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วารสารวิทยาศาสตร์สุขภาพและการแพทย์ทางเลือก



Journal Name	Journal of Health Science and Alternative Medicine
Abbreviation	J Health Sci Altern Med
ISSN (Online)	2673-0294
Publisher	School of Health Science, Mae Fah Luang University
Aims and Scope	<p>Journal aims to publish research and scientific contents in the field of health science and alternative medicine such as</p> <ul style="list-style-type: none">- Physical Therapy- Medicine- Traditional and Alternative medicine- Public Health- Occupational Health and Safety- Environmental Health- Sport Science- Nursing- Medical Technology- Other Allied Health Sciences <p>The journal adheres to stringent review process and manuscripts must get the approval of at least 2 independent reviewers followed by the editor to be considered for the publication.</p>
Frequency	3 times per year (Jan - Apr, May – Aug and Sept - Dec)
Language	Full-text articles in both Thai and English Language
Editorial Office	<p>School of Health Science, Mae Fah Luang University 333 Moo 1 Thasud Sub District, Muang District, Chiang Rai, 57100 Tel: 053-916-821 Fax: 053-916-821 E-mail: hsresearch2017@mfu.ac.th</p>
Support Agency	<p>Center of Excellence for the Hill-Tribe Health Research Mae Fah Luang University</p>



ชื่อวารสาร	วารสารวิทยาศาสตร์สุขภาพและการแพทย์ทางเลือก
ชื่อย่อวารสาร	J Health Sci Altern Med
ISSN (Online)	2673-0294
จัดพิมพ์โดย	สำนักวิชาวิทยาศาสตร์สุขภาพ มหาวิทยาลัยแม่ฟ้าหลวง
จุดมุ่งหมายและขอบเขต	วารสารฯ มีวัตถุประสงค์เพื่อเผยแพร่ผลงานวิจัย และบทความทางวิทยาศาสตร์ ในขอบเขตของสาขาวิชาวิทยาศาสตร์สุขภาพและการแพทย์ทางเลือก ได้แก่ <ul style="list-style-type: none">- ภาพกายภาพบำบัด- การแพทย์แผนปัจจุบัน- การแพทย์แผนโบราณและการแพทย์ทางเลือก- สาธารณสุข- อาชีวอนามัยและความปลอดภัย- อนามัยสิ่งแวดล้อม- วิทยาศาสตร์การกีฬา- พยาบาลศาสตร์- และวิทยาศาสตร์สุขภาพอื่น ๆ ที่เกี่ยวข้อง วารสารฯ มีกระบวนการตรวจสอบต้นฉบับบทความที่เข้มงวด โดยต้นฉบับบทความต้องได้รับการตรวจสอบจากผู้ทรงคุณวุฒิอิสระอย่างน้อย 2 ท่าน จากนั้นจึงได้รับการพิจารณาจากบรรณาธิการเพื่อการตีพิมพ์
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ภาษา :	บทความฉบับเต็ม ทั้งภาษาไทยและภาษาอังกฤษ
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Author Guidelines

Manuscript Types

1. *Special Article*
These articles are invited by Editor-in-Chief, written in Thai or English, and structured as follows: Introduction, Main text, Conclusion and References
2. *Original Article*
Original article reveals the research results regarding health sciences and alternative medicines.
3. *Review Article*
Review article aggregates acknowledge from the journals or books.
4. *Short Report*
Short report may be a preliminary study, short communication, case report or new emerging diseases.
5. *Letter to the editor*
This is for a communication between scholars or readers to the authors who published their papers in this journal.

Manuscript Preparation

All contents of the manuscript should not be presented the author's information due to blind review process. The topics are written in the manuscript as following:

1. *Title*
Thai language manuscript should provide both Thai and English concise title. Each language should not exceed 50 letters
2. *Abstract*
Thai language manuscript should provide both Thai and English abstract which includes introduction, methodology, results and conclusion. It should be written concisely (each language should not exceed 300 words)
3. *Keywords*
Thai language manuscript should provide both Thai and English keywords. Each

language does not exceed 5 words, are put at the end of the abstract for the reason of doing subject index. Key words should be in Medical Subject Headings (MeSH) terms of U.S National Library of Medicine.

