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Review Article

Medicinal Plants in Gastroesophageal Reflux Disease (GERD): A Comprehensive Review of Experimental and Clinical Evidence on Esophageal Mucosal Protection

Thaseem A., Ganeshan V., Kafardeen F. F., Gunawardhana T. N., Thennakoon T. M., Sandamali P. M. N., Bandara U. H. R. G. P. S.*, Ranadeva N. D. K.

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Abstract

Background: Gastroesophageal reflux disease (GERD) is a chronic digestive disorder that adversely impacts overall well-being, presenting symptoms such as heartburn, regurgitation, and damage to the mucosal lining. The prevalence of GERD has been increasing largely due to dietary habits, obesity, and sedentary lifestyles. Numerous studies have been conducted to evaluate alternative treatments for GERD, particularly with herbal medications. There is limited scientific evidence to support effective treatment of this disease in Sri Lanka.

Objectives: To study the scientific basis of traditional plants that have been known to have mucosal protection properties.

Methodology: A literature review was conducted using multiple sources including databases (PubMed, PubChem, Research4Life), academic search engines (Google Scholar), and publisher platforms (BMC, Springer, PLOS, and ScienceDirect) to provide evidence-based recommendations for these traditional plants, using the keywords "GERD", "Medicinal plants", "Mucosal protection activity", and "Indigenous medicine", from 2015 to 2025.

Results: Plant-derived medicines have several advantages, such as economical value, improved tolerance by the patient, and the lower side effects compared to conventional therapies. Potent esophageal mucosal defense has been demonstrated by various medicinal plants by their anti-inflammatory, antioxidant and mucin–secreting action. Ayurvedic herbs are reported to reduce GERD symptoms in animal and human clinical studies by regulating gastric acid secretion and epithelial healing. In the Unani system, plants have shown the effects to improve mucosal resiliency and relieve dyspeptic symptoms. In the Siddha medicines, plants have shown mucosal protective effect in ethanol induced gastric ulcers. After carefully screening, 30 herbal plants in 19 families from 22 selected articles were shortlisted for this review.

Conclusion: Herbal compounds protect gastric mucosa by reducing inflammation and oxidative stress, increasing mucin secretion, regulating gastric acid, promoting epithelial healing, strengthening mucosal defence, and relieving dyspeptic symptoms.

Keywords: Gastroesophageal Reflux Disease (GERD), Indigenous medicine, Medicinal plants, Mucosal Protection Activity

Introduction

Gastroesophageal reflux disease, commonly referred to as GERD, is a chronic stomach condition. This issue arises when stomach acid flows back into the esophagus. It may also destroy the esophageal lining. What distinguishes GERD, as opposed to reflux, is that it occurs frequently, is very severe and lasts a long time. This may interfere with the life of a person and make it difficult to carry out their day-to-day activities (Bertin et al., 2025; Fass, 2022; Chhabra & Ingole, 2022).

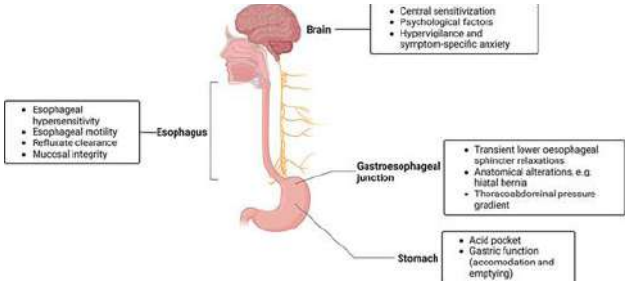


Figure 1 Main mechanisms deriving GERD and its symptoms (Bertin et al., 2025)

The prevalence of GERD is increasing worldwide. Globally, the prevalence of GERD is wide ranging, with ranges documented as 18.1–27.8% in North America, 8.8–25.9% in Europe, 2.5–7.8% in East Asia, 8.7–33.1% in the Middle East, 11.6% in Australia, and 23.0% in South America (Eusebi et al., 2017). In the United States, GERD accounts for about 4% of all primary care visits, with an incidence of 5 per 1,000 person-years (El-Serag et al., 2014). This increased prevalence is due to aging, being overweight, and lack of physical exercise. GERD is also more prevalent among individuals with obesity, unhealthy dietary habits, smoking habits, excessive alcohol consumption, and long-term use of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) (Alatawi et al., 2025).

The modern method of managing GERD is with medicines, such as proton pump inhibitors (PPI) and histamine-2 receptor antagonists (H2RA) to ensure that the stomach produces a reduced amount of acid (Chhabra & Ingole, 2022). These drugs are effective for many people. However, some individuals continue to experience the symptoms despite taking the medicine or when they stop taking it, the symptoms often come back. If these medicines are taken long-term, patients may experience severe side effects. They may fail to absorb the nutrients that they require from food. They may even suffer bone fractures (Fass, 2022; Gyawali & Fass, 2018; Świdnicka-Siergiejko et al., 2022).

Table 1: Summary of Conventional Therapeutic Approaches for Gastroesophageal Reflux Disease (GERD)

Treatment	Mechanism of Action	Indications	Limitations / Side Effects	Source
Proton Pump Inhibitors (PPIs)	Irreversibly inhibit H^+/K^+-ATPase in gastric parietal cells, reducing acid secretion	First-line therapy for erosive esophagitis and severe NERD	Long-term use associated with infections (e.g., *Clostridioides difficile*), kidney disease, Nutrient malabsorption	Fass (2022)
H2-Receptor Antagonists (H2RAs)	Block H2 receptors on parietal cells, decreasing acid production	Mild to moderate GERD, especially nocturnal reflux	Tachyphylaxis with long-term use; less effective than PPIs for healing	Pish-Kenari et al. (2018)
Antacids	Neutralize existing gastric acid	Immediate relief for occasional symptoms	Short duration of action; ineffective for mucosal healing	Argyrou et al. (2018)
Alginate-based therapy	Forms a mechanical foam/gel barrier at the gastric cardia to reduce reflux	Adjunct therapy for postprandial and nocturnal symptoms	Short-lived effect; does not inhibit acid production	Fass (2022)
LINX device (Magnetic Augmentation)	Magnetic ring reinforces the lower esophageal sphincter (LES) while allowing food passage	Moderate GERD; alternative to surgery	Not suitable for metal allergies or large hernias; postoperative dysphagia	Świdnicka-Siergiejko et al. (2022); Leowattana & Leowattana (2022)
Endoscopic therapies (TIF, Stretta)	TIF recreates the anti-reflux valve; Stretta uses radiofrequency to tighten LES	Mild to moderate GERD unresponsive to PPIs	Limited long-term outcome data; availability issues	Argyrou et al. (2018)
Lifestyle and dietary modification	Weight loss, meal timing, head elevation, and avoidance of triggers	Recommended for all GERD patients	Requires patient adherence; variable effectiveness	Fass (2022)
Baclofen (GABA-B agonist)	Inhibits transient LES relaxations (TLESRs)	Refractory GERD not responsive to acid suppression	CNS adverse effects (e.g., sedation, dizziness); poor tolerability	Gyawali & Fass (2018); Pish-Kenari et al. (2018)
Prokinetics (e.g., metoclopramide)	Improve gastric emptying and esophageal motility	Refractory GERD with delayed gastric emptying	CNS effects (e.g., fatigue, extrapyramidal symptoms)	Pish-Kenari et al. (2018)
Surgical fundoplication (Nissen)	Reinforces LES by wrapping stomach around lower esophagus	Severe or refractory GERD; large hiatal hernia	Dysphagia, gas-bloat syndrome; invasive procedure	Fass (2022)

Note. *NERD* = non-erosive reflux disease; *LES* = lower esophageal sphincter; *TIF* = transoral incisionless fundoplication.

The cost of taking these medicines for the rest of one's life is also remarkably high. People are interested in utilizing alternative treatments to improve their well-being, such as medicinal herbs (Hershcovici & Fass, 2011; Ansong et al., 2025). Medicinal plants are quite beneficial as they can assist the body in numerous ways, including decreasing inflammation, combating harmful agents, and safeguarding internal organs (Al-Sulivany et al., 2024). Medicinal plants are often easier for people to use. Plant-based therapies are generally associated with fewer side effects than conventional pharmacotherapy. Medical use of plant-based medicines has been proven to improve the defense mechanisms of the esophageal mucosa; however, a comprehensive review of such evidence is needed to inform clinical practice. Therefore, the objectives of this review are to critically assess the evidence of experiments and clinical trials on the effectiveness and mucosal protective effects of traditional medicinal plants in the treatment of GERD (Alecci et al., 2016; Zohalinezhad et al., 2015).

METHODOLOGY

A comprehensive literature review on medicinal plants in the management of Gastroesophageal Reflux Disease (GERD) was conducted using PubMed (US National Library of Medicine, USA), Research4Life and PubChem databases, Google Scholar academic search engines, BMC, Springer, PLOS, and ScienceDirect publisher platforms. The keywords used in the search included GERD, "medicinal plants", "mucosal protection activity", and "indigenous medicine". The review considered studies that had appeared between the year 2015 and 2025 and employed a two-stage methodology of evaluation and screening. Over 454 articles were identified by the initial search.

Duplicates were removed, and titles and abstracts screened, followed by relevant full texts being critically reviewed, resulting in 22 eligible studies being screened for inclusion. Articles that appeared only in English were included, and conference communications and abstracts were excluded.

RESULTS

Medicinal Plants

Throughout the review, the following medicinal plants, which are used in indigenous medicine, were identified.

Table 2

Medicinal Plants Classified by Order and Family

Class	Order	Family	Example species
Liliopsida	Poales	Poaceae	*Bambusa arundinacea*
Liliopsida	Asparagales	Asparagaceae/ Amaryllidaceae	*Asparagus racemosus; Allium sativum; Allium hookeri*
Liliopsida	Zingiberales	Zingiberaceae	*Zingiber officinale; Elettaria cardamomum; Curcuma spp.*
Magnoliopsida	Malvales	Malvaceae	*Malva parviflora*
Magnoliopsida	Piperales	Piperaceae	*Piper nigrum*
Magnoliopsida	Sapindales	Rutaceae	*Aegle marmelos*
Magnoliopsida	Caryophyllales	Cactaceae	*Opuntia ficus-indica*
Magnoliopsida	Brassicales	Brassicaceae	*Brassica oleracea*
Magnoliopsida	Rosales	Rosaceae	*Rubus spp.*
Magnoliopsida	Myrtales	Combretaceae/ Myrtaceae	*Terminalia chebula; Terminalia bellirica; Myrtus communis*
Magnoliopsida	Cucurbitales	Cucurbitaceae	*Benincasa hispida*
Magnoliopsida	Fabales	Fabaceae	*Glycyrrhiza glabra; Glycine max*
Magnoliopsida	Asterales	Asteraceae	*Artemisia campestris; Artemisia absinthium; Sonchus oleraceus L.*
Magnoliopsida	Apiales	Apiaceae	*Coriandrum sativum; Cuminum cyminum;*
			Foeniculum vulgare; Centella asiatica
Magnoliopsida	Lamiales	Lamiaceae / Oleaceae / Plantaginaceae	*Salvia officinalis; Satureja hortensis; Olea europaea; Plantago ovata*

From the above plants, 30 herbal plants from 19 Families are discussed in this review. Medicinal plants with potential Anti-GERD activity

1. Order: Poales (Family: Poaceae ex; *Bambusa arundinacea*)

'Safoof-i-Tabkheer', an Unani formulation containing *Bambusa arundinacea*, showed significant efficacy in reducing GERD symptoms (40.65–53.89%) in 30 patients without side effects, likely due to its carminative, analgesic, and anti-inflammatory properties (Sehar et al., 2021).



Figure 2 Bambusa arundinacea (Gaikwad et al., 2024)

2. Order: Asparagales (Family: Asparagaceae ex; *Asparagus racemosus* (Shatavari), Family: Amaryllidaceae ex; *Allium sativum* (Garlic), *Allium hookeri*)

Shatavari *(Asparagus racemosus)* has been traditionally utilized for urinary tract infections, kidney stones, cardiovascular disease, rheumatism, jaundice, diabetes, brain and reproductive problems, as well as respiratory conditions. In a case study, a 33-year-old man with chronic GERD received treatment with Shatavari root extract, combined with lifestyle and dietary changes, leading to total symptom relief (acidity, bleeding, epigastric pain, and sleep issues) in 45 days, with no side effects (Amarprakash et al., 2021).



Figure 3 Asparagus racemosus (Alok et al., 2013)



Figure 4 Allium hookeri plant and root (Pandey et al., 2018)



Figure 5 Allium sativum (Garlic) bulbs (Choudhary et al., 2022)

Garlic *(Allium sativum)* and *Allium hookeri* roots have antibacterial, antiviral, antifungal, anti-inflammatory, anti-diabetic, anticoagulant, and anti-obesity effects due to bioactive compounds like S-allyl cysteine and organosulfur compounds (Nan et al., 2018; Kim et al., 2019). In rat models of reflux esophagitis, black garlic extract diminished mucosal injury and inflammation by inhibiting the NF-κB pathway, highlighting its gastroprotective properties (Nan et al., 2018; Kim et al., 2019).

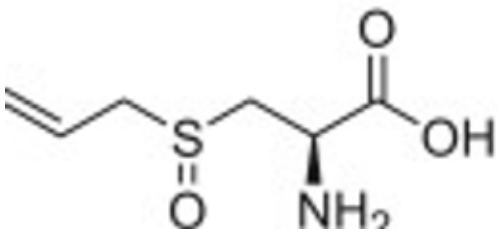


Figure 6 Chemical structure of Alliin (Kuete, 2017)

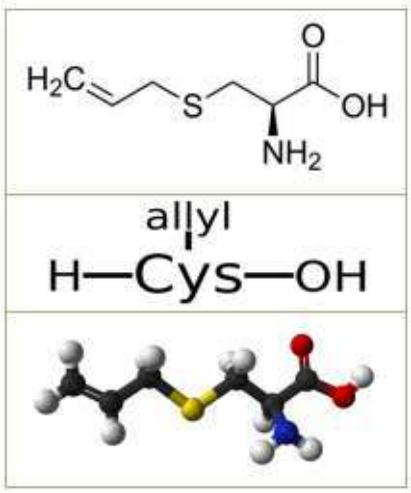


Figure 7 Chemical structure of S-Allyl cysteine (Rais et al., 2023)

3. **Order: Zingiberales (Family: Zingiberaceae ex; *Zingiber officinale* (Ginger), *Elettaria cardamomum* (Cardamom), *Curcuma* spp. (Turmeric)**



Figure 8 Zingiber officinale (Verma & Meshram, 2024)

Ginger has been traditionally utilized for digestive issues, high blood pressure, diabetes, vomiting, and nausea. It includes phenolic compounds, tannins, gingerols, shogaols, and flavonoids, which provide gastroprotective benefits by boosting mucosal protection, neutralizing acid, lowering inflammation (through arachidonate cascade inhibition), reducing acid production, enhancing digestion, and preventing ulcer formation. Its effectiveness was shown in Siddha polyherbal formulation (Yamuna et al., 2019), in Unani polyherbal formulation (Zafar et al., 2019), PEA-blended (Spigarelli et al., 2024), and monotherapy (Sharma et al., 2025) formulations, utilizing models like aspirin/alcohol-induced gastric ulcers in rats, GERD sufferers (n=10), and in-vitro esophageal cellular lines. Findings indicated decreased reflux, heartburn, and enhanced digestion without any cytotoxic effects or negative reactions.

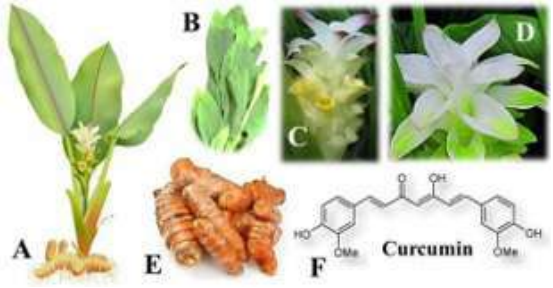


Figure 9 A. Curcuma longa plant; B. Leaves of Curcuma longa; C & D. Flower of Curcuma longa; E. Root of Curcuma longa; F. Chemical structure of curcumin phytochemical (Tripathy et al., 2021)

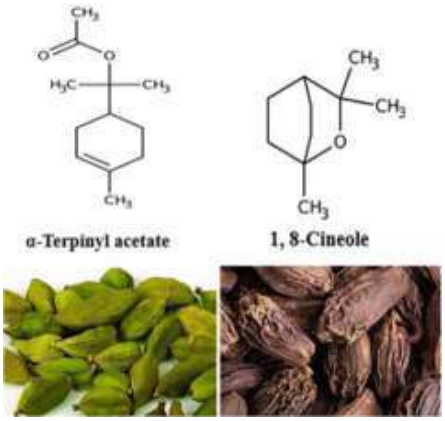


Figure 10 A. Chemical structure of α-Terpinyl acetate; B. Raw Elettaria cardamomum; C. Chemical structure of 1,8-Cineole; D. Dried Elettaria cardamomum (Cheikhyoussef et al., 2023)



Figure 11 A. Cuminum cyminum plant; B. Seeds of Cuminum cyminum (Parajapti et al., 2019)

Elettaria cardamomum showed carminative, analgesic, and anti-inflammatory actions. In 30 GERD patients, significant symptom relief was observed without side effects, confirming its safety and efficacy (Sehar et al., 2021).

HAGE-101912, a polyherbal drug with *Cuminum cyminum* (Azeemuddin et al., 2023), and turmeric (*Curcuma longa*) extract (Kong et al., 2025) showed anti-reflux, gastroprotective, anti-inflammatory, and antioxidant properties. In rat models, they diminished gastric acid and ulcer index, enhanced lower esophageal sphincter contraction, safeguarded mucosa, and decreased TNF-α, IL-1β, IL-8, and NF-κB activation. The therapy combining quercetin and curcumin outperformed each compound used separately (Azeemuddin et al., 2023; Kong et al., 2025).

4. Order: Malvales (Family: Malvaceae ex; *Malva parviflora*)

A comparative investigation demonstrated that the leaf mucilage and fruit extract of *Malva parviflora* exhibit anti-inflammatory (carrageenan-triggered paw edema), antitussive (SO_2-induced coughing), and gastroprotective (ethanol-induced gastric ulcer) properties, with leaf mucilage displaying more significant therapeutic efficacy for inflammatory and gastrointestinal conditions (Altyar et al., 2022).



Figure 12 A. Malva parviflora plant (Early vegetative stage); B & C. Flowering and fruiting stage; D. Seeds; E. Mature plant in habitat (Felger et al., 2015)

5. Order: Piperales (Family: Piperaceae ex; *Piper nigrum* (Black pepper)

Shanmuga Chooranam, which has *Piper nigrum* (black pepper), has been traditionally utilized for digestive, respiratory, and neurological issues, and it showed gastroprotective capabilities by diminishing aspirin-induced gastric ulcers and maintaining mucosal integrity in Wistar rats (Yamuna et al., 2019).



Figure 13 Piper nigrum (Wulandari, 2021)

6. Order: Sapindales (Family: Rutaceae ex; *Aegle marmelos*)

The pulp of *Aegle marmelos*, commonly utilized for numerous conditions such as digestive issues and inflammation, displayed notable anti-ulcer properties in male Wistar rats (0.19-0.20 kg) with ethanol-induced gastric ulcers. The high-dose extract was more effective than omeprazole in minimizing ulceration and enhancing gastric mucosa, with no side effects or deaths reported (Sharma et al., 2025).

