

## Impact of Mushroom Nutrition on Microbiota and Potential for Preventative Health

Ferrão J

The [current short](#) article reviews the role of mushroom biomass, rich in  $\beta$ -glucans, enzymes, germanium and secondary metabolites, the interaction with the human gut microbiota and the prevention or treatment of various metabolic syndrome-linked diseases. The microbiota is intimately involved in numerous aspects of normal host physiology, from nutritional status to behaviour and stress response. Additionally, they can be a central or a contributing cause of many diseases.

The overall balance in the composition of the gut microbial community is important in ensuring homeostasis. The bacteria species in our colon today are more or less the same as we had when we were six months old. About 80% of a person's gut microflora are transmitted from the mother during birth, being a very stable system. Imbalances in the composition of the bacterial microbiota, known as dysbiosis, are postulated to be a major factor in human disorders.

[Chemically, dietary fibre](#) consists of non-starch polysaccharides such as arabinoxylans, cellulose, and many other plant components such as resistant starch, resistant dextrins, inulin, lignin, chitins, pectins,  $\beta$ -glucans, and oligosaccharides. Because human body cannot digest fibre, it does not provide calories for energy or nutrients for cells. Despite this fact, fibre provides health benefits and is an important part of a healthy diet. Indeed, bacteria ferment  $\beta$ -glucans in the intestinal tract, producing short-chain volatile fatty acids (acetic, propionic and butyric).

In the view of the FDA, the isolation, concentration and purification targeting a single active ingredient from mushroom extracts designate them as "pharmaceuticals". Using the mushrooms and mycelium in their natural forms as biomass make them "functional foods" or "[dietary supplements](#)". Both, extracts or biomass forms, can be considered as acting as "prebiotics". Biomass is the mycelium with primordia (young fruiting body - before the mushroom blooms). It contains all the nutrients and active compounds, including enzymes, germanium, secondary metabolites and  $\beta$ -glucans. The mesenterium and the colonic microflora appear to play a vital role in health and the large bowel in health may have been underestimated in the past.

Our digestive systems are actually directly linked to our brains; in fact, our guts are actually considered our "second brain," with the two sending messages to each other constantly in an attempt to keep things in harmony, [influencing mood](#) and well-being, stress and anxiety. Some 80 % of human immune system lies in the gastrointestinal tract and 20 % in the back of our mouth (e.g. amygdala) enhancing the fact that an optimal health starts in your gastrointestinal tract.

The mechanisms by which mushrooms may influence health benefits remain an active area of investigation. Inflammation is the body's response to injury or disease. It is a protective mechanism and a necessary part of healing. Evidence supporting the impact of specific foods on inflammation in the body is limited and there is no anti-inflammatory miracle food. Some mushrooms act directly

on inflammation. *Cordyceps sinensis*, a mushroom that contains cordycepin, stimulates the production of interleukin 10, an anti-inflammatory cytokine. *Ganoderma lucidum*, *Poria cocos*, *Inonotus obliquus*, *Pleurotus ostreatus* mushrooms exert an anti-inflammatory effect less directly, by quenching damaging free radicals and counteracting oxidation.

Mushrooms contain dietary fibres including  $\beta$ -glucans, chitin and heteropolysaccharides (e.g. pectinous substances, hemicellulose, polyuronides), making up as much as 10-50% in the dry matter. Much of the active polysaccharides, water soluble or insoluble, isolated from mushrooms, can be classified as dietary fibres (i.e.  $\beta$ -glucan, xyloglucan, heteroglucan, chitinous substance) and their protein complexes. Based on their effects on the immune system, mushroom  $\beta$ -glucans have been proposed to act as "biological response modifiers" (BRM), enhancing the body's own use of macrophages and T-lymphocytes, rather than directly attacking any tumours.

[Mushrooms are good](#) sources of several bioactive compounds which are able to augment or complement a desired immune response. Such bioactive compounds are polysaccharopeptides, polysaccharide-proteins, functional proteins (ubiquinone-9, nebrodeolysin, ubiquitin-like peptide and glycoprotein),  $\beta$ -glucans, proteoglycans and many others. Most of these bioactive compounds follow the immunomodulatory pathway mechanism of polysaccharide ( $\beta$ -glucans) from mushrooms by stimulating activities for both innate and adaptive immune systems. They proliferate and activate innate immune system components such as natural killer (NK) cells, neutrophils, and macrophages, and stimulate cytokines expression and secretion. These cytokines in turn activate adaptive immunity through the promotion of B cells for antibodies production and stimulation of T-cell differentiation to T helper (Th1 and Th2) cells, which mediate cell and humoral immunities, respectively.

Some species of mushrooms synthesize enzymes that may play important functions in the organism. The biomass form of mushrooms contain, not only protein-bound polysaccharides (PSK; PSP), typical on extracts, but also active enzymes responsible for preventing oxidative stress (e.g. laccase, superoxide dismutase), inhibiting cell growth (e.g. proteases, glucoamylases) and promoting detoxification (e.g. peroxidases, cytochrome P450, glucose-2-oxidase) and there are innumerable situations and conditions related with oxidative [stress: allergies, arthritis](#), asthma, atherosclerosis, inflammation (acute, chronic), cancer, cataracts, diabetes, multiple sclerosis, hemorrhage, infections, bruising, intestinal worms, chemotherapy, radiation, stress (physical, mental), tobacco smoke and ulcers.

Cytokines are messenger molecules produced by a broad range of cells, including immune cells like macrophages, B lymphocytes, T lymphocytes and mast cells, as well as endothelial cells, fibroblasts, and various stromal cells. Cytokines include chemokines, interferons, interleukins, lymphokines, tumour necrosis factor but

---

generally not hormones or Alpha Interferon (IFN) are secreted proteins that allow communication between and within cell types. [Different cytokines](#) elicit different responses. Cytokines can activate, modulate and inhibit immune responses.

Mushroom biomass supplements are a particularly good choice for people with an already weakened immune system. They do not perform miracles neither have a specific role for each illness, rather, it supports the immune system, assisting in preventing or mitigating the effects of a range of several ailments by providing overall immune support via supplementation with  $\beta$ -glucans, enzymes and secondary metabolites.

Despite promising evidence of mushroom biomass on health much research still remains to be done.

**Contact information:** Ferrao J,  
Universidade Pedagogica,  
Rujoao Carlos Raposobeirao 135,  
Maputo,  
Mocambique.  
Email : ljferrao@icloud.com