4. *Body Text*
Includes Introduction, Methodology which should detail materials or participants, ethical approval, clinical trial registration number (if any), methods, and statistical and data analysis, results, review contents, discussion and criticism, conclusion, acknowledgements (if any) and references. Total length of the body from abstract to conclusion does not exceed 4,000 words for original and review article and do not exceed 2,000 words for others

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A cover letter must accompany with the manuscript, and it must contain the following elements. Please provide these elements in the order listed as

- Title (Thai /English)
- Name of the corresponding author, affiliation, address, telephone number, fax number and E-mail address
- Names of all other co-authors and affiliation

Manuscript file format

We request to submit manuscript in Microsoft Word format (.DOC or .DOCX). If you are using another word processor, please save final version of the manuscript (using 'Save As' option of the file menu) as a Word document. In this case please double check that the saved file can be opened in Microsoft

Word. We cannot accept Acrobat (.PDF) or any other text files.

Font Styles

Before submission the new manuscript authors should consider the following general rules for preparation of the manuscript. Please read these instructions carefully and follow the guidelines strictly.

- Manuscripts must be typed on A4 (210 × 297 mm) paper, double-spaced throughout and with ample margins of at least 2.5 cm. All pages must be numbered consecutively. Starting with the title page as page 1, is to be arranged in the following order: abstract, brief introduction, materials and methods, results, discussion, acknowledgements and references.
- Fonts: Thai manuscript uses “Angsana New” 16-point size, English manuscript uses “Times or Times New Roman” 12-point size only (other sizes as specified), and Symbol font for mathematical symbols (in the text and in the figures).
- Justification should be set to full (or left only, if preferred). Do not underline: Use italics, bold or bold italics instead and line spacing should be set at 2 (Double).

Tables, figures & illustrations

- Tables figures & illustrations are numbered independently, in the sequence in which you refer to them in the text, starting with Figure 1 or Table 1. If you change the presentation sequence of the figures and tables in revision, you must renumber them to reflect the new sequence.
- Each Tables, figures & illustrations included in the paper must be referred to from the text.

- Each Tables, figures & illustrations should be presented on a separate page of the manuscript. It should be numbered separately, in the sequence that they are mentioned in the text, with a brief and self-explanatory title.
- Tables, figures & illustrations must be in sharp and high resolution. Figures & illustrations should be saved in a neutral data format such as JPEG.

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The list of references appears at the end of your work and gives the full details of everything that you have used, according to same chronological order as cited in the text. Must be follow “Vancouver Style” by number all references, arrange your list in the order in which the references appear in your text. If there are more than 3 authors, list the first 3 authors followed by “et al.”. If the paper the authors cited is queued for publication and not provided issue and pages, the identification of “In press” or Digital Object Identifier (DOI) should be written. Journal’s name should be abbreviated (If available) based on U.S Nation Library of Medicine or website. Thesis is not acceptable.

คำแนะนำสำหรับผู้เขียน

ประเภทของต้นฉบับ

1. บทความพิเศษ

บทความที่ได้รับการเชิญจากบรรณาธิการ และเขียนเป็นภาษาไทยหรือภาษาอังกฤษ ซึ่งประกอบด้วยโครงสร้างดังต่อไปนี้ บทนำ ข้อความหลัก ข้อสรุป และการอ้างอิง

2. บทความต้นฉบับ

บทความต้นฉบับเป็นบทความเพื่อเผยแพร่ผลการวิจัยเกี่ยวกับวิทยาศาสตร์สุขภาพ และการแพทย์ทางเลือก

