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# Evaluation of Natural Products Used for Treating Male Reproductive Disorders in Selected Malay Medical Manuscripts

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Malay medical manuscripts (MMMs) reflect centuries of indigenous therapeutics, but their contribution to contemporary male reproductive medicine is little explored. This study evaluated natural treatments of male reproductive ailments recorded in selected MMMs by combining native wisdom and modern scientific verification. Five transliterated MMMs were obtained from the collection of IIUM, Kuantan, and assessed using the Scientific Analysis of Kitab Tib Index for Index of Manuscript Selection (SAKTI-iMS). Traditional formulations and pharmacological effects documented in the MMMs were compared with empirical studies retrieved from NCBI PubMed, ScienceDirect, Scopus, and Google Scholar, ensuring comprehensive appraisal of pharmacological evidence and regional publications. 79 natural products were identified in 32 formulations utilised for male reproductive disorders, with Tayyib Al-Ihsan Fi Tibb Al-Insan and Kitab Tib MSS 2515 contributing the highest number of formulations (25% each) and MSS 2515 showing the greatest diversity of natural products (34.2%). Remedies are primarily plant-based (74.3%), with honey, shallot, black seed, raisins, and sugar palm tree, noted to improve sperm quality, erectile dysfunction, and low sexual desire. Significant antioxidant activities from the high phenolic contents, reduce lipid peroxidation thus enhance cellular functions. Traditional knowledge integrated with scientific validation highlights the potential of MMMs in enhancing evidence-based medical interventions.

**Keywords:** Malay medical manuscripts; ethnomedicine; natural products; male reproductive health; pharmacological effects

## I. INTRODUCTION

Malay medical manuscripts (MMMs) serve as a documentation of Malay medical knowledge, encompassing various diseases and traditional remedies practiced over the past centuries. It is also referred to as Kitab Tib, a term derived from the Arabic language. The term 'Kitab' translates to 'a book,' while 'tib' refers to 'physical and spiritual treatment or medical knowledge.' Consequently, it is often rendered as the 'Book of Medicine.' The contents of MMMs have been predominantly shaped by Islamic elements since the introduction of Islam to the Malay Archipelago. The implementation of Islamic features in Malay manuscripts is evident through the use of Jawi-Malay handwriting, the inclusion of Quranic verses, hadith, prayers, and Arabic Phrases (Ibrahim & Ahmad Shah, 2020).

The Malay medical manuscripts discussed thousands of traditional formulations and techniques to treat various diseases, that are mostly unknown to the modern world. The male reproductive disorders are among the common diseases that are prevalent in Malay traditional medicine. Erectile dysfunction and low sexual desire are among the common conditions addressed in Malay medical manuscripts. Male reproductive disorders represent a significant issue impacting infertility globally, with approximately 40–50% of infertility cases being associated with male factor (Kumar & Amit, 2015).

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The MMMs indicate that the ancient Malays utilised natural ingredients from flora, fauna, herbs, spices, and roots, to treat diseases. Natural products, such as herbs or minerals are well-known for its medicinal values and have been used since ancient days in Ayurvedic and traditional Chinese medicine. Evidence can be seen by many articles that cited the use of natural products as the treatment of numerous diseases, including male reproductive disorders, due to its pharmacological properties including antioxidant, anti-inflammatory, antimicrobial and many more. For example, *Eurycoma longifolia*, commonly known as Longjack or *Tongkat Ali*, is widely recognised for its efficacy as an aphrodisiac herb in the treatment of erectile dysfunction (Arena *et al.,* 2019).

The therapeutic potential of natural products has prompted efforts to transliterate and analyse Malay medical manuscripts within specific medical themes, including dermatology (Kamal *et al.,* 2024), eye diseases (Mohd Shafri, 2021a), and ocular pathology (Muziman Syah *et al*., 2023). The applications of Malay traditional natural remedies for treating male reproductive-related medical conditions have not been analysed previously. Furthermore, there is a limited transliterated work that organises information on formulation and preparation methods by disease, as current resources compiled diseases solely according to the authors of the books. Therefore, this study aims to evaluate the varieties of natural products used traditionally to treat male reproductive disorders and compile their formulations and therapeutic effects as documented in Malay medical manuscripts using the SAKTI-iMS evaluation technique.

By applying the concept of ethno-medicine, this study contributes to the preservation of Malay medical culture and heritage, while also facilitating the integration of traditional Malay medicinal knowledge with modern drug innovation and discovery, thereby advancing evidence-based medical interventions.

