



Review Article

A REVIEW ON SIDDHA SASTRIC MEDICINES EFFECTIVE IN COVID-19 MANAGEMENT AT TPEC COVID CARE CENTRE, VELLORE

Thillaivanan.S^{1*}, Mubarak H², Susikannamma.S³, Parthiban. P⁴

^{1*}Asst Medical Officer (Siddha), Department of Indian Medicine and Homeopathy, Govt. of Tamilnadu, India.

²Medical Officer, CGHS, Ministry of AYUSH, Govt. of India.

³District Siddha Medical Officer, Department of Indian Medicine and Homeopathy, Govt. of Tamilnadu, India.

⁴Joint Director, Department of Indian Medicine and Homeopathy, Govt. of Tamilnadu, India.

ABSTRACT

Covid-19 is a novel virus that occurs in humans and travels globally very rapidly from person to person. Coronavirus disease is a critical challenge in high population countries such as India. The rising expense of western medicine and its adverse reactions has become an important challenge against Covid-19. Nowadays the traditional medical system and its preparations are for various ailments becoming more popular. South Asia's one of the ancient medicine is the Siddha system of medicine. *Kaba Sura Kudineer* (KSK) has become a popular Siddha medicine on this pandemic. Previously, *Nila Vembu Kudineer* (NVK) is being used more often during dengue fever, Chikungunya, and swine flu outbreaks, which reduced the mortality rate also. Some other medicines, too, are immensely beneficial. Due to a lack of modern antiviral medications, conventional medical systems in respective countries are now becoming known therapeutics, as a consequence of the pandemic. The second wave of Covid-19 is more virulent than the previous first wave. When compared to the previous, the rate of infection transmission and mortality was also higher. Over the next months, India will be targeted by the third and fourth waves of the Coronavirus infection, posing a greater threat to public health. As a result, some Siddha medicines which are administered and observed in Covid Care Centers reported satisfactory clinical outcomes and feedback reports. To justify the formulations, an attempt has been carried out to analyze the ingredients of medicines using textual evidence. This will enable researchers to evaluate the formulations to explore them in further research.

KEYWORDS: Siddha medicine, Indian Traditional medicine, Ayush medicine, Coronavirus, SARS-CoV2, Alternative Medicine.

INTRODUCTION

The emergence and rapid spread of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), a potentially fatal disease, is swiftly leading to public health crises worldwide^[1]. The zoonotic corona virus's outbreaks that have occurred in the 21st century namely SARS (Severe Acute Respiratory Syndrome) in 2002 and MERS (Middle East Respiratory Syndrome) in 2012 have resulted in several cases of pneumonia, Acute Respiratory Distress Syndrome (ARDS), multiorgan dysfunction, and approximately 800 deaths in each^[2-3]. The first case of Covid-19 was reported on 27th Jan 2020 in India. Now the second wave resulted from approximately one lakh positive cases daily. The first case of the COVID-19 in the Indian state of Tamil Nadu was reported on 7 March 2020. As of June 13, 2021, exactly 3,70,384 patients were died in India,

with Maharashtra reported the highest rate of deaths of 1, 08333. ^[4]

Residents of Tamil Nadu are well-versed in Siddha medicine. People of Tamil Nadu have been taking *Nilavembu Kudineer*, which is commonly used during dengue outbreaks when Covid cases first emerged during the pandemic. Siddha Physicians suggested prescribing *Kaba Sura Kudineer* after the Tamilnadu government officially declared in the gazette. The government developed Siddha Covid treatment centers for in-patient admission of asymptomatic, mild, and moderate Covid positive patients after all of the beds in Chennai's hospitals were occupied. As a result, the Vellore district near Chennai established the Siddha Covid Care Centre to care for Covid positive patients. At the TPEC Covid Care Centre in Vellore, nearly 4000 positive cases

were treated with Siddha medicine and Siddhars Yogam in both the first and second waves.

