Chapter 33
Traditional Uses, Phytochemistry, and Pharmacological Properties of Zingiber officinale Essential Oil and Extracts

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ABSTRACT

Ginger (Zingiber officinale) has been traditionally employed in south East Asia as well as India and China for treatment of nausea, asthma, fever, vomiting, cough, constipation, pain, arthritis, inflammation, etc. This chapter discusses the phytochemical composition and pharmacological studies of ginger extracts, ginger essential oil (GEO), and active bioactive constituents. The essential oil of fresh and dry ginger was ranged between 0.2% - 2.62% and 0.72% - 4.17% respectively. The bioactive constituent zingiberene, β-sesquiphellandrene, curcumene, β-bisabolene, β-farnesene, camphene, and gingerol and shogal are the major constituents in ginger extracts. These compounds are chief bioactive substances responsible for pharmacological activities such antioxidant, antidiabetic, anticancer, anticoagulant, antiradiation, anti-inflammatory, gastrointestinal, antimicrobial, cardiovascular, anti-obesity, and weight loss effects. Future research needs to investigate the suitable duration, maximum dosage of ginger, concerns of over-dosage, and its side effects in animal models and humans.

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INTRODUCTION

Ginger (*Zingiber officinale* Roscoe) belongs to the family Zingiberaceae and it was used in traditional medicine to treat illness almost 5000 years ago (Bode and Dong, 2004). The word ginger originated from the English word *gingivere*, while in Tamil it is known as *Ingii*, in Hindi, *adarakah*, in Chinese, *jiang* and in Arabic, *zanjabli*. Ginger is widely grown in the tropics with foremost exporting countries such as India, Nigeria, Australia, China and Jamaica. In India, ginger is cultivated in the states of Kerala, Karnataka, Orissa, Arunachal Pradesh, West Bengal, Sikkim and Madhya Pradesh. Kerala is the largest ginger producing state, which accounts for 30-40% of total production in India. Indian ginger has two popular varieties in the global market, namely Cochin Ginger and Calicut Ginger (Kubra and Rao, 2012). Dry ginger is mostly used for export purposes and fresh ginger as a vegetable.

The ginger rhizomes have a potent aroma and are extensively used as a spice and as medicine. Ginger and its extract are extensively used in beverage, food, and confectionery industries for manufacturing products such as ginger beer, ginger wine, pickles, Jam and biscuits (Wohlmuth et al., 2005). Ginger essential oil(GEO) and oleoresins are also used in several food products, especially in soft beverages and likewise various sorts of pharmaceutical formulations. It has various potential pharmacological effects in modern medicine such as anti-inflammatory, antifungal, and anticancer activities (Khan et al., 2010). In traditional medicine, ginger has been used for curing several diseases which includes cough, cold, asthma, nausea, travel sickness, morning sickness arthritis and gastrointestinal complaints (Grontved et al., 1988; Bone et al., 1990; But and Sultan, 2011; Khaki and Fathiazad, 2012).

The world health organization (WHO) has projected that nearly 80% of the global population depended on plant-based preparations as medicines to cure their health problems (WHO, 1991).

Plant-based food products are storehouses of various bioactive components like phenolics, flavonoids, carotenoids (Ashokkumar et al., 2013; Muthukrishnan et al., 2014; Ashokkumar et al., 2014; Ashokkumar et al., 2015; Ashokkumar & Shunmugam, 2016; Ashokkumar et al., 2018a; Ashokkumar et al., 2008b), folates (Jha et al., 2015; Ashokkumar et al., 2018c), terpenes (Ashokkumar et al., 2019b). These constituents have been evaluated for their potential biological effects. However, the dried ginger rhizomes contain 5 - 8% of oleoresin, and 1.5 - 3% essential oil depends upon the variety, country of origin, and quality (Zarate and Yeoman, 1996; Kayaardi et al., 2005). Also, the ginger rhizome possess significant concentration of essential nutrients, minerals and bioactive compounds such as flavonoids, terpenoids, carotenoids, essential oils, gingerols, zingiberene,zingerone, shogaolsand paradols(But and Sultan, 2011; Baliga et al., 2011; Ashokkumat et al., 2019). The pungency of ginger rhizome is mainly due to the presences of gingerols and shogaol, are key bioactive constituents of fresh ginger and it has various pharmacological effects including anticancer activity (Wohlmuth et al., 2005).However, zingiberene (10.5-16.6%), e-citrol (7.4 - 12.0%), ar-curcumene (2.9-9.8%),β-farnesene (5.1 - 8.4%), camphene (4.9 - 7.6%), β-sesquiphellandrene(5.8 - 7.2%) and citrol (5.3 - 7%) arethe major essential oil compoundsin dry ginger (Raina et al.,2005). The concentration of these compounds differs significantly depending upon the storage, country of origin, maturity stage of rhizome and preparation of ginger extract/product. The aim of this chapter is to highlight the key phytochemicals and pharmacological applications of ginger extracts and ginger essential oil (GEO) on human health.