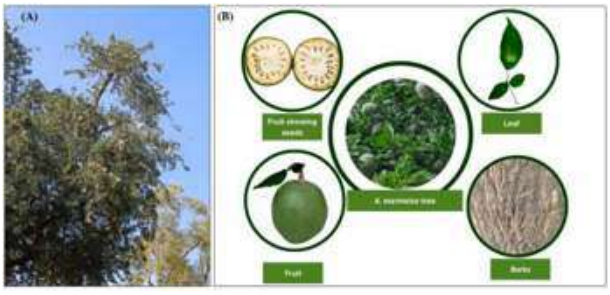


Figure 14 A. Aegle marmelos B. Parts of plant (Yadav & Rana, 2025)

7. Order: Caryophyllales (Family: Cactaceae ex; *Opuntia ficus-indica)*

Opuntia ficus-indica, rich in polyphenols and mucilage, acts as a gastric mucosal protector with anti-inflammatory and anti-ulcer properties (Alecci et al., 2016). Its flavonoid and polyphenol-rich extracts reduce reactive oxygen species and inflammation (Spigarelli et al., 2024). Clinical trials showed significant improvements in GERD symptoms and quality of life, with reductions in heartburn, acid regurgitation, and pro-inflammatory cytokines, and no adverse effects reported (Alecci et al., 2016; Spigarelli et al., 2024). The extract combined with Palmitoylethanolamide (PEA) was more effective than extract alone (Spigarelli et al., 2024).



Figure 15 Opuntia ficus-indica Fruit photographs of Opuntia ficus-indica; A. Yellow Tuna; B. Saltena Tuna; C. Cordobesa Orange Tuna; D. White Tuna; E. Reddish Tuna; F. Amyclaea. (Ahumada et al., 2019)

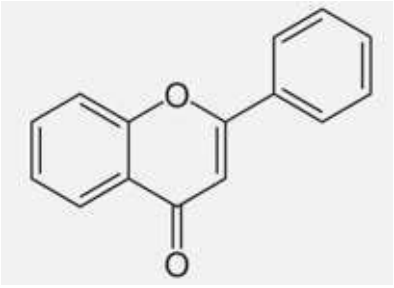


Figure 16 Flavonoids (Patel et al., 2013)

8. Order: Brassicales (Family: Brassicaceae ex; *Brassica oleracea*)

Brassica oleracea shows various pharmacological effects including anti-diabetic, anti-cancer, anti-hypertensive, anti-cholesterolemic, antioxidant, anti-inflammatory, antibacterial, anti-obesity, anticoagulant, and hepatoprotective properties. The entire plant extract consists of flavonoids, tannins, phenolics, and various compounds, while the juice of the fruit is abundant in mucilage, fiber, and glucosinolates that have cytoprotective and alkaline properties. Clinical studies involving GERD patients demonstrated complete immediate relief from heartburn and discomfort, due to mucosal coating, acid neutralization, and esophageal healing, with no side effects reported (Noah, 2022).



Figure 17 Botanical parts of Brassica oleracea (Quizhpe et al., 2024)

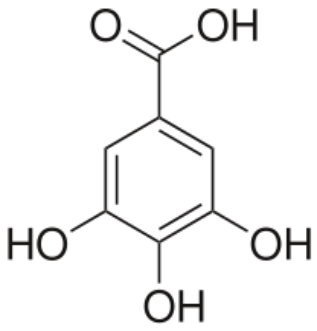


Figure 18
Tannin (Lozada-Ramírez et al., 2021)

9. Order: Rosales (Family: Rosaceae ex; *Rubus* spp.)

Extracts from Rubus spp. leaves, recognized for their antioxidant and anti-inflammatory effects, are utilized to treat GERD along with other issues such as fever, diarrhea, skin infections, joint pain, and wound healing. A randomized, double-blind, non-inferiority clinical trial involving 86 GERD patients demonstrated efficacy, with adverse effects such as gas bloat and dysphagia (Al-Sulivany et al., 2024).



Figure 19 Rubus spp.; A: Floral buds; B: Detail of flower petals, stamens, and carpels; C: In vitro germinated pollen grains; D: Fruiting; E: Ripe fruit; F. Seedling emergence (Figueiredo et al., 2013)

10. Order: Myrtales (Family Combretaceae ex; *Terminalia chebula, Terminalia bellirica,* Family Myrtaceae ex; *Myrtus communis*)

Extracts of *Terminalia chebula* and *Terminalia bellirica*, abundant in phenolics, tannins, and flavonoids, are essential components of Shanmuga Chooranam. They provide gastroprotective, antioxidant, anti-inflammatory, and acid-neutralizing benefits, safeguarding gastric mucosa and preventing ulcers without adverse effects (Yamuna et al., 2019).



Figure 20 A. Terminalia chebula B. Fruit C. Seeds (Pradeep et al., 2022)

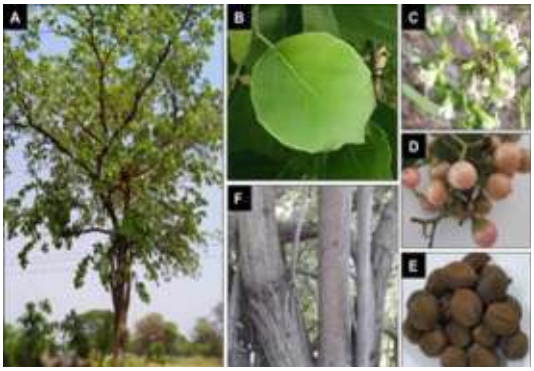


Figure 21 A. Terminalia bellirica B. Leaves C. Flower D. Fruit E. Seeds F. Bark (Gupta et al., 2020)

Myrtus communis fruit, abundant in tannins and polyphenols, demonstrates anti-inflammatory, antioxidant, anti-*Helicobacter pylori*, gastric acid-inhibiting, and mucosal protective properties. Its extract successfully alleviates GERD symptoms by minimizing reflux and dyspepsia, demonstrating similar efficacy and safety to omeprazole, with minor side effects such as dysphagia and gas bloating noted (Zohalinezhad et al., 2015; Al-Sulivany et al., 2024).



Figure 22 Myrtus communis and berries (Al-Snafi et al., 2024)

11. Order: Cucurbitales (Family: Cucurbitaceae ex; *Benincasa hispida*)

Benincasa hispida extract, derived from aerial parts, fruit juice, seed, and root, demonstrates anti-reflux, prokinetic, and gastroprotective effects in female Wistar rats, including gastric acid reduction, esophageal ulcer healing, improved lower esophageal sphincter contraction, and mucosal protection, without side effects (Azeemuddin et al., 2023).



Figure 23 Benincasa hispida (Raj et al., 1993)

12. Order: Fabales (Family: Fabaceae ex; *Glycyrrhiza glabra, Glycine max* (soybeans)

Glycyrrhiza glabra root extract exhibits anti-inflammatory, anti-reflux, prokinetic, and gastroprotective properties in Wistar rats, alleviating gastric acid and esophageal ulcers, enhancing lower esophageal sphincter contraction, and safeguarding gastric mucosa without adverse effects. Elevated doses of the extract reduced ulceration and protected the gastric mucosa more effectively than omeprazole, with no mortality or behavioural alterations (Azeemuddin et al., 2023; Sharma et al., 2025).



Figure 24 Glycyrrhiza glabra plant and its root (Abraham & Florentine, 2021)



Figure 25 Glycine max (soybeans) (Edde, 2022)

Lactobacillus delbrueckii-fermented soybeans influence gut microbiota, strengthen the intestinal barrier, reduce pro-inflammatory cytokines (IL-4, IL-6, IL-8), and alleviate GERD symptoms. A 12-week study involving 110 adults demonstrated considerable improvement in heartburn and regurgitation, along with decreased inflammation, establishing the safety and effectiveness of fermented soybeans as an adjunct treatment for GERD (Tan et al., 2024).

13. Order: Asterales (Family: Asteraceae ex; *Artemisia campestris, Artemisia absinthium, Sonchus oleraceus* L.)

Artemisia campestris, rich in antioxidants, restores antioxidant enzyme activity and protects the esophageal mucosa. Traditionally, it treats digestive issues, skin conditions, diabetes, hypertension, and venom effects (Jabri et al., 2018). *Sonchus oleraceus* L. contains flavonoids and phenolic compounds with gastroprotective, antioxidant, anti-inflammatory, antisecretory, and anti-ulcer properties, used for gastrointestinal diseases and inflammation (Vecchia et al., 2022). *Artemisia absinthium* L. (wormwood) has bioactive compounds that provide gastroprotection, anti-ulcer, anti-inflammatory, and antioxidant effects (Boeing et al., 2023). Studies on gastric ulcer and GERD models show these plants reduce ulcer indices, oxidative stress, inflammatory cytokines (TNF-α, IL-1β, IL-6), Myeloperoxidase (MPO) activity, gastric acid secretion, and restore mucus content

without harmful side effects (Jabri et al., 2018; Vecchia et al., 2022; Boeing et al., 2023).



Figure 26 Sonchus oleraceus L. (Puri et al., 2018)



Figure 27 Artemisia campestris; A. General plant; B. Flower heads; C. Inflorescence (Dib et al., 2017)



Figure 28 Artemisia absinthium L. (Tobyn et al., 2011)

14. Order: Apiales (Family: Apiaceae ex; *Coriandrum sativum, Cuminum cyminum, Foeniculum vulgare, Centella asiatica*)



Figure 29 Foeniculum vulgare; A. In its natural habitat; B. Stem; C. Leaves; D. inflorescences and flowers; E. Fruits; and F. Population of F. vulgare (Badgujar et al., 2014)



Figure 30 Coriandrum sativum (Arituluk, 2022)

Centella asiatica and *Cuminum cyminum*, extracted from various plant parts, are key in the HAGE-101912 polyherbal formulation, showing anti-reflux, prokinetic, and gastroprotective effects (Azeemuddin et al., 2023). *Foeniculum vulgare* and *Coriandrum sativum*, used in Unani formulations, primarily utilize seed extracts and roots for treating gastrointestinal, respiratory, skin diseases, asthma, arthritis, and wounds (Sehar et al., 2021; Sharma et al., 2025). Their efficacy is supported by animal studies, clinical trials, and antioxidant assays (DPPH, ABTS, FRAP), showing reduced ulceration, increased gastric mucosa, decreased gastric acid, improved esophageal sphincter function, and symptom relief comparable or superior to omeprazole (Azeemuddin et al., 2023; Sehar et al., 2021; Sharma et al., 2025).



Figure 31 Centella asiatica (Azerad, 2016)

15. Order: Lamiales (Family: Plantaginaceae ex; *Plantago ovata*, Oleaceae ex; *Olea europaea,* Lamiaceae ex; *Salvia officinalis, Satureja hortensis*)



Figure 32 Olea europaea (Calabriso et al., 2015)

Olea europaea oil extract is utilized to treat GERD owing to its antioxidant and anti-inflammatory properties. It addresses fever, diarrhea, skin infections, joint discomfort, and healing of wounds. The leaf extract, abundant in oleuropein and antioxidant, minimizes gastric mucosal harm by decreasing oxidative stress and boosting enzyme activity. Clinical trials indicated a notable decrease in pro-inflammatory cytokines, and the combination with PEA enhanced GERD treatment, although gas bloating and dysphagia were noted as side effects (Al-Sulivany et al., 2024; Alecci et al., 2016).



Figure 33 Plantago ovata; A. Vegetative; B. Reproductive phase; C. P. ovata ovaries. (Kotwal et al., 2016)

Psyllium seed (*Plantago ovata*) extract, rich in soluble fiber and mucilage, is effective and safe for managing functional constipation in GERD patients. It reduces GERD recurrence risk better than omeprazole and elimination of clinical symptoms was observed in studies (Hosseini et al., 2018).

Satureja hortensis L., with carminative, antispasmodic, and anti-inflammatory properties, was tested in a double-blind trial in GERD patients. However, 500 mg thrice daily did not improve symptoms compared to placebo; improvements were likely due to lifestyle changes in both groups (Kashani et al., 2018).



Figure 34 Satureja hortensis L. (Kazempour et al., 2021)

Salvia officinalis (sage) leaf extract contains terpenoids, phenolic acids, flavonoids, and other active compounds with strong antioxidant, antimicrobial, and anti-inflammatory activities. It scavenges free radicals, modulates oxidative stress by boosting enzymes like Superoxide Dismutase (SOD) and catalase, inhibits NF-κB, and suppresses bacterial growth. Multiple assays confirm its potency, but further clinical studies are needed to confirm its benefits in humans (Brindisi et al., 2021; Šobot et al., 2024).



Figure 35 Salvia officinalis ("Salvia Officinalis (Common Sage)," 2022)

A total of 22 studies were included, consisting of 12 animal experiments, 7 human clinical trials, and 3 in-vitro studies. For this review, no statistical analysis was performed. Quantitative data such as percentage changes, mean differences, sample size, and P-value from the included studies were extracted and synthesized descriptively. It describes the efficacy and the safety of medicinal plants used in the management of GERD.

Compared to standard proton pump inhibitor therapy, clinical studies demonstrate that symptoms improve effectively from 40% to 100% with multiple herbal formulations. Experimental animal studies demonstrated a significant reduction in ulcer index, gastric acid secretion, and inflammatory cytokine levels ($p < 0.05$), along with improvements in gastric mucosal protective mechanisms. Overall, these findings highlight the important therapeutic value of medicinal plants in the management of GERD.

The following bar chart exhibits the percentages of symptom reduction across the families of medicinal plants which are included in the study.

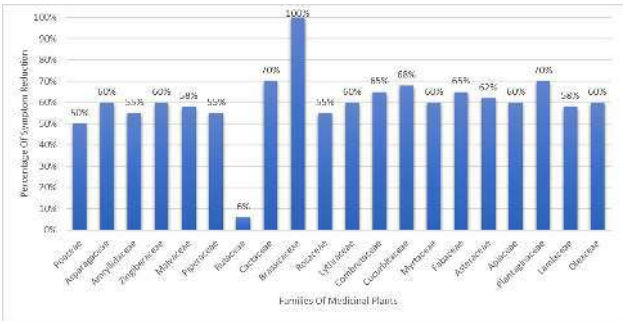


Figure 36 Percentage of symptom reduction across the families of medicinal plants

Identified side effects

Most of the clinical trials conducted on herbal formulations for the management of GERD showed a good safety profile. In preclinical studies, the herbal extracts showed no significant toxicity and mortality when tested on animals. In fact, some of the extracts showed non-cytotoxic activity. Further, clinical trials have given promising results where herbal interventions have been found to be generally well tolerated, with mild and self-limiting side effects. For example, a randomized trial of a comparison of Ayurvedic Ayucid capsules and omeprazole was conducted, and although mild side effects were noted in the herbal and omeprazole groups, respectively, there were no treatment withdrawals. In this trial, there were 26 side effects in the herbal group and 13 in the omeprazole group were identified (Tamoli et al., 2018). The reported symptoms of gas bloating, dysphagia, and constipation were found to be infrequent and mild in nature (Zohalinezhad et al., 2015; Al-Sulivany et al., 2024). Thus, it can be concluded that, according to the available evidence, herbal therapy appears to have good safety, although long-term safety and pharmacovigilance studies are limited in scale.

Linked Interactions with Medication for GERD

Herbal drugs employed in the management of GERD may be expected to produce pharmacokinetic interactions with conventional pharmacotherapy; however, evidence on the occurrence of such interactions with GERD drugs is limited. Therefore, knowledge on the safety profile of conventional GERD drugs is essential.

Antacids, proton pump inhibitors, and histamine-2 receptor antagonists are commonly used drugs for GERD. Antacids with aluminium content may cause constipation. Additionally, prolonged antacid use may cause renal problems. Diarrhoea is a possible side effect of magnesium and calcium antacids. Excessive use of calcium antacids may cause constipation, hypercalcemia, and nephrolithiasis (Hershcovici & Fass, 2011).

Long-term use of antacids and proton pump inhibitors may cause electrolyte imbalance and renal toxicity (Ansong et al., 2025). Proton pump inhibitors (PPIs) and histamine 2 receptor antagonists are highly effective at inhibiting acid secretion. But their long-term use has been associated with several potential concerns. These concerns include rebound acid hypersecretion, relapses of symptoms after the termination of the treatment, nutrient malabsorption, increased risk of infections, gastric mucosal effects, and bone mineral density loss (Zhang et al., 2021). The safety profile of the histamine-2 receptor antagonists, such as ranitidine, was generally considered satisfactory during the clinical trials. The safety considerations included the use of drug during pregnancy and regulatory issues, which need to be evaluated with caution (Zhang et al., 2021).

With the above considerations in mind, more clinical studies need to be conducted on the possible pharmacodynamic and pharmacokinetic interactions between herbal therapies and proton pump inhibitors, H2 receptor antagonists, and prokinetics. Such studies will help monitor the safety and therapeutic effects.

DISCUSSION

This comprehensive review brings forward experimental and clinical evidence with respect to the role of medicinal plants in the management of gastroesophageal reflux disease (GERD), where a particular focus has been given on esophageal mucosal protection. The reliability of the available evidence with respect to the strength and translational value has shown variability across the studies.

The preclinical evidence reviewed in this paper has revealed some notable patterns. The majority of the studies have shown supportive evidence that shows a reduction in esophageal lesion scores, oxidative stress markers, gastric acidity, and pro-inflammatory mediators after administration of these herbal extracts. On a more technical note, antioxidant activity levels may play a vital role in the protection of the gastric mucosa. The majority of the investigated plants have demonstrated a decrease in oxidation activity and an enhancement of antioxidant enzymes namely, superoxide dismutase and glutathione peroxidase. In addition, these plants have demonstrated a reduction of inflammatory pathway activity, especially NF-κB and cytokines such as TNF-α, IL-1β, and IL-6. These mechanisms support the basis of how these potential treatments may protect against GERD-related damage.

Strength of available evidence

Herbal therapies for gastroesophageal reflux disease (GERD) and related gastric disorders show valuable therapeutic potential across preclinical, animal, and limited clinical investigations. Several plant-derived compounds and polyherbal formulations appear to exert protective effects on the esophageal and gastric mucosa through multiple biological mechanisms. For example, the Ayurvedic polyherbal formulation HAGE-101912 has been reported to reduce esophageal

injury through antacid activity, proton pump inhibition, lower esophageal sphincter (LES) modulation, and prokinetic effects that improve gastric emptying (Azeemuddin et al., 2023).

Several phytochemicals with strong antioxidant and anti-inflammatory activity also play a vital role in mucosal protection. Black garlic (*Allium sativum*) has been shown to exert antioxidant and anti-inflammatory effects in reflux models by enhancing endogenous antioxidant enzymes and suppressing inflammatory cytokine (NF-κB) signaling pathways (Nan et al., 2018). Combinations of bioactive compounds such as curcumin and quercetin have demonstrated synergistic inhibition of inflammatory mediators, suggesting that polyphenolic interactions may enhance therapeutic efficacy compared with single compounds alone (Azeemuddin et al., 2023). Oxidative stress and inflammatory signaling pathways play an essential role in esophageal mucosal injury. Therefore, these mechanisms are biologically plausible in GERD pathophysiology.

Although most available evidence is derived from experimental models, several clinical investigations have reported symptomatic improvement with herbal therapies. Certain Ayurvedic formulations have shown valuable clinical outcomes compared to antacids in relieving GERD-related symptoms with favorable safety profiles (Azeemuddin et al., 2023). Similarly, some studies show psyllium seeds, mastic gum, and coriander-based triphala formulations have been reported to provide symptom relief compared to proton pump inhibitors (PPIs), with improved safety and tolerability profiles (Hosseini et al., 2018). Furthermore, meta-analytical evidence suggests that combining herbal therapies with PPIs may enhance clinical outcomes in GERD management compared with conventional therapy alone (Zhang et al., 2021).