Many of the patients gave their consent to be treated. A feedback analysis performed at the center revealed that covid positive patients' symptoms improved positively. Another pilot trial conducted at the same center confirmed the drug's safety and efficacy. The clinical research report was submitted to Govt. of Tamil Nadu and Govt. of India. *Kaba Sura Kudineer*, *Thalisathy Vadagam*, *Amukkara Mathirai*, *Bramanandha Bairavam Mathirai*, and *Adathodai Manapagu* are indeed the five Siddha medicines used to treat covid positive patients. The synergistic effect of Siddha add-on with standard treatment gave more promising results in the treatment of COVID -19^[5]. This literature review attempted to inspect the ingredients of the other five Siddha Sastric medicines used at the center and in the trials.

Clinical Features

The clinical features of COVID-19 are varied, ranging from an asymptomatic state to acute respiratory distress syndrome and multi-organ dysfunction. The common clinical features include fever (not in all), cough, sore throat, headache, fatigue, headache, myalgia, and breathlessness. Conjunctivitis has also been described. Thus, they are indistinguishable from other respiratory infections. Rapidly progressing hypoxemia and acute respiratory distress syndrome was commonly observed in patients with severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) viral pneumonia^[6]. SARS-CoV-2 causes lung inflammation which progresses to cytokine storm in the most severe cases. The lungs of patients with COVID-19 show extensive alveolar and interstitial inflammation^[7]. In a subset of patients, by the end of the first week, the disease can progress to pneumonia, respiratory failure, and death. This progression is associated with an extreme rise in inflammatory cytokines including IL-2, IL-7, IL-10, and TNF- α . The median time from onset of symptoms

to dyspnea was 5 d, hospitalization 7 d, and acute respiratory distress syndrome (ARDS) 8 d. The need for intensive care admission was in 25–30% of affected patients in published series. Complications witnessed included acute lung injury, ARDS, shock, and acute kidney injury. Recovery started in the 2nd or 3rd wk. The median duration of hospital stay in those who recovered was 10 d. adverse outcomes and deaths are more common in the elderly and those with underlying co-morbidities (50–75% of fatal cases). The fatality rate in hospitalized adult patients ranged from 4 to 11%. The overall case fatality rate is estimated to range between 2 and 3%^[8]. COVID-19 also leads to arterial thrombotic events (including strokes and ischemic limbs) as well as microvascular thrombotic disorders^[9].

Conventional Treatment for Covid-19^[10]

Until now, no promising clinical treatments or prevention strategies have been developed against human coronaviruses. However, the researchers are working to develop efficient therapeutic strategies to cope with the novel coronaviruses. Various broad-spectrum antiviral previously used against influenza, SARS and MERS coronaviruses have been evaluated either alone or in combinations to treat COVID-19 patients, mice models, and clinical isolates. Remdesivir, Lopinavir, Ritonavir, and Oseltamivir significantly blocked the COVID-19 infection in infected patients.

MATERIALS AND METHODS

The review method is done to generate Siddha formulations used in the treatment of Covid-19 that have been referenced in published Siddha literature. The information is summarized, and the herbs included in the formulations are listed. Each herb and mineral's actions are listed in Siddha literature and may be accessed by searching for its botanical name and Siddha name. The ingredients and indications of Siddha Sastric Medicines are described in Tables I to VI.

Table I: Ingredient of Kaba Sura Kudineer with Literature Review

S.No.	Botany Name / Siddha Name	Part Used	Actions	Indications as Per Literature
1	<i>Zingiber officinale</i> / Chukku	Rhizome		Reference from the same author ^[11]
2	<i>Piper longum</i> / Milagu	Fruit		
3	<i>Syzygium aromaticum</i> / Kirambu	Flower bud		
4	<i>Anacyclus pyrethrum</i> / Akkirakaram	Root		
5	<i>Tragus involucrate</i> / Sirukanjori	Root		
6	<i>Barleriaprionitis</i> / Semmulli	Root		
7	<i>Terminalia chebula</i> / Kadukkai	fruit		
8	<i>Justicia adathoda</i> / Adathodai	leaves		
9	<i>Plectranthus ambonicus</i> / Karpooravalli	leaves		

10	<i>Costus speciosus / Koshtam</i>	Root	
11	<i>Tinospora cordifolia / Seendhil</i>	Stem	
12	<i>Clerodendrum serratum / Siruthekku</i>	Root	
13	<i>Andrographis Paniculata / Nilavembu</i>	Stem, Leaves	
14	<i>Cyperus rotundus / Koraikizhangu</i>	Root, Tuber	
15	<i>Cissampelos peraira / Vattathiruppi</i>	Root	

Table II: Ingredient of Adathodai Manappagu with Literature Review

S.No	Ingredients Botany Name/ Siddha Name	Part Used	Actions ^[9]	Indications as per Literature ^[12]
1	<i>Justicia adathoda/ Adathodai</i>	Leaves	Anti spasmodic, expectorant, diuretic, germicide	Fever, cough, asthma, throat infection, purpura. Bleeding dysentery.

