# SAKTI INDEX: TOWARDS SCIENTIFIC EVALUATION OF MALAY MEDICAL MANUSCRIPTS

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**Abstract:**

Malay medical manuscripts have become new objects of study in recent years. Our research at IIUM has departed from common manuscript study by emphasising on the historical, philosophical and most importantly the practical and contemporaneous use of the manuscripts' content. In order to accelerate scientific study on these manuscripts, a scientific index called *Indeks Analisa Saintifik Kitab Tibb Melayu* or the Scientific Analysis of Kitab Tib Index (SAKTI), has been developed to analyse Malay medical manuscript data. Four integral subindices of SAKTI include (i) index of manuscript selection (iMS), (ii) index of comparison with published contemporary scientific evidence (iComPSE), (iii) index of pharmaceutical prospectivity (iPharmaprospect), and (iv) index of consensus with other manuscripts (iConText). Manuscripts and their contents would be graded according to these indices and a priority list can be generated to help a researcher in identifying the formulation with the strongest overall value to undergo development into drug therapy. The recent outbreaks of diseases including COVID-19 pandemic reiterates the value of having such an index in quickly identifying possible new cure.

**Keywords:** Malay medical manuscripts, Kitab Tib, Malay medicine, traditional medicine, index

## Introduction

Malay medical manuscripts (MMM) are naturally associated with history, philosophy, civilisation, drug discovery, natural product and ethno-medicine/pharmacology/science. The earliest Malay medical manuscript published in a modern format was the Medical Book of Malayan Medicine. This was published in 1930 based on an 1886 English translation of a Malay medical manuscript from Penang (Stephenson, 1931). The next manuscript was published in 1982 by Dewan Bahasa and Pustaka as Warisan Perubatan Melayu (Ahmad, 1982), based on a manuscript titled Ilmu Tabib, or MSS33, written in 1870s. Malay medical manuscripts continue to linger in obscurity although local interest in ethnoscience and natural products increased exponentially between 1980-2010, coinciding with global trend at the time. During this period, out of several hundred extant manuscripts in institutions such as the National Library of Malaysia, the Islamic Arts Museum Malaysia and others, only a handful was presented in the seminars on traditional medicine that took place and no new book on them was published.

One of the major challenges in bringing MMM to the fore was the lack of methodology to evaluate the content of these manuscripts scientifically. The continued narrative of the lack of scientific progress in Malay civilisation and the association of Malay medicine with mystical and unscientific practice further distance Malay intellectuals from studying these manuscripts. Hence, there had been an absence of studies by scholars of medical and health sciences, whose input is crucial in explaining the terms concerning diseases and Malay *materia medica* in scientific sense. Jawi illiteracy and lack of access or understanding of traditional Malay knowledge of medicine were also cited as the reasons behind their lack of participation in the study of Malay medical manuscripts. Modern scholars thus resorted to the most convenient sources of information such as the works of colonialists like Gimlette's *A Dictionary of Malayan Medicine* (1939) and Burkill's *A Dictionary of the Economic Products of the Malayan Peninsula* (1935). These became the primary source of reference when it comes to traditional Malay medicine. Thus, during the larger part of post-independence period, traditional Malay medicine as documented in the manuscripts remains unlocked and an underdeveloped knowledge.

In recent years, interest in MMM has surged and the format of study is no longer exclusively text-based. Scientists have begun to explore and analyse the contents of MMM seeking not only ways to read the content but also use and translate the content into practice, hoping to discover new drug candidates, get a fresh perspective or a different view on treating illnesses. Major questions still linger; these include on how to fit a medical manuscript study to a medical and health sciences curriculum, on how different is the study to current natural product or mainstream medicine research, on how to standardise presentation of data from MMM and on how data could be immediately used for tackling research and medical challenges such as an unplanned pandemic.

Responding to some of these questions, SAKTI (Indeks Analisa Saintifik Kitab Tibb Melayu or the Scientific Analysis of Kitab Tib Melayu Index) or the Scientific Index for Malay Medical Manuscripts, has been developed. This index, composed of a few scales or grading scores, is intended to be used as a tool to measure, in a more comprehensive manner, a particular text, or individual formulation, and enable their rapid selection for development into a pharmaceutical product and medical intervention. Such index for MMM has not been developed before. The idea of an index, however, is not foreign to science and social science and has been used in many contexts to quantify or illustrate quality to enable judicious selection to be made. Ibrahim & Saad (2016), in order to illustrate the aromatic strength of the flowers that they listed in their publication, provided star-grading from one star for faint smell to five stars for very strong smell. Readers including individual homeowners and town developers can use their grading to increase botanical knowledge and to guide planting in personal garden and town. Jaganath & Teik (2000) studied thirty selected Malaysian herbs, and provided a comprehensive taxonomical identification of each species supplemented with scientific findings on pharmacological properties and clinical trials. Their species-focused publication has a strong slant towards agricultural use, and thus includes grading on the ease of cultivation and market value (Table 1).