The overall strength of the above evidence is limited. Many studies involve small sample sizes, short follow-up periods, and heterogeneous herbal formulations. Several trials focus primarily on symptom-based assessment rather than objective diagnostic assessment such as endoscopic healing or ambulatory pH monitoring. Most of the research has also been conducted in Asian populations, which may limit the generalizability of the findings to other regions because the dietary habits and lifestyle of other regional populations are different compared to Asian population. Standardization of herbal preparations and consistent pharmacological characterization remain major challenges, and potential herb–drug interactions with conventional GERD medications have not been extensively investigated. Therefore, large multicenter randomized clinical trials with standardized formulations and longer follow-up periods are required to establish reliable clinical efficacy (Zhang et al., 2021).

Cultural and Regional Use of Medicinal Plants

The use of medicinal plants for gastric disorders has deep historical roots in multiple traditional medical systems. Traditional Chinese medicine (TCM) incorporates herbal formulations such as Jianpi and Ligan Hewei therapy, often combined with acupuncture, to improve gastrointestinal motility and protect mucosal integrity (Zhang et al., 2021).

Ayurvedic and Persian medical traditions aim to restore physiological balance through herbal preparations that reduce inflammation and regulate gastric acidity; for example, Ayucid capsules are used to alleviate reflux symptoms and mucosal irritation (Tamoli et al., 2018). Polyherbal formulations such as coriander-based triphala, containing *Coriandrum sativum* and related ingredients, have demonstrated antioxidant activity and anti-*Helicobacter pylori* effects (Sharma et al., 2025).

Ethnobotanical evidence highlights the extensive use of medicinal plants in indigenous medicines. For example, the Adi tribal community has been reported to use more than 54 plant species for digestive disorders, preparing herbal pastes,

decoctions, and extracts from locally available plants (Chetry et al., 2018). Even though these medicinal plants have been used since ancient times, many of them still have not been scientifically standardized and approved by the regulatory authorities.

Integration with Conventional Therapy

Herbal medicine also shows potential as an adjunctive therapy to conventional GERD therapy. Some studies suggest that combining herbal formulations with PPIs may enhance therapeutic outcomes. For example, the combination of Jianpi therapy with PPI treatment has been reported to improve clinical outcomes, while Ligan Hewei therapy combined with PPIs demonstrated improved mucosal healing compared with PPI monotherapy (Zhang et al., 2021). Certain phytochemicals such as curcumin and quercetin exert anti-inflammatory effects through inhibition of NF-κB signaling, which may complement acid suppression mechanisms of PPIs (Azeemuddin et al., 2023).

Some herbal therapies target physiological mechanisms beyond acid suppression. The polyherbal formulation HAGE-101912 has been shown to enhance LES tone and improve gastric emptying (Azeemuddin et al., 2023), while psyllium seeds have been reported to alleviate GERD symptoms in patients with constipation and reduce relapse rates compared with omeprazole therapy (Hosseini et al., 2018). Safety profiles of most herbal therapies appear favorable, although mild adverse effects such as allergic dermatitis associated with mastic gum, gas bloating, and dysphagia have occasionally been reported (Zohalinezhad et al., 2015; Al-Sulivany et al., 2024). These treatments can be used with standard medicines like PPI as a long-term therapy to keep symptoms away.

A successful integration of herbal medicine into conventional GERD management requires standardized formulations, controlled dosing, and comprehensive evaluation of potential herb–drug interactions. Detailed pharmacological studies and well-designed clinical trials are essential to ensure both efficacy and safety before widespread clinical implementation.

CONCLUSION

This review reveals that 30 medicinal plants from 19 families have significant therapeutic potential for treating Gastroesophageal Reflux Disease (GERD), primarily due to their mucoprotective, anti-inflammatory, and gastric acid-regulating effects. The findings suggest that this herbal treatment can effectively treat heartburn and regurgitation symptoms by enhancing esophageal mucosal resistance and improving lower esophageal sphincter function, serving as a cost-effective and well-accepted therapy compared to conventional Proton Pump Inhibitors (PPIs) and Histamine-2 Receptor Antagonists (H2RAs). The existing evidence is limited by small sample sizes, short trial durations, and varied preparations, although these medicines show favourable safety profiles and have a long history of traditional use. Herbal drugs play a vital role as alternative or primary treatment, but the interaction with conventional therapy should be evaluated carefully. Standardizing herbal therapy and conducting clinical trials to ensure safety and efficacy are important to integrate them into modern conventional therapy. Herbal drugs show considerable potential as an adjunctive therapy or primary therapy, particularly in regions like Sri Lanka with robust traditional medical systems.

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Original Article

Work-Related Musculoskeletal Discomforts among Nurses at Teaching Hospital Karapitiya, Sri Lanka: A Descriptive Cross-Sectional Study

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Abstract

Introduction: Work-related musculoskeletal discomforts (WMSDs) refer to pain and discomfort affecting the musculoskeletal system, often arising in specific work environments. WMSDs are one of the major occupational concerns among healthcare professionals, especially among nurses, who engage frequently in physically demanding tasks such as handling patients, engaging in repetitive movements, and prolonged standing. Such conditions may cause discomfort and affect job performance. In Sri Lanka, the burden caused by WMSDs remains underexplored.

Objective: This study aims to determine the prevalence and describe the characteristics of work-related musculoskeletal discomforts among nurses at Teaching Hospital Karapitiya, Sri Lanka.

Methods: A descriptive cross-sectional study was conducted, enrolling 350 nurses at Teaching Hospital Karapitiya, Sri Lanka via convenience sampling. Upon obtaining ethical approval and institutional permission, a pre-tested self-administered questionnaire including the Nordic Musculoskeletal Questionnaire (NMQ) was used to assess WMSDs among nurses who voluntarily consented to participate in this study. Analysis of the NMQ was performed according to established standard protocols. The demographic characteristics of nurses were analysed using descriptive statistics, and associations were determined via Pearson Chi-square test.

Results: The majority were married (86%, n=300) females (85%, n=297) with a mean age of 41 ± 8 years. The prevalence of WMSDs among nurses during the past 12 months was 87.4% (n=306; 95% CI: 83.4–90.6%). Lower back (54%, n=188) and knee(s) (51%, n=177) were the most commonly affected body regions for WMSDs. Among female nurses, lower back discomfort was reported most frequently (63%, n=162), whereas knee discomfort was most prevalent among male nurses (65%, n=32). The frequency of WMSDs was significantly associated with work units ($p \leq 0.01$) and working hours per day ($p=0.005$).

Conclusion: A higher prevalence of WMSDs was observed among nurses at Teaching Hospital Karapitiya, Sri Lanka. This implies a need for establishing strategies to reduce WMSDs among nurses.

Keywords: *Nordic Musculoskeletal Questionnaire, Nurses, Occupational discomfort, Sri Lanka, Work-related musculoskeletal discomforts.*

Introduction

Work-related musculoskeletal discomforts (WMSDs) are injuries that affect the musculoskeletal system of the body, especially in muscles, bones, spinal discs, tendons, joints, ligaments, cartilage, nerves, and blood vessels, as a result of repetitive motions, forces, and vibrations acting on the human body in certain working environments, resulting in pain, ache, or discomfort (Crawford, 2007; Punnett & Wegman, 2004; Salik & Özcan, 2004). WMSDs represent a significant global occupational health challenge, accounting for a major portion of workplace injuries across all professions (Jan de Kok et al., 2019). Among healthcare workers, nurses are disproportionately affected, with meta-analyses reporting annual WMSD prevalence of 77.2% globally, predominantly affecting the lower back region (59.5%), neck area (53.0%), and shoulder(s) (46.8%) (Sun et al., 2023; Tinubu et al., 2010). This makes nursing one of the highest-risk professions for WMSDs worldwide, surpassing rates reported among other physically demanding occupations, such as manufacturing workers and physicians (Alnaser & Aljadi, 2019; Mailutha et al., 2008; Sun et al., 2023).

WMSDs among nurses are recognized as a significant occupational health concern, with the World Health Organization (WHO) identifying musculoskeletal conditions as among the leading causes of disability and limitations in gainful employment (WHO, 2021). The burden of WMSDs in nursing is compounded by the physically demanding nature of patient care tasks, including frequent lifting, transferring, and repositioning of patients, all of which impose considerable biomechanical strain on nurses (Menzel et al., 2004; Pompeii et al., 2009). Furthermore, extended working shifts and inadequate nurse-to-patient staffing ratios have been identified as significant organizational risk factors that exacerbate physical fatigue and increase nurses' cumulative exposure to musculoskeletal injury (Rogers et al., 2004). These extrinsic factors may be particularly pronounced in resource-constrained settings such as Sri Lanka, where public hospitals often face staffing shortages and limited access to patient-handling equipment, potentially amplifying the risk of WMSDs among nursing staff (Shammika et al., 2015; Warnakulasuriya et al., 2012).

WMSDs not only cause a burden on the individual worker involved but also affect the patients receiving care. WMSDs are responsible for high morbidity among nurses, which results in poor quality of life, lowered productivity, and disability (Punnett & Wegman, 2004). Beyond individual suffering, WMSDs impose a substantial economic burden, accounting for about 40% of work-related injury treatment costs (Karwowski & Marras, 2003; Yasobant & Rajkumar, 2014). These can negatively impact patient care and generally, the entire healthcare system, as most nurses take more sick leaves per year, encounter working restrictions, resulting in job transitions (Hartvigsen et al., 2018; Jakovljević, 2024; Thinkhamrop et al., 2017) and might enter premature retirement due to WMSDs (Muthelo et al., 2023; Narsigan, 2015). In a country like Sri Lanka, where the healthcare system relies heavily on its nursing workforce to deliver services across a large population, such individual-level consequences can translate into systemic challenges affecting healthcare delivery and accessibility.

While these global patterns are well established, the extent to which they are reflected in lower- and middle-income countries, including Sri Lanka, warrants closer examination given the differences in healthcare infrastructure, nurse-to-patient ratios, and available ergonomic resources. In Sri Lankan context, limited studies have documented WMSD prevalence among nurses, with reported rates ranging from 30% to 83%. Warnakulasuriya et al., 2012 reported prevalence of 30% lower back pain in a multi-occupational study conducted among four occupational populations: postal workers, sewing machinists, nurses, and computer operators (Warnakulasuriya et al., 2012), while prevalence of 83% back pain was reported among

emergency and orthopedic nurses at National Hospital of Sri Lanka (Kavindra Masakorala et al., 2017). This substantial variation across different healthcare settings and specialities underscores the need for more studies to capture the true scope of the problem within the local healthcare landscape. Therefore, this study aimed to determine the prevalence and describe the characteristics of WMSDs among nurses at Teaching Hospital Karapitiya, Sri Lanka.

Methods

The study was reported based on the guidelines provided by Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (Vandenbroucke et al., 2007).

Study design and setting

A descriptive-analytical cross-sectional study was conducted at Teaching Hospital Karapitiya, the largest tertiary care center in the southern province, Sri Lanka, with a bed capacity of 2,050 and comprising 69 units. Ethical approval for the study was obtained from the ethics review committee of KIU *(Ref. no: KIU/ERC/21/123)*. Further approval was obtained from the authorities of Teaching Hospital Karapitiya prior to data collection. Furthermore, permission to use the Nordic Musculoskeletal Questionnaire (NMQ) was obtained from the original author before data collection.

Participant recruitment

During the data collection period (from January to June 2022), all nurses working at Teaching Hospital Karapitiya were verbally invited to participate in the study. Information sheets and consent forms were distributed, and additional details about the study were verbally explained to interested nurses. Nurses who were on maternity leave, or on leave due to illness, or had a medical diagnosis of arthritis that affects the musculoskeletal system (e.g., osteoarthritis, rheumatoid arthritis, gout, and psoriatic arthritis) were excluded from the study. Finally, 350 nurses were recruited for the study by convenience sampling technique. Printed questionnaires were distributed to nurses who signed the consent forms and voluntarily agreed to participate in the study. Participants were given one week to return the completed questionnaires to the data collectors at their convenience.

Methods of assessment

Data were collected from participants using a self-administered questionnaire, which was pretested with 10 nurses employed at the Teaching Hospital Karapitiya. The questionnaire comprised three parts: socio-demographic characteristics, the Nordic Musculoskeletal Questionnaire (NMQ), and work-related factors for musculoskeletal discomfort. Musculoskeletal discomfort was assessed using the NMQ, which has been widely used across various occupational groups, including nursing, to evaluate musculoskeletal issues. The NMQ consists of two sections (Crawford, 2007). Section one includes a general questionnaire of 40 items designed to identify areas of the body causing musculoskeletal problems, supported by a body map indicating nine symptom sites: neck, shoulders, upper back, elbows, lower back, wrists/hands, hips/thighs, knee(s), and ankles/feet. Respondents are asked if they have experienced any musculoskeletal discomfort in the past 12 months. Section two contains additional questions related to the neck, shoulders, and lower back to provide further detail on relevant issues. This section comprises 25 questions that inquire about any accidents affecting these areas, the functional impact at home and work (such as changes in job or duties), the duration of the problem, assessment by a health professional, and musculoskeletal problems experienced in the past 7 days (Crawford, 2007).

Data analysis

Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to describe the variables. Prevalence estimates are reported with 95% confidence

intervals calculated using the Wilson score method. The association between categorical variables was assessed using the Pearson Chi-square test. The IBM SPSS (version 23) was used to analyze the data.

Results

Among the 350 nurses, the majority were married (86%) females (85%) with a mean age of 41 ± 8 years (ranging from 25 to 59 years). Over half of the nurses had attained education up to the diploma level (58%), while 41% were nursing graduates. Nearly one-third (33%) of nurses were working in surgical units. They usually work about 6 hours per day (46%) (modal category), but nearly 40% reported working for 12 hours per day. The demographic characteristics of the participants are represented in Table 1.

Table 1

Demographic characteristics of the participants (n=350)

Demographic characteristics		Frequency (n)	Percentage (%)
Age (years)	≤30	43	12.3
	31-40	**136**	**38.8**
	41-50	113	32.3
	≥50	58	16.6
Gender	Female	**297**	**84.9**
	Male	53	15.1
Marital status	Married	**300**	**85.7**
	Unmarried	50	14.3
Level of education	Diploma	**204**	**58.3**
	Graduate	143	40.8
	Postgraduate	3	0.9
Working Units	Surgical	**116**	**33.1**
	Special units	74	21.1
	Medical	73	20.9
	Operation theater	61	17.5
	Intensive Care Unit (ICU)	26	7.4
Working hours	6 hours/day	**161**	**46.0**
	12 hours/day	139	39.7
	8 hours/day	50	14.3

The prevalence of WMSDs among nurses over the past 12 months was 87.4% (n=306), with a 95% confidence interval of 83.4% to 90.6%, as represented in Figure 1. The findings indicate a high frequency of WMSDs in specific body regions, with the lower back being the most affected (54%), followed by the knee(s) (51%), shoulder (42%), and neck (39%). Due to the discomfort in the lower back (39%) and knee(s) (33%), most of the nurses were prevented from normal work during the last 12 months. The frequency distribution of WMSDs is indicated in Table 2.

Figure 1

Twelve-month prevalence of WMSDs (n=306)

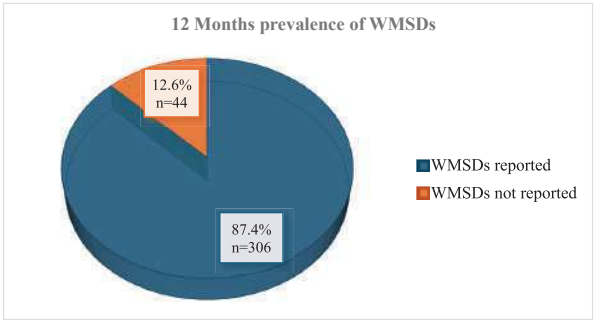


Table 2

Work-related musculoskeletal discomforts among nurses (n=350)

Frequency of WMSDs	Trouble with the musculoskeletal regions	Yes n (%)	No n (%)
Ache, pain, and discomfort during the last 12 months	Low back	**188 (53.7%)**	162 (46.3%)
	One or both knee (s)	177 (50.6%)	173 (49.4%)
	Shoulders	146 (41.7%)	204 (58.3%)
	Neck	137 (39.1%)	213 (60.9%)
	Upper back	120 (34.3%)	230 (65.7%)
	Wrist/hand	118 (33.7%)	232 (66.3%)
	One or both ankles/feet	114 (32.6%)	236 (67.4%)
	Elbows	61 (17.4%)	289 (82.6%)
	One or both hip/thighs	61 (17.4%)	289 (82.6%)
Prevented from doing normal work (at home or away from home) during the last 12 months	Low back	**135 (38.6%)**	215 (61.4%)
	One or both knee (s)	116 (33.1%)	234 (66.9%)
	Neck	91 (26.0%)	259 (74.0%)
	Shoulders	89 (25.4%)	261 (74.6%)
	Upper back	83 (23.7%)	267 (76.3%)
	One or both ankles/feet	71 (20.3%)	279 (79.7%)
	Wrist/hand	66 (18.9%)	284 (81.1%)
	One or both hip/thighs	44 (12.6%)	306 (87.4%)
	Elbows	41 (11.7%)	309 (88.3%)
Ache, pain, and discomfort during the last 7 days	One or both knee (s)	**57 (16.3%)**	293 (83.7%)
	Low back	50 (14.3%)	300 (85.7%)
	Shoulders	46 (13.1%)	304 (86.9%)
	Neck	35 (10.0%)	315 (90.0%)
	Elbows	25 (7.1%)	325 (92.9%)
	Wrist/hand	24 (6.9%)	326 (93.1%)
	One or both hip/thighs	21 (6.0%)	329 (94.0%)
	Upper back	20 (5.7%)	330 (94.3%)
	One or both ankles/feet	19 (5.4%)	331 (94.6%)

Note: (n) represents the frequency, while (%) represents the percentage.

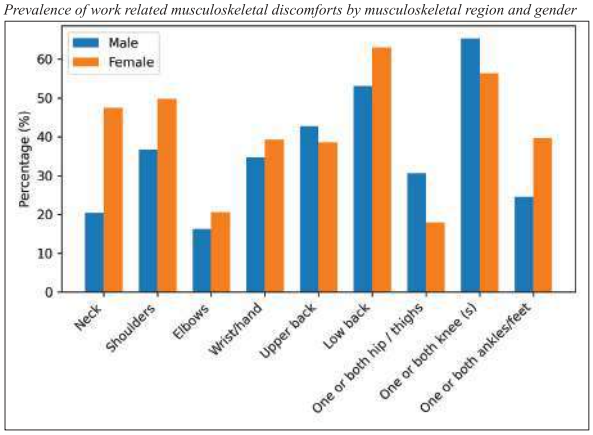
Among female nurses, ~87% (n=257) and among male nurses ~92% (n=49) reported WMSDs. When it comes to gender, the most affected body region among male nurses were the knee(s) (65%), while the female nurses mostly complained about the lower back region (63%), as depicted in Figure 2.

Among the nurses who reported WMSDs, a considerable proportion were employed in surgical wards (34%), followed by medical

wards (20%), operating theatres (19%), special units (19%), and the Intensive Care Units (ICU) (9%). A significant association was identified between the frequency of WMSDs among nurses and their assigned work units ($p \leq 0.01$) and their daily working hours ($p=0.005$).

Figure 2

Prevalence of work related musculoskeletal discomforts by musculoskeletal region and gender



Discussion

The findings of this study revealed a significantly higher prevalence (87%) of WMSDs among nursing staff, with pain in the lower back region being the predominant complaint, followed by pain in the knee(s) and shoulders. This pattern reflects the biomechanical stresses associated with patient care activities, particularly given that a significant proportion of participants worked prolonged shifts that spanned more than 12 hours per day.