3. บทความวิจารณ์

บทความที่เป็นการรวมบทความจากวารสารหรือหนังสือ

4. รายงานฉบับย่อ

รายงานฉบับย่อ เป็นรายงานการศึกษาเบื้องต้น การสื่อสารอย่างสั้นรายงานผู้ป่วย หรือโรคอุบัติใหม่

5. จดหมายถึงบรรณาธิการ

เป็นการสื่อสารระหว่างนักวิชาการ หรือผู้อ่านไปยังผู้เขียนที่ได้รับการตีพิมพ์เอกสารในวารสารฉบับนี้

การเตรียมบทความต้นฉบับ

เนื้อหาทั้งหมดของต้นฉบับไม่ควรเปิดเผยข้อมูลของผู้เขียน เนื่องจากกระบวนการตรวจสอบบทความจากผู้ทรงคุณวุฒิ โดยผู้พิจารณาไม่ทราบชื่อผู้แต่ง และผู้แต่งไม่ทราบชื่อผู้พิจารณา ตามหัวข้อดังต่อไปนี้

1. ชื่อเรื่อง

ต้นฉบับภาษาไทยควรมีทั้งชื่อภาษาไทย และภาษาอังกฤษที่กระชับ ซึ่งความยาวในแต่ละภาษาไม่ควรเกิน 50 ตัวอักษร

2. บทคัดย่อ

บทความภาษาไทยควรมีบทคัดย่อทั้งภาษาไทย และภาษาอังกฤษ บทคัดย่อควรรวมถึงการแนะนำวิธีการ

ผลและการสรุป ซึ่งควรเขียนให้กระชับ (แต่ละภาษาความยาวไม่ควรเกิน 300 คำ)

3. คำสำคัญ

ต้นฉบับภาษาไทยควรมีคำสำคัญทั้งภาษาไทย และภาษาอังกฤษ ซึ่งแต่ละภาษามีความยาวไม่เกิน 5 คำ วางท้ายบทคัดย่อ เพื่อการจัดทำดัชนี คำสำคัญควรอยู่ในข้อกำหนดหัวข้อเรื่องหัวข้อเรื่องการแพทย์ (MeSH) ของหอสมุดแพทย์แห่งชาติของสหรัฐอเมริกา

4. เนื้อความ

เป็นการเขียนรวมการแนะนำวิธีการซึ่งควรมีรายละเอียดของอุปกรณ์ หรือผู้เข้าร่วมการวิจัยที่ผ่านการอนุมัติทางจริยธรรม พร้อมระบุหมายเลขจริยธรรมการวิจัยทางคลินิก (ถ้ามี) วิธีการ การวิเคราะห์ทางสถิติ ข้อมูลผลการทดลอง การอภิปราย และการวิพากษ์วิจารณ์ ซึ่งความยาวรวมของเนื้อหาจากบทคัดย่อถึงข้อสรุปไม่ควรเกิน 4,000 คำ สำหรับบทความต้นฉบับ และบทความวิจารณ์ และไม่ควรเกิน 2,000 คำ สำหรับต้นฉบับบทความประเภทอื่น ๆ

จดหมายนำ

จดหมายนำจะต้องมาพร้อมกับต้นฉบับบทความ และจะต้องมีองค์ประกอบต่อไปนี้ตามลำดับที่ระบุไว้ ดังนี้

- ชื่อเรื่อง (ไทย / อังกฤษ)
- ชื่อของผู้เขียนบทความหลัก สังกัด ที่อยู่ เบอร์โทรศัพท์ เบอร์โทรสาร และอีเมลล์ ที่ใช้ในการติดต่อประสานงาน
- ชื่อและสังกัดของผู้เขียนร่วม ทั้งหมด

รูปแบบบทความต้นฉบับ

บทความต้นฉบับจัดเตรียมโดยใช้โปรแกรม Microsoft Word (.DOC หรือ .DOCX) หากคุณใช้โปรแกรมอื่นในการจัดเตรียมโปรดบันทึกเวอร์ชันสุดท้ายของต้นฉบับ

