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BOTANICAL SOLUTIONS FOR GLOBAL VIRAL HEALTH BURDENS

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ABSTRACT

Chikungunya virus (CHIKV) spread by Aedes mosquitoes, is a re-emerging arboviral illness characterized by fever, skin rash and body pain that frequently endures beyond the acute phase. Treatment based on symptomatic management due to the absence of particular antiviral drug or vaccine. This constraint has stimulated the investigation of natural herbs possessing antiviral, anti-inflammatory and immunomodulatory properties which include *Allium sativum (AS01)*, *Curcuma longa* (*CL02)*, *Aegle marmelos (AM03), Aloe vera (AV04)*, *Zingiber officinale (ZO05)* and *Trachyspermum ammi (TA06).* All these natural herbs have significant potential in mitigating inflammation, oxidative stress and systemic symptoms. Also study other species such as *Andrographis paniculata* and *Tinospora cordifolia* potential in alleviating CHIK symptoms. Although evidence endorses their complimentary function, safety issues underscore the necessity for standardization and clinical validation. A comprehensive strategy that merges pharmaceutical treatment with established herbal drugs may offer durable solutions for CHIK management.

INTRODUCTION

Chikungunya virus (CHIKV) is a virus in the Togaviridae family, transmitted to humans by mosquito species Aedes aegypti and Aedes albopictus. It causes an acute illness, Chikungunya fever, rash and severe body pain, which may stay for months or even years in some individuals after the acute phase. First identified in Tanzania in 1952, the name "CHIK", derives from a phrase meaning "that which bends up" a reference to the contorted posture caused by intense arthralgia. The disease was historically limited to parts of Africa and Asia, CHIK emerged in 2005 with large-scale outbreaks in Indian Ocean islands, India and South Asia. In the last two decades, global travel and wide distribution of vectors have facilitated its expansion into Europe, America and tropical as well as subtropical regions worldwide *(Lima et al., 2022)*. It is considered a major re-emerging arboviral disease due to its ability to cause explosive outbreaks with high attack rates. Although mortality is rare, the chronic debilitating arthralgia and arthritis-like symptoms can persist for months or even years, leading to significant socioeconomic and healthcare burdens. Coinfections with other arboviruses such as dengue and Zika further complicate *(Costa et al., 2023)*.

Prevalence studies showed considerably variety across regions like North America, Mexico, Haiti and Nicaragua demonstrated prevalence rates up to 2.8%, with Haiti reporting the highest prevalence at 3.5%. Co-infections appear disproportionality higher in pediatric populations 2.1% as compared with adults 0.7%. Mortality associated with CHIK is relatively low compared with other arboviral infections. Data from a Brazilian Nationwide cohort (2015–2024), encompassing 1,044 individuals, confirmed that fatalities are rare and typically linked to comorbidities, advanced age, or concurrent infections, rather than the direct pathogenic effects of CHIKV *(Brito et al., 2025; Costa et al., 2023)*. Patients frequently presents with chills, fatigue, weakness, headache, dizziness and loss of appetite, accompanied by gastrointestinal disturbance such as nausea, vomiting, abdominal pain, diarrhea or constipation. Respiratory systems including cough, sore throat, nasal congestion and dyspnea. Musculoskeletal symptoms dominate the disease spectrum, with intense joint pain, myalgia, stiffness and arthritis-like manifestations persisting well beyond the acute phase. Additional complications include dermatological conditions such as skin rashes, erythema, pruritus, swelling, sweating as well as cardiovascular signs including palpitations and edema. Collectively, these manifestations contribute to prolonged disability, psychological stress and reduced quality of life *(Hossain et al., 2018; Cunha et al., 2017)*. There is no specific antiviral therapy of CHIK, and treatment remains largely supportive. Non-Steroidal Anti-Inflammatory Drugs are the main stay for alleviating fever, pain, and inflammation. For chronic pain syndromes, tricyclic antidepressants such amitriptyline and serotonin–norepinephrine reuptake inhibitors like duloxetine are employed. In parallel, herbal and ethno pharmacological approaches have gained attention for their potential adductive role. Traditional remedies such as garlic (*Allium sativum*), neem (*Azadirachta indica*), turmeric (*Curcuma longa*), bael gree *(Aegle marmelos)*, aloe vera *(Aleo barbadensis)* and ginger *(Zingiber officinalis)*. The mortality rate is low, the persistence of symptoms, the frequency of the outbreaks and the socioeconomic impact highlight CHIK as a global health concern. An approach of combining evidence-based modern medicine with traditional plant-based therapies can offer the most effective strategy to mitigate its clinical and societal burden *(Costa et al., 2023)*.