WMSDs are one of the most common occupational injuries among healthcare professionals (Dehdashti et al., 2017). The incidence of WMSDs among nurses varies significantly across different regions and countries. The notable burden of WMSDs observed among nurses in this study is consistent with patterns reported in other developing countries, where prevalence rates typically exceed 85%. For example, a study conducted in Turkey reported a rate of 87.3% (Kalkim et al., 2019); while a study in Nigeria reported a similar rate of 85% (Tinubu et al., 2010). In contrast, the study findings from developed countries like Japan (70%) (Smith et al., 2006); Canada (66%) (Yassi et al., 2005) and the United States (U.S.) (60%) (Trinkoff et al., 2002) reported significantly lower incidences of WMSDs among nurses.

Despite the methodological differences of the studies, the persistent pattern of higher WMSD prevalence in developing countries compared to developed nations likely reflects fundamental differences in healthcare infrastructure and occupational safety frameworks. Developing countries often face challenges, including a lack of ergonomic practices (Bernal et al., 2015), staffing shortages leading to high workload (Roghayeh Abedini et al., 2015), limited resources for safety equipment (Stanchev & Vangelova, 2022), inadequate safety regulations (Stanchev & Vangelova, 2022), along with economic pressures, and exacerbated physical demand on nurses in such settings (Bernal et al., 2015; Roghayeh Abedini et al., 2015; Stanchev & Vangelova, 2022). Conversely, advanced healthcare infrastructure, strong health and safety practices, shift work regulations, and a diverse workforce are prevalent in the hospital settings of developed countries (Schultz et al., 2022). These similarities highlight the need for effective ways to prevent the negative consequences of WMSDs among nurses worldwide, hence promoting a safe and healthy working environment.

Lower back pain emerged as the predominant musculoskeletal complaint, consistent with the global literature identifying this as the most common WMSD among nursing professionals (Alexopoulos et al., 2011; Lin et al., 2020). However, the prevalence of lower back problems observed in this study (54%) appears more pronounced than the rates reported by more developed countries, where prevalence typically ranged from 25-49%. For instance, lower back discomfort was the most common, yet showed a lower incidence in countries like Italy (49%) (Carugno et al., 2012); Canada (48%) (Vieira et al., 2016); England (40%) (Smedley et al., 2003); Hong Kong (40.6%) (Yip, 2001) and the U.S. (29%) (Lipscomb et al., 2004). This disparity likely reflects critical differences in workplace ergonomics and patient handling practices, where

ergonomics practices in developed countries tend to have better ergonomics, thus reporting lower levels of lower back discomfort (Lin et al., 2020). Healthcare systems in developed countries have increasingly adopted mechanical lifting aids, adjustable equipment, and comprehensive ergonomic training programs that significantly reduce biomechanical stress on nurses' spines (Lin et al., 2020; Schultz et al., 2022). In contrast, limited resources in developing healthcare settings like Sri Lanka, often necessitate manual patient handling, prolonged standing, and suboptimal working postures (Schultz et al., 2022; Warnakulasuriya et al., 2012). The higher prevalence observed in this study highlights the urgent need for ergonomic interventions and mechanical aids to protect the spinal health of nurses in resource-limited environments.

The prominence of knee complaints among the nursing staff represents a notable finding, as knee disorders are often underemphasized in occupational health discussions despite their significant impact on mobility and function. Although some studies from developed countries report substantially lower rates of knee problems among nurses, ranging from 19–21% (Attar, 2014; Freimann et al., 2013; Santos et al., 2017), our findings align more closely with recent research highlighting the growing recognition of knee-related WMSDs in nursing practice reported by Stanchev and Vangelova in a study conducted in Bulgaria (Stanchev & Vangelova, 2022). The high prevalence of knee disorders likely reflects the cumulative impact of prolonged weight-bearing activities inherent in nursing care. Extended periods of standing, frequent walking between patient rooms, and repetitive movements such as squatting to access low supplies or assist patients create sustained mechanical stress on knee joints.

The demanding nature of 12-hour shifts, as commonly experienced by nurses in this study, may exacerbate these biomechanical stresses, leading to accelerated wear and inflammatory responses in knee structures. This pattern suggests that knee health should be prioritized alongside spinal health in occupational safety programs for nursing personnel.

The distinct patterns of musculoskeletal complaints between male and female nurses reveal important insights into how gender-related task allocation and physiological differences influence the risk of occupational injury. As seen in this study, male nurses predominantly experienced knee-related disorders, while female nurses more commonly reported lower back problems, suggesting that workplace task distribution may inadvertently create gender-specific injury patterns. This difference likely reflects both the variation in occupational roles of male and female nurses and other biomechanical factors. In most of the health care settings, we see that male nurses are often assigned physically demanding tasks such as lifting and transferring patients, which require more physical strength, leading to an increased rate of knee-related musculoskeletal discomfort (Gauci et al., 2023).

Conversely, female nurses are more likely to engage in tasks that include patient assessments, administering medications, retrieving supplies, and other bedside care responsibilities, which require prolonged standing and load bearing, leading to muscle fatigue and strains in the lower back (Dehdashti et al., 2017). These findings highlight the need for gender-sensitive ergonomic interventions and suggest that injury prevention programs should account for how task allocation patterns may create differential risk profiles between male and female nursing staff.

The multifactorial nature of WMSDs among nurses reflects the complex interplay between individual, occupational, and organizational factors that characterise modern healthcare delivery (Hou & Shiao, 2006; Lin et al., 2020; Stanchev & Vangelova, 2022). The relationship between working units, musculoskeletal disorder patterns and WMSDs among nurses reveals important insights into how specific healthcare environments create distinct occupational hazards. Surgical units present unique

biomechanical challenges that may amplify injury risk through several mechanisms: prolonged static positioning during procedures, frequent heavy lifting during patient positioning and transfers, and sustained awkward postures required for sterile technique maintenance (Chambers & Gill, 2020). However, the relationship between surgical work and musculoskeletal injury appears more complex than simple duration exposure. While some research suggests that shorter surgical procedures (under three hours) may not significantly increase injury risk (Yizengaw et al., 2021), this finding may reflect the multifaceted nature of surgical nursing work, which extends far beyond operative time to include pre-operative preparation, post-operative monitoring, and patient transfer activities.

This study presents several notable strengths that enhance the validity and relevance of its findings. The substantial sample size of 350 nurses provides adequate statistical power to detect meaningful associations and patterns within the nursing population. Comprehensive assessment of multiple body regions allows for a holistic understanding of WMSD distribution rather than focusing on isolated anatomical sites. Additionally, the inclusion of both male and female nurses enables gender-specific analysis, revealing important differences in injury patterns that have practical implications for targeted interventions.

Limitations and future recommendations

This study has several limitations that should be acknowledged when interpreting these findings. The single-center design, while allowing for detailed institutional analysis, may limit generalizability to other healthcare settings with different organizational structures, patient populations, or resource availability. Furthermore, the use of convenience sampling and voluntary participation may have introduced self-selection bias, whereby nurses experiencing musculoskeletal discomfort may have been more motivated to participate than their asymptomatic counterparts, potentially leading to an overestimation of WMSD prevalence. Conversely, nurses with severe symptoms may have been absent from work due to sick leave or job transitions, resulting in their underrepresentation in the sample.

Future studies incorporating objective measures and comprehensive risk factor assessment would strengthen our understanding of WMSD development and prevention in nursing populations.

Conclusion

The study revealed a high prevalence of work-related musculoskeletal discomfort among the nurses in the past 12 months. The commonly affected body regions were the lower back and knees. Lower back pain was prevalent among female nurses, while male nurses predominantly reported discomfort in the knee(s). The findings indicate a significant association between the frequency of WMSDs and the working units of the nurses and daily working hours, underscoring the need for targeted interventions to address these occupational health risks.

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Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Contributorship

Conceptualization: Jayamaha AR; Formal analysis: Nisansala DWD, Widyarathna ODS, Madushani WPL, Chathurani JDG, Kumarasena M; Methodology: Jayamaha AR; Supervision: Fernando CA, Dharmarathna HHND; Writing – Original Draft Preparation: Fernando AMF,

Fernando CA, Dharmarathna HHND; Writing – Review & Editing: Fernando AMF, Fernando CA, Dharmarathna HHND, and Jayamaha AR.

Ethical approval

Ethical approval was granted by the Ethics Review Committee of KAATSU International University (KIU), Sri Lanka *(KIU/ERC/21/123)* and the administrative clearance was obtained from the Teaching Hospital Karapitiya, Sri Lanka.

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Original Article

PREVALENCE AND FACTORS ASSOCIATED WITH NEEDLESTICK INJURIES AMONG NURSING OFFICERS IN NATIONAL HOSPITAL (NHSL) COLOMBO, SRI LANKA: A CROSS-SECTIONAL STUDY

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Abstract

Introduction: Needlestick injuries (NSIs) remain a serious occupational hazard for healthcare workers, particularly nurses, who are at the frontline of patient care. Data on NSIs among nursing officers in Sri Lanka remain limited.

Objective: This study aimed to assess the prevalence and factors associated with NSIs among nursing officers in the National Hospital, Colombo, Sri Lanka (NHSL).

Methodology: A descriptive cross-sectional study was conducted among 389 nurses with more than one year of experience, excluding those on leave, selected through convenience sampling. Ethical approval was obtained from the Ethics Review Committee (ERC) at KIU (KIU/ERC/23/221), and administrative approval from NHSL. Data were collected using a pre-tested, researcher-developed, self-administered questionnaire covering socio-demographics, prevalence, and factors associated with NSIs. Data was analyzed using SPSS version 25, incorporating descriptive and inferential statistics (Chi-square tests).

Results: Most of the participants were females (92%, n = 357), and 60% (n = 233) had over five years of working experience. The prevalence of NSIs was 48% (n =186), with over half of them (56%, n = 104) reporting two to five needlestick injuries within the past two years. Injuries occurred mainly during recapping (28%, n = 51) and disposal (25%, n = 47), often during the night shift (41%, n = 75). Injuries were most frequent among nurses in medical (52%, n = 95) and surgical wards (20%, n = 38), yet only 45% (n = 84) reported them. Nearly all participants (98%, n = 382) emphasized the need for continuous education. NSI were significantly associated with age (p = 0.007), bending used needles before disposal (p = 0.006), and use of one-hand recapping (p = 0.041).

Conclusion: Approximately half of the nurses at NHSL experienced NSIs. Strengthening education, enforcing reporting practices, and promoting adherence to universal precautions are essential to minimize this occupational risk.

Keywords: Associated factors, Needlestick injury, Nurses, Prevalence

Introduction

Needlestick Injury (NSI) is defined as an accidental skin-penetrating stab wound caused by a hollow-bore needle or other sharp object contaminated with another person's blood or body fluids. These injuries commonly occur during or immediately after use of sharp objects, but before proper disposal in designated sharps disposal containers (El-enen et al., 2020). NSIs pose a significant occupational hazard, particularly in healthcare environments, due to the risk of transmitting blood-borne pathogens. For Health Care Workers (HCWs) worldwide, NSIs are among the most serious occupation-related injuries (Hosseinipalangi et al., 2022). Nurses, being at the forefront of patient care and handling needles frequently, are particularly vulnerable to these injuries (Gaudel, 2023).

Awareness of NSIs as a critical occupational concern has increased in recent years due to the global burden of blood-borne infections such as Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV), which can be transmitted through contaminated sharps. A global meta-analysis reported a pooled NSI prevalence of 41% among nurses, with significantly higher rates in low- and middle-income countries, including 50% in Southeast Asia (Abdelmalik et al., 2023). Globally, approximately 45% of HCWs have reported experiencing accidental needlestick and sharps injuries during their careers (Behzadmehr et al., 2023). These risks continue to exist despite awareness and established protocols. In response, many countries have adopted enhanced prevention policies, such as vaccination and the implementation of safer medical devices (Abdo Almoliky et al., 2024).

The National Hospital of Sri Lanka (NHSL), situated in Colombo, is the largest tertiary teaching hospital and the final referral centre in the country, where more than 3000 nurses are serving more than 240,000 inpatients and two million outpatients annually (National Hospital of Sri Lanka, 2023). A survey conducted at NHSL in 2018 found that 67% of nurses with less than five years of clinical experience had experienced an NSI (Aberathna et al., 2019). Similarly, a study reports an annual prevalence of 69% in India. In contrast, 37% in Pakistan, and 35% in Saudi Arabia (Bhargava et al., 2013) were reported. Given this evidence, prevalence rates of NSIs vary by region. These figures underscore the burden of NSIs in both regional and national healthcare settings and highlight the urgent need for effective interventions tailored to specific contexts and work environments. Due to the evolving nature of healthcare systems, modifications in occupational safety protocols, and the significant influence of the COVID-19 pandemic on nursing workloads and exposure risks, current evidence is necessary to comprehend the extent and factors contributing to needlestick injuries among nursing officers at NHSL. Regular assessment of needlestick injuries is essential for evaluating the effectiveness of existing preventive measures and guiding institutional occupational health policies.

The risks of NSIs are influenced by various factors, including recapping of needles, excessive or inappropriate use of sharp instruments, absence of safety-engineered devices, lack of Personal Protective Equipment (PPE), improper sharps disposal, and insufficient training (Alfulayw et al., 2021). Moreover, staffing shortages, heavy workloads, and unpredictable patient behavior can contribute to increased vulnerability. Exposure to NSIs is not only a physical threat but also causes psychological distress among affected HCWs and their families (Bazie, 2020). Pathogens transmitted through NSIs can cause life-threatening conditions, especially HBV, which is a leading cause of liver cancer. Vaccination remains a crucial preventive tool, and the HBV vaccine is widely recommended for HCWs (Ali et al., 2023). In addition, effective prevention requires supportive workplace strategies, such as safer injection techniques, PPE, staff training, adequate disposal containers, and engineered safety devices (Jahangiri et al., 2016).

Given the risks and burden associated with NSIs, this study was conducted to assess the prevalence and associated factors of NSIs among nursing officers working in the NHSL.

Methodology

A descriptive cross-sectional study was conducted to evaluate the prevalence and associated factors of NSIs among nursing officers at NHSL, Colombo. The study was carried out over a six-month period from January to June 2024. The target sample size of 389 participants was determined using the Yamane formula. A convenience sampling method was used to recruit eligible nursing officers. Nurses with less than one year of work experience and those on leave during the data collection period were excluded from the study.

Data was collected using a researcher-developed, self-administered questionnaire comprising three sections: (A) sociodemographic characteristics, (B) prevalence of NSIs, and (C) factors associated with NSIs. The primary outcome was defined as self-reported occurrence of at least one needlestick injury within the past two years (2022–2023). Prior to the data collection, the questionnaire was pretested among 10 nurses not included in the main study to evaluate the clarity and feasibility of the questionnaire. Ethical clearance was obtained from the ERC of KIU (KIU/ERC/23/221), and administrative approval was obtained from NHSL. Written informed consent was obtained from all participants prior to enrollment.

Completed responses were cleaned, coded, and entered into Microsoft Excel before being imported into IBM SPSS Version 25 for statistical analysis. Descriptive statistics for categorical variables, including socio-demographic characteristics and behavioral factors, were expressed as frequencies (n) and percentages (%). Continuous variables, specifically age and years of clinical experience, were gathered raw and subsequently classified into distinct categories to facilitate descriptive profiling. Bivariate analysis was conducted utilizing the Chi-square test (χ^2) to determine statistically significant associations between the hypothesized factors and the occurrence of NSIs. For all inferential tests, statistical significance was set at a p-value < 0.05.

Results

A total of 389 nurses completed the questionnaire with a 98% response rate. The majority of nurses were females (92%, n = 357), aged between 31 and 40 years (41%, n = 160). Most of the nurses (45%, n = 175) had 6-10 years of work experience and completed a nursing diploma as their highest level of education (49%, n = 189). Of the total participants, 48% (n = 186) reported having experienced NSIs (Figure 1) and as illustrated in Figure 2, most sharp injuries were caused by disposable syringe needles, accounting for 135 cases (73%), making them the most frequently involved device (Figure 2).

Table 1: Frequency distribution of socio-demographic characteristics of the participants

Variable	Frequency (n=389)	Percentage (%)
Gender		
Male	32	8
Female	357	92
Age group		
23 – 30 years	156	40
31 – 40 years	160	41
41 – 50 years	56	14
51 – 60 years	17	4
Marital status		
Married	275	71
Unmarried	114	29
Years of experience as a nurse		
1 – 5	156	40
6 – 10	175	45
11 – 15	41	11
More than 15 years	17	4
Education level		
Nursing diploma	189	49
Post basic nursing education	37	9
BSc nursing	156	40
Post graduate nursing education	6	2
Others	1	0.4
Attendance of any in-service educational program on prevention and factors associated NSIs		
Yes	158	40
No	231	60

Figure 1

Prevalence of Needle Stick Injuries

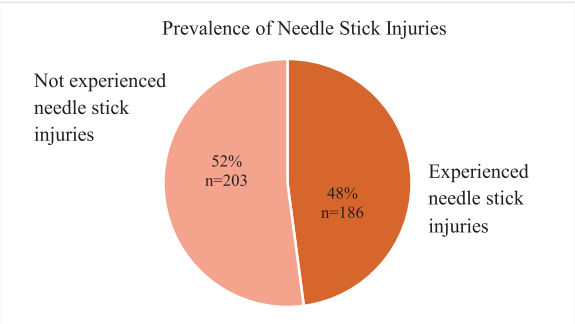
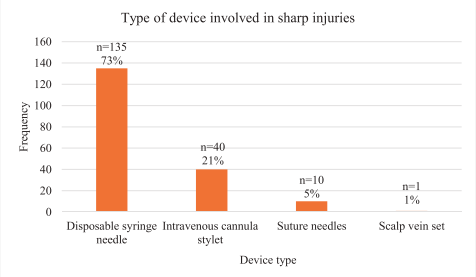


Figure 2

Type of Device Involved in Sharp Injuries



Needlestick Injury-related Respondents

Among those who had experienced NSIs within the past two years (2022-2023), the majority had been injured 2–5 times (56%, n = 104), while the most common activities leading to NSIs included recapping needles (28%, n = 51) and improper disposal (25%, n =47). A notable proportion (21%, n = 38) cited all listed risk activities as contributors (Table 2). NSIs occurred most frequently during night shifts (41%, n = 75). Regarding the workplace at the time of injury, the medical unit accounted for the highest proportion (52%, n = 95), followed by the surgical unit (20%, n = 38).

After injuries, only 39% (n = 73) of respondents followed all recommended protocols, such as washing the site, applying antiseptics, and reporting the incident. As perceived by all 389 nurses, the most common causes for NSIs were not following safety protocols (32%, n = 124) and failure to adopt universal precautions (27%, n = 106). The sharp bin was correctly identified by 91% (n = 354) as the safest disposal method. However, only 45% (n = 84) reported their injury. Among those who did not report (26%, n = 102), the main reasons cited were mainly due to fear of stigma (46%, n = 48) or lack of awareness (24%, n = 24). Among those who reported, only 14% (n =12) received medical care. Regarding preventive measures, nearly all participants (98%, n = 382) indicated that continuous education on needle stick injury prevention is necessary (Table 2). However, only 40% (n = 156) reported having attended an in-service education program on NSIs prevention (Table 1), highlighting the need of continues educational and training initiatives among nursing officers.