Table 1. Example of Grading Scales on Selected Malaysian Herbs by Jaganath & Teik (2000).

| No | Type of herb | Ease of cultivation | Traditional uses | Potentially commercial chemicals | Extent of scientific findings | Market value | Overall potential rating |
|---|---|---|---|---|---|---|---|
| 1 | *Acorus calamus* | **** | *** | *** | *** | *** | *** |
| 2 | *Aloe vera* | **** | **** | ***** | ***** | ***** | ***** |

Although it does not include specific information on medicinal formulations, the publication made a very important remark regarding herbal medicine and its major difference from modern medicine:

"In the transition from the use of herbs to clinical pills, modern medicine has lost the art of combining herbs which is considered very crucial in herbalism to modify toxicity and reduce side-effects." (Jaganath & Teik, 2000)

Sensing the need for and the lack of a reliable standard for evaluating herbal medicine, a very useful Natural Standard Evidence-based Grading Scale™ was introduced by Ulbritch & Seamon in 2010. This scale was developed to categorise the level of effectiveness, graded as A (strong), B (good), C (unclear or conflicting evidence), D (fair negative evidence) and E (strong negative evidence), for each of the herbal formulation that they presented based on available scientific research.(Ulbritch & Seamon, 2010) (Table 2). This standard drew inspiration from other works, in particular the Jadad Scale (Jadad et. al., 1996). Jadad Scale, also known as Oxford Quality Scoring Scale, is a highly cited, five-points assessment scale, which was initially used for comparing clinical trials.

Table 2. Natural Standard Evidence-based Grading Scale™

| Level of Evidence | Criteria |
|---|---|
| **Grade A** (Strong Scientific Evidence) | Statistically significant scientific evidence of benefit from more than two properly conducted randomised controlled trials (RCTs), or evidence from one properly conducted RCT and one properly conducted meta-analysis, or evidence from multiple RCTs with a clear majority of the properly conducted trials showing statistically significance evidence of benefit and with supporting evidence in basic science, animal studies and theory. |
| **Grade B** (Good Scientific Evidence) | Statistically significant scientific evidence of benefit from one or two properly conducted randomised controlled trials (RCTs), or evidence from one or more properly conducted meta-analyses, or evidence of benefit from more than one cohort/case-control/non-randomised trial and with supporting evidence in basic science, animal studies and theory. |
| **Grade C** (Unclear or Conflicting Scientific Evidence) | Statistically significant scientific evidence of benefit from one or more small RCTs with adequate size, power, statistical significance, or quality of design by objective criteria (such as by Jadad et al. 1996) or conflicting evidence from multiple RCTs without a clear majority of the properly conducted trials showing evidence of benefit or ineffectiveness; or evidence of benefit from one or more cohort/case-control/ nonrandomised trials and without supporting evidence in basic science, animal studies and theory. |
| **Grade D** (Fair Negative Scientific Evidence) | Statistically significant negative evidence (i.e. lack of evidence of benefit) from cohort/case-control/nonrandomised trials, and evidence in basic science, animal studies and theory suggesting a lack of benefit. |
| **Grade F** (Strong Negative Scientific Evidence) | Statistically significant negative evidence (i.e. lack of evidence of benefit) from one or more properly randomised, adequately powered trials of high-quality design by objective criteria (such as by Jadad et al., 1996) |
| Lack of evidence | Unable to evaluate efficacy due to a lack of adequate available human data. |

**Components of SAKTI, a Scientific Index for Malay Medical Manuscripts**

Indices such as Natural Standard Evidence-based Grading Scale™ do not use old manuscripts as information source and is greatly influenced by natural product research approach. The major disadvantage of this approach is efficacy is determined according to individual ingredient. This runs in contrast to traditional formulations in which many ingredients are mixed together. SAKTI, on the other hand, is developed to remain true to the traditional formulations. Thus, it is developed as an accumulation of available indices which take into account textual sources and their contexts and the formulations as they are. Four components, or sub-indices, make up SAKTI, namely (i.) Index of Manuscript Selection (iMS), (ii.) Index of Comparison with Published Scientific Evidence (iComPSE), (iii.) Index of Pharmaceutical Prospectivity (iPharmaprospect), and (iv.) Index of Consensus among Texts (iConText).

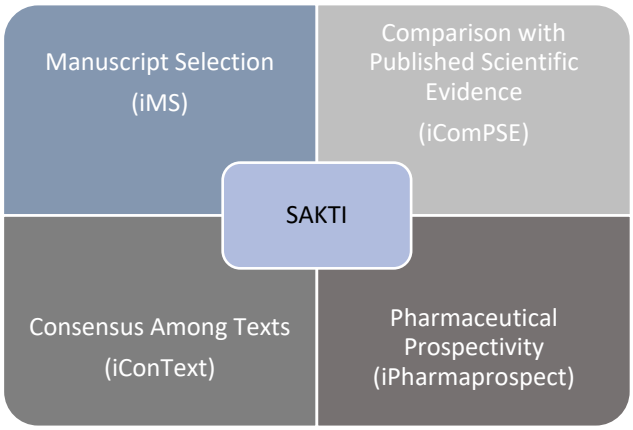



Figure 1. The four components or sub-indices of SAKTI, an index to analyse Malay Medical Manuscripts.

