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Review article

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Narrative Review on Parasitology Education Transformation in Egyptian Medical Schools: Insights and Future Shaping

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Abstract

Introduction:

Parasitology remains a cornerstone of basic medical science education in Egyptian medical schools, yet its pedagogical delivery is often traditional and undervalued.

Objective

To review parasitology education in Egyptian medical schools, identify methodological short comes, and propose innovations to enhance future teaching within integrated curricula.

Methods

A narrative review was conducted using PubMed, Google Scholar, and the Egyptian Knowledge Bank, covering literature published between 2005 and 2025. The review encompassed descriptive studies, institutional initiatives, and pedagogical advances. Examples of teaching innovations from Egyptian institutions were explored.

Results

Lecture-based instruction remains predominant, with limited clinical integration and minimal use of educational technology. Notable Egyptian initiatives include problem-solving sessions at Ain Shams University, commentary stations at Armed Forces College of Medicine (AFCM), team-based learning, and blended approaches at Mansoura University. Emerging global strategies such as virtual reality, virtual microscopy, and problem-based and case-based learning offer adaptable models for reform.

The current review highlights future directions for enhancing parasitology education through active learning approaches. Recommended innovations include implementation of interactive case scenarios with virtual patients, pre- and post-session self-assessments to stimulate critical thinking, competitive student-led assignments, integrated lectures, and the incorporation of video-based e-learning.

Conclusion

Parasitology education in Egypt remains anchored in traditional pedagogical methods. Its future integration within medical curricula depends on incorporating its clinical relevance with innovative, interdisciplinary programs. Embracing student-centered, technology-enhanced, and clinically integrated teaching approaches can substantially improve learning outcomes and better align training with national public health needs.

Keywords

Active learning, Parasitology medical education, technological innovation.

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Introduction:

Importance of basic medical sciences in medical schools

Reflecting on the legacy of Abraham Flexner, the founder of modern medical education in 1910, basic medical sciences were embedded as foundational pillars within medical school curricula [1]. The integration of medical education with community health remains a central concern for medical educators, health authorities, and other stakeholders. In 1995, the World Health Organization (WHO) introduced the concept of social accountability for medical schools, emphasizing the importance of aligning education, research, and service activities with the health priorities of the communities they serve. Despite this, further efforts are required to examine and address the challenges that hinder the effective implementation of social accountability in medical education [2].

Education methodologies in medical schools must be designed to ensure that graduates are capable to identify and respond to community health needs. Historically, the didactic approach to teaching foundational medical sciences has dominated, yet it has not been sufficiently translated into clinical practice or community health advocacy. To bridge this gap, students must be encouraged to think critically and engage with the social determinants of health through active learning strategies [3]. Despite its critical role in the professional development of aspiring physicians, teaching basic medical sciences is frequently disregarded [4]. This trend is typically evident in the teaching of parasitology, one of the core disciplines within medical education.

Does basic medical sciences education require reform?

A survey conducted among Egyptian medical students at the Faculty of Medicine for Girls, Al-Azhar University, revealed that detailed foundational concepts taught during the pre-clinical years are perceived as irrelevant to clinical practice and are gradually forgotten. Additionally, redundancy across basic science lectures contributes to cognitive overload. Physicians are generally able to manage most patients efficiently without in-depth knowledge of the biological details covered in basic medical sciences courses. Medical students in their clinical years need only a working knowledge of these subjects. This applies to all basic medical science disciplines [5]. Similar perspectives have been reported in studies from other Arab countries [6,7].

The 21st century medical educational transformation with the objective of preparing future-ready physicians must be dynamic and move beyond static knowledge transmission and simple recall aimed at passing exams and achieving high marks. Therefore, the active dynamic model requires involving “heart-head-hands” components to integrate ethics, knowledge, and skills in a lifelong pattern of learning, together with competence, clinical reasoning, and novelty [8]. This necessitates the early integration of basic and clinical sciences through co-curricular programs to achieve these potentials [9].

Besides, refining the intended learning outcomes by eliminating redundant, overly detailed, and irrelevant information that represents an unnecessary burden on the students remains an essential requirement [10].

Is parasitology still essential in medical education?