Table 2: Prevalence of needle stick injury among respondents

Description	Frequency (n=389)	Percentage (%)
Occurrence of needle stick injuries within the past two years		
Yes	186	48
No	203	52
Frequency of injury		
Once	68	37
2 – 5	104	56
More than 5 times	10	5
Cannot recall	4	2
Workplace at the time of injury		
ETU	15	8
Medical unit	95	52
Surgical unit	38	20
Orthopedic ward	18	10
Medical Intensive Care Unit	10	5
Surgical Intensive Care Unit	10	5

Activity associated with injury		
During disposal	47	25
Recap injuries	51	28
IV Cannulation	15	7
Sudden movement of patient	35	19
All above	38	21
Duty shift during which needle stick injury occurred		
Night	75	41
Morning	41	22
Afternoon	47	25
All three shift	23	12
Type of device involved in sharp injuries		
Disposable syringe needle	135	72
Intravenous cannula stylet	40	22
Suture needles	10	5
Scalp vein set	1	1
Standard protocols followed after needle stick injuries		
Washing the injury site with water	15	8
Apply antiseptic to the skin	1	1
Reporting the injury to one's superior	9	5
All above are correct	73	39
Answers 1 and 3 are correct	88	47
Possible causes of needle stick injuries as perceived by nurses		
Failure to adopt universal precaution	106	27
Not follow protocol safety	124	32
Performing risky procedure	23	6
Overcrowded patient setting	106	27
Lack of members in duty shift	30	8
Safest method for disposing of sharp instruments and needles		
Clinical waste	26	7
General waste bin	8	2
Polythene and plastic waste bin	1	0
Sharp bin	354	91
Reporting of injuries to the appropriate person after occurrence		
Yes	84	45
No	102	55
If "no", reasons for not reporting injuries		
Thinking not important	19	19
Lack of awareness	24	24
Fear to stigma	48	46
Other reasons	11	11
If "yes", did you get medical care after being injured?		
Yes	12	14
No	72	86

Responsible individuals notified following injury incidents		
Ward in charge	20	24
Infection control unit	5	6
Friend	16	19
Cannot remember	41	49
No body	2	2
Recognition of the necessity for ongoing education and training in infection control practices		
Yes	382	98
No	7	2

Factors Associated with Needlestick Injuries

Age was the only sociodemographic variable with a statistically significant association with NSIs ($\chi^2 = 12.08$, $p = 0.007$).

Among behavioural factors, bending used needles before disposal ($\chi^2 = 7.54$, p = 0.006) and use of the one-hand recapping technique ($\chi^2 = 4.18$, p = 0.041) showed statistically significant associations with NSI occurrence (Table 3).

Table 3: Behavioral actors associated with NSIs

Variable	Category	NSI Yes n (%)	NSI No n (%)	χ^2	p-value
Use gloves while treating patients	Yes	121 (49)	124 (51)	2.567	0.277
	No	11 (34)	21 (66)		
	Sometimes	54 (48)	58 (52)		
Recapping needle after injection	Yes	96 (48)	101 (52)	0.889	0.641
	No	29 (43)	39 (57)		
	Sometimes	61 (49)	63 (51)		
Bending used needles before disposal	Yes	9 (26)	26 (74)	7.540	**0.006***
	No	167 (49)	173 (51)		
	Sometimes	10 (71)	4 (29)		
Protective pad use when breaking needles/ampule	Yes	101 (46)	118 (54)	0.578	0.749
	No	32 (50)	32 (50)		
	Sometimes	53 (50)	53 (50)		
Discharge safety box at 3/4 capacity	Yes	165 (50)	165 (50)	5.152	0.076
	No	7 (47)	8 (53)		
	Sometimes	14 (32)	30 (68)		
Sealing sharp waste container	Yes	159 (49)	162 (51)	2.309	0.315
	No	7 (44)	9 (56)		
	Sometimes	20 (38)	32 (62)		

Avoid breaking/bending needles after injection	Yes	148 (48)	157 (52)	0.759	0.684
	No	6 (38)	10 (62)		
	Sometimes	32 (47)	36 (53)		
Use of safety box for needle disposal	Yes	168 (47)	189 (53)	1.295	0.523
	No	6 (50)	6 (50)		
	Sometimes	12 (60)	8 (40)		
One-hand needle recapping technique	Yes	49 (41)	71 (59)	4.180	**0.041***
	No	26 (63)	15 (37)		
	Sometimes	111 (49)	117 (51)		

Discussion

This study assessed the prevalence and factors associated with NSIs among nursing officers at NHSL. The findings showed that 48% of nurses reported experiencing at least one NSI within the past two years, with disposable syringe needles being the most frequently involved device (73%). Recapping needles and improper disposal were the leading activities associated with injuries. Significant factors for NSIs included age, bending needles before disposal, and the use of the one-hand recapping technique.

The prevalence observed in this study is lower than that reported in a previous NHSL survey conducted in 2018, which found 67% of nurses with less than five years of experience had sustained NSIs (Aberathna et al., 2019). This difference may be explained by variations in participant characteristics. In the current study, the majority of participants had over five years of clinical experience, which may have contributed to greater adherence to infection control practices and safer handling of sharps. In contrast, the previous study included a larger proportion of early-career nurses, who are more likely to be exposed due to limited experience. Additionally, improvements in institutional safety protocols, infection control training, and the adoption of safer devices over the past years may have further reduced NSI prevalence. Regional comparisons show that NSI rates among nurses range from 45% to 48% in South India and Pakistan (Gulnaz et al., 2024; Uddin Mohammed & Reddy, 2021), suggesting that the observed prevalence aligns with trends in similar healthcare settings.

The study also highlights that recapping remains a major risk factor. In this study, 28% of NSIs occurred during recapping and 8% during cannulation. These findings are consistent with international studies from Iran and Ethiopia, where improper handling, including recapping, significantly increased the risk of NSIs (Fathizadeh et al., 2023; Mengistu & Tolera, 2020). A meta-analysis also reported that syringe needles were involved in the majority of NSIs and that double-handed recapping substantially increased injury risk (Aliyo & Gemechu, 2024). The lower rate of recapping-related injuries observed in our study may reflect better compliance with infection control training and stricter institutional enforcement in Sri Lankan hospitals.

Behavioral and demographic factors were significantly associated with NSIs in this study. Younger nurses, particularly those aged 23 to 40 years, experienced higher injury rates, which is consistent with findings from studies in Malaysia and India, where early-career nurses were more likely to sustain NSIs due to limited clinical experience and higher involvement in high-risk procedures (Lyngdoh et al., 2018; Othman et al., 2024). This suggests that experience plays a protective role, as nurses with longer service are generally more familiar with safe handling

practices and institutional protocols. Unsafe practices, including bending needles before disposal and the use of the one-hand recapping technique, were associated with increased NSI risk. Similar patterns have been observed in studies from Iran and Ethiopia, where improper needle handling significantly elevated the likelihood of injury (Fathizadeh et al., 2023; Mengistu & Tolera, 2020). These findings underscore that despite theoretical knowledge of universal precautions; behavioral compliance remains a critical determinant of occupational safety.

Despite high awareness regarding safe disposal methods (91% correctly identified the sharp bin), under-reporting of NSIs was common; only 45% of incidents were officially reported. This aligns with reports from Pakistan and South India, where fear of stigma, lack of awareness, and perception that injuries were minor led to significant under-reporting (Gulnaz et al., 2024; Uddin Mohammed & Reddy, 2021). Limited reporting has important implications for occupational health monitoring, post-exposure prophylaxis, and institutional policy enforcement.

Education and training emerged as crucial protective factors. Only 40% of nurses attended in-service programs on NSI prevention, yet nearly all (98%) recognized the need for ongoing education. Comparable studies from Trinidad and Malaysia have similarly shown that formal training improves adherence to safety practices and reduces the incidence of NSI (Kwanzaa et al., 2020; Othman et al., 2024). These findings indicate that while awareness of safe practices is high, practical reinforcement through regular, structured training remains essential to further reduce occupational risk.

This study has some limitations. First, convenience sampling may limit the representativeness of findings to other hospitals or regions. Second, self-reported retrospective data are subject to recall bias, potentially underestimating the true frequency of NSIs. Third, the single-site, cross-sectional design precludes causal inference. These limitations should be considered when interpreting and generalizing the findings.

Conclusion

The findings of the study revealed a high prevalence of NSIs among nurses, with a particularly elevated risk among those who practiced one hand recapping. Age, bending used needles before disposal, and the use of the one-hand technique for needle recapping were the factors found to be significantly associated with NSIs. These results highlight the urgent need to strengthen occupational safety regulations in low- and middle-income countries. To reduce the incidence of NSIs, it is essential to first implement targeted prevention strategies, such as comprehensive training programs on safe injection practices, proper handling and disposal of sharps, and the consistent use of PPE. In addition, awareness campaigns using Information, Education, and Communication (IEC) materials should be prominently displayed at all worksites to reinforce best practices. Hospital administrations should ensure adequate staffing, especially in high-risk wards, and include NSI prevention strategies in Continuing Professional Development (CPD) programs for nurses. The establishment of a clear and efficient NSI reporting mechanism is critical. A user-friendly and confidential reporting system will encourage prompt reporting of injuries, which enables timely medical interventions, including post-exposure prophylaxis and necessary treatment.

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Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Original Article

KNOWLEDGE, ATTITUDES AND SELF-EFFICACY REGARDING EXCLUSIVE BREASTFEEDING AMONG ANTENATAL MOTHERS ATTENDING THE ANTENATAL CLINIC AT BASE HOSPITAL KAHAWATTA, SRI LANKA

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Abstract

Background: Exclusive breastfeeding (EBF) is defined as feeding an infant only breast milk, with no additional foods or liquids, for the first six months of life. Ensuring adequate knowledge and fostering positive attitudes toward EBF among antenatal mothers is essential for its successful implementation.
Objective: To assess the knowledge, attitudes and self-efficacy regarding exclusive breastfeeding among antenatal mothers attending the antenatal clinic at Base Hospital Kahawatta, Sri Lanka.
Methodology: A descriptive cross-sectional study was conducted among 277 pregnant mothers at the Base Hospital Kahawatta, Sri Lanka, who were selected by a convenience sampling method. Data were collected through a pre-tested interviewer-administered questionnaire, which included socio-demographics, adapted tools for knowledge assessment on breastfeeding, the Iowa Infant Feeding Attitude Scale (IIFAS) and Breastfeeding Self-Efficacy Scale-short form (BSES-SF). Microsoft Excel 2011 and IBM SPSS (v. 26) were used for the data analysis. The study was conducted with ethical approval from the Ethics Review Committee-KIU, Sri Lanka (KIU_ERC_N_116).
Results: A total of 277 pregnant mothers with a mean age of 31 ± 5 years participated in the study. The majority of them were Sinhala (84%, n=232), Buddhist (83%, n=229), and from nuclear families (57%, n=157). Overall, 85% (n=234) demonstrated high knowledge on EBF, although misconceptions remained regarding cessation timing (29%, n=79), 72% (n=198) correctly identified the duration of EBF, while 98% (n=272) knew that complementary foods should be introduced after six months. Regarding attitudes, the majority (60%, n=167) reported neutral or moderate attitudes, while 40% (n=110) had strongly positive attitudes. The majority had moderate self-efficacy on breastfeeding (62%, n=172).
Conclusion: The study indicates that pregnant mothers possessed high knowledge, predominantly neutral or moderate attitudes, and moderate self-efficacy toward EBF; however, misconceptions about feeding adequacy and cessation timing persisted, and self-efficacy remained moderate. Strengthening antenatal education and providing postpartum support are recommended to enhance the mothers' confidence and sustain EBF practices.

Keywords: Antenatal mothers, Exclusive breastfeeding, Sri Lanka

Introduction

Exclusive breastfeeding (EBF) is defined as providing an infant with only breast milk, either directly from the breast or expressed, for the first six months of life, with no additional food or fluids, including water. The only exceptions include oral rehydration solutions, vitamins, minerals, or prescribed medications when medically indicated (WHO, 2021). EBF during the first six months is crucial for optimal infant growth, immune system development, and long-term health benefits, reducing the risk of infections, malnutrition, and chronic diseases later in life (WHO, 2021; Victora et al., 2016).

Breastfeeding is widely recognized as the optimal source of nutrition for infants, providing essential nutrients, immune protection, and long-term health benefits for both the child and the mother (WHO, 2021). The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) recommend EBF for the first six months of life, followed by continued breastfeeding with complementary feeding up to two years or beyond (Victora et al., 2016). Despite these recommendations, breastfeeding practices vary globally and are influenced by maternal attitudes, cultural beliefs, healthcare support, and socio-economic status (Rollins et al., 2016).

Globally, only 48% of infants under six months are exclusively breastfed, far below the 2030 target of 70% (WHO & UNICEF, 2022). Suboptimal breastfeeding may prevent approximately 823,000 child deaths annually, accounting for 8% of under-five mortality worldwide (Victora et al., 2016). Evidence suggests that achieving universal optimal breastfeeding could prevent up to 13% of under-five deaths and reduce the risk of diarrhoeal disease by 43% (Victora et al., 2016). Strengthening breastfeeding promotion and support is therefore critical to reducing child morbidity and mortality globally.

In Sri Lanka, national breastfeeding policies align with global recommendations, and supportive health initiatives have contributed to relatively high EBF rates. The 2016 Demographic and Health Survey reported that approximately 82% of infants under six months were exclusively breastfed; however, this proportion declined to 64% among those aged four to five months, reflecting a progressive decrease in EBF practices with increasing infant age (Department of Census and Statistics & Ministry of Health, 2017).

While Sri Lanka is recognized internationally for its strong breastfeeding support systems, addressing barriers such as maternal employment and caesarean deliveries remains essential to achieving optimal and sustained EBF. However, challenges such as misconceptions about breastfeeding, social influences, and conflicting advice from family or healthcare providers may impact maternal decision-making and adherence to recommended practices (Senarath et al., 2012). The antenatal period serves as a crucial window of opportunity for educating mothers about breastfeeding, reinforcing positive attitudes, and addressing potential barriers. During the pregnancy mothers are in the regular contacts with the health care providers and the system through scheduled antenatal clinic visits, providing structured opportunities for health education that may not be as consistency available in postnatal period. Therefore understanding the level of knowledge, attitudes and self-efficacy toward breastfeeding among expectant mothers is essential for developing targeted interventions that enhance breastfeeding practices and improve infant health outcomes.

This study aimed to assess the knowledge, attitudes, and self-efficacy regarding EBF among pregnant mothers attending the antenatal clinic at Kahawatta, Sri Lanka. By identifying gaps in knowledge, attitude-related factors, and self-efficacy among pregnant mothers, the findings of this research can contribute to improving breastfeeding education programs and healthcare strategies, ultimately supporting optimal infant nutrition and maternal well-being by improving EBF practices.

Methodology

A descriptive cross-sectional study was conducted with the ethical approval of the Ethics Review Committee (KIU_ERC_N_116) of KIU and with the permission of the hospital director and the consultants of Base Hospital Kahawatta, Sri Lanka. Data collection was conducted from May 2024 to June 2024. Two hundred and seventy-seven pregnant mothers from the antenatal clinic, were selected through a convenience sampling method. Pregnant mothers aged 18 and above were included irrespective of the trimesters and parity. Pregnant mothers who were in pain and ill were excluded from the study.

Sample size was calculated at a 95% confidence level (Z = 1.96) (Daniel & Cross, 2018), with a margin of error of ±5% (0.05) and an estimated prevalence of 76.4% for positive attitudes toward EBF (Khadka, Ghimire, & Shrestha, 2019), resulting in a sample size of 277 participants. Participants were approached by trained investigators using an online pretested interviewer-administered questionnaire. The questionnaire was pretested among 10 pregnant mothers with similar characteristics to the target population to assess the clarity, comprehensibility, wording, flow, and time required for administering the questionnaire. Pregnant mothers who participated in the pretest were excluded from the final sample. Feedback from the pretest informed refinements to ambiguous or confusing items and optimized response options, enhancing clarity of the questionnaire. Data was collected by trained investigators who first approached potential participants, assessed eligibility, comprehensively explained the study, and obtained written informed consent before recruiting participants. Privacy and confidentiality were strictly maintained throughout the process.

The questionnaire consisted of three sections. Section 1 evaluated the socio-demographic characteristics of the participants. Section 2 assessed the knowledge regarding EBF using adapted tools derived from previous studies by Sakarkar et al. (2018) and Ogbo et al. (2019). The adapted knowledge tool comprised of fifteen items covering initiation, duration, benefits, and practical aspects of EBF. Content validity was assessed by two subject matter experts prior to data collection. The internal consistency of the tool in this study was Cronbach's $\alpha = 0.69$. The knowledge scores were categorized according to Bloom's cut-off values as high (80–100%), moderate (60–79%), and low (<60%) (Bloom, 1956).

Section 3 evaluated attitudes toward EBF using the Iowa Infant Feeding Attitude Scale (IIFAS), an internationally validated instrument. The IIFAS consists of 17 items, each rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Negatively worded items were reverse-scored. The total IIFAS score ranges from 17 to 85, where scores of 70–85 indicate a strongly positive attitude, 49–69 indicate a neutral or moderate attitude, and 17–48 indicate a negative attitude toward breastfeeding. The internal consistency of the original scale has been reported as Cronbach's $\alpha = 0.68$ (De la Mora et al., 1999).

The Breastfeeding Self-Efficacy Scale – Short Form (BSES-SF) developed by Dennis (2003) was used to measure maternal breastfeeding self-efficacy. The BSES-SF comprises 14 items rated on a 5-point Likert scale ranging from 1 (not at all confident) to 5 (always confident). Total scores are obtained by summing the item scores, yielding a range of 14 to 70. Scores of 56–70 indicate high self-efficacy, 42–55 indicate moderate self-efficacy, and 14–41 indicate low self-efficacy. The BSES-SF demonstrates a high level of internal consistency, with a Cronbach's $\alpha = 0.94$ (Dennis, 2003). Both the IIFAS and BSES-SF, tools were translated into Tamil and Sinhala languages by professional translators and subsequently back-translated to English to ensure linguistic and conceptual accuracy.

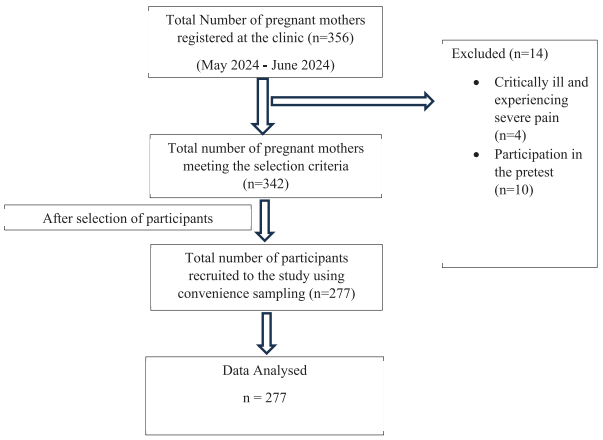
Data analysis was performed using IBM SPSS (v.26), with descriptive statistics (mean, standard deviation, frequencies, and percentages). Due

to the descriptive nature of the study design, inferential analyses were not conducted; however, future studies should examine associations between knowledge, attitudes, self-efficacy, and socio-demographic variables.

Results

Recruitment of participants

Three hundred and fifty-six pregnant mothers were registered at the antenatal clinic of Base Hospital Kahawatta, of these, 342 met the inclusion criteria after initial screening. Fourteen were subsequently excluded, four who were critically ill or in severe pain, and ten who had participated in the pretest, resulting in a final sample of 277 participants who consented and completed the questionnaire during the data collection period (May 2024 – June 2024). Figure 1 depicts the participant recruitment procedure.



3.2. Demographic details of study participants

The mean age of the participants at the time of study was 31 ± 5 years. The majority (50%) reported being belonged to the 18–24 age range at the time of marriage. Most participants (82%) followed Buddhism, and 57% came from nuclear families. Most participants (57%) were multigravidas. The majority (97%) took iron and folic acid supplements, and 18% had shared concerns about breastfeeding with healthcare workers. Additionally, 87% had attended at least one session on breastfeeding education. Table 1 shows the demographic details of the participants.