## II. MATERIALS AND METHOD

### *A. Sources*

Transliterated Malay medical manuscripts (MMMs) were obtained from the International Islamic University Malaysia (IIUM) Kuantan library and from the collection of the Department of Biomedical Science, Kulliyyah of Allied Health Sciences (KAHS), IIUM Kuantan. Online dictionary, such as *Pusat Rujukan Persuratan Melayu* (www.prpm.dbp.gov.my), glossaries of MMMs, and Malay dictionaries were utilised to define and compile a list of Malay terms associated with male reproductive disorders. Information regarding the scientific, vernacular, and family names of the natural products was sourced from reputable platforms such as Forestry Image (www.forestryimages.org), Plants for a Future (www.pfaf.org), and other reliable websites.

### *B. Study Selection*

The assessment of Kitab Tib Index for Index of Manuscript Selection (SAKTI-iMS) developed by Mohd Shafri (2021b) was utilised and modified to evaluate Malay medical manuscripts (MMM) and objectively assess the quality of the manuscript. The selection of Malay medical manuscripts was based on their availability, accessibility and the presence of information pertinent to natural products formulation for the treatment of male reproductive disorders. Keywords such as *"dhakar"* (penis), *"mani* (semen), and *"shahwat"* (sexual desire) were used to extract information from the glossary and contents in each transliterated manuscript. The manuscripts were scored and graded based on five criteria: (i) author's profile (known = 1, unknown = 0), (ii) text completeness (complete >80% = 1, incomplete = 0), (iii) text legibility (legibility>80% = 1, illegible = 0), (iv) the depth of medical content (>80% = 3, 50%-80% = 2, 5-50% = 1, <5% = 0), and (v) content on male reproductive disorders (yes = 1, no = 0). The final score (Σx) was between 0 to 7. Grade A (Σx = 5-7) indicated a strong candidate, or of high priority for inclusion in research, grade B (Σx = 3-4) indicated medium or intermediate priority, grade C (Σx = 1-2) denoted low priority, and grade D (Σx=0) indicated very low priority.

### *C. Data Extraction*

Data extracted from the MMMs include (i) the types of natural products (i.e., plants-, animals- or mineral-based), (ii) types of male reproductive disorders, (iii) natural product formulations and their applications to treat specific male reproductive disorders, and (iv) pharmacological effects. Data were tabulated using Google Spreadsheet.

### *D. Comparative Evaluation*

The traditional formulations of the natural products and their pharmacological effects found in the MMM texts that were used for male reproductive disorders were compared to the empirical studies published in scientific databases such as NCBI PubMed, ScienceDirect, Scopus and Google Scholar. Original articles that provided a comprehensive laboratory analysis of animal and clinical research, and articles published in English, and Malay, regardless of the publication year, that focused on research related to natural products derived from plants, animals, and marine sources and their effects on male reproductive health were included for evaluation. This study excluded articles that were not completely accessible, articles that utilised synthetic products, and articles that were related to the non-medicinal properties of natural products used to treat male reproductive disorders. Keywords such as "male reproductive health", "pharmacological properties", "therapeutic effects", "pharmacological action" and "traditional medicine" were used in the search strategy. The Boolean Operators technique was applied, utilising combinations such as 'honey AND therapeutic effects' to retrieve information from online databases regarding natural products and their pharmacological effects.

## III. RESULT

### *A. Assessment of Selected MMMs using SAKTI-iMS*

A total of five MMMs were graded as A in accordance with the SAKTI-iMS, signifying high-quality manuscripts that fulfilled the criteria to study medical content written in it (Table 1). The five selected manuscripts include Khazinat Al-Insan (KI), Tayyib Al-Ihsan Fi Tibb Al-Insan (TI), Al-Rahmah Fi Al-Tibb Wa Al-Hikmah (AR), Kebun Segala Raja-Raja Bab VII (KSRR) and Kitab Tib MSS 2515 (MSS 2515). The overall SAKTI-iMS score was 7, with the exception of Kitab Tib MSS 2515, which received a score of 6 due to the absence of information regarding the original author, who could not be identified in the manuscript or in the Malaysian National Library's catalogue. All five selected manuscripts showed satisfactory in terms of legibility and textual integrity, with all contents being over 80% complete and readable. All manuscripts received the highest score of '3' in medical content, which indicates that the medical content constituted over 80% of the manuscript, qualifying them to be classified as medical manuscripts. Contents related to male reproductive disorders were present in all five selected manuscripts.