**Index of Manuscript Selection (SAKTI-IMS)**

SAKTI-iMS in the first component in SAKTI to help enable a systematic and objective evaluation of a manuscript prior to study selection. Manuscript to be used in a study must be selected carefully because of the possibility of manuscripts being unoriginal. Gallop (2017) noted that the sudden surge to collect Malay manuscripts in the 1980s in Malaysia had led to the phenomenon in which 'manuscripts had been manufactured or at least 'processed' in some way to meet market demand.' Gallop provided ample evidence of such activity to have really taken place. Although none of the unoriginal Malay manuscripts described in her article was of the medical type, the possibility that Malay medical manuscripts could have been involved too could not be side-lined. Malay medical manuscripts are known to fetch a higher price than other types of manuscripts hence the inducement and motivation that lead to recent manufacturing or even faking of manuscripts do exist.

Techniques such as carbon-dating exists to help with dating a manuscript and detecting unoriginal ones, but not all manuscript owners are happy to allow such investigation to take place. There are also limitations such as slight destruction of manuscript, contamination, use of solvent and other technical factors that can cause ambiguity and error in dating them (Kasso et. al., 2021). Sometimes the dating of a manuscript, if made up of paper, can be performed by assessing the watermark. But watermark does not always present and the precise date of writing may be different due to the lapse of time that took place between paper manufacturing and its use by the scribe (Sasaki, 1992; Kirakosian, 2016).

Given these challenges, Index of Manuscript Selection in SAKTI (SAKTI-iMS) is developed based on four major criteria: (i) author's profile, (ii) completeness of text, (iii) legibility of text), and (iv) amount of medical content in the manuscript (Table 3).

Table 3. Index of Manuscript Selection (SAKTI-iMS) to Help in the Prioritisation of MMM for Research.

| No. | Author's profile (x=score) | | Integrity of text (x=score) | | Legibility of text (x=score) | | Medical content (x=score) | | | | ∑x Score * | Selected Grade | Priority for research |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Unknown (0) | Known (1) | Incomplete (0) | Complete >80% (1) | Illegible (0) | Legibility >80% (1) | <5% (0) | 5-50% (1) | 50-80% % (2) | >80% (3) | | | |
| 1 | ✓ | | ✓ | | ✓ | | ✓ | | | | 0 | D | Very low |
| 2 | ✓ | | ✓ | | ✓ | | | ✓ | | | 1 | C | Low |
| 3 | ✓ | | ✓ | | ✓ | | | | ✓ | | 2 | C | Low |
| 4 | ✓ | | ✓ | | ✓ | | | | | ✓ | 3 | B | Medium |
| 5 | ✓ | | ✓ | | | ✓ | ✓ | | | | 1 | C | Low |
| 6 | ✓ | | ✓ | | | ✓ | | ✓ | | | 2 | C | Low |
| 7 | ✓ | | ✓ | | | ✓ | | | ✓ | | 3 | B | Medium |
| 8 | ✓ | | ✓ | | | ✓ | | | | ✓ | 4 | B | Medium |
| 9 | ✓ | | | ✓ | ✓ | | ✓ | | | | 1 | C | Low |
| 10 | ✓ | | | ✓ | ✓ | | | ✓ | | | 2 | C | Low |
| 11 | ✓ | | | ✓ | ✓ | | | | ✓ | | 3 | B | Medium |
| 12 | ✓ | | | ✓ | ✓ | | | | | ✓ | 4 | B | Medium |
| 13 | ✓ | | | ✓ | | ✓ | ✓ | | | | 2 | C | Low |
| 14 | ✓ | | | ✓ | | ✓ | | ✓ | | | 3 | C | Medium |
| 15 | ✓ | | | ✓ | | ✓ | | | ✓ | | 4 | C | Medium |
| 16 | ✓ | | | ✓ | | ✓ | | | | ✓ | 5 | A | High |
| 17 | | ✓ | ✓ | | ✓ | | ✓ | | | | 1 | C | Low |
| 18 | | ✓ | ✓ | | ✓ | | | ✓ | | | 2 | C | Low |
| 19 | | ✓ | ✓ | | ✓ | | | | ✓ | | 3 | B | Medium |
| 20 | | ✓ | ✓ | | ✓ | | | | | ✓ | 4 | B | Medium |
| 21 | | ✓ | ✓ | | | ✓ | ✓ | | | | 2 | C | Low |
| 22 | | ✓ | ✓ | | | ✓ | | ✓ | | | 3 | B | Medium |
| 23 | | ✓ | ✓ | | | ✓ | | | ✓ | | 4 | B | Medium |
| 24 | | ✓ | ✓ | | | ✓ | | | | ✓ | 5 | A | High |
| 25 | | ✓ | | ✓ | ✓ | | ✓ | | | | 2 | C | Low |
| 26 | | ✓ | | ✓ | ✓ | | | ✓ | | | 3 | B | Medium |
| 27 | | ✓ | | ✓ | ✓ | | | | ✓ | | 4 | B | Medium |
| 28 | | ✓ | | ✓ | ✓ | | | | | ✓ | 5 | A | High |
| 29 | | ✓ | | ✓ | | ✓ | ✓ | | | | 3 | C | Medium |
| 30 | | ✓ | | ✓ | | ✓ | | ✓ | | | 4 | C | Medium |
| 31 | | ✓ | | ✓ | | ✓ | | | ✓ | | 5 | A | High |
| 32 | | ✓ | | ✓ | | ✓ | | | | ✓ | 6 | A | High |

*∑x is a mathematical formula denoting total sum.