Table III: Ingredients of Thalisythy Vadagam with Literature Review

S.No	Botany Name/ Siddha Name	Part Used	Actions ^[9]	Indications as Per Literature ^[12]
1.	<i>Abies Webbiana/ Thalisapathiri</i>	Leaves	Stomachic, carminative, expectorant, tonic	Fever, diarrhea, chronic cough, wheezing, vomiting, indigestion, gastric discomfort
2.	<i>Piper nigrum /Milagu</i>	Fruit	Carminative, acrid, antiperiodic, rubefacient, stimulant, antidote, resolvent, antivatha	Fever with chills, anemia, loss of taste, diarrhea, cough, otalgia, indigestion, jaundice, delirium, piles.
3.	<i>Piper nigrum root / Sevviyam</i>	Root	--	Chronic fever and cough, pain, phlegm, diseases of the throat, hoarseness of voice
4.	<i>Piper longum/Thippili</i>	Fruit	Stimulant, carminative	Cough, peptic ulcer, anemia, headache, loss of taste, sinusitis, ENT diseases, worm infestation, flatus
5.	<i>Piper longum root / Thippilimoolam</i>	Root	Stomachic	Thirst, cough, hoarseness of voice, fever, diarrhea, myalgia, loss of appetite.
6.	<i>Zingiber officinale / Sukku</i>	Rhizome	Stomachic, carminative, stimulant	Indigestion, heartburns, acidity, cough, wheezing, flatus, anemia, fever due to <i>Kabam</i> , headache, diarrhea, Sinusitis
7.	<i>Cinnamomum zeylanica / Lavangappattai</i>	Bark	Stimulant, carminative, aphrodisiac	Cough, wheezing, stomach pain, snakebite, spider bite, vomiting, flatus, ulcer.
8.	<i>Cinnamomum tamala / Lavangappathiri</i>	Leaves	Stomachic, carminative, Stimulant, diaphoretic	Fever due to <i>Kabam</i> , cough, wheezing, thirst, vomiting, stomatitis, white discharge
9.	<i>Mesua ferrea / Sirunagappoo</i>	Flower	carminative, astringent	Cough, diarrhea, white discharge, urinary obstruction, wound, burning sense of legs.
10.	<i>Elettaria cardamomum / Elam</i>	Seed	Stomachic, carminative, Stimulant	Cough, diarrhea, Dysuria, diseases of throat and mouth, spider venom, phlegm of chest
11.	<i>Vetivera zizanoids / kuruver</i>	Root	Stimulant. Tonic, diaphoretic, diuretic, emmenagogue, febrifuge antispasmodic	Fever, jaundice, diseases of head, eyes, and neck, hypertension, burns, abscess
12.	<i>Alpinia officinarum / Chiththarathai</i>	Rhizome	Expectorant, febrifuge, stomachic	Fever, cough, vomiting, phlegm, headache, eczema