Table 1. Analysis of Transliterated Malay Medical Manuscripts using Index of Manuscripts Selection (Sakti-Ims)

| Manuscripts | Author's profile (x=score) | Text completeness (x=score) | Text legibility (x=score) | Medical content (Physical treatment) (x=score) | Male Reproductive Disorders content (x=score) | ∑x Score | Grade | Priority for research |
|---|---|---|---|---|---|---|---|---|
| KI | 1 | 1 | 1 | 3 | 1 | 7 | A | High |
| TI | 1 | 1 | 1 | 3 | 1 | 7 | A | High |
| AR | 1 | 1 | 1 | 3 | 1 | 7 | A | High |
| KSRR | 1 | 1 | 1 | 3 | 1 | 7 | A | High |
| MSS 2515 | 0 | 1 | 1 | 3 | 1 | 6 | A | High |

### *B. Natural Products Formulations for Male Reproductive Disorders*

Table 2 provides a summary of the original authors, year of original text, and transliterated authors of the selected manuscripts. A total of 32 natural products formulations were identified across five MMMs. The highest number of formulations for male reproductive disorders was found in Kitab Tayyib Al-Ihsan Fi Tibb Al-Insan and Kitab Tib MSS 2515, with each containing 8 (25%) formulations. This is followed by Kitab Al-Rahmah, 7 (21.9%), Kitab Kebun Segala Raja-raja, 6 (18.8%), and Kitab Khazinat Al-Insan, 3 (9.4%). As for the total number of natural products used in the formulations across the five MMMs, Kitab Tib MSS 2515 contained the highest number of natural products used, 27 (34.2%). Kitab Kebun Segala Raja-raja, Kitab Tayyib Al-Ihsan Fi Tibb Al-Insan, Kitab Al-Rahmah, and Kitab Khazinat Al-Insan contained a total of 20 (25.3%), 18 (22.8%), 8 (10.1%), and 6 (7.5%) items of natural products in the formulations, respectively.

Table 2. Distribution of Total Formulations and Applications in Male Reproductive Disorders in Selected Malay Medical Manuscripts

| **Malay Medical Manuscripts** | **Original Author** | **Year of Original Text** | **Transliterated by** | **Total number of formulations for male reproductive disorders, N (%) [Applications]** | **Total number of natural products used in the formulations for male reproductive disorders, N (%)** |
|---|---|---|---|---|---|
| Kitab Perubatan Melayu: Khazinat Al-Insan, Perbendaharaan Manusia | Hakim ‘Abdullah | 1951M | Mohd Affendi Mohd Shafri, (2017) | 3 (9.4) [Swollen penis/testicles -1; Erectile dysfunction – 1; Hypospermia – 1] | 6 (7.5) |
| Kitab Perubatan Melayu: Tayyib Al-Ihsan Fi Tibb Al-Insan | Shaykh Ahmad al-Fatani bin Wan Muhammad Zayn al-Abidin | 1894M | Mohd Affendi Mohd Shafri, (2018) | 8 (25) [Swollen penis/testicles -4; Hernia – 3; Scabies – 1] | 18 (22.8) |
| Kitab Perubatan Melayu: Al-Rahmah Fi Al-Tibb Wa Al-Hikmah | Shaykh ‘Abbas Kuta Karang | 1853M | Mohd Affendi Mohd Shafri & Hermansyah Muhammad Yahya, (2017) | 7 (21.9) [Low sexual desire – 6; Urethritis – 1] | 8 (10.1) |
| Kitab Perubatan Melayu: Kebun Segala Raja-Raja Bab VII, Bustan Al-Salatin | Nur Al-Din Al-Raniri Nur Al-Din Al-Raniri | 1638M | Mohd Affendi Mohd Shafri & Hermansyah Muhammad Yahya, (2022) | 6 (18.8) [Low sexual desire – 6] | 20 (25.3) |

| | | | | | |
|---|---|---|---|---|---|
| Kitab Tib MSS 2515: Perpustakaan Negara Malaysia: KajianTeks dan Suntingan | Unidentified | Unidentified | Harun Mat Piah & Zawiyah Baba, (2014) | 8 (25) [Erectile dysfunction -2; Bladder stone – 5; *Restung* (sexual function impairment) – 1] | 27 (34.2) |
| | | | **Total number, N (%)** | 32 (100) | 79 (100) |

A total of 9 disorders associated with the male reproductive system were identified in the selected MMMs. These disorders include swollen penis and testicles, erectile dysfunction, hypospermia, testicular hernia, scabies of testicles, bladder stones affecting penis, *restung* (impairment of sexual function), low sexual desire and urethritis (Table 2). Low sexual desire was the most frequently mentioned condition in the MMMs, appearing six times in each Kitab Kebun Segala Raja-raja and Kitab Al-Rahmah. Bladder stones were noted five times in Kitab MSS 2515, while swollen penis and testicles were mentioned five times as well, with one reference in Kitab Khazinat Al-Insan and four in Kitab Tayyib Al-Ihsan Fi Tibb Al-Insan. Hernia was mentioned three times in Kitab Tayyib Al-Ihsan Fi Tibb Al-Insan, meanwhile erectile dysfunction was mentioned once in Kitab Khazinat Al-Insan and twice in Kitab Tibb MSS 2515. Other disorders were mentioned once in the selected MMMs.