The inclusion of parasitology in medical curricula remains a subject of debate. Nevertheless, the study of the burden of parasitic diseases remains vital in modern medical practice, even in industrialized nations as the increasing global travel, migration, and climate change are facilitating the spread of parasitic diseases beyond their traditional endemic regions [11, 12]. This is particularly true given the ease of global travel which allows people to move between northern and southern areas within hours. This underscores the importance of studying parasitology in travel medicine and international health [13].

For instance, recent research confirmed that parasites affecting the human liver still represent a significant global health burden [14]. A 2025 study conducted in Kenya highlighted that limited awareness of visceral leishmaniasis (VL) among patients significantly contributed to diagnostic delays. This emphasizes the need to consolidate health education and improve awareness campaigns in VL-endemic areas, aiming to encourage positive behavior change for better disease control and eventual elimination [15].

The world witnessed 229 million malaria cases, which resulted in 409,000 deaths in 2019 alone. Although malaria cases are reported from 87 countries globally, Africa bears the brunt of these infections and deaths with approximately 94% of total malaria cases and deaths occurring in this continent, particularly in sub-Saharan regions [16].

Latest studies also demonstrate the substantial global burden of schistosomiasis which poses significant health challenges [17, 18, 19]. This is particularly true across African countries including Egypt’s rural areas. Besides, gastrointestinal parasitic (GIP) infections remain underrecognized in rural communities in Egypt as well as in other Arab countries [20, 21, 22]. Currently, regular screening and treatment of GIP infections in children are strongly recommended, alongside public education initiatives focusing on personal hygiene and prevention. These measures might also extend to family members of infected individuals [23].

Methods

A comprehensive review of literature was conducted to address the following research questions:

1. What is the significance of basic medical sciences in medical education?
2. Is it essential to include parasitology in medical curricula?
3. Does parasitology education require reform?
4. What are the limitations and innovative prospects in parasitology education?

Accordingly, publications on Google Scholar, PubMed and Egyptian Knowledge Bank published between 2005 and 2025 were explored. The keywords used were “clinically relevant education”, “interdisciplinary approach”, “teaching methods” and “prevalence of parasitic infections”. Inclusion criteria comprised peer-reviewed articles and research studies related to parasitology and medical education. Exclusion criteria included non-database online articles and closed-access articles with unclear abstract.

Results and discussion

1. Significance of Basic Sciences in Medical Education

A solid foundation in basic medical sciences remains crucial for developing clinical reasoning and advancing both clinical practice and medical research [24]. However, the literature has criticized the current practices that risk reverting the medical educational process to the pre-Flexnerian zone (Figure 1). These include the trend of disrespect and absenteeism from both theoretical and clinical/practical classes, the gradual decline in the importance of basic science subjects for students, the decline in the number and quality of investigator-initiated research among clinical researchers, and a lesser emphasis on bedside training through detailed clinical examination and appropriate observation of signs to reach a diagnosis rather than over reliance on laboratory tests and radiological modalities for the diagnosis. Simply, students' mindset is to fulfill their attendance requirements to avoid being disqualified from taking exams. This de-Flexnerization tendency and a return to pre-Flexnerian norms, beliefs, structures, processes, and attitudes are certain to produce pre-Flexnerian results.

