



## Review Article

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### ROLE OF AMALAKYADI RASAYANA IN LOWERING DOWN THE MORBIDITY RATE IN CHILDREN: A REVIEW

Ajay Kushwaha <sup>1\*</sup>, Nisha Kumari Ojha <sup>2</sup>

<sup>1</sup> P.G. Scholar, P.G. Department of Kaumarabhritya - Balroga, National Institute of Ayurveda, Jaipur, Rajasthan, India

<sup>2</sup> Associate Professor, P.G. Department of Kaumarabhritya - Balroga, National Institute of Ayurveda, Jaipur, India

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**\*Corresponding author**

E-mail: drajayr1993@gmail.com

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#### ABSTRACT

Children are more susceptible to various infections because of underdeveloped immune system as compared to adults. Strengthening the immune system is a natural way to help the body fight against the disease-causing pathogens and immunomodulators can play a major role in this context. Various Ayurveda classics and studies published in journals related to Ayurveda drugs for improving immunity are reviewed and analysed. In Ayurveda, the objective of immune enhancement is achieved through the use of the Amalakyadi Rasayana (an Immunomodulators), as it increases longevity of life, memory, intellect, lustrance, complexion, voice, strength of the body functions, strength of all senses and provides the resistance to disease, improves glow and power. Analysis of classical references and various experimental studies show that Amalakyadi Rasayana posse immuno-modulatory, Antioxidant, Anti-inflammatory, Antimicrobial, Anthelmintic activity. Present paper is a review to update knowledge on pharmacological properties, therapeutic actions and possible mode of action of the selected formulation, Amalakyadi rasayana from Yogaratnakara (Rasayanadhikara/17) to enhance the immunity in children. Rasayana is an important part of Ayurvedic therapeutics used to improve the quality of life by strengthening the tissue quality and by reducing the age-related tissue degeneration. This study reveals that Amalakyadi Rasayana have potential to improve or strengthen the immune system in children and thereby can lower down the morbidity rate in children.

**Keywords:** Vyadhikshamatva, Rasayana, Immunity

#### INTRODUCTION

Medicinal plants are natural gift to human lives to promote disease free healthy life. *Emblica officinalis*, commonly known as Amla is widely distributed in tropical and subtropical areas and has therapeutic potential against various diseases. *Emblica officinalis* (Amla) are widely used in the Indian system of medicine and believed to increase resistance against diseases. *Emblica officinalis* is a versatile plant due to its various medicinal properties. *Emblica officinalis* seeds, leaves and fruits are commonly used for medicinal purpose. The various medicinal properties of *Emblica officinalis* such as Antioxidant, Antipyretic, Analgesic, Cytoprotective, Anti-ulcer, Immune modulatory, Anti-inflammatory, Antitussive has been studied. *Emblica officinalis* having a strong Antimicrobial action and Memory enhancing property are reviewed. This article reviewed the applications of a formulation known as Amalakyadi Rasayana containing Amla (*Emblica officinalis*), Tila (*Sesamum indicum*), and Palasha (*Butea monosperma*) along with Goghrita, Sharkara and Madhu (honey). This drug has been indicated for rasayana purpose for immunomodulation against various diseases and disorders with its rich medicinal value for the benefits of child health.

A healthy immune system is vital for children as they are exposed to a plethora of germs. Balyavastha (childhood) has been described in Ayurvedic text as period of minimal relative bala (physical strength and immunity) and hence children of this period are more prone for various diseases. A considerable decrease in physical strength and immunity are said to be added factor for disease occurrence and severity. Vyadhikshamatva is the strength to protect the body against diseases. Immunity is the state of having sufficient biological defences to avoid infection,

disease, or another unwanted biological invasion. An immunomodulator influence any constituent or function of the immune system in a specific or nonspecific manner. In Ayurveda, the objective of immune enhancement is achieved through the use of the rasayana (Immunomodulators). Rasayana increases longevity of life, memory, intellect, lustrance, complexion, voice, strength of the body functions, strength of all senses and provides the resistance to disease, improves glow and power.