Allium sativum (garlic/lehsan)

Allium sativum (AS01) belongs to the family Amaryllidaceae. It is native to Central Asia, particularly Iran and Turkmenistan and is now cultivated worldwide *(Bayan et al., 2014)*. *AS01* contains allicin as its main bioactive compound, which exhibits potent antibacterial, antiviral, antifungal and antioxidant activities *(Verma et al., 2023).* Other sulfur compounds, such as diallyl sulfide and ajoene, support cardiovascular health, while vitamins and minerals which promote its medicinal properties. *AS01* demonstrates a wide range of therapeutic benefits, including antimicrobial, antihypertensive, cholesterol-lowering, antioxidant and immune-boosting effects *(Saadony et al., 2024; Bayan et al., 2014)*.

Curcuma longa (turmeric/haldi)

Curcuma longa (CL02) belongs to the family of *Zingiberaceae*. Native to South Asia, mainly India, it is widely cultivated in semitropical areas. *CL02* rhizomes contain curuminoids, volatile oils, along with proteins and sugars *(Ajanaku et al., 2022)*. It exhibits anti-inflammatory, antioxidants, anticancer, hepato-protective and immune-boosting effects, while also improving digestion, aiding wounds healing *(Farzaei et al., 2018; Hewlings et al, 2017)*.

Aegle marmelos (bael/bel)

Aegle marmelos (AM03) is a medicinal plant of the family *Rutaceae,* native to India and Southeast Asia. It contains marmelosin, aegeline, skimmianine, rutin, coumarins, alkaloids, tannins and essential oils *(Monika et al., 2023)*. *AM03* fruit pulp is widely used for treating diarrhea and dysentery, while leaves are beneficial in diabetes and cardiac disorders. It also possesses anti-inflammatory, antioxidant and antimicrobial activities *(Sahoo et al., 2025)*.

Aloe vera (Ghritkumari)

Aloe vera (AV04) belongs to the family of *Asphodelaceae*., native to the Arabian Peninsula, it is now cultivated in tropical, arid and semi-arid regions worldwide. The plant contains aloin, aloesin, aloe-emodin, barbaloin, acemannan, saponins, anthraquinones, amino acids and multivitamins *(Matei et al., 2025)*. *AV04* is widely used for healing burns and wounds, skin hydration and exhibits anti-inflammatory, antimicrobial and antioxidant properties. Additionally, it supports digestion, boosts immunity and is commonly used in cosmetics and health drinks. *(Sánchez et al., 2020)*.

Zingiber officinale (Ginger/Adrak)

Zingiber officinale (ZO05) is a rhizomatous plant of the family *Zingiberaceae,* native to Southeast Asia and now cultivated in semitropical regions. *ZO05* rhizomes contain gingerols, shogals, paradols, zingerone and essential oils such as zingiberene, bisabolene, cineole and citral *(Ballester et al., 2022)*. *ZO05* is well-known for GIT disorders, antioxidant, cholesterol-lowering and immunity-boosting agent, also used in arthritis management *(Ayustaningwarno et al., 2024)*.

Trachyspermum ammi (Ajwain/Carom)

Trachyspermum ammi (TA06) is member of the family of *Apiaceae*. *TA06* is widely cultivated in India, Iran, Afghanistan and Pakistan. The seeds contain thymol (major active ingredient), α-pinene, p-cymene, γ-terpinene, limonene, flavonoids, saponins, tannins and glycosides *(Modareskia et al., 2022; Singh et al., 2004)*. *TA06* is traditionally valued for its carminative, antispasmodic and antimicrobial properties. *TA06* is effective in relieving indigestion, colic, cough, asthma and is commonly used as both spices and medicine *(Mishra et al., 2020; Bairwa et al., 2012)*.

Method

A robust, mixed-methods survey design was employed to systematically investigate individual experiences management strategies, pertaining to chikungunya, integrating both quantitative and qualitative data collection. The research instrument consisted of 14 rigorously reviewed items, capturing a broad spectrum of information including symptoms

profile, therapeutic interventions, home remedies utilization, side-effects incidence, preventive practices, recovery dynamics, post-disease complications and demographic characteristics. The survey was disseminated electronically via Google Forms to maximize reach and inclusivity, targeting participants with confirmed or suspected histories of Chikungunya infection.

