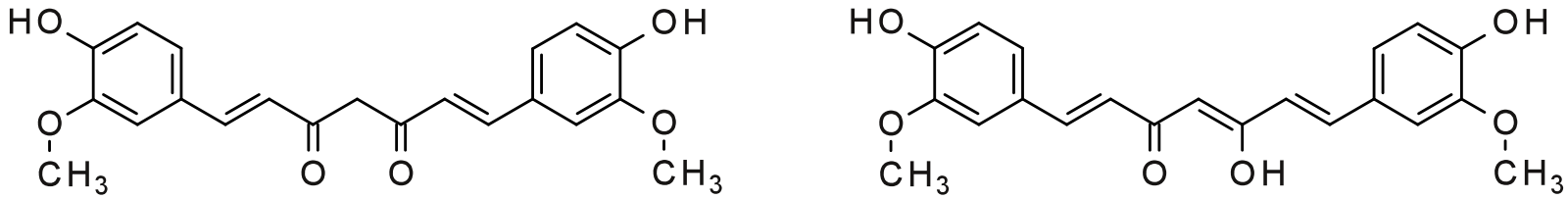
Curcumin
(60-70% of the weight of the curcuminoids)

Aggarwal, B.B., Yuan, W., Li, S., and Gupta, S.C.: 'Curcumin-free turmeric exhibits anti-inflammatory and anticancer activities: Identification of novel components of turmeric', Molecular nutrition & food research, 2013, 57, (9), pp. 1529-1542

Nutritional Analysis of Turmeric

- 60-70% carbohydrates
- 6-8% protein
- 5-10% fat
- 2-7% fibre
- 3-7% mineral matter
- 1-6% curcuminoids
- 6-13% moisture
- 3-7% Volatile oils

Keto and Enol chemical forms of Curcumin



The chemical name of curcumin is (1E,6E)-1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione, also called diferuloylmethane, and it has the chemical formula $C_{21}H_{20}O_6$, and molecular weight of 368.38

100 g sample of turmeric contains: 390 kcal; 69.9 g carbohydrates; 8 g protein; 8.9 g fat; 200 mg calcium; 260 mg phosphorous; 10 mg sodium; 2500 mg potassium; 47.5 mg iron; 0.09 mg thiamine, 0.19 mg riboflavin, 4.8 mg niacin, and 50 mg ascorbic acid

Ravindran, P.N., Babu, K.N., and Sivaraman, K.: 'Turmeric. The Genus Curcuma' (CRC Press, 2007. 2007)

Pharmacological Effects

- Atherosclerosis and Cardiac Diseases
- Osteoarthritis
- Digestive Disorders
- Cancer and Tumour
- Antioxidant/Radical Scavenging Property
- Liver Disease and Hepatoprotective Activity
- Antimicrobial Activity
- Wound Healing
- Antifertility
- Anti-inflammatory
- Eye Disorders

TURMERIC

Turmeric possesses a great variety of pharmacological activities

[Ravindran et al. 2007]

Ravindran, P.N., Babu, K.N., and Sivaraman, K.: 'Turmeric. The Genus Curcuma' (CRC Press, 2007. 2007)