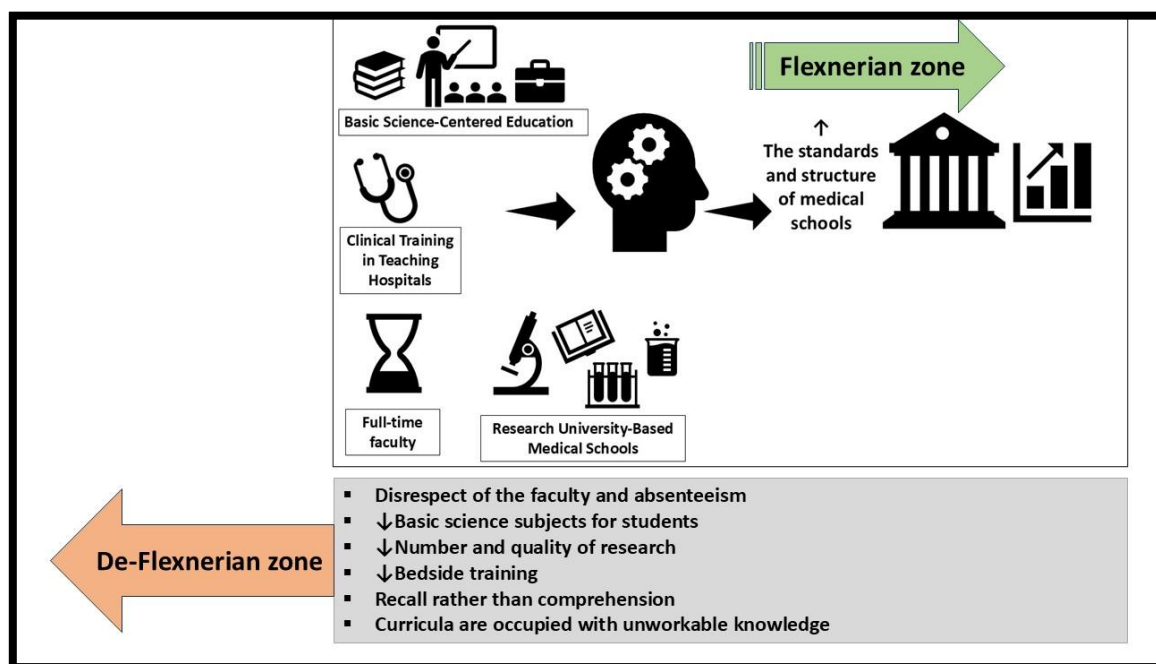


Fig. 1 Factors of Flexnerian zone versus de-Flexnerization

2. Is it essential to include parasitology in Egyptian medical curricula?

The reviewed literature highlights the high prevalence of parasitic diseases among the Egyptian population with wide spectrum of presentation (Supplementary tables 1, 2 and 3). Accordingly, parasitology education remains essential for equipping medical students with the knowledge and competence to consider parasitic diseases in the right differential diagnosis of real-world clinical cases.

3. Does parasitology education in Egypt require reform?

By analysing the parasitology content as one of the basic medical sciences in Egyptian medical school curricula, it has

been found that the parasitology syllabus predominantly focuses on detailed biological aspects of parasites, such as taxonomy, microscopic morphology, and life cycle, rather than its clinical relevance. Furthermore, teacher-centered approach still dominates, with minimal student engagement and limited clinical exposure to parasitic diseases (Figure 2). A study examining medical students' perception of the taught curriculum identified parasitology as one of the least preferred basic medical sciences [5]. Many medical students complete the parasitology course without a clear understanding of the parasitic conditions they are likely to encounter in clinical practice [25].

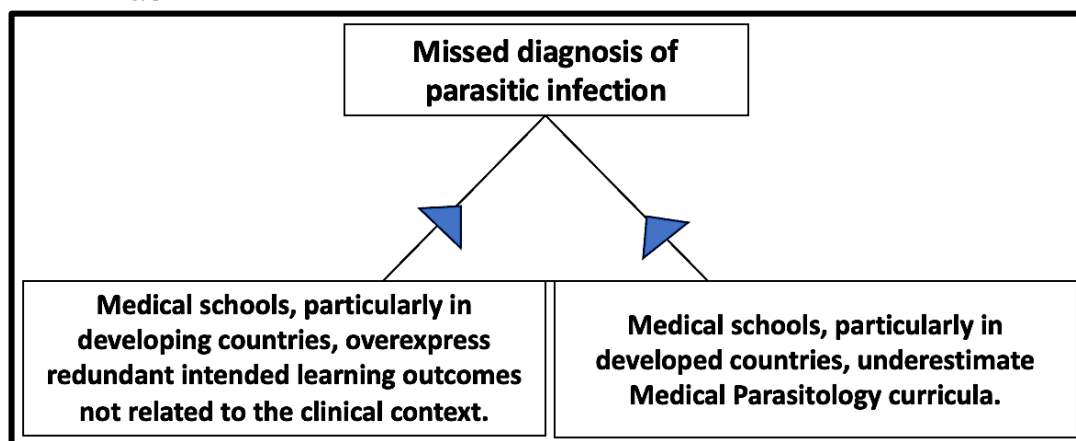


Fig. 2: The current situation of the Parasitology teaching in Egyptian medical schools, as compared to developed countries medical schools.