Both closed and open-ended questions were included, enabling detailed data triangulation. Quantitative response was systemically analyzed using descriptive statistics to evaluate prevalence and distribution trends, while qualitative comments were subjected to thematic analysis for identification of emergent patterns and nuanced insights. The methodology prioritized ethical compliance by ensuring confidentiality and voluntarily participation, with informed consent obtained digitally prior to response submission. Such a rigorous approach enabled the derivation of actionable knowledge that informs contemporary understanding of chikungunya and contributes meaningfully to the development of improved clinical and public health response.

Result

A total of 34 chikungunya viral patients responded, with the majority in the 16-30 years' age group. Out of these, 58.8% were females and 41.2% were males (Fig.1). Most common symptoms were joint pain/arthralgia observed in 79.4% participants, high fever 61.7%, muscle pain 52.9%, headache 50%, skin rash 44.1% and fatigue 38.2%. Multiple symptoms experience was frequent. In term of medications, 61.7% patients used pain relievers including paracetamol and NSAIDs, vitamin supplements (35.2%), corticosteroids (20.5%) and fluids/electrolytes included ORS or salines (17.6%) and almost 44.1% chikungunya viral patients tried home remedies such as herbal teas like *AS01*, *CL02*, *AM03, AV04, ZO05, TA06* and citrus fruits (Fig.2).

Reported side effects included nausea (23.5%), stomach pain (14.7%), heartburn (11.7%), gastric issues (8%) and appetite problems (5.8%). Of the patients surveyed, 29.5% were satisfied with home remedies, 23.5% were not satisfied and 11.7% reported a natural experience. For preventive measures, 70.5% used insect repellents, 52.9% wore protective clothing, 41.2% practiced fumigation and 29.4% focused on healthy diet and hydration (Fig. 3). Approximately 35.2% always carried repellents while travelling. Impact on daily life was significant showed 55.8% faced fatigue, 35.2% muscle/joint pain, 23.5% described immobility and insomnia ratio was 20.5%, while 17.6% faced social isolation. Chronic joint pain post-recovery was noted by (29.4%), and persistent fatigue by 23.5%. Duration of recovery was distributed as follows: (26.4%) reported 1-7 days, (32.3%) reported 8-15 days, (20.5%) experienced 16-21 days and (20.5%) described recovery as taking almost one month. Around (41.2%) made significant dietary or lifestyle changes during recovery and (38.2%) reported full return to pre-illness health.

These findings highlight the prevalence of home remedies usage, common symptoms, recovery duration and the importance of preventive measures against chikungunya.

Discussion

CHIKV infection continues to be a significant public health concern worldwide, especially in semitropical areas where Aedes Mosquitoes are present *(Azari-Hamidian et al., 2019)*. The illness caused by CHIKV can have symptoms such as prolonged and incapacitating musculoskeletal pain and severe fatigue *(Ramazani et al., 1995)*.

Currently, treatment for CHIKV is symptomatic. NSAIDs, amitriptyline and duloxetine are prescribed to reduce symptoms like inflammation, pain and neurological symptoms *(Lazdins et al., 1999)*. However, the inadequacy of antiviral drug confine

therapeutic efficacy. This has encouraged researchers and clinicians to explore integrative approach, particularly the use of medicinal plants formulations *(Liu et al., 1996)*. The absence of targeted therapy has promoted the use of herbal medications, which are widespread in traditional systems that accommodate many pharmacological benefits *(Ayurveda* and *Siddha, 2009)*. *AS01* rich in allicin and Sulphur compounds, exhibits antimicrobial, free radical scavenger and immunomodulatory properties that may allay systemic inflammation and boost host defense; however, excessive consumption may lead to gastrointestinal distress and high bleeding risk *(Millsapps et al., 2022; Gudalwar B, 2021)*. *CL02*, which features curcumin, an active ingredient, shows anti-inflammatory and anti-viral effects that may diminish arthralgia and oxidative stress associated with CHIKV; nonetheless, excessive intake may cause gastrointestinal discomfort and kidney problems *(Adrover-López et al., 2016)*. *AM03* exhibits antidiarrheal, antioxidant and antiphlogistic properties that aid individuals with gastrointestinal problems and systemic inflammation; however, excessive consumption of its unripe fruit and seeds may lead to constipation and intestinal obstruction *(Rahman et al., 2014)*. *AL04* exhibits advantages of dermatological healing and immunomodulatory activity that may alleviate skin conditions and promote; nevertheless, prolonged consumption of its latex can cause severe diarrhea, electrolyte imbalance and potential renal damage *(Kaur et al., 2023)*. Besides, *ZO05* remediate nausea, boost digestion and provide potent antiphlogistic and free radical scavenger effects that may reduce joint pain related to CHIKV and prohibit viral attachment *(Millsapps et al., 2022; Basalingappa et al., 2020)*; nevertheless, excessive intake can lead to gastric irritation, diarrhea and elevated propensity for bleeding *(Basalingappa et al., 2020)*. *TA06* alleviate indigestion and respiratory issues linked to viral infections as it possesses carminative, antimicrobial, antiviral activity and bronchodilatory aspects; besides, high doses may induce stomach irritation, ulcers and hepatotoxicity *(Bairwa et al., 2012; Yadav et al., 2011)*.