The amount of medical content in a manuscript is the major defining factor in a manuscript selection according to SAKTI-iMS. Previously, many researchers deemed the mere mention of one or two medical formulations in a manuscript as sufficient a criterion to consider the manuscript being eligible to be catalogued as a medical manuscript. This is problematic, erroneous and misleading as many manuscripts which is better suited for another genre had been assigned as a medical manuscript. Using SAKTI, this problem is navigated by not directly discounting this opinion *in toto*, but by appealing to the judicious use of the index of manuscript selection to influence selection.

After the initial screening based on the amount of medical content, the strength of manuscripts in terms of its usability is then increased if it is complete and legible. In SAKTI-iMS, legibility takes precedence over completeness of the whole manuscript as intelligible manuscript could affect individual formulation, risking its use to the occurrence of side-effects, or to issues during formulation stage, or to becoming completely inefficacious at clinical level. With regard to completeness of a manuscript, incomplete manuscript should not be totally disregarded as manuscripts that may have lost a few parts could still contain intact formulations that are still of use.

Author's profile is important too as a manuscript with a completely unknown author's background will weaken its provenance point and may raise the question of integrity, honesty and reliability. Nonetheless, many Malay medical manuscripts have no mention of their authors, due to factors such as missing pages or because it was common for Malay authors in the past to subscribe to a high ethical standard in which keeping a low profile and avoiding fame and popularity were considered virtuous and a mark of sincerity. The lack of author's name in SAKTI, while important, does not necessarily or immediately entails a manuscript to be taken out from the list for priority for research. Such manuscript would be further analysed further using other sub-indices in SAKTI such as the index of comparison with published scientific evidence (SAKTI-iComPSE) and the index of consensus among texts (SAKTI-iConText).

There are other criteria that could also help a researcher in deciding and prioritising which manuscript to be used. The manuscript of *al-Raḥmah fī al-Ṭibb,* which is now in the collection of *Yayasan Pendidikan Ali Hasjmy,* is one fine example. Apart from fulfilling the criteria to be considered a Grade A MMM, its research is also considered urgent considering the location of the manuscript in Acheh, a natural disaster-prone area. Aceh was badly affected by the 2006 earthquake and tsunami, which saw some major manuscript centres such as *Pusat Dokumentasi dan Informasi Aceh (PDIA)* were completely wiped out (Feneer, 2011). Added to this is the fact that the thick manuscript is a *codex unicus*, i.e. the sole remaining example in existence, and crucial in completing Achehnese history. For SAKTI, however, these unique factors are not included as they are neither repetitive nor integral, and are left at the liberty of individual researcher to add one mark or two to the final score.

According to SAKTI-iMS (Table 3), each manuscript will be given a score according to the four major criteria. The final score, $\sum x$, is between 0-6. The score will enable grading to be made between A ($\sum x$ = 5-6), B ($\sum x$ =3-4), C ($\sum x$ = 1-2) or D ($\sum x$=0). Grade A indicates a strong candidate, or of high priority for inclusion in research, whereas B indicates medium or intermediate priority, C denotes low priority, and D indicates very low priority. In Table 3, the grades are colour-coded with Grade A in green, Grade B in orange, Grade C in red, and Grade D in white.

The index, as presented in Table 3, could also be used to validate several recent publications of Malay medical manuscripts (Table 4). The first thirteen manuscripts in the list clearly fall in the Grade A as they scored between 5-6 points in total score. Other manuscripts, such as *Kitāb Berladang* and *Mujarrabāt al- Fawā'id* are included for the purpose of comparison. The former manuscript comes from a rice-farming community in Putussibau in Kalimantan. It is a *mujarrabāt* text, containing some medical formularies in addition to advices on agricultural practice, building houses, and others (Amin, 2013). The word *mujarrabāt*, مجربات, carries the meaning of 'things tried and tested. In the Malay literary tradition, *mujarrabāt* texts are usually texts that compile living tools and tips related to various essential disciplines and arts such as agricultural practices, building of houses, trades, and medicine. In contrast to popular

belief, a *mujarrabāt* text does not always have medical content. When it does, the amount of medical content in the text may be proportionally small, or may be significantly high. In other words, each text has to be assessed individually to see whether it warrants a proper study to be carried out. In Table 4, the text *Kitāb Berladang* does not score highly in SAKTI-iMS, and graded as Grade B (Table 4). The latter, *Mujarrabāt al-Fawā'id*, as the name suggest, also comes from the *mujarrabāt* genre and also graded B indicating an intermediate priority for study.