(ใช้คำสั่ง 'Save As' ในเมนูไฟล์) ให้อยู่ในรูปแบบของเอกสารจากโปรแกรม Microsoft Word. ในกรณีนี้โปรดตรวจสอบอีกครั้งว่าไฟล์ที่บันทึกสามารถเปิดได้ในโปรแกรม Microsoft Word เราไม่สามารถรับไฟล์จาก Acrobat (.PDF) หรือไฟล์ข้อความจากโปรแกรมอื่น ๆ

รูปแบบตัวอักษร

ก่อนนำส่งบทความใหม่ ผู้แต่งควรพิจารณาข้อกำหนดทั่วไปดังต่อไปนี้สำหรับการจัดเตรียมต้นฉบับกรุณาอ่านคำแนะนำเหล่านี้อย่างละเอียด และปฏิบัติตามแนวทางอย่างเคร่งครัด

- ต้นฉบับต้องพิมพ์ลงบนกระดาษขนาด A4 (210 × 297 มม.) เว้นระยะสองบรรทัดตลอดหน้ากระดาษ และมีระยะห่างขอบกระดาษที่เพียงพออย่างน้อย 2.5 ซม. หน้าทั้งหมดจะต้องมีหมายเลขติดต่อกัน เริ่มต้นด้วยหน้าชื่อเรื่องเป็น p.1 ข้อความที่ขึ้นต้นเป็น p.2 ซึ่งเนื้อความจะถูกจัดเรียงตามลำดับต่อไปนี้: บทคัดย่อ บทนำอย่างสั้น วัสดุและวิธีการ ผลการศึกษา วิพากษ์ ผลการศึกษา หน่วยงานสนับสนุน และเอกสารอ้างอิง
- แบบอักษร: ต้นฉบับภาษาไทยใช้ Angsana New - ขนาด 16 พอยต์ ต้นฉบับภาษาอังกฤษใช้ขนาด 12 พอยต์ Times New Roman เท่านั้น อักษรทางคณิตศาสตร์ให้ใช้ข้อความสัญลักษณ์ (ในข้อความและในรูป) จัดเอกสารให้ชิดขอบ ใช้ตัวอักษรรูปแบบตัวเอียง ตัวหนา หรือตัวหนา และเอียง แทนการขีดเส้นใต้ ระยะห่างบรรทัดควรตั้งไว้ที่ 2 บรรทัด

ตาราง รูป และภาพประกอบ

- ตาราง รูป และภาพประกอบ ต้องมีการระบุหมายเลขตามลำดับที่ถูกระบุอ้างอิงในบทความ เริ่มต้นด้วย รูปที่ 1 และตารางที่ 1 หากการแก้ไขได้มีการเปลี่ยนลำดับของตัวเลขหรือตาราง ผู้เขียนต้องระบุหมายเลขลำดับใหม่

แต่ละตาราง รูป และภาพประกอบที่ปรากฏอยู่ในบทความจะต้องได้รับการอ้างอิงถึงในเนื้อความ

- ตาราง รูป และภาพประกอบ ต้องนำเสนอในหน้ากระดาษที่แยกออกจากเนื้อความของบทความต้นฉบับ และควรจะมีหมายเลขตามลำดับที่ถูกระบุอ้างอิงในบทความ และมีการระบุชื่อสั้นๆ ที่สามารถอธิบายถึง ตาราง รูป และภาพประกอบนั้น
- ตาราง รูป และภาพประกอบ ต้องมีความคมชัดและความละเอียดสูง ควรบันทึกรูป และภาพประกอบ ในรูปแบบข้อมูลภาพที่เป็นกลาง เช่น .JPEG