Table 1

Demographic Characteristics of the Participants (n = 277)

Variable	Category	Percentage (%)	Frequency (n)
Race	Sinhala	84%	232
	Tamil	16%	45
Religion	Buddhism	83%	229
	Hinduism	14%	40
	Muslim	1%	4
	Christianity	1%	4
Educational Level	No schooling	3%	8
	Up to Grade 5	6%	16
	Up to Grade 10	24%	65
	Passed Ordinary Level (O/L)	37%	102
	Passed Advanced Level (A/L)	23%	64
	Degree Holder	8%	22
Occupation	Employed	37%	103
	Unemployed	63%	174
Type of Family	Joint	43%	120
	Nuclear	57%	157
Gravida	Primigravida	43%	120
	Multigravida	57%	157
Number of Antenatal clinic Visits	No visits	11%	30
	Less than 2 visits	33%	91
	Two or more visits	56%	156
Source of knowledge on EBF	Antenatal clinic (ANC)	49%	136
	Health professionals	37%	101
	Mothers	8%	21
	Family members	4%	12
	Friends	3%	7

3.3. Knowledge on Breastfeeding

High knowledge was observed in 85% (n=234) of participants, while moderate knowledge was demonstrated by 15% (n=43) of participants. No participants demonstrated low knowledge. While respondents demonstrated adequate knowledge (High and moderate knowledge), some misconceptions were observed in the timing of EBF cessation (29%, n=79). While most participants correctly identified weight gain and increased stool passing as signs of adequate breastfeeding, a notable proportion (34%, n=95) selected sleep after breastfeeding, and 26% (n=72) selected weight loss, both of which are incorrect indicators, suggesting residual misconceptions regarding feeding adequacy assessment. Table 2 shows the responses regarding knowledge on breastfeeding.

Table 2
Responses Regarding Knowledge on Breastfeeding (n = 277)

Question	Answer	Percentage (%)	Frequency (n)
Breast milk should be given to the baby immediately after delivery	Yes	99%	274
	No	1%	3
Importance of colostrum	Yes	95%	263
	No	5%	14
Baby should be breastfed on demand	Yes	81%	225
	No	19%	52
How do you know that your child gets enough breastfeeding? (multiple responses were allowed)	By increasing weight	40%	110
	Sleep after breastfeeding	34%	95
	Increased stool passing	78%	216
	Loss of weight	26%	72
When do you stop exclusive breastfeeding your child?	Before 6 months	29%	79
	At 6 months	72%	198
	After 6 months	0%	0
How many times do you breastfeed your child?	Less than 3 times/day	16%	43
	4 to 8 times/day	69%	191
	More than 8 times/day	16%	43
Is it necessary to introduce supplementary food after 6 months?	Yes	98%	272
	No	2%	5

3.4. Maternal Attitudes and Self-Efficacy towards Breastfeeding

Based on the IIFAS scoring protocol: majority (60%, n=167) reported neutral or moderate attitude with no participants with negative attitude. Figure 2 presents the distribution of maternal attitudes according to the IIFAS total scores. The BSES-SF score among the participants was moderate, reflecting predominantly neutral maternal self-efficacy (62%, n=172). Figure 3 presents the scores of self-efficacy on EBF among the participants.

Figure 2
Maternal Attitudes Toward Breastfeeding (n = 277)

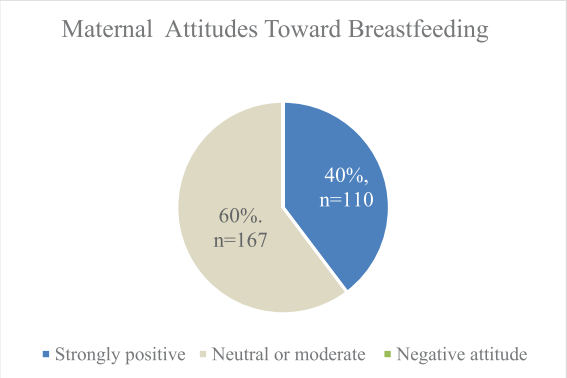
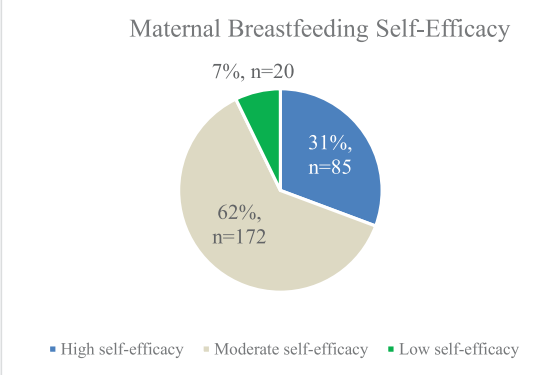


Figure 3
Distribution of Maternal Breastfeeding Self-Efficacy (BSES-SF) Scores (n = 277)



Discussion

This study assessed maternal knowledge, attitudes, and self-efficacy regarding EBF among 277 pregnant mothers attending the antenatal clinic at Base Hospital Kahawatta, Sri Lanka. High maternal knowledge was observed, but attitudes were predominantly neutral, and self-efficacy was mainly moderate. These results highlight the complex interplay between cognitive understanding, affective disposition, and confidence in breastfeeding, suggesting that knowledge alone may not be sufficient to ensure optimal EBF practices.

It should be noted that the absence of inferential analysis in this study limits the ability to establish associations between these three constructs; the relationships discussed here are therefore informed by the broader literature rather than derived from the present dataset.

The Cronbach's alpha value of 0.69, for the knowledge questionnaire, suggests that the tool had acceptable but not high internal consistency. This finding may be attributed to the diversity of the knowledge items included in the questionnaire. Future studies may consider revising or refining individual items and conducting further psychometric testing to enhance the reliability of the instrument.

The majority of participants demonstrated high knowledge regarding EBF, consistent with the relatively high national rates reported in Sri Lanka (Wickramasinghe et al., 2013). The 2016 Demographic and Health Survey indicated that approximately 82% of infants under six months were exclusively breastfed, although this decreased to 64% among 4–5-month-olds (Department of Census and Statistics & Ministry of Health, 2017). The high knowledge levels observed in this study reflect effective national health initiatives, such as antenatal education programs and community-based support, which align with WHO and UNICEF recommendations for EBF (WHO, 2021). Nevertheless, some participants exhibited misconceptions regarding signs of adequate feeding and the timing of EBF cessation. Similar knowledge gaps have been reported in Sri Lankan studies, particularly in rural areas, suggesting that educational interventions should focus not only on the general concept of EBF but also on practical guidance for assessing breastfeeding adequacy and duration (Ratnayake et al., 2018; Agampodi et al., 2021).

Internationally, maternal knowledge has been consistently associated with EBF practices. Studies in India and Nigeria found that mothers with higher knowledge levels were significantly more likely to initiate and sustain EBF (Adejuyigbe et al., 2019), whereas insufficient knowledge was linked to early cessation and mixed feeding practices (Vijayalakshmi, 2015; Sokan-Adeaga et al., 2023). These global findings reinforce the importance of targeted educational programs, particularly for addressing misconceptions and promoting evidence-based breastfeeding practices.

Maternal attitudes were predominantly neutral or moderate, a finding that aligns with Sri Lankan studies where suboptimal attitudes contributed to early cessation of EBF (Ratnayake et al., 2018). Cultural norms, family influences, and workplace pressures likely play a role in shaping maternal attitudes, even among mothers with high knowledge levels. Studies in Oman and Mali demonstrate that attitudes are influenced by societal expectations, perceived support, and community norms, which can either facilitate or hinder EBF practices (Madhavanprabhakaran et al., 2025; Bicchieri et al., 2021). These findings highlight that promoting positive attitudes requires interventions beyond information dissemination, incorporating motivational counseling, social support, and engagement of family members.

Moderate self-efficacy scores reported in this study suggest that mothers may lack confidence in managing breastfeeding challenges, which could impede sustained EBF. It has been consistently reported in the literature that maternal breastfeeding self-efficacy serves as a strong predictor of EBF duration and overall success, although variations have been noted across different contexts. In studies conducted in Iran, moderate levels of self-efficacy were identified, with mean scores around 50.8, which aligns with trends reported in several other populations (Pakseresht et al., 2019). By contrast, findings from a longitudinal study in Greece indicated that higher self-efficacy scores were observed among mothers who exclusively breastfed, suggesting a positive association between maternal confidence and breastfeeding continuation (Zerva et al., 2021).

Research indicates a strong correlation between maternal self-efficacy and EBF duration. Studies in Bangladesh found that higher self-efficacy was associated with increased initiation and continuation of EBF, while low confidence contributed to early cessation (Thomas et al., 2015; Habib et al., 2021). Similarly, Sri Lankan studies have reported that perceived inadequate breast milk, concerns about infant growth, maternal employment, and limited social support are key barriers to exclusive breastfeeding up to six months (Perera et al., 2012; Ratnayake & Rowel, 2018; Agampodi et al., 2021). These findings underscore the importance of interventions designed to strengthen maternal confidence through practical guidance, peer support, and healthcare provider encouragement. Challenges such as perceptions

of maternal fatigue and discomfort with public breastfeeding were also highlighted in prior research. In Turkey, it was reported that more than half of mothers in the early postpartum period demonstrated low BSES-SF scores due to experiences of fatigue, which adversely affected breastfeeding continuation (Sahin et al., 2018). Overall, the evidence suggests that although maternal self-efficacy tends to be reported at moderate levels across various populations, item-specific barriers such as fatigue, stigma, and public discomfort have persisted, thereby emphasizing the importance of context-specific strategies to strengthen maternal confidence and normalize breastfeeding practices. These findings collectively suggest that antenatal education in this setting has been effective in building foundational knowledge yet falls short in translating that knowledge into confident and positive breastfeeding behaviours. Culturally based interventions that address practical barriers, such as family pressure, return to employment, and uncertainty about breastfeeding adequacy, may be more effective than information-only approaches.

Overall, the study highlights a nuanced relationship between maternal knowledge, attitudes, and self-efficacy regarding EBF. While knowledge levels were generally high, specific misconceptions regarding feeding adequacy and EBF cessation persisted, suggesting that knowledge alone does not guarantee confidence in practice.

This study used validated instruments (IIFAS, BSES-SF) with rigorous translation and back-translation procedures, enhancing reliability and cultural relevance. The pretesting of the questionnaire ensured clarity and appropriateness for the local population. Conducting the study in a primary healthcare setting at Base Hospital Kahawatta, allowed inclusion of mothers from diverse socio-demographic backgrounds, making the findings locally relevant.

This study has several notable limitations. The cross-sectional design precludes causal inference. Convenience sampling at a single facility over two months limits the representativeness of the findings. Mothers who attended the clinic regularly may have had greater exposure to health education, potentially inflating knowledge and attitude scores. Future studies should employ probability sampling across multiple sites to improve generalisability. Self-reported data could be influenced by social desirability bias. Additionally, the moderate internal consistency of IIFAS (Cronbach's $\alpha = 0.68$) may limit the precision in measuring maternal attitudes. Finally, the findings may not be generalizable to pregnant mothers outside the study hospital.

Despite these limitations, the study does offer valuable insights into antenatal education programs suggesting targeting persistent knowledge gaps, reinforcing positive attitudes, and enhancing maternal self-efficacy. Interventions could include skill-building workshops, motivational counseling, and postnatal follow-up. Engaging partners and family members may further support mothers in practicing EBF. Future research should explore longitudinal outcomes to assess whether maternal knowledge, attitudes, and self-efficacy predict actual EBF duration.

Conclusion

The study highlights high breastfeeding knowledge, predominantly neutral or moderate attitudes, and moderate self-efficacy toward EBF among pregnant mothers attending the antenatal clinic at Kahawatta, but identifies gaps in public breastfeeding perceptions and comprehensive knowledge. To address these gaps, antenatal education programs should be strengthened by incorporating hands-on breastfeeding demonstrations, role-playing scenarios for public breastfeeding, and guidance on recognizing signs of adequate infant feeding. Future research should evaluate the effectiveness of these targeted interventions in improving EBF duration and maternal confidence. Strengthening antenatal

and postnatal education with emphasis on practical skill-building and partner involvement could enhance exclusive breastfeeding rates.

Acknowledgement

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List of Abbreviations

ANC	Antenatal Clinic
BSES-SF	Breastfeeding Self-Efficacy Scale – Short Form
EBF	Exclusive Breastfeeding
ERC	Ethics Review Committee
IIFAS	Iowa Infant Feeding Attitude Scale
WHO	World Health Organization
UNICEF	United Nations Children's Fund

Conflicts of Interest

The authors declare that they have no conflicts of interest related to this study.

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Original Article

Psychosocial Determinants of Child Mental Health in Sri Lankan Suburban Communities: A Narrative Review

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Abstract

The research examines psychosocial factors which impact child mental health in Sri Lankan suburban regions because scientists have not conducted sufficient academic or policy-based studies on this topic. The suburban areas of Colombo, Gampaha, and Kalutara experience rapid urban expansion, but their social bonds weaken, their economic security remains unstable, and their fundamental infrastructure remains underdeveloped. Children who reside in these areas encounter various safety threats because they must face parental control, schoolwork, poverty, violence, discrimination, institutional care, and the effects of their parents leaving or becoming homeless. The review uses 34 sources from 2010 to 2025 to analyse the determinants of child mental health, drawing on Bronfenbrenner's Ecological Systems Theory and the World Health Organisation's social determinants of mental health framework. The review demonstrates that these risk factors accumulate together and affect children through their family environment, school experience, and community surroundings. The review examines three concealed threats which impact children in state care and migrant families, and those who have depressed mothers and experience gender-based discrimination. The review shows that mental health services in these areas require improvement because schools do not have adequate counselling programs, and community mental health services operate without organisation. There are no suitable intervention models for local populations. The review identifies two main research gaps: children remain underrepresented in studies, and scientists need new methods to track long-term development while working with local communities. The narrative review shows that mental health needs urgent implementation of trauma-sensitive methods which use local customs and operate across different sites to address individual symptoms and community inequalities. The review also integrates research data with environmental studies to develop mental health programs for children living in Sri Lankan suburban areas that are undergoing rapid urbanisation.

Keywords: *Child mental health, Community-based interventions, Psychosocial determinants, Sri Lanka, Suburban communities*

Introduction

National development, social equality, and public health initiatives depend on child and adolescent mental health as their core foundation. According to the World Health Organisation (2021), mental health disorders impact 5% of children globally who start showing symptoms before reaching their 14th birthday. The combination of underdiagnosed mental health problems, insufficient treatment, and social discrimination against mental health issues in Low- and Middle-Income Countries (LMICs), including Sri Lanka, results in prolonged psychosocial distress which persists into adulthood (Kohrt et al., 2018).

The failure to detect mental health issues at an early stage creates two significant problems, which negatively affect child development and academic performance, and generate extended healthcare expenses, welfare needs, and criminal justice system expenses.

Children in Sri Lanka face unique social and historical factors, including the civil war, natural disasters, migration, and changing family patterns, that affect their emotional development. The national effort to develop mental health policies has not provided sufficient funding for child mental health programs because these programs lack adequate research and experience, and their implementation is irregular (Rohanachandra, 2023; Hettiarachchi, 2021). Existing empirical studies have concentrated on mental health issues affecting urban and rural populations yet have not investigated the psychological needs of children residing in suburban areas between urban and rural areas.

The western province of Sri Lanka, which includes the Gampaha, Colombo, and Kalutara districts, is experiencing rapid population growth driven by urban development and new residential projects. The two regions follow different paths of development, yet their native inhabitants face discrimination from society. Children in these communities encounter multiple psychosocial threats because they must handle their academic work and financial difficulties, follow social norms based on gender, deal with absent parents and institutional prejudice, and witness violent incidents (Karunanayake et al., 2020). The academic field, together with government organisations, has not recorded the mental health needs and individual experiences of this specific population segment.

The World Health Organisation (2014) defines psychosocial determinants of child mental health as the social, cultural, economic, and relational elements which affect psychological health. Mental health affects people beyond their individual traits as it interacts with various structural factors, which include poverty levels, discrimination practices and healthcare service accessibility and cultural attitudes toward help-seeking. The Sri Lankan suburban setting generates psychosocial elements because of changing family dynamics, insufficient educational access, unequal healthcare delivery, and past discrimination against mental illness (Deivanayagam et al., 2024; Knipe et al., 2021). Research has not established a clear understanding of how psychosocial determinants affect suburban areas through specific intervention studies. The absence of research evidence makes it impossible for psychologists, educators, and public health professionals to develop effective interventions which fulfil the cultural requirements of their communities.

The research synthesizes peer-reviewed academic literature alongside high-quality grey literature from 2010 to 2025 to comprehensively evaluate child mental health challenges in suburban Sri Lanka. The review uses Bronfenbrenner's Ecological Systems Theory and the WHO social determinants of mental health framework to analyse how different levels of influence affect child mental health in suburban Sri Lankan communities.

The review aims to determine vital psychosocial elements which impact child mental health in Sri Lankan suburban areas and to choose evidence-based interventions for these factors. The

review organises its content into seven sections that examine family and parenting factors, educational stress, economic inequalities, gender-based discrimination and exposure to violence, institutional care, mental health service availability, and the effects of displacement and migration. The review concludes with policy and practice recommendations following its thematic analysis.

The analysis of child mental health psychosocial determinants needs to consider their relationship with Sri Lanka's suburban areas through their economic, political, and socio-cultural frameworks. Research studies across the world recognise child mental health as a critical public health matter because early childhood problems affect children's development, their academic success, their social bonds, and their future mental wellness (WHO, 2014; Kohrt et al., 2018). The majority of worldwide research about child mental health has focused on wealthy cities and towns. However, researchers have not studied children living in low-income, developing suburban areas of low-income countries enough.

The term "suburban" in Sri Lanka refers to areas undergoing rapid urbanisation located outside major cities, including Colombo, Gampaha, Kalutara, Kandy, and Jaffna. The areas exhibit dual characteristics of rural traditions and new urban problems, including land division and unregulated housing, dense population growth, and insufficient basic services (Siriwardhana & Wickramage, 2014). The social structure of suburban areas differs from that of rural areas because residents there experience social disconnection, limited family support, and insufficient public service resources. Children in these communities face multiple psychosocial threats because they experience poverty, their parents work abroad, face school pressure, experience violence, and experience community relocation and lose their traditional support networks (Karunanayake et al., 2020).

The country of Sri Lanka demonstrates better outcomes in child survival and primary school enrollment, yet its public health system lacks sufficient mental health treatment services (Perera, 2009; Engelgau et al., 2010). The Sri Lankan mental health system bases its operations on institutional psychiatry and centralised service delivery, which prevents the growth of community-based prevention programs and school-based initiatives (Rohanachandra, 2023). The National Institute of Mental Health (NIMH), along with district hospitals, operate as the leading provider of psychiatric care. The facilities lack child-friendly infrastructure and insufficiently trained child psychologists, while being located in distant areas from suburban neighbourhoods, which creates barriers for early intervention support to reach vulnerable populations.

The ongoing mental health discrimination which targets children and teenagers creates additional challenges for service delivery. Children develop psychological problems which remain undiagnosed because their caregivers and teachers incorrectly identify their issues as behavioural problems or spiritual matters, thus choosing religious or traditional care instead of medical treatment (Deivanayagam et al., 2024; Daluwatta, 2024). Children struggle to express their emotions because society enforces gender-based rules which stop girls and gender-nonconforming youth from seeking help for their mental health problems (Knipe et al., 2021).

The review draws on two fundamental theoretical frameworks to analyse the multiple dangers that affect children. According to Bronfenbrenner's Ecological Systems Theory (1979), children develop within multiple environmental layers, beginning with their family, peers, and school, and expanding to cultural and economic systems. The model shows how daily experiences in home conversations, school environments, and playground activities connect to national economic factors and educational system stability, which, in turn, affect children's mental health through direct and extended effects.

The World Health Organisation (2014) Social Determinants of Mental Health Framework demonstrates that mental health outcomes result from social conditions, which include income differences, housing standards, educational opportunities, and social network strength. The framework identifies three categories of determinants: structural elements (e.g., economic and political factors), intermediary factors (e.g., material conditions), psychosocial elements, and health system elements. The model allows researchers to analyse how social inequalities affect child mental health in Sri Lankan suburban areas using a public health framework.