4. What are the limitations and innovative prospects in parasitology education?

4.a Limitations of traditional approaches,

- **Passive Formats:** Lecture-heavy approaches limit critical thinking and long-term information retention.
- **Resource Constraints:** Laboratories often lack adequate microscopes and/or well-preserved specimens, hindering practical engagement.
- **Crowded Curriculum:** Limited contact hours compress content delivery and reduce the opportunity for meaningful student interaction.
- **Assessment Gaps:** Assessment strategies often focus on factual recall and slide identification, and fail to assess applied competencies.

4.b Innovative Practices in the Egyptian Context

Recent publications have highlighted several promising educational strategies:

- **Problem-Solving Sessions (Ain Shams University):** Enhanced knowledge retention and student satisfaction [26].
- **Commentary Stations AFCM:** Facilitated deeper conceptual understanding [10].
- **Team-Based Learning:** Improved student preparedness and application of knowledge in clinical scenarios [27].
- **Blended Learning and Problem-Based Learning (Mansoura University):** Integration of e-learning and small-group teaching formats [28].

- **Blended learning with self-paced formative assessments and discussion blogs (Helwan University):** increased motivation and improved student engagement and performance [29]

4.c Global Pedagogical Innovations

- **Virtual Reality Simulation:** Boosted student motivation and improved learning outcomes in parasitology [30].
- **Virtual Microscopy:** Enabled flexible access to high-quality digital slides, overcoming physical resources limitations [31, 32].
- **Problem-Based Learning (PBL):** Promotes critical thinking, clinical reasoning and long-term knowledge retention [26, 33].
- **Community-Based Exposure:** Enhances relevance through experiential field-based learning [34].

Despite these advancements, parasitology education in Egyptian medical schools continues to lag modern pedagogical developments. However, effective successful local initiatives and international models offer feasible pathways for transformation. Strategic implementation of blended learning, faculty development, curricular realignment, clinical integration, and assessment reform can improve educational outcomes.

Proposed Strategies:

- **Curricular integration**

Parasitology should be embedded within clinical and community medicine modules to enhance relevance and application. Simultaneously, curricular reform must preserve foundational knowledge, including the infective stage, mode of transmission, parasitic pathway within the host, its pathogenesis, diagnosis, and treatment regimen to ensure that clinical competencies are not compromised [35].

- **Pilot Blended Modules**

The parasitology curriculum must foster integration with other related disciplines such as infectious diseases, microbiology, and pathology within a system-based, clinically positioned curricula. Emphasis should be placed on clinical competencies, including diagnosis and management of parasitic diseases, global health, and the importance of travel medicine. The curriculum should also address re-emerging parasitic diseases driven by migration and climate change. Interdisciplinary teaching integrating parasitology within broader courses such as infectious diseases in adults and children reinforces its clinical relevance [36].

- **Formulation of clinically oriented learning outcomes**

The learning outcomes and expected competencies should cover the mode of transmission of parasitic infections, associated pathogenesis, clinical picture, suitable investigation tools for definitive diagnosis, treatment modalities, and broad lines of preventive strategies [37].

- **Implementation of faculty development programs**

Teaching faculty must be encouraged to move away from standalone teaching and focus on teaching core concepts using modern pedagogical tools for delivery. This can include interactive case-enhanced lectures with unpublished data and clinically correlated commentary stations during practical sessions [10]. Such methods consolidate knowledge gained in didactic lectures and foster development of critical thinking and problem-solving skills (Figure 3). The duration and credit allocation of the parasitology course should also be considered. The integration of virtual labs, digital microscopy, and artificial intelligence (AI) -powered diagnostics offers revolutionizing potential for parasitology education, making learning more interactive and accessible [38,39]. Faculty experts should be leveraged to ensure parasitology remains accessible, engaging and clinically relevant, even with limited contact hours.