The overall distribution of different types of natural products used to treat various male reproductive disorder is listed in Table 3. A total of 70 individual natural products utilised to treat male reproductive disorders have been identified through the review of the five selected MMMs. Natural products are further categorised into three primary categories either plant-based, animal-based or mineral-based. The majority of the natural products originated from plant-based formulations, 52 (74.3%), mainly derived from herbal sources, encompassing various plant parts such as roots, leaves, flowers, seeds, and fruits. This is followed by animal/ human-based (n=15, 21.4%), and mineral-based (n=3, 4.3%) natural products. The animal-based natural products include honey, cow's milk, egg, woodpeckers, bat, bone ash, chicken, cow bile, deer, goat, pigeon, quail, sheep's milk, ghee, and mother's milk, while the three mineral-based natural products include alum, manganese, and selenium sulphide.

Table 3. Distribution of Different Types of Natural Products Used to Treat Various Male Reproductive Disorder in The Selected Malay Medical Manuscripts

| No | Natural Products Used | Swollen penis & testicles | Erectile Dysfunction | Hypospermia | Testicular hernia | Scabies of testicles | Bladder Stone affecting penis | *Restung (Impairment sexual function)* | Low Sexual Desire | Urethritis | Total appli-cations |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Honey (AB) | - | 1 | - | - | 1 | - | - | 4 | - | 6 |
| 2. | Shallot (PB) | - | 1 | - | - | - | 1 | - | 2 | - | 4 |
| 3. | Cow's milk (AB) | - | - | 1 | - | - | - | - | 2 | - | 3 |
| 4. | Colocynth (PB) | 1 | - | - | 1 | - | - | - | - | - | 2 |
| 5. | Mother's milk (AB) | 1 | - | - | - | 1 | - | - | - | - | 2 |
| 6. | Egg (AB) | - | 1 | - | - | - | 1 | - | - | - | 2 |
| 7. | Raisins (PB) | - | - | 1 | 1 | - | - | - | - | - | 2 |
| 8. | Black seed (PB) | - | - | - | - | - | 1 | - | 1 | - | 2 |
| 9. | Wheat (PB) | - | - | - | - | - | - | - | 2 | - | 2 |
| 10. | Woodpeckers (AB) | - | 1 | - | - | - | - | - | 1 | - | 2 |
| 11. | Alum (MB) | - | - | - | - | 1 | - | - | - | - | 1 |
| 12. | Areca Palm Tree (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 13. | Banana (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 14. | Banana Tree (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 15. | Bat (AB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 16. | Betel nut leaf (PB) | - | - | - | - | - | 1 | - | - | - | 1 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 17. | Black pepper (PB) | - | - | - | - | - | 1 | - | - | - | 1 |
| 18. | Bone ash (AB) | - | - | - | - | 1 | - | - | - | - | 1 |
| 19. | Cabbage (PB) | 1 | - | - | - | - | - | - | - | - | 1 |
| 20. | Castor bean (PB) | 1 | - | - | - | - | - | - | - | - | 1 |
| 21. | Chamomile (PB) | - | - | - | - | 1 | - | - | - | - | 1 |
| 22. | Chicken (AB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 23. | Chili (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 24. | Chrysanthemum (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 25. | Cloves (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 26. | Coconut tree's root (PB) | - | - | - | - | - | - | 1 | - | - | 1 |
| 27. | Coriander (PB) | 1 | - | - | - | - | - | - | - | - | 1 |
| 28. | Corn (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 29. | Cotton's seeds (PB) | - | - | - | 1 | - | - | - | - | - | 1 |
| 30. | Cow bile (AB) | - | - | - | - | 1 | - | - | - | - | 1 |
| 31. | Cucumber (PB) | - | - | - | - | - | - | - | - | 1 | 1 |
| 32. | *Daun Gelembir Lembu* (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 33. | Deer (AB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 34. | Dry black shoots (PB) | - | - | - | - | - | 1 | - | - | - | 1 |
| 35. | Eucalyptus oil (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 36. | Fava beans (PB) | - | - | - | 1 | - | - | - | - | - | 1 |
| 37. | Flower essence (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 38. | Gaharu (PB) | - | - | - | - | - | - | - | - | 1 | 1 |
| 39. | Galangal (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 40. | Garlic (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 41. | Ghee (AB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 42. | Ginger (PB) | - | - | - | - | - | 1 | - | - | - | 1 |
| 43. | Glorybower (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 44. | Goat (AB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 45. | Jasmine plant (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 46. | Lime (PB) | - | - | - | - | - | 1 | - | - | - | 1 |
| 47. | Longjack (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 48. | Manganese (MB) | 1 | - | - | - | - | - | - | - | - | 1 |
| 49. | *Minyak 'Ud* (PB) | - | - | - | 1 | - | - | - | - | - | 1 |
| 50. | Monkey Pod Tree (PB) | - | - | - | - | - | - | - | - | 1 | 1 |
| 51. | Nibung Palm Tree (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 52. | Olive oil (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 53. | Opium (PB) | 1 | - | - | - | - | - | - | - | - | 1 |
| 54. | Papaya (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 55. | Peppermint (PB) | 1 | - | - | - | - | - | - | - | - | 1 |
| 56. | Pigeon (AB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 57. | Quail (AB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 58. | Red cowpea shoots (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 59. | Rice (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 60. | Selenium Sulfide (MB) | - | - | - | - | - | - | 1 | - | - | 1 |
| 61. | Sheep's milk (AB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 62. | Sugar (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| 63. | *Temu Jantan* (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 64. | Terebinth tree (PB) | 1 | - | - | - | - | - | - | - | - | 1 |
| 65. | Tiger Milk Mushroom (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 66. | Tiger taro plant (PB) | - | - | - | - | - | 1 | - | - | - | 1 |
| 67. | Tobacco leaves (PB) | 1 | - | - | - | - | - | - | - | - | 1 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 68. | Watermelon (PB) | - | - | - | - | - | - | - | - | 1 | 1 |
| 69. | White cumin (PB) | - | 1 | - | - | - | - | - | - | - | 1 |
| 70. | Yellow chickpea shoots (PB) | - | - | - | - | - | - | - | 1 | - | 1 |
| | **TOTAL** | **10** | **20** | **2** | **5** | **6** | **9** | **2** | **29** | **4** | **87** |

