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Review Article

Lectins; A Hope of Treatment For COVID-19

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Abstract

COVID-19, a newly emerged infectious disease caused by SARS-CoV-2, arose in Wuhan China. Which is a challenge for scientists worldwide. The available vaccine is expensive and not easily assessable. However, the most of the enveloped viruses' express glycoproteins on their surface. While lectins are proteins that directly bind to glycosylated residues, and certain lectins have been suggested as viral infection therapies. Many antiviral lectins have been successfully used against hepatitis C, influenza A/B, herpes, Japanese encephalitis, HIV and Ebola. Lectin have shown significant activity against SARS coronavirus that occurred in 2003. This agent is cheap and easily accessible, if it succeeds in SARS-CoV-2 treatment, it will have a huge advantage. In order to treat COVID-19, scientific attention is needed on lectins.

Key words: Lectin; COVID-19; SARS-Cov-2; Treatment; Glycoprotein

Background

In November 2019, COVID-19 emerged in central China, Wuhan city [1], and none of the epidemiologists had predicted the pandemic. However current situation has devastated the world and the stress is on upsurge, because still there is no proper vaccines or medicines available to population. The therapy with various antivirals and antibiotic is also limited because it does not directly target viral pathogens. However still the nature opens the ways, that most of the enveloped viruses' express glycoproteins on their surface. While lectins are proteins that directly bind to glycosylated residues, and certain lectins have been suggested as viral infection therapies [1]. Many antiviral lectins have been successfully used against hepatitis C, influenza A/B, herpes, Japanese encephalitis, HIV and Ebola [2].

Lectins are non-immune proteins or glycoproteins with at least two binding sites that identify unique carbohydrate residue sequences. The physiological roles of lectins are still theoretical, but their involvement in growth cell adhesion and recognition interventions phagocytosis fertilization ontogenesis differentiation mechanism modifications, secretion phenomena and proteolytic stability have been seen. Due to its strict specificity for various glycan's, lectins have been the weapon of choice for the biochemical and histochemical characterization of cell glycol-conjugates. Interaction of lectins and glycoproteins is the cornerstone of many biological phenomenon, such as the adhesion of viruses to the host cell membrane. Many lectins impede viral replication by interfering with glycoproteins [3]. Thus, inhibition of this interaction by lectins will allow the development of new antiviral therapies.

Lectins a potential antiviral

Coronavirus has a spherical shape with an average diameter of 120nm. Modified proteins which are formed during post translation modification such as glycoproteins and transmembrane proteins are the constituent of the virus outer surface envelope. These antigenic proteins act as prime mediating agents by attaching to the specific receptors on host. The potential virus integrates the genetic RNA code and start replication inside host cell.

Any viral therapy is important for the early suppression of the cell invasion of viruses, the choice of inhibitors, and the recognition and characterization of molecules that obstruct the entry of viruses. The transmission of viruses and the progression of the disease relies on the direct association between the virus and the receptors of the host cells [4], typically glycoproteins in nature. The glycoprotein of the virus envelope is heavily glycosylated, and the lectin has binding properties to such carbohydrates involved in antiviral activity, thus blocking the interaction between the glycoprotein of the virus envelope protein is a successful strategy for developing antiviral therapy. In addition, lectins are powerful components for further understanding the early stages of viruses entering host cells. Several lectins isolated from natural sources can inhibit microbial and viral pathogens in vitro and in vivo [5]. These lectins specifically bind to glycoproteins in the virus envelope, restricting the virus from entering the host cell. Therefore, any agents which interfere the integrity of the enveloped virus discourage the entry of the vial particle and prevent its infectivity.

The coronavirus has been widely recognized in the veterinary world since the 1930s. In 2003, coronavirus was recognized as a causative agent for the outbreak with a pandemic with severe acute respiratory syndrome (SARS) [6]. A new human coronavirus, MERS-CoV, emerged in the Middle East in 2012. It is responsible for SARS-like pathology [7]. These coronaviruses are characterized by single-stranded, non-segmented RNA genomes. They are the largest viral RNA genomes reported so far [8], have shown that lectin Agglutinin Urtica Dioica) binds to N-acetylglucosamine-like residues on glycosylated envelope glycoprotein, thus inhibiting SARS-CoV binding to host cells. Lectin galanthus nivalis lectin (GNA) has been effectively used to remove the MERS-CoV virus, which can detect the disaccharide mannose (1-3) at the end of the glycoprotein viral envelope [9]. The surface glycoprotein (S) of severe acute respiratory syndrome coronavirus (SARS-CoV) attaches to angiotensin 2 converting enzyme (ACE2) to allow its penetration into host cells [10]. The discrepancy between SARS-CoV and SARS-CoV 2 in terms of viral proteins is just 25 percent, and SARS-CoV 2 also binds to angiotensin 2 converting enzyme [11]. SARS-CoV protein S contains numerous N-glycosylated surface sites, rich in mannose, hybrid N-glycans and complex N-glycans [12]. Glycoprotein S is the gateway to viruses and the primary target of antiviral drugs (such as lectins) and is proposed to prevent COVID-19 from binding to these target cells. *Canavalia ensiformis (Con A), Pisum sativum (PSA), Lensculinaris (LCA), Vicia faba agglutinin (VFA), Vicia cracca (VCA), Onobrychis viciifolia (OVA) and Lathyrus sativus (LEC)* are among the lectins that can optionally be mixed with glycoprotein S [2].

Lectins has demonstrated considerable promise for inhibition and avoidance of several infections and/or recovery of individuals afflicted with the virus. COVID-19 envelope glycoprotein S is abundant in mannose, intermediate and complex glycans. This glycoprotein is the gateway to the life cycle of the virus and the primary target of antiviral drugs (such as lectins). With the preference of these lectins, the specificity of the glycoprotein viral envelope must be valued. In order to inhibit COVID-19 from binding to these target cells, it is desirable to use lectin in conjunction with mannose or/and hetero-and complex glycans. Therefore, we recommend the following lectin as therapeutic agents due to specificities such as COVID-19 glycoprotein, for example: *Canavalia ensiformis (Con A), Pisum sativum (PSA), Lensculinaris (LCA), Vicia faba agglutinine (VFA), Vicia cracca (VCA), Onobrychis viciifolia (OVA) and Lathyrus sativus (LEC)*. Given the number of lectins used as therapeutic agents against several viruses, it is not surprising that some may be used as COVID-19 drugs.

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Conflict of interest

The authors declare no conflicts of interest.

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Ethical Approval

None.

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