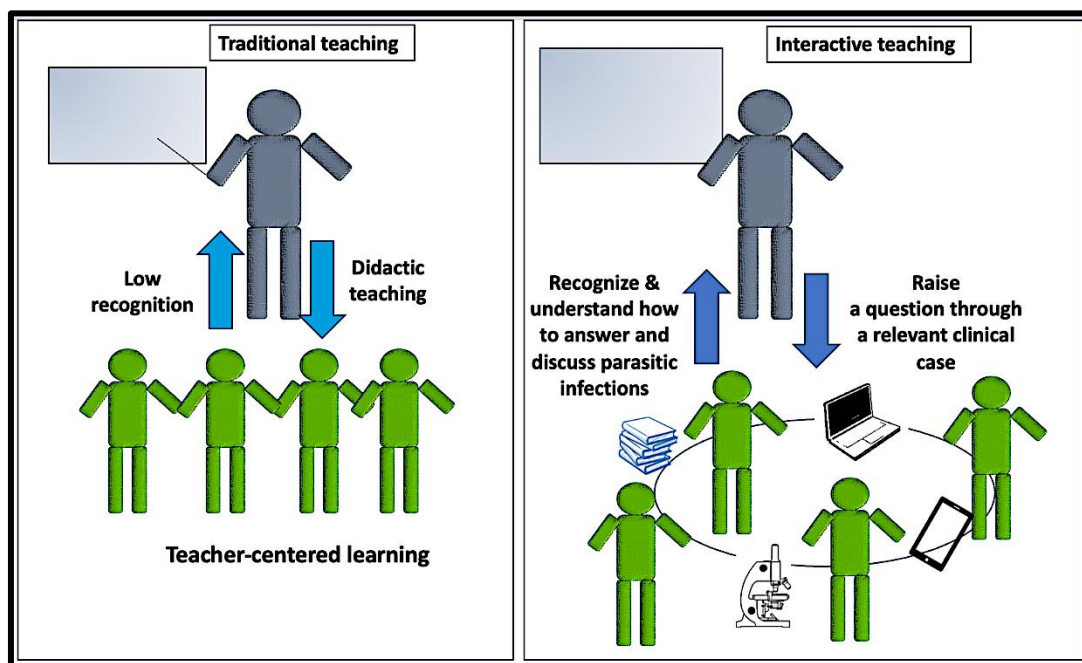


Fig. 3: The current traditional teaching method (teacher-centered learning) versus the targeted interactive learning (student-centered learning)



• Considering global discrepancies and One Health

In low- and middle-income countries, where parasitic diseases such as malaria, schistosomiasis, and leishmaniasis remain highly prevalent, parasitology should occupy a more prominent position within the curriculum compared to high-income developed countries. An integrated, cross-disciplinary approach involving human, animal, and environmental health (known as One Health) is gaining traction and expanding the relevance of parasitology to a broader range of fields such as veterinary medicine, public health, and environmental science [40].

• Assessment Reform

Assessments should be explicitly aligned with learning outcomes [41] and a diverse range of assessment methods should be used to evaluate knowledge, skills, and attitudes. Emphasis should be placed on clinical relevance through case-based evaluations. Specific, measurable, achievable, relevant and timely (SMART) feedback is crucial in formative assessments to support student development and enhance their performance.

Future Shaping for Parasitology Faculty in Medical Schools

• Adopting an active learning approach

While technology serves as a foundational enabler, its true value lies in promoting student engagement [41]. Active engagement in the learning process enhances students' self-confidence and perception of their intelligence, as well as strengthens their trust in educators [42]. In this context, several technology-enhanced learning tools offer promising avenues for transformation and are discussed below.

a. Interactive case scenarios using virtual patients.

The growing demands for clinical training coupled with limited educational resources pose a significant challenge for health professions education. One solution lies in the use of virtual patient case-based learning (VPL) which are interactive, computer-based clinical scenarios that simulate real-world clinical encounters [43]. Through contextualized narrative statements based on authentic professional situations, VPL can bridge the gap between theoretical knowledge and clinical practice by allowing the learners to engage actively with the case, develop clinical reasoning and practical skills, and receive feedback to develop their professionalism.

Widely adopted across Japan, Scandinavia, Europe, and Australia, case-based learning (CBL) has become a cornerstone in adult professional education. Cases typically consist of text-based narratives portraying work-related scenarios that are likely to be encountered in real-life professional context. CBL is frequently used when learning objectives call for making decisions in challenging, authentic scenarios. To spark the reader's interest, well-designed cases include captivating tale elements such as characters, conflicts, dilemmas, and even suspense. Cases based on actual events frequently convey the norms, traditions, dialect, and practices of a specific culture and community of practice [44].