Paediatric Recurrent Respiratory Tract Infections (RRTIs) are the most common childhood illnesses, associated with significant morbidity and mortality. It is estimated that around 6% of children younger than 6 years of age present with RRTI. In developed countries, up to 25% of aged less than 1 year and 18% aged between 1 to 4 years, experience RRTI.<sup>1</sup> Preventable infections mainly of the upper airways are common in children and their recurrence constitutes a concern for both parents and the paediatrician. Treatment includes inadvertent use of antibiotics which may lead to antibiotic resistance in future. Also, excessive antibiotic use may have adverse effect on health of children. Antibiotic overuse not only leads to drug-resistant superbugs; it may also permanently wipe out the body's good bacteria which help making vitamins and boosting immunity. Rasayana therapy is one of the most important parts of Ayurveda system of medicine. They sustain the Ojus and bala in the body and promote Vyadhikshamatva (immunity). The concept of Naimittika rasayana may also be used as adjunct therapy along with specific conventional treatment of different diseases with added advantage. In present work an attempt has been made to examine the concept of Naimittika rasayana in Ayurveda and role of Amalakyadi rasayana as an adjuvant therapy in lowering the incidences of recurrent respiratory tract infections (RRTIs).

Table 1: The Ingredients of “Amalakyadi Rasayana”

S. No.	Name of Drug	Part used	Proportion
1	Goghrita	-	One part
2	Amalaki ( <i>Emblica officinalis</i> )	Fruit	One part
3	Sharkara	-	One part
4	Tila ( <i>Sesamum indicum</i> )	Seed	One part
5	Palasha ( <i>Butea monosperma</i> )	Seed	One part
6	Madhu (Honey)	-	Five part <sup>2</sup>

## Clinical and Experimental Evidences

### Goghrita (Cow Ghee)

Cow ghee is rich in the oil soluble vitamins A and E<sup>3</sup> and also rich in vitamin K2 and CLA (Conjugated Linoleic Acid); an antioxidant with anti-viral and anti-cancer properties, if sourced from grass fed cows<sup>4,5</sup>. Ghee, unlike other oils exclusively contain butyric acid; a short chain fatty acid<sup>6</sup>, which contributes to its distinct flavor and easy digestion. Research shows that adequate production of butyric acid supports the production of killer T cells in the gut and thus a strong immune system<sup>7</sup>

Conjugated linoleic acid (CLA) that occurs in high concentrations in milk fat has been recognized as an anti-carcinogen and its anti-carcinogenic effect has been demonstrated in several animal models<sup>8</sup>.

### Amalaki (*Emblica officinalis*)

#### Immunomodulatory Effect

Aqueous extract of dried *Emblica officinalis* Gaertn, (Amla) fruit pulp powder was evaluated for immunomodulatory effect on male Swiss Albino mice. The mice were divided into three groups. First group received vehicle alone to serve as control. The second and third groups received the extract orally at 100 and 200 mg/kg body weight dose levels respectively per day for a period of 19 days. There was a significant dose dependent increase in haemagglutination antibody titre, sheep red blood cells induced delayed type of hypersensitivity reaction, macrophage migration index, respiratory burst activity of the peritoneal macrophages, total leukocyte count, percentage leukocyte distribution, serum globulin and relative lymphoid organ weight in *Emblica* treated mice indicating its ability to stimulate humoral as well as cell mediated immunity along with macrophage phagocyte.<sup>9</sup>

Amalaki rasayana possesses significant immunostimulant activity and moderate Cytoprotective activity.<sup>10</sup> It has been demonstrated that extracts of *E.officinalis* fruit have significant immunomodulatory action. Amalaki is shown immunostimulant activity and moderate cytoprotective activity. But to get the desirable pharmacological action one need to triturate Amalaki churna with Amalaki swaras.<sup>11</sup>