Besides the aforementioned herbs, there are several other medicinal plants that have an important role in symptomatic management. *Ipomoea aquatica* possesses strong free radical scavenger and anti-apoptotic capacity to protect against oxidative stress, thus supporting systemic immunity when a virus infects the host; however, it is notable that high doses may cause GI distress *(Laczko-Zold et al., 2023; Dua et al., 2015)*. Similarly, *Persicaria odorata* is copious in phenolic compounds, which possess free radical scavenger and antibacterial abilities, that could help alleviate secondary bacterial infections and systemic inflammation; however, large amounts may induce stomach irritation *(Vo et al., 2023)*. Other medicinal plants have shown considerable efficacy against CHIKV. In vivo, the extract of *Rhapis excelsa* leaves significantly inhibited the multiplication of CHIKV virus in vitro, with a reduction of viral load of up to 98%, but its toxicity must be evaluated *(Chan et al., 2016)*. *Tradescantia spathacea* demonstrated substantial antiviral potency and antiphlogistic effects to alleviate joint pain associated with infection; however, prolonged use may cause GIT problem *(Chan et al., 2016; Tan et al., 2024)*. *Vernonia amygdalina* showed consequential antiviral potency, with reductions in viral epidemic upwards of 95% effectiveness, alongside significant free radical scavenger and analgesic effects; however, excessive consumption may induce GIT disorders (*Chan et al., 2016; Adeoye et al., 2018)*. Furthermore, herbs with immunomodulatory properties, such as Andrographis paniculata, have displayed significant antiviral effects against CHIKV.

Andrographis paniculata was converted to nanoparticles, and this aqueous extract significantly improved the cell viability of infected Vero cells; however, high doses resulted in gastrointestinal irritation *(Wintachai et al., 2015)*. Research found that *Phyllanthus niruri* extracts had blocking effects on the entrance of CHIKV virus into host cells, indicating its potential use in the early stages of the infection *(Ayurveda* and *Siddha, 2009)*. At the same time, leaf extract of *Tinospora cordifolia* significantly reduced increased intracellular oxidative stress leukocytes from CHIKV patients experiencing persistent chronic pain, suggesting its antioxidant and symptomatic relief properties *(Banerjee et al., 2018)*. The presence of strong analgesic and anti-inflammatory properties of the stem bark extract of *Oroxylum indicum,* in both carrageenan-induced and formalin-induced paw edema models, provides partial rationale for the proposed use in alleviating CHIKV-induced arthritis *(Laloo et al., 2016; Lalrinzuali et al., 2016)*. In rabbit models of fever induction, Cynodon dactylon showed significant antipyretic effects, and rhizome extracts showed good antioxidant capacity, providing partial rationale for the use in ameliorating fever and oxidative stress in CHIKV infection *(Savadi et al., 2020; Louis et al., 2016)*. Moreover, *Psidium gujaja* leaf extract has shown a strong ability to kill free radicals in diabetic animals, which emphasizes its role in reducing oxidative stress in viral infection *(Anand et al., 2016)*.

The data emphasize that herbal treatments demonstrate a good anti-viral, anti-inflammatory and immunodyulatory benefit towards CHIKV, however, they may pose toxicity risks if overdosed or unsupervised. Therefore, herbal treatments should be given attention in the supportive therapy plan, and this requires careful planning informed by clinical evidence and dose to be used.