เอกสารอ้างอิง

รายการข้อมูลอ้างอิงใส่ตอนท้ายของบทความ และให้ระบุรายละเอียดทุกอย่าง ตามรูปแบบ แวนคูเวอร์ ต้องมีการระบุหมายเลขการอ้างอิงทั้งหมด จัดเรียงรายการตามลำดับการอ้างอิงในบทความ หากมีผู้เขียนมากกว่า 3 คนให้เขียนชื่อผู้เขียน 3 คนแรกแล้วตามด้วย “ et al.” หากบทความที่เขียนอ้างอิงนั้นอยู่ระหว่างรอการตีพิมพ์ และไม่มีเลขหน้าของเอกสารควรระบุ “ In press” หรือ Digital Object Identifier (DOI) ชื่อวารสารควรเป็นตัวย่อ (ถ้ามี) ตามห้องสมุดการแพทย์แห่งชาติของสหรัฐอเมริกาหรือเว็บไซต์ วิทยานิพนธ์ไม่สามารถนำมาใช้ในการเป็นเอกสารอ้างอิงได้

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การส่งต้นฉบับและคำแนะนำสำหรับกระบวนการประเมินบทความ

1. การลงทะเบียน

ผู้เขียนที่ต้องการส่งบทความมายังวารสารฯ จะต้องลงทะเบียนบัญชีในวารสารวิทยาศาสตร์สุขภาพ และการแพทย์ทางเลือกเพื่อเริ่มการส่งต้นฉบับออนไลน์ URL: www.tci-thaijo.org หรือสแกน QR Code



2. กระบวนการประเมินบทความ

วารสารฯมีการประเมินคุณภาพแบบปกปิดรายชื่อทั้งผู้ประเมินและผู้เขียนบทความ (Double-blind review) โดยหลังการส่งบทความต้นฉบับ เจ้าหน้าที่ของวารสารจะดำเนินการตรวจสอบในขั้นต้น ต้นฉบับภาษาอื่น ๆ นอกเหนือจากภาษาอังกฤษ และภาษาไทย ต้นฉบับที่การจัดรูปแบบไม่ถูกต้อง จะถูกส่งกลับไปยังผู้แต่งเพื่อดำเนินการแก้ไขก่อนที่จะส่งต่อไปยังกองบรรณาธิการ

ผู้ทรงคุณวุฒิในสาขาวิชาที่มีความเกี่ยวข้อง และเชี่ยวชาญ กับบทความต้นฉบับอย่างน้อย 2 คน ได้รับการคัดเลือกอย่างรอบคอบ โดยบรรณาธิการส่วน เพื่อพิจารณาบทความในการตีพิมพ์ วารสารฯ ได้หลีกเลี่ยงการเลือกเฉพาะผู้ทรงคุณวุฒิภายในเท่านั้น บทความต้นฉบับที่ได้ผ่านการยอมรับจากผู้ทรงคุณวุฒิอยู่ภายใต้การพิจารณาของบรรณาธิการส่วน และบรรณาธิการ

การตอบรับบทความ หรือการปฏิเสธการตรวจสอบบทความโดยผู้ทรงคุณวุฒิให้อยู่ภายใต้การพิจารณาของบรรณาธิการเท่านั้น

3. การตรวจสอบแก้ไขบทความขั้นสุดท้าย

ปฏิบัติตามแนวทางต่อไปนี้เพื่อตรวจสอบบทความขั้นสุดท้าย

- ทำเครื่องหมายการแก้ไขของคุณด้วยหมึกสีแดง โดยตรงในบทความ ตรวจสอบให้แน่ใจว่าการแก้ไขของคุณชัดเจน และเข้าใจง่าย
- ตรวจสอบทุกหน้า ทุกรายการในบทความ ตรวจสอบชื่อเรื่องรายการตัวย่อ และเอกสารประกอบ
- ตรวจสอบข้อมูลในตารางกับข้อมูลในตารางต้นฉบับเดิมของคุณ
- ตรวจสอบสมการ กับสมการต้นฉบับเดิมของคุณ ตรวจสอบให้แน่ใจว่าอักขระพิเศษ ไม่หายไป
- ตรวจสอบให้แน่ใจว่ารูป หรือภาพประกอบนั้นมีความชัดเจน สามารถอ่านได้ รวมถึงข้อความขนาดเล็ก