Previous studies demonstrated that VPL significantly improves knowledge retention and clinical reasoning compared to traditional teaching methods [45]. Notably, these outcomes were possible to achieve in a cost-effective and unique model [46]. Virtual patients could also effectively enhance skills and knowledge, particularly regarding clinical reasoning and procedural skills [47]. Their utility was validated across educational settings in both high-income and low-income countries, showing their global relevance [48]. A virtual patient model developed by the chief author of this article, was implemented with third-grade medical students (see Supplementary 1, unpublished material). Virtual simulation offers a viable solution to the many constraints that restrict simulation-based training in various health care systems. To advance the design and application of virtual simulation-based emergency medical trainers, ongoing collaboration between educators, engineers, and clinicians remains essential [43].

b. Pre- and post-self-assessment to boost brainstorming.

Brainstorming is a student-centered learning approach that promotes collaborative idea-sharing among learners. Small groups are encouraged to engage, express their ideas and share their understanding based on their prior knowledge at the beginning of a lecture or a practical session. Another model involves multiple-choice questions supplied with images to explore parasitic diseases. This approach has been shown to increase student motivation and eagerness for subsequent tutorial and/or practical sessions [10]. A recent study demonstrated that using pre- and post-class assessments around lectures dramatically improved learners' cognitive performance compared to controls. The learners exhibited 32% improvement in outcomes mapped to Bloom's Taxonomy [49].

c. Competitive student-based assignments.

The primary purpose of the competition-based student assignment management system is to motivate students and encourage task completion. To create a dynamic, collaborative learning environment that can boost students' enthusiasm to complete their assignments, implementation of time-bound competition approach model, incorporating plagiarism detection and peer evaluation, could be employed [50]. One effective example involves grouping students to competitively represent parasitic diseases, with recognition awarded to top-performing students based on a readily available, structured checklist. This would encourage creativity, accountability and collaborative learning.

d. Integrated lectures.

Integrated lectures combine content from multiple topic areas to achieve interconnected learning outcomes, thereby promoting student learning by linking distinct concepts. This pedagogical approach aims to provide a more holistic and interconnected understanding of the subject matter. It can take several forms, such as merging Biochemistry, Physiology and Pharmacology courses or bringing together diverse fields to tackle a challenging health problem [51]. Based on staff experience, integrated lectures can bridge interdisciplinary



gaps, enhance comprehension, improve student engagement and motivation, and represent a model for real-life application of medical knowledge (supplementary 2 <https://www.youtube.com/watch?v=cv-FftU3Ims>)

e. Incorporation of video-based e-learning.

The use of educational videos can increase the interest of medical students in basic medical sciences when appropriately fitted into the curriculum. This is attributed to their feasibility and ability to stimulate visual and auditory incentives; thus, triggering active learning [52]. Evidence suggests that video-based resources improve academic performance and enhance knowledge retention, particularly when utilized as pre-class preparatory tools [53]. Additionally, most higher education students favor animated and short educational videos [54]. Niekrenz and Spreckelsen (2024) [55] developed a valuable comprehensive checklist to guide the design, creation, and reporting of medical educational videos. Yet, the effectiveness of video-based learning is contingent upon student-motivation and readiness for self-directed learning.

Limitations

As a narrative review, the findings presented rely on existing available literature. While this offers valuable insights, further rigorous, empirical studies are needed to validate the proposed strategies.

Conclusion

The position of parasitology in medical education is evolving, shaped by both global health priorities and curricular reformation in medical schools. The future of parasitology in medical education depends on maintaining its clinical relevance while embracing innovative, interdisciplinary, and globally informed approaches. By integrating emerging technologies and fostering cross-section collaboration, medical educators can ensure that graduates are well-equipped with the competencies needed to diagnose, treat, and prevent parasitic diseases in a rapidly changing healthcare landscape.

Statements and Declarations

Ethics approval and consent to participate:

Not applicable.

Competing interests:

The authors declare no competing interests.

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Authors' contributions:

AI Eladawy conceptualized the manuscript, performed literature synthesis and writing. EA Elsaftawy performed literature synthesis and writing and served as the corresponding author. RM Wassef critically reviewed and edited the manuscript. All authors reviewed and approved the final version for submission.

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