Conclusion

Natural herbs are commonly used by patients due to their bioactive component they have significant potential against various disorders. Current study provide an evidence that natural herbs including *AS01*, *CL02*, *AM03, AV04, ZO05* and *TA06* possess potent antiviral, anti-inflammatory and immune-modulatory advantages in CHIKV, so it may be used in future against CHIKV.

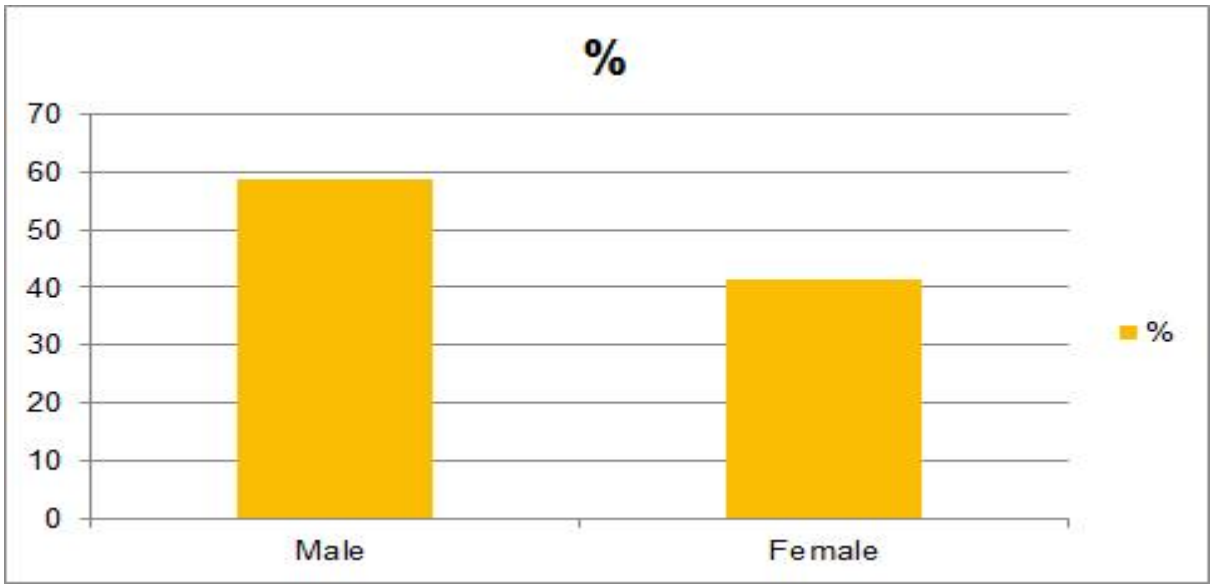

Fig.1: Percentage of chikungunya patient gender

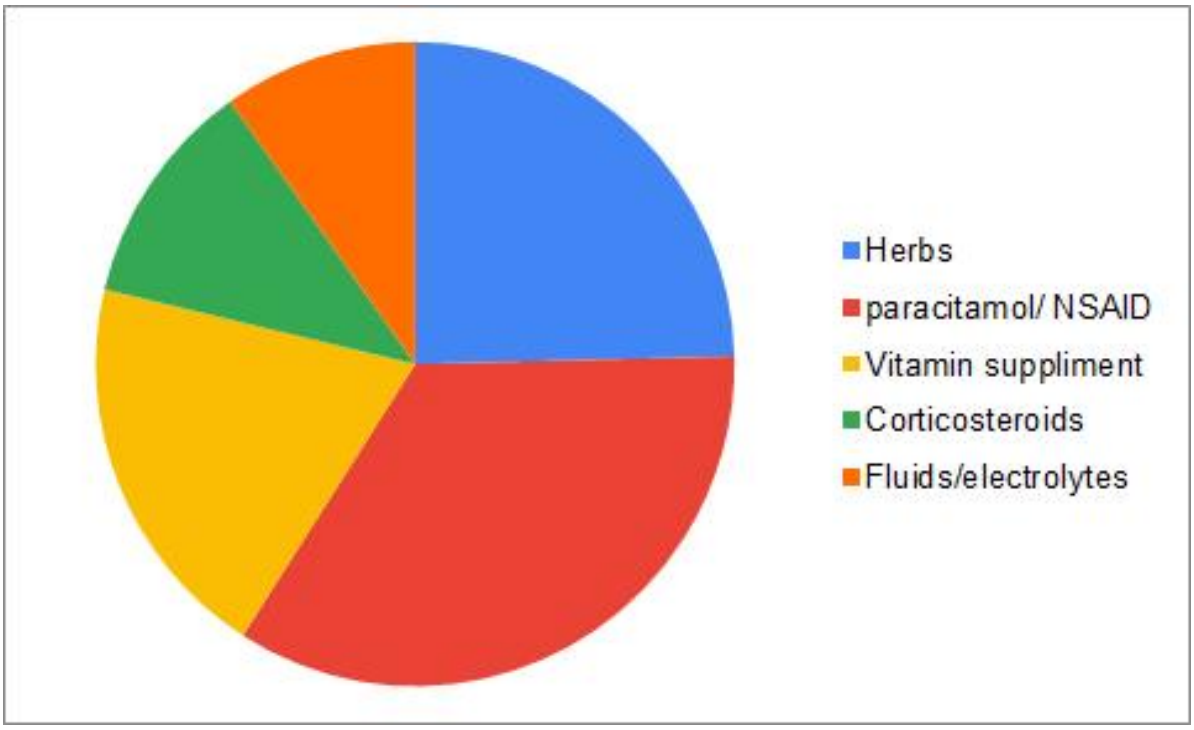

Fig.2: Ratio of herbal remedies and medication for chikungunya treatment

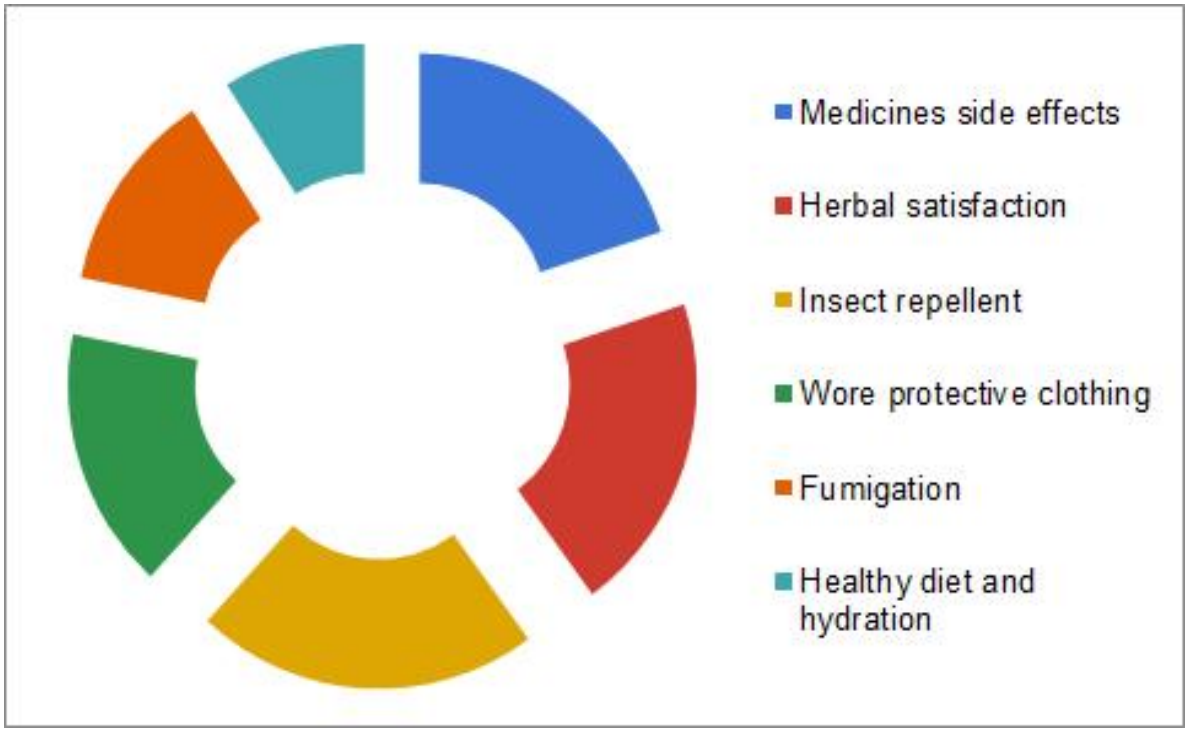

Fig.3: Percentage of medication side effect and preventive measures

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