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Lentinus sp. RJ-2 Mushroom is Important Source of Natural Antioxidative Polysaccharides

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Reactive oxygen species of free radicals are the metabolic products of human body which play their role in signaling, but their overproduction results in damage to various cellular molecules like lipids, proteins and DNA (Valko *et al*., 2006). This oxidative stress causes a redox imbalance and mutation in normal signaling pathways of cell, which results in the onset of disease. Although oxidative products facilitate cell division and defense against pathogens, their overproduction create more deleterious effects by damaging the membranes and causing a number of diseases (Valko *et al*., 2007). The diseases they assist include cancer, diabetes, hypertension, oxidative pathogenesis, ischemia, neurodegenerative diseases etc. Thus, oxidative imbalance have a huge burden on human health. Use of antioxidants is the only way to deal with it; several synthetic and natural antioxidants are used to reduce oxidation problems in food and human health (Kayode *et al*., 2009; Shahidi and Zhong, 2010; Karim *et al*., 2011). But synthetic antioxidants have some adverse effects on human health which create doubts in their reliability; on the other hand natural antioxidants are safer. Moreover, these naturally occurring antioxidants have the potency to provide more protection from oxidative stress, as their antioxidant capacity is significantly higher than synthetic antioxidants (Hossain *et al*., 2008). Rosmarinic acid (a natural polyphenol) showed a high antioxidant potential from strongest synthetic antioxidant; propyl gallate. Polysaccharides are one of the major antioxidant metabolic products in fungi; they can act as antitumor, antimutagenic, anti-infection and antigenotoxic agents (Kogan *et al*., 2008). Because polysaccharides inhibit the lipid peroxidation and DNA damage, enhance the excretion of tumor necrosis factor alpha from macrophages and thus help in inhibiting tumor formation. Polysaccharides are also an important component of mushrooms body, they are well known for antitumor activities but less is known about their chemical structure (Zhang *et al*., 2007). Hence, mushrooms polysaccharides can build a significant base for natural antioxidants; their use can be facilitated through investigating their structures and active ingredients.

Lentinus is a genus of edible and medicinal mushrooms; its members are rich source of carbohydrates, its moisture, carbohydrate and protein contents are higher than some other edible mushrooms (Adejumo and Awosanya, 2005; Yu *et al*., 2009). Its polysaccharides can increase the antioxidant enzymes' activity with decrease in interleukin-2 and tumor necrosis factor alpha levels. Thus, study of its polysaccharides will be helpful in medicinal field. Thetsrimuang *et al*. (2011) studied the polysaccharides of *Lentinus* sp. strain RJ-2 Fresh (FB) and dried fruiting bodies (DB) to interpret their antioxidant potential and composition of polysaccharides. According to their results both fruiting bodies (FB and DB) contained huge amount of polysaccharides (47.7 and 42.5%, respectively), which were higher in FB. These polysaccharides were constituted by reducing sugars, proteins, carbohydrates and phenols. All these contents except proteins were slightly lower in DB than FB, which might be due to the effect of drying technique (dried at room temperature). Where, the protein contents in DB extracts were significantly higher than FB and many of their proteins showed a similar smear in Tris-tricine SDS-PAGE. Some of which were lower weight proteins (20.1 kDa), while some showed the weight higher than 66 kDa. Likewise their polysaccharides also showed similarities in their structure and both fruiting bodies extracts strongly absorbed radiations within the range of 1200-1000 cm^{-1} in infrared spectroscopy. This indicated existence of a pyranose ring and thin layer chromatography results identified the presence of mannose as the major component both extracts. But these spectroscopic and chromatographic techniques did not provide detailed investigation of polysaccharides structures. Furthermore, the result of their antioxidant assays revealed that these polysaccharides acted differently in quenching the free radicals. As the FB extracts showed higher antioxidant activities in 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) and 2,2-Diphenyl-1-picryhydrazyl radical essays. While, DB showed higher antioxidant capability in ferric reducing antioxidant power essay, these differences might be due to their different concentration of phenols. Thus the polysaccharides of both DB and FB were active in reducing the oxidative products but their results were lower than the standard antioxidant trolox (analog of vitamin E). This might also be due to differences in phenolic composition and their pathway of action.

Moreover, *Lentinus* sp. RJ-2 polysaccharides were higher in concentration than derived from other mushrooms, as these were lower than 2% in *Russula virescens* fruiting bodies (Sun *et al*., 2010). Hence, *Lentinus* sp. RJ-2 was rich source of polysaccharides and drying did not cause a significant change in their concentration in FB and DB. But there is more need of research on polysaccharide structure and their relative curative properties.

Reactive oxygen species are the biologically important part of body but their overproduction can cause a state of oxidative stress. This stress damages the cellular contents and is responsible for many metabolic disorders, which include cancer, diabetes, neurodegeneration etc. The application of antioxidant can reduce the risks of these diseases through enhancing the activity of antioxidant enzymes, which protects the lipids, proteins, DNA and cellular membranes. Polysaccharides are important antioxidant of mushrooms and can reduce the risk of many diseases. Thetsrimuang *et al.* (2011) studied their concentration in fresh and dried fruiting bodies of *Lentinus* sp. RJ-2. They concluded that *Lentinus* sp. RJ-2 like other mushrooms was a rich source of polysaccharides, which contained proteins, phenols and carbohydrates. Its polysaccharides were majorly constituted by mannose and were able to reduce various oxidants. In addition, their concentration and composition in both fresh and dry fruiting bodies were very much similar, while dry body contained more proteins; hence these can also be used in dried from. In conclusion, more research on *Lentinus* sp. RJ-2 polysaccharides structure and composition will help their use as both dried and fresh forms.

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