

Medicinal value of Mushroom

Mode of action → these anticancer agents do not act directly on the tumor itself, but act through immune system of the host.

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These agents/metabolites act as "biological response modifiers" or BRM or immunopotentiators.

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Mushroom extracts inhibit the role of enzyme cox-2 (responsible for tumorigenesis)

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As a result cancer is prevented

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Agents (β-D-glucan)

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come in contact of receptor, present on the surface of a no. of WBC (leucocytes, monocytes, macrophages and other lymphocytes).

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stimulate WBC

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As a result cytokines, lymphokines (cell mediators such as IL-1, IL-2, IL-4, (interleukin), Interferon, TNF (Tumour Necrosis Factor) are produced)

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Increases T-cells function and antibody production

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Many immune parameters are improved.

Q. What is immunopotentiators OR BRM?

Ans:- Antibodies that target immune regulatory pathways, or also called immunostimulants.

Q. What is Interleukin?

Ans:- A class of Glycoprotein produced by leukocytes for regulating immune responses
OR,

These are the substances secreted by certain cells of immune system and have an effect on other cells.

Medicinal properties of Mushroom

- Since thousands of years, edible fungi have been revered for their immense health benefits and extensively used in folk medicines.
- Specific biochemical compounds in mushrooms are responsible for improving human health in many ways. These bioactive compounds include polysaccharides, tri-terpenoids, low molecular weight proteins, glycoproteins and immuno-modulating compounds.
- Hence mushrooms have shown to promote immune function; boost health; lower the risk of cancer; inhibit tumor growth; help balancing blood sugar; ward off viruses, bacteria and fungi; reduce inflammation; and support the body's detoxification mechanisms.
- **chemoprevention** :- Cancer chemoprevention agents are non-steroidal anti-inflammatory drugs.
 - Their action is on the enzyme COX-2 (cyclooxygenase-2) responsible for tumorigenesis.
 - Plant extracts in the form of drug evaluated against COX-2
 - These type of research is also directed against mushroom extracts.
- **constituents of anti-tumour** :- Polysaccharides, proteins, glycoproteins, lipids, etc.
- **Polysaccharide** :- Isolated from Agaricomycetes, Trametes, Polyporales - considered as BRM (Biological response modulator) and active for host immunological function.
The principal components are - β -D-glucose (heteropolymers of xylose, mannose, galactose, uronic acid etc.)

Name some polysaccharide carcinostatic agents in Japan.

Important points :-

1. Name of the mushroom
2. Name of the agent
3. Against the type of problem/disease & target organ
4. Country
5. Active ingredients
6. Mechanism of action

- if any

1. PSK, Krestin from Trametes versicolor
2. Lentinan from Lentinula edodes
3. Befungin from Inonotus obliquus
4. Sonifilan, SPG, Schizophyllan from Schizophyllum commune
5. PSPC (Polysaccharide bound protein complex) from Tricholoma sp.

→ Ganoderma lucidum is also active against the microorganisms, staphylococcus streptococcus, ~~Bas~~ Bacillus pneumoniae and hepatitis B virus.

→ Combine effect of G. lucidum -

* GL-P fraction from G. lucidum inhibited fibrosarcoma in mice when was
(Ganoderma lucidum polysaccharide) in combination with bleomycin.

* GL extract in combination with glutathione beneficial in hepatic necrosis, and hepatitis in mice.

→ Mechanism of action -

* Biological response modifiers (BRM) → stimulates host own defense system

* Most of the critical problem (antitumour, antiinflammatory, anti HIV, activities, bactericidal etc) are mediated through immune system.

* cell surface is the target site (in the receptor).

* β -D-glucan receptor on the surface of WBC (leukocyte, monocyte, macrophase and other lymphocyte) in animals and humans have been discovered recently.

* β -glucan stimulates and release cytokines and lymphokines (cell mediators such as IL-1, IL-2, IL-4 (Interleukins), Interferon, etc.)

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As a result many immune parameter improves.

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For eg. Improve of T-cell function and antibody production.

T-cells :- white blood cells that are produced in bone marrow but mature in thymus. They are important in body's defense against certain bacteria and fungi. B-lymphocytes make antibodies and help in recognition and rejection of foreign tissues. It is also important in body's defense against cancer.

Triterpene :-

Ganoderma

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Inserted with membrane of platelets

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Membrane contributes to inhibition of platelet aggregation by triterpene at a concentration of 20 μ m or lower.

Antiviral effects →

- Calvatia gigantea possess antitumour activity.
- Extracts of a number of edible species eg. Boletus frostii, Calvatia gigantea, Agaricus campestris protect us from poliomyelitis.
- Extracts of Grifola frondosa (maitake) were shown to inhibit the virus in an in vitro culture system.