Table 4. Analysis of Several Selected MMM Using Index of Manuscript Selection in SAKTI-iMS.

| | Author's profile (x=score) | | Integrity of text (x=score) | | Legibility of text (x=score) | | Medical content (physical treatment) (x=score) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Abbreviated Name of Manuscript | Unknown (0) | Known (1) | Incomplete (0) | Complete >80% (1) | Illegible (0) | Legibility >80% (1) | <5% (0) | 5-50% (1) | 50-80% % (2) | >80% (3) | ∑x Score | Selected Grade | Priority for research |
| TI | | ✓ | | ✓ | | ✓ | | | | ✓ | 6 | A | High |
| AR | | ✓ | | ✓ | | ✓ | | | | ✓ | 6 | A | High |
| RU | | ✓ | | ✓ | | ✓ | | | | ✓ | 6 | A | High |
| SSU | | ✓ | | ✓ | | ✓ | | | | ✓ | 6 | A | High |
| AITM | | ✓ | | ✓ | | ✓ | | | | ✓ | 6 | A | High |
| BMM | | ✓ | | ✓ | | ✓ | | | | ✓ | 6 | A | High |
| KTAWB | | ✓ | | ✓ | | ✓ | | | | ✓ | 6 | A | High |
| RO | ✓ | | | ✓ | | ✓ | | | | ✓ | 5 | A | High |
| 2515 | ✓ | | | ✓ | | ✓ | | | | ✓ | 5 | A | High |
| KTT | ✓ | | | ✓ | | ✓ | | | | ✓ | 5 | A | High |
| 1292 | ✓ | | | ✓ | | ✓ | | | | ✓ | 5 | A | High |
| 2999 | ✓ | | | ✓ | | ✓ | | | | ✓ | 5 | A | High |
| WPM | ✓ | | | ✓ | | ✓ | | | | ✓ | 5 | A | High |
| KB | ✓ | | | ✓ | | ✓ | | ✓ | | | 3 | B | Medium |
| MF | ✓ | | | ✓ | | ✓ | | ✓ | | | 3 | B | Medium |

Note: TI = *Ṭayyib al-Iḥsān* (Mecca), AR = *al-Raḥmah fī al-Ṭibb* (Acheh), RU = *Rumah Ubat di Pulau Penyengat* (Riau), SSU = *Sari Segala Ubat* (Pontianak, Kalimantan), AITM = *Aṣal 'Ilmu Ṭabīb Melayu* (Riau), BMM = Medical Book of Malayan Medicine (Penang), KTAWB = *Kitāb Ṭibb 'Abd Allah Wan Besar* IAMM1998.1.3370 (possibly Fathani), RO = *Ramuan Obat* EAP 153/9/4 (Riau), 2515 = MSS2515 (Fathani), KTT = *Kitāb Ṭib Muzium Terengganu* (Terengganu), 1292 = MSS1292 (Fathani), 2999 = MSS2999 (unknown), WPM = MS33 (Kelantan), KB = *Kitāb Berladang* (Putussibau, Kalimantan), MF = *Mujarrabāt al- Fawā'id* (Terengganu).

**Index of Comparison with Published Scientific Evidence (SAKTI-iComPSE)**

This index comes from a method in which the use of individual herbal or animal or mineral in a traditional formulation in a text such as MMM is considered 'scientifically supported' when there is a journal paper, in support of the exact use as in the manuscripts or of related use, that has been published in modern scientific journals. (Mohd Shafri, 2021a). Two most common databases of published journals are PubMed and Google Scholars. The databases are used according to suitability, to be considered by

individual researchers based on the nature of their study, as these databases have their own technical limitations. One major limitation of these databases is the fact that most scientific research, and hence the published papers, use natural product approach. In this approach, ingredients used in the formulations in traditional herbal medicine are tested and reported individually instead of as a whole formulation. This approach does not consider material-material interaction which would affect organoleptic properties, formulation stability and formulation compatibility. It does, however, have utility in guiding selection of materials at the beginning of a research. Hence, the absence of any search hit from the database does not necessarily mean that the traditional use is to be immediately dismissed as many of the traditional Malay formulations, or even the individual ingredients from the Malay world, have not been studied by modern scientists (Mohd Shafri, 2021a).

Table 5. Advantages, limitation and use of journal databases. (Mohd Shafri, 2021b)

| Database | Advantages | Limitations | Usability |
|---|---|---|---|
| PubMed | Articles from indexed and refereed journals only. | Number of journals are restricted. | Used if materials are already studied well, or if the integrity and quality of articles are of utmost concern. |
| Google Scholar | Articles may come from indexed/non-indexed, and refereed/non-refereed journals. | Articles may come from predatory as well as non-predatory journals. | Used if materials are new or studied less extensively; or if the integrity and quality of articles are not of utmost concern. (e.g. for the purpose of *narrative* or *scoping review*). |

The scientific evidence search strategy, established to ensure that the scientific evidence retrieved for any *materia medica* is reliable and relevant, follows Mohd Shafri (2021a) and incorporates Boolean Operator. For example:

a. In vitro study OR In/ex vivo study OR Animal study OR Randomised controlled trial study OR human case study.
b. Any parts of the *materia medica* that is used in the clinical study.