The review combines these frameworks to create a complete understanding of psychosocial elements which affect children's mental health in Sri Lankan suburban areas. The review shows that mental health services need to begin right away with local changes through community-based facilities which support children.

Methodology

The research design uses a narrative review to examine complex psychosocial events by combining methods, yielding an interpretive analysis (Greenhalgh et al., 2018). The review focuses on essential research findings which explain how psychosocial factors affect children's mental health in Sri Lankan suburban areas.

Search Strategy

The research team performed a multi-stage electronic search across five major databases (PubMed, PsycINFO, Web of Science, Scopus, and Google Scholar) from January to May 2025. The team used multiple keyword combinations to search PubMed, PsycINFO, Web of Science, Scopus, and Google Scholar for studies that matched their criteria. The search strings required multiple modifications using Boolean operators and truncation with primary search strings such as 'child mental health', 'suburban', and 'Sri Lanka to achieve the desired level of inclusion in search results.

The research team conducted additional searches across Sri Lankan academic journals and university repositories, government and non-governmental organisation reports, and UNICEF and WHO publications specific to Sri Lanka. The research team conducted manual searches of the reference sections of key studies to identify additional relevant studies.

Inclusion and Exclusion Criteria

The review included research studies which fulfilled these specific requirements.

1. The research studies investigated children and/or adolescents between 0 and 18 years old and their families, caregivers, and service organisations which support this age range.
2. The research studies took place in Sri Lanka with special emphasis on suburban, peri-urban, and urban-fringe areas. The review included national studies which provided specific data about suburban populations.
3. The study examined mental health factors by studying how parenting methods, family bonds, school stress, economic conditions, violent exposure, migration events, detention, and access to services affect individuals.
4. The research included quantitative, qualitative, and mixed-methods studies together with narrative, theoretical, and policy analyses and high-quality grey literature.
5. The research spanned from 2010 to 2025 to analyse mental health changes after the war and tsunami disasters.
6. The research publications needed to be written in English for inclusion.

The research team excluded studies that (a) studied only adult participants who did not interact with children or adolescents, (b) used mental health data from clinical groups that did not represent community populations, and (c) failed to provide essential methodological information for assessment.

The research team selected 34 studies which met the inclusion criteria for analysis.

Study Selection and Data Extraction

The research team conducted title and abstract assessments to identify suitable studies for their investigation from the search results. The research team retrieved full versions of potential articles to confirm their eligibility through established inclusion and exclusion criteria. The research team extracted essential data from each included study, including study design information, participant demographics, research location, key psychosocial factors, and primary results on child mental health.

The review used narrative evaluation rather than standardised risk-of-bias assessment tools. The research team evaluated study quality by assessing participant numbers, measurement precision, and the appropriateness of statistical methods. The research team evaluated conceptual and policy papers based on their ability to present simple arguments applicable to Sri Lankan suburban areas.

Synthesis Approach

The research team used thematic synthesis to merge findings from different studies. The research team started by organising the extracted data into five main categories: family and school; socioeconomic status; gender expectations; violence exposure; institutional care; displacement; migration; and service delivery. The research team performed multiple rounds of analysis to convert the first domains into core themes, which serve as the foundation for this review.

The researchers applied Bronfenbrenner's Ecological Systems Theory and the WHO Social Determinants of Mental Health framework to examine how different environmental levels interact. The review used interpretive methods to analyse existing evidence by identifying patterns, contradictions, and missing information.

Thematic Sections

Research about child mental health in Sri Lankan suburban areas shows that multiple psychosocial factors work together to affect children's mental health status. The determinants that affect psychological well-being operate at multiple levels, from the individual to the family, school, and community, before influencing cultural and structural systems. The research literature identifies eight fundamental themes, organised into two categories that highlight risk factors and institutional system vulnerabilities.

Family Environment and Parenting Practices

Children reach their best mental health development when they remain in their original family environment. The parenting style in Sri Lankan suburban homes develops because of economic difficulties, cultural gender expectations, and past family trauma. The combination of strict discipline, unresponsive emotions, and demanding behaviour in lower-income families leads to depression, anxiety, and decreased self-esteem in their children (Vithana et al., 2023; Wijesekaea, 2022; Knipe et al., 2021).

Children who experience insecure attachment develop from families that face marital problems and financial challenges and have parents with mental health issues. Karunanayake et al. (2020) studied preschool children from low-income suburban Colombo families who showed emotional control problems and social conflicts with peers and conduct disorder symptoms.

The condition of maternal depression exists as an unaddressed factor which affects children's development. Social discrimination against mothers, together with insufficient mental health services, prevents numerous cases of maternal depression from obtaining appropriate treatment. According to Palfreyman (2021), children who experience their mother's mental illness during their early development period will develop emotional and cognitive problems.

According to Siriwardhana et al. (2015), the Middle Eastern migrant workforce in Sri Lanka poses special challenges for family relationships in the suburban areas of Gampaha and Kalutara. Children who stay home after their fathers depart for work abroad must handle changing family responsibilities, financial worries, and emotional challenges under the care of their mothers or grandparents. The children face increased risks of behavioural problems, school failure, and identity issues because their home environment remains unstable. Lakshman (2018) notes that corporal punishment continues to function as a child abuse tool, which affects disadvantaged families because it exists outside of current legal systems. Children who experience punitive discipline develop aggressive behaviour and withdraw from social interactions while experiencing ongoing fear, which directly results from a lack of emotional support in their home environment.

The research evidence demonstrates that suburban communities need parenting education programs and mental health services for parents, and mental health awareness programs to raise awareness about mental health issues.

Education and School-Related Stress

The educational system of Sri Lanka operates through a competitive framework which focuses on examination results. The academic pressure in suburban areas reaches extreme levels because these schools receive less funding than urban schools, which have access to better resources. Schools protect students through their proper psychosocial structure, but they create major student stress when this structure breaks down.

Manori et al. (2025) demonstrated that Grade 10 students in suburban Gampaha developed somatisation and depressive symptoms and school refusal because of their heavy academic responsibilities, strict rote-learning methods, and extreme examination stress. The research by Wijesekaea (2022) and Deivanayagam et al. (2024) demonstrated that students encountered two significant obstacles to receiving psychological help because they lacked access to trained counsellors, and there were no specific areas for students to share their mental health issues.

The schools based in suburban locations experience ongoing difficulties because of bullying and peer aggression problems. According to Daluwatta (2024), students at co-educational suburban schools in Colombo faced bullying because of their social position and physical looks, and their failure to fulfil traditional gender expectations. Students who faced continuous bullying developed persistent absences from school, thoughts of suicide, and severe social isolation, which became worse when their problems received no attention.

Teachers who work long hours without psychosocial training develop disciplinary methods which increase student academic stress levels. The research by Rajasuriya et al. (2021) showed that teachers who lacked mental health training would ignore student emotional problems through psychological discipline practices. The practice of corporal punishment persists in schools because it erodes students' trust in educational institutions (Lucas, 2025).

Research shows that schools that build strong bonds between teachers and students and offer extracurricular activities and peer-mentorship programs experience lower rates of behavioural issues and emotional problems (Vithana et al., 2023). The majority of these interventions are in urban and private educational institutions, leaving suburban schools without access.

Socioeconomic Disparities and Material Hardship

The three main factors which lead to poor child mental health in suburban areas include poverty and income inequality, and insufficient housing security. The rapid urban expansion of Colombo's districts has led to the development of numerous unauthorised residential areas

and affordable housing projects that lack vital services and secure play areas (Dayaratne, 2010; Van Dort, n.d.).

Children who experience food insecurity in crowded homes with unemployed parents develop chronic stress, which leads to behavioural problems, sleep problems, and increased irritability (Deivanayagam et al., 2024). According to Vithana et al. (2023), the Western Province cohort study found that children from low-income families had lower health-related quality of life. Various educational obstacles are encountered by Students from low-income backgrounds as they attend underfunded schools, experience social discrimination at school, and miss school time to work or take care of their families (Vithana et al., 2023). The two main barriers to child development stem from insufficient resources, which negatively affect academic achievement and self-esteem.

The expensive nature of mental health services creates an obstacle which prevents people from obtaining their required treatment. The high costs of private psychiatric care stem from public mental health facilities being located far away, which makes it difficult for patients to get necessary family support. As mental health care remains unavailable to them, Children experience worsening mental health problems.

Gender Norms and Cultural Expectations

As in many other areas, the social norms of suburban Sri Lankan communities demand that girls remain humble while following rules, while boys must hide their emotions to demonstrate leadership and strength (Knipe et al., 2021; Wijesekaea, 2022). Children express their distress through specific communication methods, which adults use to understand their behavioural responses. Girls tend to hide their problems inside their minds, which results in developing anxiety, depression, and psychosomatic symptoms. Boys tend to show their distress through aggressive behaviour, drug consumption, and rule-breaking at school (Siriwardhana & Wickramage, 2014).

People face additional challenges when managing their mental health issues because public discussions about these problems remain absent. People tend to explain mental health issues through spiritual weaknesses, supernatural forces, or karma, which creates feelings of shame and forces people to hide their problems until treatment becomes necessary. According to Daluwatta (2024), the social discrimination against LGBTQ+ individuals and gender-nonconforming people leads to higher rates of bullying and family rejection.

The practice of social exclusion creates two major problems which prevent people from seeking help for their mental health issues while maintaining a culture of hidden problems and unmet needs.

Exposure to Violence, Abuse, and Neglect

The suburban environment exposes children to multiple types of violence, which occur inside their homes and schools and throughout their communities. Financial difficulties, together with relationship problems, lead to domestic violence, which expresses itself through emotional mistreatment and physical harm (Catani et al., 2008). The practice of corporal punishment continues because parents and teachers use it as their primary disciplinary tool even though it is officially banned (Lucas, 2025).

Children who experience continuous violence develop multiple trauma symptoms, which include post-traumatic stress disorder, dissociation, and constant alertness. Wijewardana (2024) studied street-involved girls in Colombo's suburban areas to show that sexual abuse within homes and institutions results in major trauma symptoms and emotional instability. Schools and law enforcement need to identify and manage these situations appropriately, as the combination of social discrimination, violence acceptance, and insufficient child protection education makes it difficult. Girls develop severe emotional problems because they need to

support their families while facing higher sexual violence threats, which results in ongoing mental health problems (Karunanayake et al., 2020; Ranasinghe & Wickramasinghe, 2016).

The combination of gang violence and alcohol-fuelled fights and drug-related problems in peri-urban areas creates excessive psychological tension for young people.

Community Mental Health Services and Accessibility

The national mental health policy of Sri Lanka has shown progress, but suburban areas continue to face challenges in accessing mental health services. The current healthcare system relies on institutional care but lacks adequate connections between these facilities and basic healthcare services and educational programs (Rohanachandra, 2023).

Community members seek help from religious leaders and ayurvedic practitioners before accessing professional mental health services (Deivanayagam et al., 2024). Support systems provide emotional comfort to children, but they prevent children from receiving evidence-based treatment while continuing to spread false information about mental health conditions.

The study by Manori et al. (2025) found that suburban public schools lacked established procedures for obtaining psychological support services. The shortage of trained school counsellors exists alongside teacher shortages for psychological first aid and mental health promotion training.

The National Institute of Mental Health (NIMH), considered the central institute for mental health in Sri Lanka, is located in Mulleriyawa. However, NIMH's central location makes it difficult for suburban families to access, as they must travel long distances at high cost. The health system encounters various obstacles because community health officers experience excessive workloads while psychiatric units operate with insufficient staff and absent culturally appropriate intervention approaches (Rajasuriya et al.,2021).

Institutionalisation and Alternative Care Arrangements

The state operates multiple children's homes, which house orphaned and abandoned children and at-risk youth in suburban areas near urban areas. The protective environment of institutions fails to prevent children from experiencing emotional abandonment and social discrimination, and strict rules which block their normal psychological growth (Karunanayake et al., 2020).

Children who reside in institutions develop depression and behavioural problems and attachment issues at higher rates than children who live with foster families or relatives. The facilities face a staffing problem because they lack sufficient trained mental health professionals who can provide suitable trauma-focused treatment for children (Samaranayake, 2015).

The majority of alternative care arrangements exist outside official regulatory systems because people question foster care methods, and the systems fail to provide adequate monitoring (John & Mendis, 2017). Institutionalised children or those who receive informal care experience social exclusion, which leads to identity problems and prolonged mental health issues.

Displacement, Natural Disasters, and Migration

Children in Sri Lanka continue to develop psychologically because of previous civil war conflicts and natural disasters, which include the 2004 tsunami and flooding in resettlement areas and peri-urban relocation sites. The combined effects of conflict-related displacement and recurring natural disasters leave many families facing unstable housing, disrupted schooling, and persistent financial insecurity (Siriwardhana & Wickramage, 2014).

Children who reside in these homes experience two forms of trauma because they carry inherited ancestral pain and directly witness violent events and experience loss. Children who experience these events develop sleep disorders and have recurring nightmares while their schoolwork declines and they withdraw emotionally (Deivanayagam et al., 2024). The short-term nature of most mental health interventions in these areas, combined with insufficient local system integration and external funding restrictions, results in poor sustainability.

Domestic workers who spend time abroad are away from their children, which creates particular risks for these women. The research by Senaratne et al. (2011) shows that children of migrant mothers experience behavioural and emotional problems because their caregivers are absent, their homes are unstable, and they face social discrimination because of their mother's migration.

The combination of disaster-prone areas with high migration rates in suburban regions results in insufficient funding and short-term NGO programs that dominate the area. The programs lack an understanding of local cultural requirements, leading to lower program success and fewer participants.

Discussion

The research data reveal that Sri Lankan suburban children face multiple interconnected psychosocial factors which affect their mental health. The studied determinants, which include family dynamics, school stress, poverty, gender norms, cultural stigma, violence exposure, institutionalisation, and service access gaps, function as interconnected elements that create multiple barriers to child development.

Children residing in Sri Lankan suburban areas face a distinct psychosocial environment because community support is unpredictable. However, they do not have enough money to access the required services. The social environment of these communities remains at risk because they lack strong social connections, their social systems are fragmented, and their policies are inconsistently delivered (WHO, 2014; Siriwardhana & Wickramage, 2014).

Multi-Level Interactions and Cumulative Risk

Research studies demonstrate that poverty, together with authoritarian parenting and academic pressure, creates a chain of adverse effects which result in enduring damage. Children receive harsher discipline and diminished emotional support from their parents when their parents experience stress and live in poverty. Children who live in these settings must deal with two types of difficulties because they experience both family relationship trauma and schoolwork pressure while facing obstacles to receive professional counselling and peer support (Vithana et al., 2023; Daluwatta, 2024).

Ecological Systems Theory, developed by Bronfenbrenner, enables researchers to analyse how the different elements of the system interact. The microsystem of family, school, and peer groups in many suburban areas is under strain, while the exosystem and macrosystem fail to provide sufficient protective measures. Children who experience fast cultural and family changes develop internalising behaviours such as anxiety and depression, and externalising behaviours including aggression and risk-taking because their protective structures fail at multiple levels.

Hidden Epidemics and Data Gaps

The research shows that psychosocial stressors function secretly because of social discrimination, inadequate monitoring systems, and established cultural practices. The public fails to identify maternal depression and children's behavioural issues and child abuse because these problems get mistaken for spiritual issues or regular disciplinary practices (Deivanayagam et al., 2024; Ranasinghe & Wickramasinghe, 2016). The national policy discussions fail to address the

experiences of children who live in institutions and children who stay behind when their parents work abroad and LGBTQ+ youth (Daluwatta, 2024; Wijewardana, 2024).

The research fails to provide vital information about the psychosocial development of suburban Sri Lankan children over time because no longitudinal studies exist, and most research relies on teacher or parent reports rather than direct child participation. The research lacks data about children who live in alternative care facilities and displaced communities, and those who belong to marginalised identity groups.

The Sri Lankan context lacks standardised assessment tools which were developed to measure child mental health. The existing assessment tools do not enable practitioners and researchers to distinguish between typical child development and psychiatric disorders, which prevents them from providing appropriate interventions at the correct time. The development of trained personnel among educators, healthcare staff, and community-based organisations represents an essential requirement.

Structural Blind Spots in Mental Health Policy

The research findings demonstrate that national mental health policies lack sufficient local-level implementation plans. The National Mental Health Policy of Sri Lanka established community-based care models, but these initiatives have not been successful in suburban areas. The current number of trained school counsellors remains insufficient, while teachers receive inadequate education to detect or manage student mental health problems. The shortage of mental health professionals in communities, together with psychiatric service concentration in central areas, makes it difficult for low-income families to obtain mental health services (Manori et al., 2025).

Children in post-disaster areas and institutionalised settings face two main problems which affect their current situation. Children who live in care facilities or experience disasters receive short-term psychosocial help, but they usually do not get ongoing support, complete reintegration services, and extended medical services. The financial stability of NGO services remains precarious because they rely on donations and short-term programs that do not connect with state systems and neglect local cultural needs (Karunanayake et al., 2020; Siriwardhana & Wickramage, 2014).

The research findings indicate that suburban children need psychosocial support, which current planning efforts at the national and local levels do not address. Research must identify and address existing knowledge gaps to demonstrate that mental health equality can become a reality.

Towards Multi-Sectoral, Culturally Grounded Interventions

The solution to this complex problem requires targeted intervention approaches and partnerships across sectors to address multiple psychosocial threats. The solution to this problem needs multiple sectors to unite through partnerships between schools, community health officers, religious leaders, child protection services, and NGOs.

The development of interventions requires cultural awareness and local adaptation, as people seek help through their religious faith, traditional childcare practices, and personal experiences with discrimination (Wijesekaea, 2022; Deivanayagam et al., 2024). The organisation needs to start working on these areas right away. Schools need to create mental health education programs that align with their students' developmental needs.

The training program needs to teach frontline workers, including teachers, primary healthcare staff, and community volunteers, to identify mental health signs and deliver basic counselling and psychological first aid techniques. The creation of accessible community referral systems needs official mental health services to establish respectful partnerships with traditional support networks.

Research programs need to include children because this method enables policymakers to develop solutions that fulfil children's needs at different stages of development.

The implementation of trauma-informed care approaches should focus on areas with conflict and disaster zones and institutional settings to prevent re-traumatisation while helping children build resilience.

Conclusion

The review aims to determine vital psychosocial elements which impact child mental health in Sri Lankan suburban areas and to choose evidence-based interventions for these factors. The research shows that child mental health suffers from adverse effects when children experience authoritarian parenting, poverty, school pressure, social demands, violence exposure, institutional care, and insufficient mental health services. The Sri Lankan suburban areas experience high child mental health risks because their social system continues to change without proper research or support infrastructure.

The current treatment models, which focus on individual patients, need to be replaced with preventive methods that create systemic change through community-based initiatives. The interventions need to recognise how trauma impacts people while using evidence-based methods that preserve cultural practices through family and child real-life experiences. Schools have not achieved their full potential to enhance mental health because they can identify student mental health problems at an early stage and provide vital support services.

Sri Lanka must establish mental health as a social justice priority to achieve equal mental health results for children. The country needs ongoing research funding, together with policy changes and multiple institutional partnerships, to enable meaningful and developmentally appropriate child participation within community-based mental health initiatives. Sri Lanka should develop a future in which every child-centred approach helps all children achieve mental and emotional well-being by addressing psychosocial challenges.

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Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to the content, authorship, or publication of this manuscript.

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This manuscript is the authors' original work. No part of the content has been generated or written by artificial intelligence tools.