Hepatoprotective and antidiabetic effect →

- Mushrooms are effective against hepatic disorders including hepatitis.
- The following mushrooms have hepatoprotective effect -
Grifola frondosa, Dendropolyporus umbellatus, Schizophyllum commune,
Trametes versicolor, Tremella fuciformis.
- Diabetes can be controlled by Grifola frondosa.
- 'Coriolan' from submerged culture mycelial biomass of Trametes versicolor showed active in animals against diabetes.

Medicinally significant species :-

1. Ganoderma lucidum -

Active ingredients :-

(a) Polysaccharides

- Anticancer, Hepatoprotective, Radiation protective, Immunomodulatory.

(b) Triterpene

- Cytotoxic tumours, Anti-HIV, Hypotension (low blood pressure), Hepatoprotective, Analgesic

(c) Ling zhi-8

(128, 110 amino acid)

- Antihypersensitivity, Antihepatitis B, Immunomodulatory.

Function :-

- Ganoderma is used in the treatment of liver problem, chronic hepatitis, arthritis, hypertension, insomnia, bronchitis, gastric ulcer, asthma, and has antitumour, immunostimulating and antibacterial activities.

- Out of all these agents Krestin - top selling anticancer agent in Japan prescribed for cancer of digestive system (stomach, oesophagus and colon) and to eliminate immunosuppressive function.
- Another anticancer agents from Grifola frondosa - a proteoglycan - the protein with β -glucan.

Dietary fibre and lectins :-

β -glucan, chitin, heteropolysaccharides - have the capacity to absorb carcinogen substances - thus preventing their absorption into intestine - thus prevent cancer in colon and rectum.

- cardiovascular and hypercholesterolemia effects :- (Reduction in cholesterol) [i.e. absorption of cholesterol from intestine].

→ Lovastatin and Intadine from Pleurotus and Lentinula edodes respectively hypcholesterolemia in animals and sometimes humans (lowering cholesterol content).

→ Adenosine from Auricularia polytricha - for low incidence of atherosclerosis (decrease of arterial deposition of fatty material).

→ Lowering blood pressure by taking mushroom.

Antimicrobial / Antiprotozoal effect :-

→ Penicillin - 1940

→ list of fungi has been incorporated - having the capability to produce antibiotic compound.

→ Active principles :- Polyacetylene, terpenoids, phenolics, purines, pyrimidines, quinoid compounds.

→ A number of fungi has antifungal property.

→ Antiprotozoal (Illudium M. and Illudium S terpenoids) (from Irfex flavus) active against Plasmodium gallinaceum.

• Active ingredients :-

1. Lentinan from Lentinula edodes
2. Schizophyllan from Schizophyllum commune
3. PSP (polysaccharide peptide) and erinolan and keratin from Coniolum versicolor.
4. GIPs (Ganoderma lucidum Polysaccharides) fraction from Ganoderma lucidum.
5. Calvacin: Calvatia gigantea :- strong tumour relationship compound.

all the above metabolites are referred as Immunomodulators, enhancing immune system.

4. Auricularia auricula & A. polytricha :-

- (a) known to control inflammation of throat and for eye irritation. Used as boiler in a liquid.
- (b) lowering blood cholesterol
- (c) as an anticoagulant
- (d) antidiabetic.

5. Proteus edulis :-

- (a) Treatment of leg pain
- (b) lumbago
- (c) Numbness in limbs
- (d) Tendon discomfort.

6. Cordyceps sinensis :- commonly called ~~cater~~ caterpillar fungus.

- (a) Used in the strengthening of the body after exhaustion or long time illness.
- (b) Used as an antidote for opium poisoning.
- (c) Remedy for weakness and fatigue.
- (d) Used as rejuvenators for increase in energy.
- (e) for curing of renal, liver and cardiovascular diseases.

2. Lentinula edodes

Lots of functions :-

Anti-inflammatory; antitumour, antiviral, antibacterial, anti-parasitic, blood pressure regulation, antidiabetic, immunomodulating, hypercholesterolemia, hepatoprotective, sexual potentiator.

- Active ingredients - Lentinan (β -D-glucan)
- KS-2 - a Mannan peptide.
- LEM, LAP - heteroglucan protein

How to act? → β -D-glucan binds to lymphocyte surfaces or serum specific proteins

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which activate macrophage, T-helper cell or other effector cells

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Increase the production of antibiotics, Interleukins (IL-1, IL-2) and γ Interferon (IFN- γ)

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Released upon activation of effector cells.

• Medicinal property :-

- has antitumour property.
- liver protection
- Produces antibodies for hepatitis B.
- lowers blood cholesterol
- lowers blood pressure.

3. Coriolus versicolor :-

A bracket fungus also referred to as turkey tail.

- Effective against many form of cancer
- treats pulmonary disorders
- and cures ringworm.