ขั้นตอนต่อไปในกระบวนการตีพิมพ์ คือส่งหลักฐานการตรวจสอบขั้นสุดท้าย ทำตามขั้นตอนต่อไปนีเพื่อเตรียมการแก้ไขบทความขั้นสุดท้าย

- สแกนบทความ โดยเฉพาะหน้าที่ถูกทำเครื่องหมายด้วยการแก้ไข
- บันทึกแต่ละหน้าที่สแกนในรูปแบบ PDF หรือ JPG
- ส่ง หน้าสแกนทั้งหมดผ่านระบบออนไลน์ หรืออีเมล: hsresearch2017@mfu.ac.th

กรุณาส่งบทความต้นฉบับที่ผ่านการตรวจสอบขั้นสุดท้าย ภายใน 72 ชั่วโมง หลังจากการรับแจ้งแก้ไข การส่งบทความต้นฉบับคืนล่าช้า อาจหมายถึงการเลื่อนระยะเวลาการตีพิมพ์ออกไป

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Public Health in the Digital Era: An Overlooked Public Health Issue

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ABSTRACT

Public health in the digital era is a significant aspect and important challenge for all public health professionals. Public health innovation, technology, and information are accelerating the advanced technique to improve the understanding of social, economic and political determinants of health; and these technologies are used for a population's health improvement. Today, several modified/improved technologies are used to support public health professionals to achieve the availability, affordability, inter-activity, accessibility and portability of access to health care systems of a population. Therefore, in digital 4.0 era, we as public health professionals need to improve our perspective and skill to use these advanced and suitable technologies to support our missions to maximize population health utilization and benefit.

Summary

The "Digital Era" is characterized by the development of information and communication technology with the increases in speed and breadth of "knowledge turn over" within the society [1]. In the system we live, sustainability of gains from our development efforts rely very much on knowledge turnover. Faster knowledge turnover is advantageous, as new knowledge is more frequently produced and added, allowing for organizations to timely adapt to the changing surrounding environment.

The social implications of the development in digital era are huge and will increase as the advances in technological functionality become more "knowledge-based" [2]. Understanding the digital era in terms of its evolution will help ensure the balance and sustainability between socio-cultural and economic developments. Which positively impact on advancement in the development and innovation of holistic interventions in public health. In public health work, information systems are indeed vital, they help public health practitioners collect, store and use data that drive the outcomes of such interventions. For years before and during the "digital era", public health agencies have faced daunting challenges in managing information systems to ensure effective support to public health work.

The growing demand for enhanced electronic exchange of data for information use creates a compelling need for concerned agencies to critically assess their key information needs and management

capabilities, and they proceeded to developing a toolkit for improvement of public health information systems. That is the start of "public health informatics", it is the systematic application of information and computer science and technology to public health practice, research, and learning [3]. The informatics is intended to help identify the specific requirements needed for current information systems to better support public health functions. These functions include, among other things, the broad areas of epidemiological investigation and surveillance, disease prevention and control, emergency preparedness and response, health promotion and health maintenance.

Public health informatics and related population informatics together work coordinately on several issues of information and communication technology from the perspective of health of the entire population or health of groups of individuals in community. Informatics is an applied information science that designs the blueprints for the complex data systems that keep specific information available, secure, usable and responsive to the users' needs [3].

Various stages of development in the digital era, which come along with the development of informatics, have greatly advanced the information management and use in public health work. These stages are from the development of Internet connection and website, through the use of social media and social network, as well as data application on smartphone. These developments have also contributed greatly to the

ways people taking actions on the care of their own health.

A range of digitized health promotion practices have emerged during the digital era. Some of these practices are voluntarily undertaken by people themselves who are interested in improving their own health and well beings, with particular attention to problem interventions [4]. But, some other practices in digitized health promotion are employed in the interest of agencies to render specific services in areas of health improvement and health maintenance. It should also be aware that many digitized health promotion strategies focus on individual responsibility for health, but fail to recognize adequately the psychosocial, cultural and political implications of their use.