### *C. Applications of Natural Products for Various Male Reproductive Disorders*

Table 4 presents the frequently cited natural product formulations utilised in the treatment of various male reproductive disorders (except for *restung* and urethritis), as indicated in the selected MMMs. Honey was the most commonly referenced natural product in the Malay manuscripts. Honey was utilised to address low sexual desire in Kitab Kebun Segala Raja-raja and Kitab Al-Rahmah, erectile dysfunction in Kitab Tib MSS 2515, and scabies of the testicles in Kitab Tayyib Al-Ihsan Fi Tibb Al-Insan.

Table 4. The Applications of Natural Products Formulations Used for Various Male Reproductive Disorders According to The Selected Malay Medical Manuscripts

| **No** | **Manuscript** | **Male Reproductive Disorder** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Swollen penis & testicles** | **Erectile Dysfunction** | **Hypospermia** | **Hernia of testicles** | **Scabies of testicles** | **Bladder Stone affecting penis** | **Low Sexual Desire** |
| 1 | Khazinat Al-Insan | - | Egg | Cow's milk<br>Raisins | - | - | - | - |
| 2 | Tayyib Al-Ihsan Fi Tibb Al-Insan | Mother's milk<br>Colocynth | - | - | Colocynth<br>Raisins | Honey<br>Mother's milk | - | - |
| 3 | Kitab Tib MSS 2515 | - | Honey<br>Shallot<br>Sugar palm tree | - | - | - | Shallot<br>Egg<br>Black seed<br>Sugar palm tree | - |
| 4 | Kebun Segala Raja-raja | - | - | Honey<br>Cow's milk | - | - | - | Honey<br>Shallot<br>Cow's milk<br>Black seed |
| 5 | Al-Rahmah Fi Al-Tibb Wa Al-Hikmah | - | - | - | - | - | - | Honey<br>Shallot<br>Wheat<br>Cow's milk |

Shallot was applied to treat low sexual desire in Kitab Kebun Segala Raja-raja and Kitab Al-Rahmah, as well as erectile dysfunction and bladder stones affecting the penis in Kitab Tib MSS 2515. Black seed was utilised for the treatment of low sexual desire in Kitab Kebun Segala Raja-raja and for bladder stones in Kitab Tib MSS 2515. Colocynth, breastmilk, and raisins were utilised to address conditions such as swollen penis/testicles, testicular hernia, and scabies of the testicles in Kitab Tayyib Al-Ihsan Fi Tibb Al-Insan. Kitab Khazinat Al-Insan utilised cow's milk and raisins as a remedy for hypospermia.

