Simerdip Kaur takes a look at the latest ophthalmology-related news stories and asks which are based on facts and which are 'fake news'.

Headline: A curry a day could keep the ophthalmologist away

The dietary supplement market is a multibillion-dollar industry that continues to grow year on year. Whilst some experts argue that the majority of supplement intake is merely excreted by the kidneys, others have been proven to be effective, for example the AREDS and AREDS2 formula in dry age-related macular degeneration (AMD). In the last three decades, a large amount of research has been focused on the therapeutic effects of curcumin in various ailments. Within ophthalmology there has been a growing interest on its neuroprotective role in glaucoma. Can this ancient curry spice be the next breakthrough in medicine?

The turmeric plant, also known as Curcuma longa, is revered in traditional Indian and Chinese medicine for its multitude of benefits on human health. The root of the plant, i.e. the rhizome, contains curcuminoids, which are the active chemical components consisting mainly of curcumin (80%), demethoxycurcumin (18%) and bisdemethoxycurcumin (2%) [1]. Curcumin, a hydrophobic polyphenol, also known as diferuloylmethane, is responsible for the yellow colour in turmeric powder [2]. It was first isolated by Vogel and Pelletier in 1815 but it took over 100 years before any scientific evidence emerged proving its benefits [1]. In 1937, Oppenheimer treated 67 patients suffering with cholecystitis using oral sodium curcumin and all but one of them were cured without reported adverse events over a three-year monitoring period [1]. Since then, there have been thousands more scientific papers on this plant extract and how it works.

Curcumin exerts its effect by acting on a range of molecular targets. It has been shown to possess anti-inflammatory effects by down regulating the expression of cycloocygenase-2 gene (COX-2) along with other prostaglandin and interleukins [3]. Like vitamin E, it is also an antioxidant and scavenges reactive oxygen species (ROS) and reactive nitrogen species (RNS) [4]. Another mechanism of its action is on the homeostasis process of angiogenesis in pathological states. In corneal neovascularisation, curcumin has been shown to suppress the release of vascular endothelial growth factor (VEGF) as well as basic fibroblast growth factor (bFGF) in in vitro and in vivo mouse cornea studies [5]. In another study involving patients with recurrent anterior uveitis, oral curcumin was found to be comparable to corticosteroid therapy in improving vision and decreasing flare and keratic precipitates (KPs) [5].

Whilst curcumin has poor water solubility and low bioavailability it has been found to be safe for human consumption even at high doses of between 8-12 grams per day, despite causing some mild gastrointestinal side-effects. Nevertheless, this means a large number of tablets which are poorly tolerated by patients. And so other methods of delivery are required, specifically topical preparations for use in ophthalmic conditions.

The most promising discovery so far is a curcumin-loaded nanocarrier (CN) developed by Cordeiro et al. [6] Their formulation is combined with a surfactant and stabiliser that increases the solubility of curcumin by a factor of 400,000 and was found to be stable at a temperature of 25°C for approximately two months with sustained release capacity. They tested this drop in two in vivo rodent model studies by administering it twice a day for three weeks beginning two days before simulated ocular hypertension and partial optic nerve transection. At the end of the study, the retinal ganglion cell layer density was preserved in the treatment group in comparison to the control group. Additionally, they concluded that curcumin exerts its neuroprotective effects independent of IOP lowering, as there was no difference in the IOP profiles between the two groups. There were also no ocular surface signs to suggest any local side-effects of the drop [6]. It is not known, however, if the drop would be as efficacious had it not been started prior to the simulated optic nerve injury related stress. Nonetheless, the triumph of their work lies in the discovery of the nanocarrier formulation that could transform all bench to bedside research in the future.

Plant-based products have played a significant role in the development of treatments in the field of medicine, from the foxglove plant and digitalis, to the pacific yew and paclitaxel [2]. Curcumin is safe, inexpensive and it is widely available in many forms from energy drinks to capsules, ointments to soaps. It has also received Federal Drug Authority (FDA) approval for being generally recognised as safe (GRAS) [1]. However, further studies, in particular randomised controlled double blind trials in human patients, are needed to fully ascertain its potential in treating disease.

References

1. Gupta S, Patchva S, Aggarwal BB. Therapeutic roles of curcumin: lessons learned from clinical trials. *The AAPS Journal* 2013;**15**:195-218.
2. Kumar S, Houreld N, Abrahamse H. Therapeutic potential and recent advances of curcumin in the treatment of aging-associated diseases. *Molecules* 2018;**23**:835.
3. Pescosolido N, Giannotti R, Plateroti AM, et al. Curcumin: therapeutical potential in ophthalmology. *Planta Med* 2014;**80**:249-54.
4. Radomska-Leśniewska D, Osiecka-Iwan A, Hyc A, et al. Therapeutic potential of curcumin in eye diseases. *Centr Eur J Immunol* 2019;**44(2)**:181-9.
5. Liu X-F, Hao J-L, Xie T, et al. Curcumin, a potential therapeutic candidate for anterior segment eye diseases: a review. *Frontiers in Pharmacology* 2017;**8**:66.
6. Cordeiro MF, Davis BM, Pahlitzsch M, et al. Topical curcumin nanocarriers are neuroprotective in eye disease. *Sci Rep* 2018;**8(1)**:11066.

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