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Original Article

Striking Versus Grappling Combat Sports: Differences in Aggression and Psychological Self - Regulation

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Abstract

Background: Striking and grappling combat sports differ substantially in their permitted techniques, but whether these modality differences correspond to aggression or psychological self-regulation remains uncertain. Methods: This descriptive cross-sectional study analysed 314 national-level Sri Lankan combat-sport athletes recruited between August and December 2024: 274 strikers and 40 grapplers. Six mixed martial arts athletes were excluded from the primary comparison. Aggression, emotion dysregulation, and self-control were assessed with the Buss-Perry Aggression Questionnaire (BPAQ), Difficulties in Emotion Regulation Scale-Short Form (DERS-SF), and Brief Self-Control Scale (BSCS). Welch's t-tests, Hedges' g, 95% confidence intervals (CIs), and HC3-robust regression models were used. Results: No statistically significant modality differences were detected for BPAQ total aggression (79.13 ± 16.74 vs. 78.54 ± 16.51; mean difference = 0.59, 95% CI [-5.26, 6.44], p = .839, g = 0.04), the 15-item DERS score (40.20 ± 10.06 vs. 39.74 ± 10.53; mean difference = 0.46, 95% CI [-3.15, 4.06], p = .800, g = 0.05), or BSCS self-control (44.74 ± 9.43 vs. 44.58 ± 7.98; mean difference = 0.16, 95% CI [-2.69, 3.01], p = .909, g = 0.02). Adjusted models produced the same overall pattern. Conclusion: Among the national-level Sri Lankan athletes represented by this convenience sample, statistically significant striking-versus-grappling differences were not detected and observed point estimates were small. The confidence intervals, however, do not establish equivalence and remain compatible with small differences in either direction.

Keywords: aggression; combat sports; emotion regulation; self-control; Sri Lanka

Introduction

Combat sports involve regulated physical confrontation, with rules governing permissible techniques, target areas, and competitive objectives. A strike, throw, or takedown performed within competition is therefore not equivalent to dispositional hostility outside sport. Systematic reviews of martial arts and combat-sport participation have reported heterogeneous findings for aggression, anger, emotional functioning, and self-related outcomes, with no consistent evidence that participation produces a uniform increase in aggression (Ciaccioni et al., 2024; Lafuente et al., 2021).

Technical modality nevertheless provides a plausible basis for psychological comparison. Grappling disciplines emphasise gripping, takedowns, throws, positional control, and pins, whereas striking disciplines emphasise punches, kicks, and other forms of offensive contact. Mixed martial arts (MMA) combines both repertoires and is analytically distinct from either category (Barley & Harms, 2021). Recent studies further suggest that aggression-related and emotion-regulation patterns may vary by discipline, competitive exposure, and athlete characteristics rather than by a single general 'combat-sport' profile (Kuśnierz et al., 2025, 2026; Patenteu et al., 2024; Predoiu et al., 2024).

Sri Lankan evidence remains limited. A previous national-level study within the same research programme found no significant difference in overall aggression between combat-sport and non-combat-sport athletes and identified the absence of sport-specific combat data as a limitation (Deva Adithiya et al., 2022). The present study used a newly recruited 2024 cohort to address that gap through a direct comparison of striking and grappling athletes.

Aggression was assessed with the BPAQ, which distinguishes physical aggression, verbal aggression, anger, and hostility (Buss & Perry, 1992). Psychological self-regulation was examined through the BSCS, reflecting dispositional self-control (Tangney et al., 2004), and the DERS-SF, which assesses difficulties in emotion regulation (Kaufman et al., 2016). For the DERS-SF, the primary score followed recent Sri Lankan psychometric evidence supporting a five-factor structure excluding Awareness (Weerasinghe et al., 2025). The primary objective was to compare striking and grappling athletes on total aggression, emotion dysregulation, and self-control. Secondary subscale analyses were exploratory. Adjusted analyses examined whether modality associations persisted after accounting for age, sex, training years, and recent competition exposure.

Methods

Study design, sampling and participants

This descriptive cross-sectional study was conducted from August to December 2024 as an extension of the earlier Sri Lankan research programme (Deva Adithiya et al., 2022). No data from the 2020 parent-study sample were reused. National-level combat-sport athletes were recruited by convenience sampling. Eligibility criteria were age 18 years or older and at least one national-level medal during the preceding three years. Training experience was recorded as a study variable but was not an eligibility criterion in 2024. Athletes reporting a diagnosed mental disorder were excluded to maintain a non-clinical athletic sample and to reduce potential confounding of aggression, emotion-regulation, and self-control scores by psychiatric conditions or treatment. This exclusion limits generalisability to athletes with diagnosed mental disorders.

The original recruitment target for the broader 2024 study was estimated using Cochran's formula with a 50% assumed prevalence, consistent with the parent-study sampling approach. This prevalence-based calculation was not a statistical power calculation for the present two-group comparison of continuous outcomes. The striking and grappling group sizes arose from the distribution of recruited

disciplines; accordingly, the present analysis was not designed as an equivalence or non-inferiority study and no minimum between-group effect was prespecified.

A total of 320 eligible athletes were recruited. Boxing, karate, kickboxing, Muay Thai, taekwondo, and Wushu/Sanda were classified as striking disciplines; judo and wrestling were classified as grappling disciplines. Six MMA athletes were retained for discipline-level descriptive reporting but excluded from the primary striking-versus-grappling analyses because MMA combines both technical modalities. The primary analytic sample therefore comprised 314 athletes: 274 strikers and 40 grapplers.

Data collection, language adaptation and ethics

Participants were recruited face-to-face and completed a self-administered online questionnaire accessed through a QR code. All administrations were online. Electronic informed consent was obtained before participants could proceed to the questionnaire. The original English versions of the BPAQ, DERS-SF, and BSCS were used and pilot tested. Sinhala and Tamil versions were translated specifically for this study using forward translation, back-translation, expert review, pilot testing, and face/content validation. Formal measurement invariance across the three language versions was not tested. Ethical approval was granted by the KIU Ethics Review Committee (KIU/ERC/24/181).

Measures and score construction

Aggression was measured with the 29-item BPAQ (Buss & Perry, 1992). The Physical Aggression, Verbal Aggression, Anger, and Hostility subscales were prorated only when at least 8/9, 4/5, 6/7, and 7/8 items, respectively, were present; BPAQ total was calculated only when all four subscales were available. Emotion dysregulation was measured with the 18-item DERS-SF (Kaufman et al., 2016). Each three-item subscale was prorated when at least two items were present; the 18-item total required at least 15 items, and the Sri Lanka-oriented 15-item five-factor score excluding Awareness required at least 12 items (Weerasinghe et al., 2025). Self-control was measured with the 13-item BSCS, with the total prorated when at least 11 items were present (Tangney et al., 2004). Higher BPAQ and DERS scores indicate greater aggression and emotion dysregulation, whereas higher BSCS scores indicate greater self-control. Internal consistency in the striking/grappling sample was $\alpha = .91$ for BPAQ total, $\alpha = .89$ for the 15-item DERS score, $\alpha = .87$ for DERS-SF total, and $\alpha = .88$ for BSCS.

Outcome missingness was modest: 22/314 (7.0%) participants lacked BPAQ total, 7/314 (2.2%) lacked the 15-item DERS score, and 16/314 (5.1%) lacked BSCS total; subscale missingness ranged from 0.3% to 4.1%. Available-case analysis was used for each outcome.

Statistical analysis

Continuous variables were summarised using means and standard deviations, and categorical variables using frequencies and percentages. Welch's independent-samples t-tests compared striking and grappling groups because of unequal sample sizes; mean differences, 95% CIs, and Hedges' g were reported. Pearson chi-square tests examined categorical variables. Expected-count assumptions were met for sex and injury status; for competition level, 2 of 14 expected counts (14.3%) were below 5 and none was below 1.

Three separate ordinary least-squares models examined BPAQ total, the 15-item DERS score, and BSCS total using HC3 heteroskedasticity-robust standard errors. Striking was coded 1 and grappling 0; male was coded 1 and female 0. Age, training years, and competitions in the previous 12 months were entered as continuous covariates. The three primary outcomes were prespecified for interpretation. BPAQ subscales, the DERS-SF total and subscales, and discipline-level descriptives were exploratory; no multiplicity adjustment was applied to these secondary

analyses. All tests were two-tailed with α = .05, and interpretation emphasised effect estimates and CIs rather than statistical significance alone.

Results

Of the 320 recruited athletes, 314 entered the primary modality analysis (274 strikers [87.3%] and 40 grapplers [12.7%]); the six MMA athletes were excluded from that comparison. Discipline frequencies and descriptive primary-outcome scores are shown in Table 1. The striking group was 72.6% male (199/274) and the grappling group 65.0% male (26/40), $\chi^2(1) = 0.66$, $p = .417$. No statistically significant group differences were detected for age, training years, weekly training frequency, session duration, competitions in the previous 12 months, injury status, or competition level (Table 2).

Table 1
Participant Distribution and Descriptive Primary Outcomes by Combat Sport

Combat sport	Modality	n	BPAQ total, M ± SD (n)	DERS-15, M ± SD (n)	BSCS total, M ± SD (n)
Boxing	Striking	55	80.88 ± 18.69 (49)	39.00 ± 9.26 (55)	43.76 ± 9.24 (55)
Karate	Striking	73	78.61 ± 17.31 (70)	41.24 ± 10.35 (72)	43.87 ± 9.10 (71)
Kickboxing	Striking	39	78.68 ± 16.29 (37)	38.26 ± 9.45 (38)	47.86 ± 8.43 (36)
Muay Thai	Striking	36	81.88 ± 17.98 (33)	40.77 ± 10.78 (35)	46.13 ± 9.38 (31)
Taekwondo	Striking	54	77.10 ± 14.07 (52)	41.50 ± 10.42 (52)	42.98 ± 10.34 (53)
Wushu/Sanda	Striking	17	77.93 ± 15.39 (14)	38.81 ± 10.23 (16)	48.57 ± 8.88 (14)
Judo	Grappling	21	83.74 ± 15.18 (19)	41.00 ± 10.81 (20)	42.58 ± 6.77 (19)
Wrestling	Grappling	19	73.06 ± 16.46 (18)	38.42 ± 10.35 (19)	46.58 ± 8.76 (19)
MMA	Mixed	6	84.67 ± 18.32 (6)	41.33 ± 8.76 (6)	47.67 ± 10.56 (6)

Note. Values in parentheses after M ± SD are the available n for that outcome. MMA = mixed martial arts; BPAQ = Buss-Perry Aggression Questionnaire; DERS-15 = 15-item five-factor Difficulties in Emotion Regulation Scale score excluding Awareness; BSCS = Brief Self-Control Scale. MMA athletes were excluded from the striking-versus-grappling inferential analyses.

Table 2
Participant Characteristics by Combat-Sport Modality

Characteristic	Striking (n = 274)	Grappling (n = 40)	p
Age, years	24.77 ± 4.36	24.68 ± 3.85	.887
Male, n (%)	199 (72.6)	26 (65.0)	.417
Training years	8.95 ± 5.40	8.48 ± 5.62	.621
Sessions/week	3.73 ± 1.41	3.65 ± 1.63	.775
Session duration, min	102.88 ± 26.16	103.08 ± 25.59	.964
Competitions, previous 12 months	5.57 ± 2.83	5.49 ± 3.32	.877
Injury in previous 12 months, n (%)	73 (26.6)	12 (30.0)	.695

Note. Values are M ± SD unless otherwise indicated. Continuous variables were compared with Welch's t-tests; sex and injury status were compared with Pearson chi-square tests.

For BPAQ total, strikers scored 79.13 ± 16.74 (n = 255) and grapplers 78.54 ± 16.51 (n = 37), yielding a mean difference of 0.59 points, 95% CI [-5.26, 6.44], $p = .839$, $g = 0.04$. For the primary 15-item DERS score, the corresponding means were 40.20 ± 10.06 (n = 268) and 39.74 ± 10.53 (n = 39), mean difference = 0.46, 95% CI [-3.15, 4.06], $p = .800$, $g = 0.05$. BSCS totals were 44.74 ± 9.43 (n = 260) and 44.58 ± 7.98 (n = 38), mean difference = 0.16, 95% CI [-2.69, 3.01], $p = .909$, $g = 0.02$. No exploratory BPAQ or DERS-SF subscale comparison reached $p < .05$; point estimates and CIs are presented in Table 3.

Table 3
Psychological Outcomes in Striking and Grappling Athletes

Outcome	Striking, M ± SD	Grappling, M ± SD	Mean difference (95% CI)	p	Hedges' g
BPAQ total	79.13 ± 16.74	78.54 ± 16.51	0.59 [-5.26, 6.44]	.839	0.04
Physical aggression	22.01 ± 6.83	21.41 ± 6.00	0.60 [-1.51, 2.70]	.572	0.09
Verbal aggression	15.19 ± 4.38	15.15 ± 3.72	0.04 [-1.25, 1.34]	.947	0.01
Anger	20.80 ± 5.43	20.50 ± 5.34	0.30 [-1.52, 2.12]	.744	0.05
Hostility	21.21 ± 6.25	21.47 ± 5.54	-0.26 [-2.22, 1.70]	.789	-0.04
DERS-15	40.20 ± 10.06	39.74 ± 10.53	0.46 [-3.15, 4.06]	.800	0.05
DERS-SF total	47.63 ± 10.79	47.18 ± 10.79	0.45 [-3.27, 4.16]	.810	0.04
DERS Nonacceptance	8.04 ± 2.58	8.23 ± 2.83	-0.19 [-1.15, 0.78]	.699	-0.07
DERS Goals	8.25 ± 2.46	7.62 ± 2.79	0.63 [-0.31, 1.58]	.184	0.25
DERS Impulse	7.93 ± 2.85	7.82 ± 2.73	0.11 [-0.83, 1.06]	.812	0.04
DERS Awareness	7.44 ± 2.57	7.43 ± 2.55	0.01 [-0.85, 0.88]	.973	0.01
DERS Strategies	7.93 ± 2.60	7.54 ± 2.36	0.39 [-0.43, 1.22]	.340	0.15
DERS Clarity	8.16 ± 2.66	8.68 ± 2.87	-0.52 [-1.48, 0.45]	.287	-0.19
BSCS total	44.74 ± 9.43	44.58 ± 7.98	0.16 [-2.69, 3.01]	.909	0.02

Note. Mean difference = striking minus grappling. BPAQ = Buss-Perry Aggression Questionnaire; DERS-SF = Difficulties in Emotion Regulation Scale-Short Form; DERS-15 = five-factor score excluding Awareness; BSCS = Brief Self-Control Scale. Secondary subscale analyses were exploratory and were not adjusted for multiplicity.

In HC3-robust regression models, striking modality was not statistically associated with BPAQ total (B = 0.44, 95% CI [-5.54, 6.41], $p = .886$), DERS-15 (B = 0.47, 95% CI [-3.22, 4.16], $p = .804$), or BSCS total (B = 0.26, 95% CI [-2.65, 3.17], $p = .861$) after adjustment for age, sex, training years, and recent competition exposure. Full model coefficients are reported in Table 4. Across these models, male sex was associated with a lower DERS-15 score and greater recent competition exposure was associated with a higher BSCS score; these covariate findings were not primary hypotheses and should be interpreted cautiously.

Table 4
HC3-Robust Regression Models for Primary Psychological Outcomes

Outcome / predictor	B	SE	95% CI	p	n
BPAQ total					279
Striking modality	0.44	3.05	[-5.54, 6.41]	.886	
Age	-0.03	0.39	[-0.80, 0.74]	.942	
Male sex	-2.24	2.33	[-6.81, 2.33]	.337	
Training years	-0.12	0.31	[-0.73, 0.49]	.704	
Competitions, previous 12 months	0.07	0.36	[-0.64, 0.78]	.843	
DERS-15					294
Striking modality	0.47	1.88	[-3.22, 4.16]	.804	
Age	-0.00	0.22	[-0.44, 0.44]	.999	
Male sex	-3.46	1.39	[-6.18, -0.73]	.013	
Training years	-0.08	0.18	[-0.43, 0.27]	.649	
Competitions, previous 12 months	-0.20	0.22	[-0.63, 0.22]	.347	
BSCS total					286
Striking modality	0.26	1.48	[-2.65, 3.17]	.861	
Age	0.10	0.20	[-0.29, 0.49]	.621	
Male sex	0.91	1.23	[-1.50, 3.32]	.457	
Training years	0.07	0.16	[-0.24, 0.39]	.636	
Competitions, previous 12 months	0.54	0.20	[0.15, 0.92]	.006	

Note. Striking = 1, grappling = 0; male = 1, female = 0. Age, training years, and competitions were entered as continuous variables. B = unstandardised regression coefficient; SE = HC3-robust standard error; CI = confidence interval.

Discussion

No statistically significant striking-versus-grappling differences were detected for the three primary outcomes, and the observed standardised effects were small (g = 0.02-0.05). The same general pattern was seen across exploratory aggression and emotion-regulation subscales and after covariate adjustment. These findings do not demonstrate equivalence. Rather, they indicate that the present sample provided little evidence of a large modality-related difference while remaining compatible with small effects in either direction, as reflected by the confidence intervals.

The aggression results are consistent with the broader literature cautioning against equating combat-sport participation with dispositional aggression (Lafuente et al., 2021) and with the earlier Sri Lankan parent study, which did not detect higher overall aggression among national-level combat-sport athletes than non-combat athletes (Deva Adithiya et al., 2022). The present comparison extends that work within combat sport. In particular, the Physical Aggression point estimate was only 0.60 points higher in strikers (g = 0.09), despite striking disciplines making direct impact a central competitive mechanism. This supports a distinction between rule-governed sporting behaviour and trait aggression, while not excluding smaller population differences.

The self-regulation findings were similarly modest. DERS-15 and BSCS group differences were less than half a scale point, and the largest exploratory DERS subscale effect concerned difficulty maintaining goal-directed behaviour under distress (g = 0.25), with a CI that included zero. Recent discipline-specific research also suggests that relations between emotion regulation and aggression may be nuanced rather than uniform across combat sports; Kuśnierz et al. (2026), for example, found discipline moderation for hostility in one emotion-regulation model but not for total aggression, physical aggression, or anger. Together with broader adult evidence (Ciaccioni et al., 2024), this supports examining discipline, training context, and athlete characteristics rather than assuming a single modality effect.

Several limitations constrain interpretation. The groups were markedly imbalanced (274 strikers vs. 40 grapplers), and the original Cochran calculation was not designed to power this specific continuous-outcome comparison or an equivalence test. Consequently, precision was lower for the grappling group. Broad modality categories also combined disciplines with different rules and training cultures, although discipline-level descriptives are now reported for transparency. The cross-sectional design cannot separate self-selection from training effects,

and self-report measures remain vulnerable to response biases. The translated Sinhala and Tamil instruments underwent forward/back-translation, expert review, pilot testing, and face/content validation, but measurement invariance across language versions was not established. Excluding athletes with diagnosed mental disorders supported the intended non-clinical sampling frame but further limits generalisability.

The findings therefore apply specifically to the national-level Sri Lankan athletes represented by this convenience sample. Coaches, clinicians, and sporting organisations should avoid using broad combat modality alone as a proxy for aggression or self-regulatory functioning. Future longitudinal research should recruit larger and more balanced discipline-specific samples, evaluate measurement equivalence across language versions, and incorporate training climate, contact intensity, sparring exposure, and behavioural indicators.

Conclusion

Among national-level Sri Lankan combat-sport athletes in this convenience sample, no statistically significant differences were detected between striking and grappling groups in total aggression, emotion dysregulation, or self-control, and observed point estimates were small. These results should not be interpreted as evidence of equivalence because the confidence intervals remained compatible with small differences and the grappling sample was comparatively limited. The findings support cautious, individual-level psychological assessment rather than assumptions based on combat-sport modality alone.

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Conflicts of Interest

The authors declare no conflicts of interest.

Ethical Statement

Ethical approval was granted by the KIU Ethics Review Committee (KIU/ERC/24/181). Electronic informed consent was obtained from all participants before they accessed the questionnaire through the QR-linked online form.

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