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Indigenous Herbs: Antiviral Potentials and Usage

"Does herbal medicine research take place as regularly as synthetic drug development research?" This has actively been a matter of concern among young herbal medicine students and enthusiasts all around the globe. Since the COVID-19 pandemic, synthetic drug development research against the SARS-CoV-2 virus has been coinciding with the vaccine developments. As the use of antiviral drugs in human and veterinary medicine is limited because of viral mutation, toxic effects, the severity of viral diseases, the ability of the virus to survive intracellularly, the high costs, and the non-availability of specific antiviral chemical agents against veterinary pathogens [1], herbs based pharmacotherapy may be a proper alternative for treating viral diseases. Herbs or herbal constituents have been used to treat viral diseases in humans and livestocks alike for centuries throughout time; significantly, here in the Indian subcontinent. Moringa, Neem, and Turmeric are three of the Bangladeshi native herbs that have antiviral potentials against many human and animal viruses.

Moringa oleifera (Common name: Drumstick/ Moringa, Bengali name: Sajina/ Sajna/ Sajne) exerts antiviral activity against different human and animal viruses due to its alkaloids, saponins, glycosides, niazimin, phenolic compounds, and terpenoids [2]. Roots, flowers, leaves, and pods of moringa are used by humans and livestock. Almost every part of the moringa tree can be used for food or other beneficial applications [3]. All moringa food products have a very high nutritional value. Human can eat the leaves, especially young shoots, young pods, flowers, roots, and in some species even the bark. Cattle, sheep, pigs, goats, and poultry browse the bark, leaves, and young shoots of moringa. The best diet for pigs is 70% moringa, 10% Leucaena, and 20% other leaves [4]. This plant is native in Asia Minor, Africa, the Indian subcontinent (Bangladesh, India & Pakistan) [5]. Moringa prefers neutral to slightly acidic soils and grows best in well-drained loam to clay-loam. Moringa showed antiviral activities in several different

studies. Murakami et al. [6] reported that Epstein-Barr virus (EBV) activation could be inhibited by the leaves of *Moringa oleifera*. Lipilun et al. [7] showed that the ethanol extract of moringa exhibits anti-herpes simplex virus (HSV) type activity. Treatment with moringa extract could delay skin lesion development, prolong the mean survival times, and reduce the mortality of HSV-1[1] infected mice [7], [8]. Waiaput [9] suggested that 80% ethanol crude extracts of moringa fruit showed anti-HBV[2] activity by inhibiting HBV replication [9]. Moringa has also traditionally been used in the treatment of HIV/AIDS-related symptoms, possibly by improving the immune system. In the case of animals, it showed antiviral activity against equine herpesvirus 1 [2], herpes simplex virus 1 [10] and foot and mouth disease virus (FMDV) [11], newcastle disease virus (NDV) of poultry [12]. By reviewing the studies discussed in this section, we can conclude that *Moringa oleifera* can be used in the development of promising antiviral drugs.

Azadirachta indica (Common name: Neem, Bengali name: Nim) has been extensively used in the Indian subcontinent for over 2000 years for its healing and antiviral properties.. This tree has been used to relieve so many different ailments that it has been named as "the village pharmacy". Leaves, roots, twigs, and seeds of neem trees are used for different purposes. Leaf, bark, seed, and all part of the neem tree contain useful substances that can be taken as a tea, oil, and prepared medicine. Neem is an indigenous tree species of Bangladesh and is found in abundance in the Barind tracts of the country. It is planted all over the country, more specifically in the drier part. It is also the native species of dry forest areas of India, Pakistan, Sri Lanka, Malaysia, Indonesia, Thailand, and Myanmar [13]. If not cut down, this perennial tree can survive up to from 200 to 300 years. The neem is a very sustainable plant as it grows on almost all types of soils including clayey, saline, and alkaline soils [14]. It has shown antiviral possibilities against different viruses found in animals and humans. The methanol extract of neem leaves reduced plaque development of numerous serotypes of coxsackievirus B, according to Badam et al. [15]. According to Sairam et al. [16] neem oil can inhibit poliovirus replication. Parida et al. [17] found that the aqueous extract of neem leaves inhibited dengue virus type 2 in vivo and in vitro. According to Vaibhav et al. [18] neem bark aqueous extract has a direct anti-HSV-1 activity in addition to inhibiting virion glycoprotein driven cell-cell fusion and

1 HSV-1: Herpes Simplex Virus 1

2 HBV: Hepatitis B Virus

polykaryocyte development in cell culture. Isolated polysaccharides from neem leaves had a strong antiviral efficacy against Bovine herpesvirus type 1 (BoHV-1) replication, according to Saha et al. [19]. The traditional use of neem leaves as an antiviral is documented for treating animals infected with bovine and avian poxviruses by applying a paste of neem leaves directly to the affected skin [20]. Ishrat et al. [21] also demonstrated significant antiviral activity of aqueous leaves extracts of neem against foot and mouth disease virus (FMDV). Hence further proving the strong antiviral potentials of *Azadirachta indica*.

Curcuma longa (Common name: Turmeric, Bengali name: Holud) has a wide range of antiviral activity against different viruses, which has been demonstrated through several studies [22]. The roots or rhizomes and bulbs, are used in medicinal and food preparations. They are generally boiled and then dried, then grinded into the familiar yellow powder. It is also used as a feed additive in animals, especially in poultry. Turmeric is commonly used as a food coloring and is one of the basic ingredients in curry powder used in human foods. Furthermore, increasing evidence indicates that utilization of curcumin, the main polyphenolic compound of turmeric, in animals and humans can be safe in various doses [23]. This herbaceous perennial is extensively cultivated in the tropical areas of South Asia, including Bangladesh (Khulna and Chattogram Hill tracts), India, and China [24]. It thrives best on loamy or alluvial fertile soils. A wide range of antiviral activity was exerted by curcumin in different studies. Curcumin exhibits inhibitory ability against the proliferation of diverse viruses, such as dengue virus [25], hepatitis B virus [26], Zika virus (ZIKV), and chikungunya virus (CHIKV) [27], transmissible gastroenteritis virus (TGEV) [23]. Antiviral activity of different concentrations of curcumin, gallium-curcumin, and Cu-curcumin had remarkable antiviral effects on replication of HSV-1 [28] and also on hepatitis B virus (HBV) by decreasing the transcription of Hepatitis B Virus X (HBx) gene [29]. Parainfluenza virus type 3 (PIV-3), feline infectious peritonitis virus (FIPV), vesicular stomatitis virus (VSV), herpes simplex virus (HSV), flock house virus (FHV), and respiratory syncytial virus (RSV) assessed by MTT test showed the potent antiviral activity of curcumin and its bioconjugates [30]. From these different research studies, we can conclude that *Curcuma longa* is a potent antiviral against a wide range of viruses.

In conclusion, Moringa, Neem, and Turmeric, these native Bangladeshi herbs have strong capabilities against different types of human and animal viruses. These three antiviral herbs are home grown, here, in our country, promising us their extraordinary aid. Further research on the mechanisms by which these herbs exhibit their antiviral effect will allow the development of successful target-specific herbal drug development and delivery system. We, the young herbal medicine students, hope that more high-quality therapeutically relevant research will appear in the literature in the near future. This could provide insights on the full potential of these herbs and herbal compounds as novel antiviral agents.

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