#### Anti-inflammatory and Antipyretic

Extracts of *Emblica officinalis* fruits possess potent antipyretic and analgesic activities. The contents like tannins, alkaloids, phenolic compounds, amino acids and carbohydrates are proved to be having antipyretic effect.<sup>12</sup>

#### Antibacterial Activity

Amalaki have been reported to possess potent antibacterial activity against *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Escherichia coli*, *K. ozaenae*, *S. paratyphi A*, *S. paratyphi B* and *Serratia marcescens*.<sup>13</sup>

#### Anti-inflammatory Activity

In a study, leaves of *Phyllanthus emblica* were extracted with ten different solvents (n hexane, diethyl ether, and methanol, acetic acid, dichloromethane, toluene, chloroform, water etc.). The inhibitory activity of the extracts against human polymorph nuclear leukocyte (PMN) and platelet functions was studied. The Methanol extracts (50 micrograms/ml) inhibited leukotriene B4-induced migration of human PMNs by 90% and N-formyl-L-methionyl- L-phenylalanine (FMLP)-induced degranulation by 25-35%. Diethyl ether extract inhibited calcium ionosphere A23187-induced leukotrienes, release form human PMNs by 40% thromboxane B2 production in platelet during blood clotting by 40% and adrenaline induced platelet aggregation by 36%. Anti-inflammatory activity was found in the water fraction of methanol extract of the plant leaves too.<sup>14</sup>

Anti-inflammatory activity was in both acute as well as chronic model of inflammation comparable to diclofenac reduced inflammation by Carrageenan induced rat paw oedema method (Acute); Rexin pellet granuloma method (Chronic); Leukocyte emigration rat paw oedema method.<sup>15</sup>

#### Antioxidant Activity

*Emblica officinalis* was studied against the cold stress-induced alterations in the behavioural and biochemical abnormalities. Triphala administered orally about 1 g/kg/animal body weight for 48 days significantly prevented cold stress-induced behavioural and biochemical abnormalities in albino rats. Thus, Triphala supplementation can be regarded as a protective drug against stress.<sup>16</sup>

Vitamin C in *Emblica officinalis* accounts for approximately 45-70% of the antioxidant activity. Rats were examined for the antioxidant properties of *Emblica officinalis* extracts and its effect on the oxidative stress in streptozotocin induced diabetes was also reported. The extracts showed strong free radical scavenging activity.<sup>17</sup>

#### Immunomodulatory Activities

*Emblica officinalis* has an Immune activation property which is an effective as well as protective approach against emerging infectious diseases. This property of *Emblica officinalis* has been proved by assessing the immunomodulatory activities of Triphala on Albino rats. On oral administration of Triphala appears to stimulate the neutrophil functions in the immunized rats and stress induced suppression in the neutrophil functions were significantly prevented by Triphala.<sup>18</sup> Also, *Emblica officinalis* has been reported for its Cytoprotective and Immune modulating properties against chromium (VI) induced oxidative damage. It inhibited chromium induced Immunosuppression and restored gamma-IFN production by macrophages and phagocytosis.<sup>19</sup>

#### Antitussive Activity

Antitussive activity has been seen in conscious cats by mechanical stimulation of the laryngo-pharyngeal and trachea-bronchial mucous areas of airways. Its Antitussive activity was more effective than the non-narcotic antitussive agent dropropizine but less effective than shown by the classical

narcotic antitussive drug codeine. The dry extract of *Emblica officinalis* exhibit the antitussive activity not only due to Antiphlogistic, Anti spasmolytic and Antioxidant efficacy effects, but also to its effect on mucus secretion in the airways.<sup>20</sup>

#### Antimicrobial Activity

Amalaki as Antimicrobial various studies have demonstrated potent antimicrobial properties of *Emblica officinalis*<sup>21</sup> and it is used as antiviral for cold and flu. In the respiratory infections, it has an antibiotic activity against a wide range of bacteria, used traditionally in the treatment of lungs.<sup>22</sup> It also has shown antifungal activity.<sup>23</sup> *In vitro* *Emblica officinalis* has an antimicrobial activity against microbes, due to its chemical constituents like flavonoids (quercetin), ascorbic acid, gallic acid, alkaloids (phyllantine, phyllantidine) and hydrolysable tannins (emblicanin A and B).<sup>24</sup>