BIOACTIVITY OF CURCUMIN

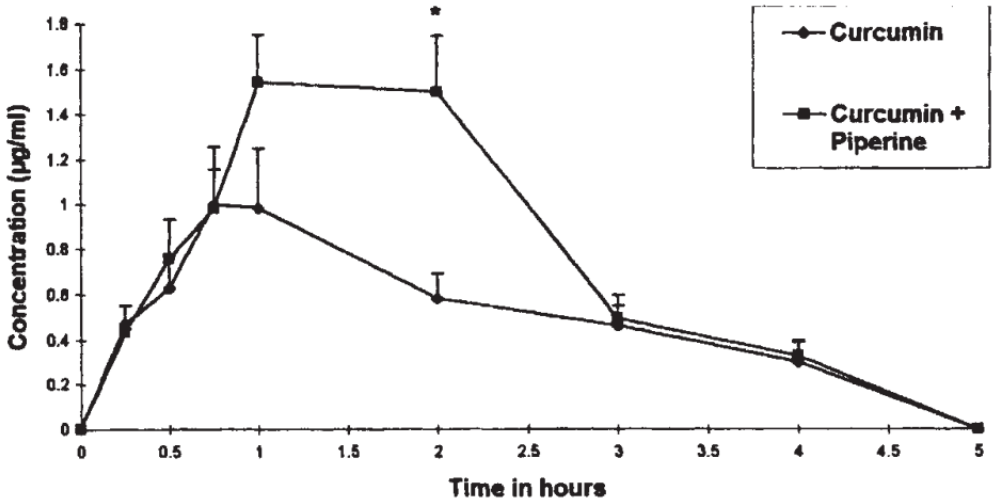


Fig.1 Serum concentrations of curcumin 20 g/kg oral alone and with piperine 20mg/kg in **rats** [Shoba et al. 1998]

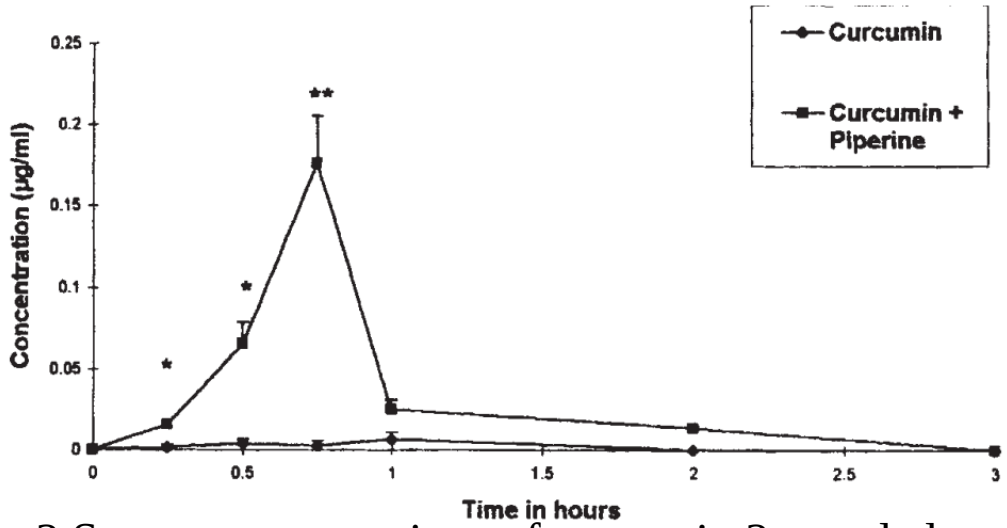


Fig.2 Serum concentrations of curcumin 2 g oral alone and with piperine 20mg in **humans** [Shoba et al. 1998]

Piperine increases the bioavailability of Curcumin

154% in rats

2000% in humans

Shoba, G., Joy, D., Joseph, T., Majeed, M., Rajendran, R., and Srinivas, P.S.:
'Influence of piperine on the pharmacokinetics of curcumin in animals and human volunteers', Planta medica, 1998, 64, (4), pp. 353-356

Application of Turmeric in Traditional and in Modern Medicine

- Turmeric has been used as a **medicine** and flavouring agent **since 600 B.C.**
- In **Ayurvedic medicine** and in **traditional Chinese medicine**, turmeric is well documented for the treatment of various conditions: asthma, allergies, gastric problems, inflammatory conditions, infectious diseases, hepatic disorders, colds, and others (Prasad, Aggarwal, 2011).
- In India and Bangladesh, the spice is mixed with calcium oxide (CaO), then it is warmed and used to treat inflammation and the swelling of limbs caused by different external injuries (Ravindran et al., 2007).
- Prasad and Aggarwal summarised numerous modern **in vitro studies**, which showed that turmeric is a powerful antioxidant, anti-inflammatory, antimutagenic, antimicrobial, and anticancer agent, as well as **in vivo studies**, in which turmeric exhibited anticancer, hepatoprotective, cardioprotective, hypoglycaemic and antiarthritic properties (Prasad, Aggarwal, 2011).
- In **studies on humans**, turmeric/curcumin has been applied in the fight against different diseases. Promising effects were observed on pain, inflammatory conditions, chemoprevention activity (Prasad, Aggarwal, 2011). It has been shown to reduce fatigue, as well as lowering total and LDL cholesterol in healthy elderly people (Cox et al., 2015).