### *D. Comparative Evaluation on Pharmacological Effects*

A comparative analysis was performed on 10 distinct natural products used for male reproductive disorders, that were cited multiple times in the selected MMMs, in relation to modern scientific literature (Table 5). The majority of the empirical studies were conducted on animals (n=10). Two studies involved human subjects, and one study each for *in vitro* and *in vivo* techniques. The natural products that have been scientifically proven to treat various male reproductive disorders include honey, raisin (*Vitis vinifera*), cow's milk,

shallot (*Allium cepa*), black seed (*Nigella sativa*), egg and sugar palm tree (*Arenga pinnata*). The majority of the natural products shared common therapeutic effects such as antioxidant, anti-inflammatory, anti-microbial and anti-parasitic. Mother's breastmilk and colocynth were written as materials used for swollen penis and testicles in the MMMs. However, no related scientific publications were identified. Similarly, no scientific evidence was found for the medicinal properties of breastmilk and colocynth in treating scabies of testicles and testicular hernia, respectively.

Table 5. Comparative Evaluation of The Modern Scientific Evidence on Natural Products Used For Male Reproductive Disorder

| Target Intervention | Natural Products | Scientific Evidence | Pharmacological effects | Type of study | References |
|---|---|---|---|---|---|
| Hypospermia | Honey | Induced spermatogenesis in rats by increasing epididymal sperm count, higher percentage of normal sperm and lower percentage of sperm head and tail abnormalities. | Antioxidant properties derived from its phenolic constituents neutralise ROS. | Animal study | Abdul Ghani *et al.*, 2008<br>Syazana *et al.*, 2011<br>Budin *et al.*, 2017<br>El Nady *et al.*, 2022 |
| | Cow's milk | Milk did not impact epididymal sperm concentration, motility, morphology, or head number. | - | Animal Study | Ganmaa *et al.*, 2004<br>Ma *et al.*, 2009 |
| | Raisin | Grape juice and raisins produced from *Vitis vinifera* decreased sperm count and sperm motility at 100 mg, 200 mg, 400 mg and 1600 mg for 35 days in adult male rats. | Certain polyphenols can be harmful at higher concentrations and have antiandrogenic effects. | Animal study | Afzalzadeh *et al.*, 2015 |
| | | Polyphenol-rich grape pomace extract (5 µg/mL) protects thawed bovine spermatozoa, preserving sperm motility, viability, and acrosomal integrity. | Antioxidant properties. | *In vivo* study | Sapanidou *et al.*, 2014 |
| Erectile dysfunction | Honey | Increased the percentages of rats achieving intromission and ejaculation as well as increased mating and fertility indexes. | Antioxidant properties. | Animal study | Mohamed *et al.*, 2012 |
| | Shallot<br>*(Allium cepa aggregatum)* | Reduced impaired testicular function including the increase of gonadal index and sperm quality in streptozotocin induced diabetic mice. | Quercetin acid scavenges the blood from free radicals. | Animal study | Ampa *et al.*, 2013<br>Aziza *et al.*, 2023 |
| | Egg | Improved the International Index of Erectile Function-5 (IIEF-5) score in patients with mild to moderate erectile dysfunction. | Egg white peptides that have anti-microbial, anti-inflammatory, anti-bacterial, and immunomodulatory effects. | Human subjects | Kamohara *et al.*, 2014 |

| | | | | | |
|---|---|---|---|---|---|
| Low sexual desire | Honey | Improved sperm quality, spermatogenesis, and sexual libido. | Antioxidant properties | Animal study | Akmar & Noor, 2019 |
| | Black Seed | Increased ejaculation volume by 50.56%, shorten reaction time (libido), and increased testosterone concentration. | Antioxidant properties. | Animal study | Habeeb *et al.*, 2023 |
| | Cow's milk | Improved semen physical features and significantly increased buck' libido. | Probiotics affect certain enzymes involved in spermatogenesis and steroidogenesis. | Animal study | Al-Sobayil *et al.*, 2007 |
| Swollen penis/testicles | Mother's milk | No scientific report has been found | | | |
| | Colocynth | No scientific report has been found | | | |
| Hernia of testicles | Raisins | No scientific report has been found | | | |
| | Colocynth | No scientific report has been found | | | |
| Scabies of testicles | Honey | Topical application of a honey-propolis mixture once weekly was more effective for scabies therapy in rabbits than both ivermectin 1% and sulphur ointment 20%. | Anti-parasitic effect of propolis increases parasite plasma membrane fluidity and permeability, causing cell lysis. | Animal study | Mervat *et al.*, 2023 |
| | Mother's milk | No scientific report has been found | | | |
| Bladder stone affecting penis | Black seed | Reduced the dimensions and quantity of urinary stones, and alleviated associated pain. | Thymoquinone exhibits anti-inflammatory and antioxidant properties that inhibit calculus formation. | Human subjects | Shakeri *et al.*,2021 |
| | Shallot (*Allium cepa*) | Significant protective effect against the formation of kidney stones. | Antioxidant properties. | Animal study | Wahid *et al.*, 2023 |
| | Sugar palm tree (*Arenga pinnata*) | The root extract of palm sugar at concentrations of 9%, 18%, 27%, 32%, and 45% (v/v) demonstrates the ability to dissolve calcium kidney stones. | The root of the sugar palm is rich in saponins, flavonoids, and polyphenols. Flavonoids are able to dissolve calcium kidney stones. | *In vitro* study | Haris & Rahayu, 2019 |