Fruits of *Emblica officinalis* are the richest source of Vitamin C, tannin and flavonoids, etc. Tannin has antimicrobial properties by enzyme inhibition, substrate deprivation, cell wall inhibition by inhibiting oxidative phosphorylation, metal ion deprivation etc.<sup>25</sup>

Several studies have examined the relationship between Flavonoids structure and antimicrobial activity e.g. Quercetin has been partially attributed to inhibition of DNA gyrase. Also sopharaflavone G and epigallocatechingallay inhibit cytoplasmic membrane function and licochalcones inhibit energy metabolism.<sup>26</sup>

*Emblica officinalis* have been found to be active against a range of bacteria including *Staphylococcus aureus*, *Escherichia coli*, *Mycobacterium tuberculosis*, *S. typhi* and *Candida albicans*.<sup>27</sup>

#### Antiviral Activity

Pentagalloylglucose can inhibit Influenza A virus replication with a dual mode of action assessed by WST-1 assay, Plaque-forming unit assay, Time of-addition assay and Haemagglutination inhibition (HI) assay, Viatwo mechanisms: prevention of virus adsorption and suppression of virus release.<sup>28</sup>

#### Antipyretic and Analgesic Activity

The anti-pyretic and analgesic activity of ethanol (EEO) and aqueous (AEO) extracts of *Emblica officinalis* fruits was investigated in several experimental models. A single oral dose of EEO and AEO (500 mg/kg, i.p.) showed significant reduction in brewer's yeast induced hyperthermia in rats. EEO and AEO also elicited pronounced inhibitory effect on acetic acid-induced writhing response in mice in the analgesic test. Both, EEO and AEO did not show any significant analgesic activity in the tail-immersion test.<sup>29</sup>

#### Sharkara (*Saccharum officinarum*)

##### Antioxidant Activity

The phenolic extract obtained from sugar cane juice showed a protective effect against *in vivo* MeHgCl intoxication and potent inhibition of *ex vivo* lipoperoxidation of rat brain homogenates, which indicates its potential use for health effects and therapeutic applications.<sup>30</sup>

##### Immunotherapeutic Effect

The effects of aqueous and ethanolic extracts of sugar cane (*Saccharum officinarum*) juice and bagasse, respectively on protective immune responses in industrial broiler chickens against coccidiosis was investigated. Findings showed that both ethanolic and aqueous extracts of sugar cane possess immune enhancing properties and their administration in chickens augments the protective immunity against coccidiosis.<sup>31</sup>

#### Anti-inflammatory Activity

A mixture of fatty acids obtained from sugar cane (*Saccharum officinarum* L.) wax oil (FAM), in which the main constituents are palmitic, oleic, linoleic and linolenic acids was evaluated in two models of inflammation viz. Arthritis and psoriasis. The anti-inflammatory effects exerted by FAM may be due to its inhibitory effects on arachidonic acid metabolism.<sup>32</sup>

#### Tila (*Sesamum indicum*)

##### Antipyretic and Anti-inflammatory Activity

Sesame oil produced significant antipyretic effect comparable to paracetamol. Sesame oil administered as dietary supplement produced analgesic, antipyretic and anti-inflammatory activities in animal models.<sup>33</sup>

##### Antioxidant Activity

Both the white and black varieties of *Sesamum indicum* were extracted in ethanol and the extracts were assayed for their antioxidant activities. Result demonstrated that both the extracts showed antioxidant activity in respect to its ability in inhibiting the lipid peroxidation. The hydroxylradical scavenging by the white sesame extract was observed to be more than that of black sesame. Also, the white sesame seed extract was notably a more potent scavenger of superoxide anion than the black one. Further, the reducing power of the seed extracts was in substantiation with the antioxidant property. Fe<sup>++</sup> chelation by the extracts was also found to be high.<sup>34</sup>