Prasad, S., and Aggarwal, B.B.: 'Turmeric, the Golden Spice: From Traditional Medicine to Modern Medicine', (2011)
Cox, K.H., Pipingas, A., and Scholey, A.B.: 'Investigation of the effects of solid lipid curcumin on cognition and mood in a healthy older population', Journal of psychopharmacology, 2015, 29, (5), pp. 642-651

Benefits for Athletes

- Turmeric has anti-inflammatory properties, so it helps **reducing** the **repetitive trauma, inflammation, and pain** that sports training can cause.
- Turmeric was reported to be used by **yoga practitioners**, due to its **beneficial effect on the ligaments** (Ravindran et al., 2007).
- Curcumin was observed to **stimulate muscle regeneration** after trauma (Thaloor et al., 1999) and **offset the muscle-damaging effects** after downhill running in mice (Davis et al., 2007).
- **Reduces** exercise-induced **muscle soreness** in humans (20 healthy men, 1 g of curcuminoids twice a day or a placebo) (Drobnic et al., 2014).

Drobnic, F. et al. 'Reduction of delayed onset muscle soreness by a novel curcumin delivery system (Meriva(R)): J Int Soc Sports Nutr, 2014, 11, pp. 31
Ravindran, P.N., Babu, K.N., and Sivaraman, K.: 'Turmeric. The Genus Curcuma' (CRC Press, 2007. 2007)
Thaloor, D. et al.'Systemic administration of the NF-kappaB inhibitor curcumin stimulates muscle regeneration after traumatic injury', 1999, 277, (2)

Benefits for Athletes

- Curcumin may **decrease recovery time**, and, therefore, **improve performance** during subsequent training sessions (McFarlin et al., 2016).

curcumin group (n=16, 400 mg/day curcumin for 2 days before and 4 days after exercise test)

placebo group (n=12).

- 2 g of curcumin and 20 mg of piperine (3 times a day) **reduced** some aspects of **muscle damage** in elite level **rugby players** (Delecroix et al., 2017).

The study included **16 elite level rugby players** in a *randomized, balanced cross-over design* according to the condition (mix of curcumin and piperine vs placebo) and the legs (dominant vs non-dominant).

McFarlin, B.K., et al. 'Reduced inflammatory and muscle damage biomarkers following oral supplementation with bioavailable curcumin', BBA clinical, 2016, 5
Delecroix, B. et al. 'Curcumin and Piperine Supplementation and Recovery Following Exercise Induced Muscle Damage: A Randomized Controlled Trial', 2017

Supplementation of Turmeric and Side Effects

- The Allowable Daily Intake (ADI) value of **curcumin is 0–3 mg/kg body weight** (Kocaadam 2017).
- The average intake of **turmeric** by Asians varies from **0.5 to 1.5 g/day/person** (Eigner 1999), and that used in the Indian diet is approximately **2–2.5 g /day/person** (60–100 mg curcumin) (Amalraj 2017).

- The use of turmeric as a spice and as a household remedy has been known to be safe for centuries.
- Possible side effects were reported in some cases: diarrhoea, headache, rash, and yellow stool (Hewlings et al, 2017).
- To date, no studies in either animals or humans have discovered any toxic effects associated with the use of turmeric (Prasad, Aggarwal, 2011).
- The U.S. Food and Drug Administration (FDA) has declared turmeric and its active component curcumin as generally regarded as safe.

Amalraj, A., Pius, A., Gopi, S., and Gopi, S.: 'Biological activities of curcuminoids, other biomolecules from turmeric and their derivatives - A review', 2017, 7, (2), pp. 205-233
Eigner, D., and Scholz, D.: 'Ferula asa-foetida and Curcuma longa in traditional medical treatment and diet in Nepal, 1999, 67, (1), pp. 1-6
Kocaadam, B., and Sanlier, N.: 'Curcumin, an active component of turmeric (Curcuma longa), and its effects on health', 2017, 57, (13), pp. 2889-2895
Prasad, S., and Aggarwal, B.B.: 'Turmeric, the Golden Spice: From Traditional Medicine to Modern Medicine', (2011)
Hewlings, S.J., and Kalman, D.S.: 'Curcumin: A Review of Its' Effects on Human Health', Foods, 2017, 6, (10)

Thank You

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