Table IV: Ingredients of Amukkara Chooranam Mathirai with Literature Review

S.No	Botany Name/ Siddha Name	Part Used	Actions ^[9]	Indications as Per Literature ^[12]
1.	<i>Syzygium aromaticum</i> / Kirambu	Flower	Carminative, Stomachic, Antispasmodic	Diarrhea, vomiting, Ear diseases, sinusitis, headache
2.	<i>Mesua ferrea</i> / Sirunagappoo	Flower	carminative, astringent	Cough, diarrhea, white discharge, urinary obstruction, wound, burning sense of legs
3.	<i>Elettaria cardamomum</i> / Elam	Seed	Stomachic, carminative, Stimulant	Cough, diarrhea, Dysuria, diseases of throat and mouth, spider venom, phlegm of chest
4.	<i>Piper nigrum</i> / Milagu	Fruit	Carminative, acrid, antiperiodic, rubefacient, stimulant, antidote, resolvent	Fever with rigor, anemia, loss of taste, diarrhea, cough, otalgia, indigestion, jaundice, delirium, piles.
5.	<i>Piper longum</i> / Thippilimoolam	Root	Stimulant, carminative	Cough, peptic ulcer, anemia, headache, loss of taste, sinusitis, ENT diseases, worm infestation, flatus
6.	<i>Zingiber officinale</i> / Sukku	Rhizome	Stomachic, carminative, Stimulant	Indigestion, heartburns, acidity, cough, wheezing, flatus, anemia, fever due to <i>Kabam</i> , headache, diarrhea, sinusitis
7.	<i>Withania somnifera</i> / Amukkara	Root	Febrifuge, Diuretic, Alterative, Tonic, Sedative, Soporific, Aphrodisiac.	Swelling, Low back pain, Loss of appetite, Tiredness, Wound, Fever, eczema,
8.	<i>Saccharum officinarum</i> / Sarkkarai	Sugar	Demulcent, Cooling, Laxative, Diuretic, Nutrient, antiseptic	Vomiting, hiccup, <i>Vatham</i> diseases, mucolytic, loss of taste

Table- V: Ingredients of Bramanandha Bairavam Mathirai with Literature Review

S.No	Scientific name/ Siddha name	Actions ^[9-10]	Indications as Per Literature ^[12-13]
1.	Sodium tetraborate / Venkaram	Coolant, Diuretic, lithotriptic, Alterative, Astringent, Emmenagogue	Peptic ulcer, itching, bleeding piles, cough, urinary tract infection, epilepsy, sinusitis, menorrhagia, stomatitis
2.	Elemental Sulphur / Gandhagam	Laxative, alterative, diaphoretic, germicide, alterative	Hepatomegaly, ascites, fever, cold, skin diseases, scabies, asthma, cough, piles
3.	Red Orpiment / Manosilai	Alterative, Tonic, Febrifuge	Fever with rigor, cough, wheezing, spider bite, eye diseases, skin diseases
4.	<i>Aconitum ferox</i> / Karunabi	Febrifuge	Fever
5.	Arsenic trisulphide / Paththira Thalagam	Febrifuge, expectorant, alterative, Tonic, Antidote	Fever with rigor, cough with expectoration, eczema, ulcers, wheezing, bronchial asthma
6.	<i>Zingiber officinale</i> / Chukku	Stomachic, carminative, Stimulant	Indigestion, heartburns, acidity, cough, wheezing, anemia, fever due to <i>Kabam</i> , headache, sinusitis
7.	Mercuric sulfide / Lingam	Tonic	Fever, non-healing ulcer, abscess, skin diseases, cough, scabies, eczema, <i>Vatham</i> diseases
8.	<i>Zingiber officinale</i> - Processed in <i>Inji Saaru</i>	Stomachic, carminative, Stimulant	Indigestion, heartburns, acidity, cough, wheezing, flatus, anemia, fever due to <i>Kabam</i> , headache

Table VI: Literature Review of Siddha Sastric Medicines

S.NO	Name of Siddha Sastric Medicine	Indication as Per Literature ^[14]
1	<i>Kaba Sura Kudineer</i>	Fever Due to <i>Kabam</i>
2	<i>Amukkara Choorana Mathirai</i>	Peptic Ulcer, Anemia, Hiccup, Bronchial asthma, Tuberculosis, Gastric Disturbances, Leucorrhoea, Dryness, Peripheral Neuritis, Diseases of Spleen
3	<i>Thalisathy Vadagam</i>	<i>Kabam</i> , <i>Vatham</i> , Diarrhea, Indigestion, Vomiting, various origins. Pleural diseases
4	<i>Adathodai Manapagu</i>	Diseases of <i>Vatham</i> , Diseases of <i>Kabam</i> , Cough, Disorders of Stomach, Fever due to various origins.
5	<i>Bramanadha Bairavam Mathirai</i>	Fever, Delirium.