## IV. DISCUSSION

This study scientifically evaluated the medicinal contents of five transliterated Malay medical manuscripts, dated between 17th and 19th century, using the SAKTI index for manuscript selection. All the selected manuscripts were graded A based on sufficient medical contents, completeness of texts and identifiable author's profile, indicating high priority and usability for inclusion in research.

From the five selected MMMs, 32 formulations utilised for various male reproductive disorders were identified. Despite originating from different parts of the Malay Archipelago and written years apart, these manuscripts shared similarities in terms of the types of natural products, formulations, and

preparation techniques for treatment of diseases. A total of 79 natural products were identified from the MMMs, with Kitab Tib MSS 2515 recording the highest number of natural products (27, 34.2%) used in 8 formulations made for treating male reproductive disorders. The varying number of formulations and natural products used in the selected MMMs, reflects the unique contributions of each text and highlights the dynamic evolution of traditional Malay medical knowledge across the centuries and of the different manuscript authors. These findings also demonstrated the role of MSS 2515 as a rich source of reproductive health remedies. Thematic focus on the types of male reproductive disorders was seen to be varied between the MMMs. Kitab Al-Rahmah Fi Al-Tibb Wa Al-Hikmah focused on low sexual desire and urethritis with a total of 8 natural products used in 7 formulations, but Kitab Kebun Segala Raja-Raja focused solely on low sexual desire with a total number of 20 natural products used for the 6 formulations. Besides the slight difference in focus, low sexual desire or low libido was still a prominent male reproductive issue spanning more than two centuries in the Malay historical society. The different ranges of male reproductive disorders covered in each of the manuscript could indicate the health priorities at the time, and the formulations used to determine by the availability of natural products in specific regions (Ramya *et al*., 2024).

Findings from this study revealed that plant- and animal-based products have been used as traditional Malay remedies for various male reproductive diseases for many centuries and until today. From the total of 70 natural products used to treat male reproductive disorders identified in the selected MMMs, natural products such as honey, shallot, black seed, raisins, and sugar palm tree have been cited to be effective in improving sperm quality, erectile dysfunction, low sexual desire as well as dissolving calcium formation in urinary stones affecting the reproductive organs.

These materials have been scientifically proven to have high antioxidant activity due to their high phenolic contents such as flavonoids and polyphenols that can neutralise reactive oxygen species (ROS), and reduce lipid peroxidation, hence able to protect cells from damage, thereby, enhancing cellular functions. When compared with modern pharmacological studies, the traditional claims of these natural products in the MMMs were found to have varying scientific support.

In Zaid *et al.* (2021), honey demonstrated protective effects from oxidative stress in rat testes and have helped maintain sexual behaviour in rodents that have been exposed to cigarette smoke. In addition, Hadi (2017) reported that the fructose and glucose contents in honey contribute as the source of energy for enhancing sperm motility in rats. There seemed to be consistency between traditional use and scientific validation thus underscoring the value of honey as a credible reproductive health remedy.

Black seed (*Nigella sativa*) has been shown to improve spermatogenesis, by enhancing sperm quality and protecting normal sperm morphology in many animal studies (Leisegang *et al.,* 2021; Roozbeh *et al.,* 2021). The pharmacological effects of black seed are attributed to its active compound known as thymoquinone (Hannan *et al.,* 2021). These modern findings strongly corroborated the effects of black seeds in improving sperm quality, as mentioned in the manuscripts. Black seed is one of the natural products highly researched globally and its effectiveness in reproductive health is a clear example of traditional knowledge validated by empirical science.

The manuscripts highlighted the use of *Allium* in treating erectile dysfunction, low sexual desire and cases of bladder stone. Comparative evaluation with scientific data demonstrates similar pharmacological effects in similar pathophysiological conditions. Modern research has recurrently shown that shallots can improve testicular function, for instance, in diabetic mice by increasing the gonadal index and sperm quality (Luangpirom *et al*., 2013). Significant increase in the numbers of spermatogonia, primary spermatocytes, spermatids, and the size of the tubules and germinal layer in animals treated with shallot extract has also been demonstrated (Kazemian *et al*., 2017).