##### Anti-inflammatory Activity

The effect of sesamol on the inflammatory oxygenase - lipoxygenase (LOX) was studied. Findings revealed that sesamol was a potent inhibitor of soy LOX-1. Sesamol prevented the conversion of inactive LOX (Fe<sup>2+</sup>) to active LOX (Fe<sup>3+</sup>) by arresting the oxidation state of iron and prolonging the lag phase by virtue of its ability to scavenge hydroperoxides.<sup>35</sup>

##### Antibacterial Activity

Antibacterial assays against food borne pathogens demonstrated sesamol to be an antimicrobial agent with minimal inhibitory concentration (MIC) of 2 mg /mL in the culture. This activity was synergistic with  $\gamma$ -tocopherol, present in sesame seeds.<sup>36</sup>

The sesame oil shows greatest antimicrobial activity and also equal with standard Kanamycin and also shows highest zone of inhibition against *S. Typhi*. It is also reported that sesame oil is found to have the antibacterial activity against *Streptococcus*.<sup>37</sup>

##### Anthelmintic Activity

Extracts of *Sesamum indicum* L. (ethanolic and petroleum ether) were found to possess dose dependant anthelmintic activity when compared to piperazine citrate. The alcoholic extract of *Sesamum indicum* L. seeds took lesser time to cause paralysis of the earthworm than that of petroleum extract.<sup>38</sup>

#### Palasha (*Butea Monosperma*)

##### Anti-inflammatory Effect

Cotton pellet induced granuloma and carrageenin-induced paw oedema method were used for the evaluation of anti-inflammatory activity of *Butea monosperma* (BM) seed extract. On oral administration of *Butea monosperma* extract, showed significant anti-inflammatory effects which may be due to presence of fixed oil, mixed fatty acids, and unsaponifiable matter present in the *Butea monosperma* extract.<sup>39</sup>

#### Antimicrobial Activity

*Butea monosperma* seed oil demonstrated a significant fungicidal and bactericidal effect *in vitro* which may be due to the presence of active constituents like medicarpin.<sup>40</sup>

#### Anthelmintic Activity

The methanolic extract of crude powder obtained from the seeds of *Butea monosperma* (1, 2 and 3 mg/kg) showed anthelmintic effect against Trichostongylid nematodes in sheep. Time and dose dependency was noticed. In addition, extract of same solvent also possessed significant anthelmintic activity.<sup>41</sup>

The methanolic extracts of seeds also possess significant anthelmintic activity against *Caenorhabditis elegans*.<sup>42</sup>

#### Antiviral Activity

Flavone glycoside isolated from the seeds of *Butea monosperma* possess significant antiviral properties.<sup>43</sup>

#### Madhu (Honey)

##### Antioxidant Activity

Honey exhibited a strong antioxidant potential and its activity is significantly correlated with the content of total phenolics and the color of honey. It was demonstrated that dark honey has a higher total phenolic content and consequently a higher antioxidant capacity.<sup>44</sup>

##### Immunomodulatory Activity

This study investigated the immunomodulatory properties of glycoproteins and glycopeptides fractionated from *Ziziphus* honey. The fractionated proteins exhibited potent, concentration-dependent inhibition of reactive oxygen species production in zymosan- activated human neutrophils (IC<sub>50</sub> = 6-14 ng/mL) and murine macrophages (IC<sub>50</sub> = 2-9 ng/mL). Honey proteins significantly suppressed the nitric oxide production by LPS-activated murine macrophages (IC<sub>50</sub> = 96-450 ng/mL). Also, honey proteins inhibited the phagocytosis latex bead macrophages. The production of pro-inflammatory cytokines IL-1 $\beta$  and TNF- $\alpha$  by human monocytic cell line in the presence of honey proteins was also analyzed. Honey proteins did not affect the production of IL-1 $\beta$ ; but, TNF- $\alpha$  production was significantly suppressed. Findings suggest that honey glycoproteins and glycopeptides significantly interfere with molecules of the innate immune system.<sup>45</sup>