At the same time, there is increasing blurring (no clear demarcation line) between voluntary health promotion practices, professional health promotion, government and corporate strategies for health promotion. These areas of haziness require our due attention and acknowledgement of its implications in their implementations. There is also increasing influence of digital media corporations over digital technologies and the data they generate, which may not be developed with adequate transparency and fairness. These issues provoke questions for health promotion in general, which is a practice, as well as health promotion as a field of research and development, that hitherto have been little addressed in information system development.

The advent and appearance of the internet technology did lay down foundations for the new information revolution in the digital era [5]. It is the rise of the smartphone that really revolutionized electronic communication toward exponential increase in the use of internet technology. According to a report of “We are Social Media and Hot Suite”, over half of the world’s population owns a smartphone. And about 1% of all the searches done on smartphone or Google are health related. While this 1% even represents a huge figure of millions of searches. This means that people are more and more inclined toward educating themselves on health matters, or at least they search online for different solutions for their health.

Nowadays, we have to recognize that everything or most of things in the area of information and communication is affected by the digital progress and revolution. The opportunities for “interdisciplinary digital health research and development” bring computer science to dramatically improve health and well beings of individuals and population through various means of public health intervention [5].

The recent technological breakthroughs made it possible by creation of real-time big data streams, social media, participatory and context-awareness systems, as well as infectious disease modelling are the focus of public health information management [6]. These technological advances are also addressing acute information needs of natural and manmade disasters to

leverage opportunities for improving the development of community resilience, early warning and response to the emergency situations. Technologies developed in the digital era are allowing us to be more connected, and with greater access than ever before to data and information as needed. And we may be able to say that mobile phones have now become the most widely adopted communication technology in human history.

The digital public health, and in particular, mobile health—the use of electronic mobile communication and devices for achieving public health outcomes—is now at a tipping point [6]. Mobile communication has some unique assets—not least—availability, affordability, inter-activity, accessibility and portability. These assets open up new possibilities for supporting people to protect and improve their health more efficiently and cost-effectively. New technological developments and advancements affect almost every aspect of our daily life, including in the areas of healthcare-promotive, preventive and curative [7].

However, successful adoption and sustainable integration of e-Health and Telemedicine in public health strategies depend a lot on the relevant knowledge; and the constant assessment of consumer’s needs, proficiencies, and preferences. Technologies known as “Health apps”, has a great potential to improve individual and community health as said; and importantly, the Health apps contribute efficiently and cost-effectively to the prevention of lifestyle diseases, most of them are chronic and non-communicable [8]. Therefore, these technologies really build an important pillar of public health strategies and approaches, which take into account the “Social, Economics and Political Determinants of Health”. Healthcare providers could take advantage of consumer-oriented health apps to assess individual needs of specific target groups, such as elderly people.

With the accelerated development of health technologies over the past decade, both patients and care providers have entered a particular period, in which much of our information is stored, processed, transmitted and utilized digitally [9]. We have become more and more dependent on digital technology to access and receive care, in health or otherwise; and the providers of healthcare rely on it to diagnose and deliver treatment services to people. This rapid progress in the development of communication technology has gone beyond the confines of hospitals and clinics, and the progress has moved health technology into the patients’ hands and homes. With this trend of contacting points, which has turned “digital”, we are able to communicate and access health information from the comfort of our living room.

With modern health technologies, we carry devices on our bodies to monitor and mitigate our medical conditions at any time, any place. or we bring our smartphones to track and share our workouts, and collect our vital signs as part of our daily routines. There are mobile apps that help us monitor our sleep, manage

our stress, calculate our insulin doses, and remind us to take our medications.

However, at another angle, a manufacturer's rush to market, or their lack of adequate concern about the possible risks of those devices on security and privacy; such risks have often become an afterthought. And the users of those technologies have become at risks, or the victims of development. We must be fully aware and play important roles in protecting the confidentiality of our digital health footprints, to ensure that technologies are used to our benefit and cannot be used against us. This is in the same way as we protect our personal and financial information.