SAKTI-iComPSE then adopts Natural Standard Evidence-based Grading Scale™ with some modifications (Table 6). Firstly, the grading criteria has been simplified. Two grades, E and No Grade were also introduced to enable the introduction of score. This will allow the grade to be analysed semi-quantitatively and used with other indices in SAKTI.

Table 6. Matching of grade (modified from Natural Standard Evidence-based Grading Scale™ (in Table 2) to SAKTI-iComPSE score.

| GRADE | **SCORE** |
|---|---|
| A: Positive results with significance in > 2 RCT, *or* 1 RCT + 1 Meta-analysis, *or* a few RCT supported by fundamental results. | 5 |
| B: Positive results with significance in 1-2 RCT, *or* more than 1 Meta-analysis, *or* a few cohort/case-control/non-randomised trial with fundamental results. | 4 |
| C: Positive results not strong significance from a few small-sized RCT, *or* majority of findings show positive results but there are inconclusive *or* contradictory resuts from a few studies *with* no fundamental results. | 3 |
| D: Negative results in > 2 RCT, *or* negative results in 1 RCT and 1 Meta-analysis, *or* negative results in a few RCT but there are supports from fundamental studies. | 2 |
| E: Negative results very significant statistically. | 1 |
| No grade: No scientific evidence. | 0 |

**Index of Pharmaceutical Prospectivity (SAKTI-iPharmaprospect)**

Bioprospect is the systematic search to discover potential and useful application of an information or formulation, in this case the medical knowledge in MMM, to be developed as commercially valuable and viable products. The Index of Pharmaceutical Prospectivity (SAKTI-iPharmaprospect) is the grading of individual formulation in individual MMM, allowing the prioritising of those that can be developed into pharmaceutical products. At the same time, due to constraint of cost, the formulations in question must also be considered in relation to the convenience of research and research's industrial and commercial directions.

In SAKTI-iPharmaprospect, scores are given based on several components including (i) material provenance, (ii) complexity of formulation e.g. use of single or mixed materials, (iii) ease of preparation and (iv) ease of use / delivery route e.g. local vs systemic (oral) vs more complex route (aerosol) (Table 7). The fundamental spirit and concept of the SAKTI-Pharmaprospect index is similar to the grading by Jaganath & Teik (2010) for their herbals, but differs by having an emphasis on the pharmaceutical perspectives in determining prospective strength.

According to SAKTI-iPharmaprospect, the best formulation is the one that contains ingredients that can be sourced locally, can be efficacious even if formulated singly, and can be immediately used. The drug delivery system is useful to prioritise between several different types of formulation for the same disease because the type of delivery system will determine complexity and cost. During those days, however, some modern types of drug delivery system such as injectables and respiratory delivery are non-existent, hence SAKTI-iPharmaprospect only considers three major drug delivery systems: topical/external, eye and ear drops, and oral drug delivery system.

The score will enable grading to be made between A ($\sum x$ = 10-12), B ($\sum x$ =7-9), and C ($\sum x$ = 4-6). Due to the scoring system, the maximum score is 12 and the minimum is 4. Those graded A is recommended for shortlisting, considered valuable and deemed to hold high prospect of being developed into pharmaceutical products. As this index does not take into account the efficacy of the formulation, it has to be used concurrently with the SAKTI-iComPSE which covers that aspect.

Table 7. Example of how four types of hypothetical formulations (F1-F4), differing only in the steps of preparation, will be scored and graded by SAKTI-iPharmaprospect to reflect complexity and cost.

| | | Material Provenance | | | Type of Formulation | | Drug Delivery System | | | Ease of Preparation | | | | $\sum x$ Score | **GRADE:**<br>**Easy:** A: 10-12<br>**Intermediate:** B: 7-9<br>**Difficult:** C: 4-6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Local material | Foreign material | Mix | Single ingredient | Mixed ingredients | Topical /external | Ear / Eye drop | Oral | Immediate use | 1 step, in a day | >2 steps, in a day | >1 day | | |
| | SCORE | 3 | 2 | 1 | 2 | 1 | 3 | 2 | 1 | 4 | 3 | 2 | 1 | | |
| FORMULATION NUMBER, F(X) | F1 | ✓ | | | ✓ | | ✓ | | | ✓ | | | | 12 | A |
| | F2 | ✓ | | | ✓ | | ✓ | | | | ✓ | | | 11 | A |
| | F3 | ✓ | | | ✓ | | ✓ | | | | | ✓ | | 10 | A |
| | F4 | ✓ | | | ✓ | | ✓ | | | | | | ✓ | 9 | B |

The Table 7 may be modified slightly depending on the type of disease and treatment. As an example, when evaluating some formulations concerning eye diseases in the manuscript Ramuan Obat from Riau, the '*drug delivery system*' component was replaced with '*ease of use*'. The delivery modes were then described as eyeliner (*celak*), eyepatch (*balut*), eyedrop (*titis*) and oral (*makan*) as these four modes are used in the manuscript. They were then be given the score of 3, 3, 2, and 1 respectively as the eyeliner and eyepatch are essentially similar in terms of drug delivery system i.e. topically or externally applied.