##### Anti-inflammatory Action

Honey reduces the activities of cyclooxygenase-1 and cyclooxygenase-2, showing anti-inflammatory effects and demonstrates immunomodulatory activities. Also, ingestion of diluted natural honey showed reduction effect on concentrations of prostaglandins such as prostaglandin E<sub>2</sub>, prostaglandin F<sub>2 $\alpha$</sub> , and thromboxane B<sub>2</sub> in plasma of normal individuals. Anti-inflammatory activity of honey was as effective as prednisolone, reference drug. It was proved that honey has an anti-inflammatory action free from adverse side effects such as suppression of immune response and tissue growth, formation of ulcers in stomach, etc.<sup>46</sup>

Another study investigated the potential protective effect of a honey flavonoid extract (HFE) on the production of pro-inflammatory mediators by lipopolysaccharide-stimulated N13

microglia. The results demonstrate that HFE significantly inhibited the release of pro-inflammatory cytokines such as TNF- $\alpha$  and IL-1 $\beta$ . The expressions of iNOS and the production of reactive oxygen intermediates (ROS) were also significantly inhibited.<sup>47</sup>

##### Antimicrobial Activity

Honey is a potent antimicrobial agent, exhibiting a broad spectrum of activity. A variety of components add to the antimicrobial potential of honey, including sugar content, polyphenolic compounds, hydrogen peroxide, 1,2-dicarbonyl compounds and bee defensin-1. All of these are present in varying levels, depending on nectar source, honey bee and storage. These components act synergistically, letting honey to be effective against a variety of microorganisms.<sup>48</sup>

Manuka (*L. scoparium*) honey has been demonstrated to be effective against several human pathogens, including *Escherichia coli*, *Enterobacter aerogenes*, *Salmonella typhimurium*, *S. aureus*. Laboratory studies have revealed that the honey is effective against Methicillin Resistant *S. aureus* (MRSA),  $\beta$ -haemolytic streptococci and vancomycin-resistant Enterococci (VRE).<sup>49</sup>

Honey has been reported to have antibacterial activity against various bacterial species including *Bacillus anthracis*, *Klebsiella pneumoniae*, *Corynebacterium diphtheriae*, *Haemophilus influenzae*, *Listeria monocytogenes*, *Mycobacterium tuberculosis*, *Pasteurella multocida*, *Yersinia enterocolitica*, *Proteus* species, *Pseudomonas aeruginosa*, *Acinetobacter*, *Salmonella diarrhoea*, *Salmonella typhi*, *Serratia marcescens*, *Shigella dysenteriae*, *Staphylococcus aureus*, *Streptococcus faecalis*, *Streptococcus mutans*, *Strep. Pneumoniae*, *Streptococcus pyogenes* and *Vibrio cholerae*.<sup>50</sup>

##### Anthelmintic Activity

Study documents that natural honeys of different floral sources showed Nematicidal activity against different developmental stages of *C. elegans*. The Nematicidal action of honey was may be due to the reproductive anomaly as manifested by defects in egg-laying and hatching by *C. elegans*.<sup>51</sup>

##### Antiviral Activity

Honey, in general and particularly Manuka honey, has potent inhibitory activity against the influenza virus, demonstrating a potential medicinal value.<sup>52</sup>

##### Bioavailability Enhancing Activity

Honey is a supersaturated solution of sugars, mainly composed of fructose (38%) and glucose (31%), containing also minerals, proteins, free amino acids, enzymes, vitamins and polyphenols. Among polyphenols, flavonoids are the most abundant and are closely related to its biological functions, the evidence of the biological actions of honey can be ascribed to its polyphenolic contents.<sup>53</sup>

The ingredients of the drug Amalakyadi Rasayana possesses immunomodulatory, antioxidant, anti-bacterial, anti-viral and anti-helminthic property and can be therefore beneficial in preventive as well as fortherapeutic use in lowering down the morbidities in children.