The traditional use of raisins in treating hypospermia and hernia of the testicles have been documented in the MMMs. In modern investigations, raisins have been shown to preserve sperm motility, viability and acrosomal integrity in thawed bovine spermatozoa (Sapanidou *et al*., 2014). In addition, raisins also exhibited strong anti-inflammatory properties (Niknami *et al.,* 2020). Raisins are dried grapes produced from *Vitis vinifera* species. Its protective effects are attributed to its polyphenol contents, making it high in antioxidants. The phytochemical composition and medicinal

properties of grapes can be found in various parts of the fruit such as the skin, seeds, pomace, and stems (Nassiri-ASL, 2016). Nevertheless, high concentrations of raisins and grape juice at 400 mg and 1600 mg have been reported to induce reproductive toxicity in adult male rats by decreasing sperm count and sperm motility (Afzalzadeh *et al.*, 2015). Certain polyphenols may also have antiandrogenic effects that can impact male fertility, such as genistein, an isoflavone polyphenol, which can down-regulate testosterone biosynthesis, lowering testosterone levels in mice and men (Yang *et al.*, 2022). The effects of raisins on hernia of the testicles were, however, not found in contemporary research.

Cow's milk provides essential nutrients, including protein, calcium, potassium, and vitamins D and B12 (Kubala, 2018). These nutrients are essential for overall health, including reproductive health. Zinc is crucial for sperm production and testosterone metabolism, whereas vitamin D, present in fortified cow's milk, has been associated with enhanced sperm quality and elevated testosterone levels. Malekinejad and Rezabakhsh (2015) indicate that milk contains prolactin, oestrogens, progesterone, corticoids, and androgens. Despite concerns regarding hormonal disruption of the endocrine system, the study demonstrates that milk enhances sperm motility in male golden hamsters. Cow's milk also contains probiotics that influence enzymes related to spermatogenesis and steroidogenesis, potentially serving as a beneficial agent for enhancing low libido (Al-Sobayil *et al.*, 2007). The role of cow's milk in male reproductive health is, however, inconsistent, as some animal studies did not observe significant effects on sperm parameters including motility and morphology and the results on the effects of exogenous hormones in milk requires careful interpretation and further research.

Human breast milk comprises various bioactive molecules that provide protection to newborns against infections and inflammation (Nuzzi *et al.,* 2021). These components facilitate immune system development, organ growth, and the formation of beneficial microbial communities. Breastfeeding is associated with decreased rates of illness and mortality in infants relative to formula feeding, along with a reduction in gastrointestinal infections, inflammatory diseases, respiratory problems, and allergies. While direct scientific studies on the impact of mother's milk on male reproductive health are lacking, its significant anti-inflammatory properties may have played a role in its therapeutic effects, as noted in the Malay medicinal manuscripts.

*Study Limitations*

Language presents as a limitation in this study, as certain terminologies and plant names are unfamiliar. The authors of the MMM acquired medicinal knowledge from various scholars, including those from Mecca. Therefore, several Arabic phrases were incorporated into the manuscripts, including references to specific plants or substances that were exclusively available in the Middle East during that period. There was also limited information available in the ancient Malay medicine regarding certain natural products used for the treatments of male reproductive disorders, such as *temu jantan*, *daun gelembir lembu* and *minyak 'ud al-qarh*. The lack of scientific evidence for certain natural products may be attributed to the absence of research on the materials in the context of treating male reproductive disorders or due to limitations in search strategies. This does not diminish the potential of the materials, rather, it underscores the necessity of additional scientific clinical research to evaluate their therapeutic potential.

## V. CONCLUSION

The evaluation of selected Malay medical manuscripts highlights the effectiveness of the natural-based materials for the interventions of male reproductive disorders as proven by scientific evidence in modern literature. Honey, shallot, and black seed are among the commonly used natural remedies identified for treating hypospermia, low libido and erectile dysfunction. These materials are also combined with other ingredients such as herbs, fruits, oils or extracts, indicating variations in Malay traditional medicinal formulations.

Research focusing on isolation and characterisation of the bioactive compounds within these traditional formulations, followed by pharmacological and clinical evaluations to ascertain their safety and efficacy, represents a critical pathway for leveraging the information documented in Malay medical manuscripts. Malay medical heritage has a meaningful role in contributing to evidence-based

interventions for male reproductive health and also in modern drug discovery for related health conditions. The integration of traditional knowledge into contemporary scientific frameworks enhances therapeutic innovation as well as strengthens cultural identity and continuity. Bridging historical wisdom with modern sciences provides an important opportunity for the diversification of treatment options to address the growing global concern and challenge of male infertility and related disorders.

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## VII. CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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