**Index of Consensus among Texts (SAKTI-iConText)**

The final index in SAKTI concerns the consensus among texts i.e., manuscripts, on individual formulation. A formulation may occur in an early text and appear again in a more recent text. The texts involved may not only differ temporally in terms of age, but also spatially. For example, two manuscripts originating from two different regions, one from 18th century and the second one from early 20th century, may relay one similar formulation. Such occurrence may be related to the interconnection among Malay scholars of medicine as the knowledge spread (Mohd Shafri, 2020), or as similar author may recourse to similar type of source or reference material. The presence of such occurrence gives some indications on the effectiveness of the formulation, or particular *materia medica*, indicated by its continuous used, albeit there is also no guarantee that that the formulation had been passed or copied down uncritically. Nevertheless, it has a value in supporting the use and selection of the formulation due to the cultural and ethnoscientific proofs.

The repetition of a formulation in manuscripts may actually occur in two manners. The first is a type of repetition which is strikingly similar words for words, containing exactly similar ingredients and mode of preparation. Table 8 shows an example, for the treatment of cold cough (*batuk angin sejuk*) taken from *MSS905 Petua Kitab Tib* and *al-Raḥmah fī al-Ṭibb*.

Table 8. Two strikingly identical formulations for the same disease from two different manuscripts from two different regions.

| MSS 2905 Petua Kitab Tib (possibly Fathani) | *al-Raḥmah fi al-Ṭibb (Aceh)* |
|---|---|
| *Sebagai pula ubat batuk yang jadi daripada angin yang sejuk, sebabnya jadi itu kemudian daripada wati atau kemudian daripada menanggung benda yang berat-berat. Alamat demikian itu barangkali ia batuk rasa terbuka dadanya. Dan akan ubatnya, ambil mur dan gandarukam dan mustaki berat tiga emas yang kali beratnya. Maka bubuh di dalam minyak lenga, maka permasak hingga hancur sekalian itu. Maka bungkuh(s)kan segera-segera suam-suam dapat minum.* | *Al-su'al al-rihi ertinya batuk yang datang ia daripada sebab angin sejuk atau datang ia kemudian jima' atau kemudian menanggung sesuatu yang berat dan barang sebagainya. Bermula alamat yang empunya penyakit batuk itu, tatkala itu datang batuk merasai seolah-olah bercerai segala sendi. Bermula ubatnya diambil mur dan gandarukam dan mustaki dan tiap-tiap suatu satu dirham beratnya, maka dicampak dalam minyak lenga beratnya tiwa wiqyah. Setelah itu maka ditutup atas api yang lemat lembut hingga hancur sekaliannya. Kemudian maka diminum pesam-pesam.* |

The second type is shown in Table 9, showing two formulations for the same disease (*mengah/lelah*), that contains some similarity in terms of ingredients and preparation.

Table 9. Two formulations for the same disease from two different manuscripts from two different regions with some degree of similarity in terms of the ingredients used.

| MSS 2905 Petua Kitab Tib (possibly Fathani) | Sari Segala Ubat (Pontianak, Kalimantan) |
|---|---|
| *Sebagai pula ubat lelah, di dalam tubuh-tubuh anak Adam. Pertama ambil jemuju, jintan hitam, dan lada sulah, dan cabai, bawang putih. Segala itu diserbuk maka hancurkan dengan telur ayam hitam. Maka makan tiga pagi, 'afiyyah.* | *Ini ubat mengah ambil bonglai segantang, lada segantang, telur hayam, dihancur dengan garam, asam jawa secawan, pipis sekaliannya itu. Ditelan, sembuh alahnya.* |

Finding similar formulations in different manuscripts is not easy as it requires that the researcher to have read many and widely the available Malay medical manuscripts. Examples however do exist and will become clearer when thematic analysis of diseases or *materia medica* is made or when a database of Malay medicine is developed digitally fully.

In SAKTI, SAKTI-iConText is scored in the following manner (Table 10):

Table 10. The scoring for SAKTI-iConText

| Type | Score |
|---|---|
| 80% similarity | 4 |
| 50% similarity | 3 |
| 30% similarity | 2 |
| 10% similarity | 1 |

The higher score in iConText can be used to strengthen the justification for prioritising a particular formulation for research especially when several formulations are available but resources are limited. The lack of or low score in iContext should not be the sole determining factor in manuscript or formulation selection as it only functions as an additional score to the three afore-mentioned sub-indices.

**Conclusion**

The need for a method to analysed MMM scientifically is a perennial concern. SAKTI provides a logical and systematic method to enable scientific evaluation at the selection or pre-experimentation stage (Figure 2) before scientific evidence of the content of MMM is collected by performing laboratorial experimentation and clinical research.

SAKTI with all four sub-indices would be easier to be generated and calculated if a digital database is available (Figure 3). This requires careful computation of data in the system, with additional information from non-manuscript data such as toxicology, efficacy and genetic. A formulation that has a high overall score could be selected more efficiently through such database, instead of manual input and computation.