Table 2: The Pharmacodynamics of Trial Drug

S. No.	Drug	Rasa	Guna	Virya	Vipaka	Dosha Shamaka
1	Goghrita <sup>54</sup>	Madhura	Guru, Snigdha	Sheeta	Madhura	Vata-Pitta shamaka, kapha vriddhikar
2	Amalaki <sup>55</sup> ( <i>Embllica officinalis</i> )	Madhur, Amla, Tikta, Katu, Kashaya (pancha rasa) <sup>56</sup>	Laghu, Ruksha	Sheeta	Madhura	Vata and kapha hara, Pitta shamaka
3	Sharkara <sup>57</sup>	Madhura	Guru, Snigdha	Sheeta	Madhura	Vata and Pittahara, Kapha vardhaka
4	Til <sup>58</sup> ( <i>Sesamum indicum</i> )	Madhura, Tikta, Kashaya, Katu	Guru, Snigdha	Ushna	Madhura	Vatahara, Kaphapitta vardhaka
5	Palash <sup>59</sup> ( <i>Butea monosperma</i> )	Katu, Tikta, Kashaya	Laghu, Snigdha	Ushna	Katu	Kaphavata nashaka
6	Madhu <sup>60</sup>	Madhura, Kashaya	Guru <sup>61</sup> , Ruksha	Sheeta	Katu	Kaphaghna, Raktapitta nashaka

Table 3: Clinical Effects of Ingredient of Trial Drug

S. No.	Drugs	Clinical Effect
1	Goghrita	Antioxidant, anti-viral and anti-cancer properties <sup>3,4,5</sup> , Immunomodulatory Activity <sup>7</sup> , Anti carcinogen property <sup>8</sup> ,
2	Amalaki	Bronchodilation Activity <sup>62</sup> , Immuno-Modulatory Activity <sup>9-12,63,64</sup> , Mast Cell Stabilising Activity/ Anti histaminic Activity <sup>62</sup> , Anti-inflammatory Activity <sup>12,14,15,65</sup> , Antimicrobial <sup>24-27,66</sup> , Antibacterial Activity <sup>13,67</sup> , Antipyretic Activity <sup>12,29,68</sup> , Anthelmintic Activity <sup>69</sup> , Anti-Viral Activity <sup>28,70</sup> , Antitussive <sup>20</sup> , Bio-Availability Enhancement <sup>71</sup>
3	Sharkara	Antioxidant Activity <sup>16,17,30</sup> , Immuno-Modulatory Activity <sup>19,31</sup> , Anti-inflammatory Activity <sup>32</sup>
4	Tila	Antioxidant Activity <sup>34</sup> , Anti-inflammatory Activity <sup>35</sup> , Antibacterial Activity <sup>36,37</sup> , Anthelmintic Activity <sup>38</sup>
5	Palash	Anti-inflammatory Activity <sup>39</sup> , Antimicrobial <sup>40</sup> , Anthelmintic Activity <sup>41,42</sup> , Anti-Viral Activity <sup>43</sup>
6	Madhu	Antioxidant Activity <sup>44</sup> , Immuno-Modulatory Activity <sup>45</sup> , Anti-inflammatory Activity <sup>46,47</sup> , Antimicrobial <sup>48,49,50</sup> , Anthelmintic Activity <sup>51</sup> , Anti-Viral Activity <sup>52</sup> , Bio-Availability Enhancement <sup>53</sup>

## CONCLUSION

Present review reveals that Amalakyadi rasayana possesses immunomodulatory, mast cell stabilizing, bronchodilating, anti-inflammatory, antibacterial, anti-viral, antipyretic, antitussive and antioxidant activity. Therefore, can be successfully used for the management of RRTIs in children and can be a better alternative of antibiotics. Further the review supports that Amalakyadi rasayana is a potent immunomodulatory drug, and its regular use in children may lower down their morbidity rate.

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