DISCUSSION

In the current situation, drug development against viral pathogens will take a while. To combat viral infections, there are no effective antiviral drugs available. As a consequence of the pandemic, conventional medical systems are in greater abundance across the world. Every country has its medical system. India is a country with a huge amount of traditional knowledge. In India, the AYUSH system of medicine has been used for thousands of years. In southern India, Siddha is one of the most popular medical systems. The three humors of the Siddha system are *Vatham*, *Pitham*, and *Kabam*. According to Siddha, ailments are caused by an imbalance in the three humors.

According to Siddha medicine, there are 4448 diseases. 64 types of *Suram* (Fever) are portrayed in Siddha scriptures. *Suram* is considering one of the separate diseases in Siddha Medicine. Synonyms, causes, pathology, and types of *Suram* have been mentioned in many Siddha literatures ^[15]. One of the *Suram* types, *Kabasuram*, has a positive correlation with the symptoms of Covid-19. In the current pandemic, classical Siddha medicines for *Kabasuram* and symptoms related to *Kaba suram* are commonly practiced. The *Kaba sura kudineer* is a kind of Siddha formulation, used throughout the world, not only through India. The medicine's effectiveness against covid-19 has been demonstrated in docking, and pilot studies.

During the emergence of covid-19, *Adathodai Manapagu* is such a well Siddha Sastric formulation. According to a literature review, this medicine treats respiratory system diseases, particularly in the lower respiratory tract. The herb *Adathodai* has mucolytic and bronchodilator properties. It will benefit in the treatment of respiratory symptoms such as cough and difficulty breathing in Covid patients. This is also being researched in the case of dengue fever since it can increase platelet count ^[16]. In the second wave of covid-19, the majority of Covid patients reported low

platelet counts. This is unquestionably beneficial in the treatment of low platelet counts in Covid-19.

The literature review of *Thalisathy Vadagam* and its ingredients strongly indicates that it can treat symptoms such as *Kabam*-related fever, diarrhea, nausea, vomiting, cough, wheezing, headache, throat soreness, body pain, and so on. These signs and symptoms resemble those of Covid-19. These compounds are also being investigated pharmacologically for a variety of respiratory ailments. This medicine will almost definitely be beneficial in the treatment of Covid-19.

The contents of *Amukkara Chooranam Mathirai* highly suggest that it will be useful in the symptoms of lack of appetite, bodily ache, cough, and fatigue. There have been several studies on the herb *Amukkara*. To treat Covid patients, it contains adaptogenic, antioxidant, and anti-stress properties. There are no known contraindications to using this herb during pregnancy or breastfeeding. All of that is well-known all across the world. As a result, this Sastric preparation can be used as a pandemic preventative due to its immune-boosting properties.

The herbo mineral formulation *Bramanandha Bairavam Mathirai* is commonly prescribed for the treatment of fevers of various causes. Despite the presence of hazardous minerals, typical purifying processes will mitigate the harmful effects. This formulation's elements imply fever with rigor, cough, wheezing, and infection of various origins. These symptoms are very similar to those of covid-19 pneumonia. As a result, it can be effectively used in the treatment of covid infection in the lungs.

The antiviral, bronchodilator, mucolytic, antipyretic, and anti-inflammatory, immunomodulatory properties of the ingredients in Siddha Sastric medicines have already been evaluated. The safety and efficacy of the above formulations were evaluated already in a pilot study at the same Covid Care Centre. There are few unproven antivirals and anti-inflammatory medications available for the

treatment of Covid-19. These Siddha formulations may be utilized to fill this space.

CONCLUSION

It is the inference from this review that the ingredients in the discussed Siddha formulations and herbs can manage the symptoms of Covid-19. Siddha literature strongly indicates the five Sastric Siddha medicines named *Kaba Sura Kudineer*, *Thalisathy Vadagam*, *Amukkara Mathirai*, *Bramanandha Bairavam Mathirai*, and *Adathodai Manapagu* can be a good defense against *Kabam*-related disorders like Covid-19 and its complications as well as a curative one. It has also been found that, regardless of the etiological cause, these drugs have the innate potential to fight numerous respiratory illnesses, particularly outbreaks of viral origins, such as COVID-19. This review reveals that Siddha medications help patients to recover quicker from illness of Covid-19.

ACKNOWLEDGMENT

We, authors, acknowledge Mr.Ganesh, IAS., Director, Department of Indian Medicine and Homeopathy, Govt of Tamil Nadu, India, and Mr.Shanmuga sundaram, IAS., District Collector, Vellore, Govt of Tamil Nadu, India for their guidance and support.