The presence of databases has been key to the direct engagement of Traditional Chinese Medicine in solving modern-day problems including the urgency created by H1N1 (Chang et al., 2011) and Covid-19 pandemic. While we cannot dictate who will use and what purpose SAKTI will serve in the future, it is envisioned that the use of SAKTI will not only dispel any hesitation on how to use the MMM scientifically, but also speed up and spur new findings and tools for research.

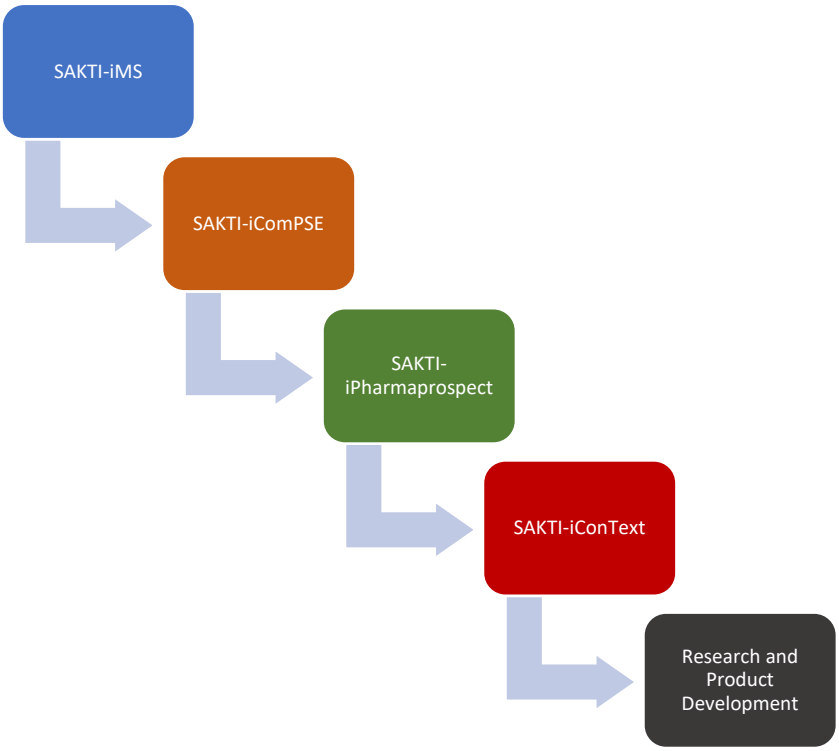
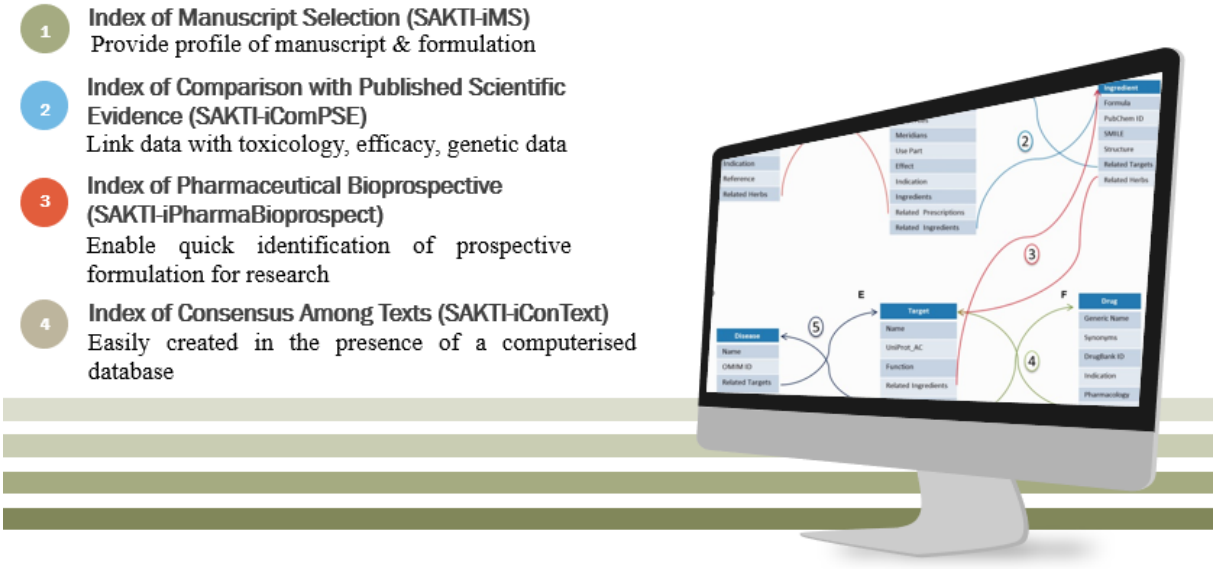



Figure 2. The stepwise approach in the scientific evaluation of MMM using SAKTI leading towards research and product development.




The Figure 3. SAKTI will help inform the content and structure of any digital database of Malay medicine sourced from the Malay medical manuscripts in readiness for data mining.

## ACKNOWLEDGEMENT

The study is funded by IIUM RIGS Flagship IRF19-023-0023.

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