

Mushroom-based functional food in Malaysia

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Opinion

Edible mushrooms represent untapped source of nutraceuticals and valuable palatable food. Long viewed as tonics, they are now treasured as functional food that can improve human health and quality of life. Numerous varieties of pharmaceutical substances with potent and unique health-enhancing properties were isolated from medicinal mushrooms and distributed worldwide. They represent a novel class of dietary supplements or nutraceuticals. The two terms have been used interchangeably with functional food, nutraceuticals, phytochemicals, mycochemicals, and biochemopreventatives. Mushroom-based nutraceuticals are products from mycelia or the fruiting bodies of mushrooms, and are consumed in the form of capsules, tablets, or extracts, and have potential therapeutic effects.¹

Mushroom-based products are being utilized by holistically oriented physicians, herbalists, naturopathic physicians, chiropractors, acupuncturists and Chinese herbal practitioners. Clinical efficacy of mushrooms depends on their precise scope of activity verifiable through *in vitro* and *in vivo* studies, dose range, extraction methods, source of substrates, duration and frequency of administration.

Mushrooms have been identified as one of the high-value commodities under Malaysia's National Agro-Food Policy (2011-2020). Development of the mushroom industry emphasizes on further area expansion, increased productivity, development of new varieties and product quality improvement. At present, three medicinal mushroom varieties, namely the *Hericium erinaceus* (Bull.: Fr.) Pers., *Lignosus rhinocerotis* (Cooke) Ryvarden and *Ganoderma lucidum* (Curtis) P. Karst are developed as functional food products in Malaysia.

Hericium erinaceus, also known as Lion's mane, Monkey's head, Hedgehog mushroom, Satyr's beard, Pom pom blanc, Igelstachelbart, and Yamabushitake is distributed in Asia, Europe and North America. It is a temperate mushroom that requires cool temperatures of 18 °C to 24 °C to produce fruiting bodies. Since 2000, it has been domesticated via adaptation to tropical climate in Malaysia. A standardized aqueous extract from fruiting bodies that contains approximately 21% β-(1-3), (1-6)-glucans and 0.2% adenosine was marketed as NevGro™ by Ganofarm R&D Sdn Bhd. The mushroom has been extensively tested in *in vitro* trials in our laboratories using neuronal cell lines, as the neurite outgrowth stimulator in the cultured cells of neural hybrid clone NG108-15 and PC12, and as the regulator of oxidative stress in the dermal fibroblasts of Friedreich's ataxia patients. Further, we explored the ability of locally cultivated *H. erinaceus* in the enhancement of peripheral nerve regeneration and acceleration of motor functional recovery after crush injury. Upregulation of signaling pathways as well as axonal protein synthesis and degradation are consistent with the beginning of motor functional recovery of injured limb.²

On the other hand, *Lignosus rhinocerotis* is a unique National Treasure that has a limited geographical distribution encompassing the Southern China, Thailand, Malaysia, Indonesia, Philippines, Papua New Guinea, New Zealand, and Australia. It is also known as Tiger's milk mushroom or *Cendawan susu rimau* in Malay language. The indigenous population has been consuming the mushroom

as mycomedicine for multi diseases. The freeze-dried cultivated sclerotium marketed as Ligno TM02® by Ligno Biotech Sdn Bhd, were reported to elicit immunomodulation, neurogenesis³ and anti-neuroinflammatory effects.⁴

Ganoderma lucidum, also known by the Japanese name Reishi and Chinese name Ling zhi, is the most revered mushroom in Traditional Chinese Medicine documented in *Shen Nong Ben Cao Jing*. Ling zhi is consumed in the form of concoctions by Asian populations for promoting health and longevity. This feature is primarily attributed to polysaccharides and their derivatives. The formulation of 10% broken spore powder and 90% concentrated fruiting body powder developed by Ganofarm Sdn Bhd facilitates bioavailability and absorption in the digestive tract.

Mushroom-based functional food as discussed here provide biomaterials with medicinal applications for *in vitro* and *in vivo* assessments by targeting multi-mechanisms actions. Therefore, it is essential to establish internationally recognized guidelines for assessing their quality. These products need to be standardized by manufacturing companies. However, a standardized product doesn't necessarily guarantee a product of high quality as there is no legal definition of it. Consumers are often left on their own to decide what is safe and effective for them and the lack of consistent labelling on herbal products can be a source of consumer frustration. Without the

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implementation of required regulation and reliability in safety and efficacy data, the belief in natural medicines will continue to stagger along.

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Conflict of interest

The authors declare that they have no conflict of interest.

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