REFERENCES

1. Atul Sharma, Swapnil Tiwari, Manas Kanti Deb, and Jean Louis Marty, Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2): a global pandemic and treatment strategies. *Int J Antimicrob Agents*. 2020; 56(2): 106054.
2. Cui J, Li F, Shi ZL. Origin and evolution of pathogenic coronaviruses. *Nat Rev Microbiol*. 2019; 17: 181-192.
3. Cauchemez S, Van-Kerkhove MD, Riley S, Donnelly CA, Fraser C, et al. Transmission scenarios for the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) and how to tell them apart. *Euro Surveill*. 2013; 18: 18.
4. <https://www.mygov.in/corona-data/covid19-statewise-status/>
5. Chitra SM, Mallika P, Anbu N et al. An open clinical evaluation of selected Siddha regimen in expediting the management of COVID-19 ea randomized controlled study, *J Ayurveda Integr Med*, <https://doi.org/10.1016/j.jaim.2021.01.002>.
6. Paules CI, Marston HD, Fauci AS. Coronavirus infections – more than just the common cold. *JAMA* 2020; 323: 707.
7. McGonagle D, O'Donnell JS, Sharif K, Emery P, Bridgewood C. Immune mechanisms of pulmonary intravascular coagulopathy in COVID-19 pneumonia. *Lancet Rheumatol*. 2020; 2(7): e 437-45.
8. Cheng ZJ, Shan J. 2019 Novel coronavirus: Where we are and what we know. *Infection* 2020; 48: 155-63.
9. Geoffrey D. Wool Jonathan L. Miller. The Impact of COVID-19 Disease on Platelets and Coagulation. *Pathobiology*. 2021; 88: 15-27.
10. Muhammad Adnan Shereen, Suliman Khan, Abeer Kazmi, Nadia Bashir, Rabea Siddique, COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses, *Journal of Advanced Research*.2020; 24: 91-98.
11. Thillaivanan S et al. A Review on "*Kapa Sura Kudineer*" - A Siddha Formulary Prediction for Swine Flu: *International Journal of Pharmaceutical Sciences and Drug Research*. 2015; 7(5): 376-383.
12. Murugesamudaliyar KS. *Siddha Materia Medica (Medicinal Plants Division)*. 8th edition, Chennai: Directorate of Indian Medicine & Homeopathy. 2006; 7-713.
13. Thyagarajan R. *GunapadamThaathu Jeeva Vaguppu*, 4th ed. Chennai: Department of Indian Medicine and Homeopathy; 2004: 55-280.
14. Kuppusamudaliyar KN, Utthamarayan KS. *Siddha Vaidya Thirattu*. 3rd edi, Chennai: Directorate of Indian Medicine & Homeopathy. 2009: 1-294.
15. Thayalini Thileeban, Vidhya Milano Prasad. Review on *Suram* (Fever) in Siddha Medicine. *J.res.tradit.med*. 2018; 4(1): 21-25.
16. Kalaiarasi R, Jeeva Gladys R, Elangovan S, Soundararajan DK, Mubarak H. and Kanakarajan A. A combination of *Nilavembukudineer* and *Adathodai manapagu* in the management of dengue fever. *International Journal of Current Research*.2013; 5(04): 978-981.

Cite this article as:

Thillaivanan.S, Mubarak H, Susikannamma.S, Parthiban.P. A Review on Siddha Sastric Medicines Effective in Covid-19 Management at TPEC Covid Care Centre, Vellore. *International Journal of Ayurveda and Pharma Research*. 2021;9(5):56-61.

Source of support: Nil, Conflict of interest: None Declared

*Address for correspondence

Dr. Thillaivanan S

Asst Medical Officer (Siddha),
Department of Indian Medicine and Homeopathy, Govt. of Tamilnadu,
India.

Email: drthillai.mdsiddha@gmail.com

Disclaimer: IJAPR is solely owned by Mahadev Publications - dedicated to publish quality research, while every effort has been taken to verify the accuracy of the content published in our Journal. IJAPR cannot accept any responsibility or liability for the articles content which are published. The views expressed in articles by our contributing authors are not necessarily those of IJAPR editor or editorial board members.