Some of the best features in today's health technologies are their "ease of use" and "portability", which in so many cases require the internet connection and a Smartphone to enable them. With these advantages mobile phones and applications have increasingly become some of the favorite targets of "hackers" who can steal our personal information for illegal use, because a smartphone is a mini-computer with superpowers. It has a Microphone, a Camera, a GPS, and Antenna to connect from anywhere. And most importantly, it contains so much of your personal information, including telephone numbers, addresses, e-mails, photos, contact and access to your bank accounts and credit cards, and so on. This is a dangerous combination, if not secured properly [10].

With health and wellness technologies, we as users have a great responsibility for what we choose to use, and where we deposit and share our personal and health information. These technologies may hold and transmit our information in the wrong hands that could potentially be used to harm us in many ways. We are now very much in the period of technology applications and big data management, whereby social media and social network play the key role to facilitate the ease of such applications.

In the digital era, as we are also aware that we are entering the "Digital 4.0". We are attempting to do our work through the use of "machine to machine", reducing human role in the process, by increasing the use of "Artificial Intelligent (AI)", developing "tools or machine with brain" to replace human labor in the workforce [8]. Machines with intelligence or brain will communicate and work together automatically without operational control from man. However, in this regard "human intellectual potentials" will have to increase to ensure that man can think beyond the current limit of their abilities toward the creation of more "new things", and ability to control them. Development of machine with brain is with the purpose to change routine service to higher value service, to change SME to Smart Enterprise; and to focus more attention of organizations or enterprises to consumers' needs and requirements as the main target of their services [11].

Now, there is a lot of research work for the development and application of AI and machine with

Brain. Indeed, it is a very challenging development at this point in the digital era. We already have heard about the use of many AI applications in the medical field, especially in the curative area. However, we are yet to hear more about the applications of AI in public health field, that is in the broad areas of health promotion, health protection and health maintenance. Whatever and however, we must always keep in mind in this regards that AI and machine with brain are made by man, and man must be able to handle them effectively for the benefit of mankind. This is with the condition that man in future must have excellent health with superior brain and superior intelligence to ensure their superpower over AI and machine with brain or robot in the future.

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Bronfenbrenner's Ecological Model: Theoretical Lens for a Community-based Research

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ABSTRACT

A community-based research is used for addressing a complex situation in a community. It focuses on a people as a central of the development and also concerns all surrounding factors to move forward to achieve a better life of a person and a community as its ultimate goal. Bronfenbrenner's model has been developed to improve the research method conducting in a community. The model involves person, process, context, and time to make change of a person by interaction with people and other environment in certain community. The model is used as a major of research method to improve community health today.

Keywords

Community-based research, Bronfenbrenner's model, Ecological model, Development, Community

Introduction

A community-based research is a crucial approach for managing a complex situation in a community. It can bring a change to better meet the needs of community members. Community-based research requires a strongly concept on three (3) c; conducted by, conduct with, and conduct for a community [1]. The ultimate goal of a community-based research is to improve the quality of life of people who are living in a community. This approach focuses on the power of the relationships among the community members, therefore, it can improve equality in all aspects of a community.

Commonly, a community-based research approach is based on two techniques; participation and action-oriented research [2]. To achieve these goals, a research needs to be done as "a community-based" not "a community-placed" [3]. This means conducting a research with a community, not merely, locating it in a community setting. A community-based research, therefore, needs to provide steps of its procedure; develop a framework to explore situation, engaging participants, establishing collaborative relationship, and building a community strengths to improve all determinant relate to health including social situation which related to health [4, 5]. Thus, an appropriate framework to explore the whole situation of a community, and also to focus on specific issues such as

the interactions between different people or different settings are required.

Ecological model: The theoretical lens for community-based research

Bronfenbrenner's ecological model is a suitable framework to get a better understanding of a community phenomena, and used for effective intervention development to solve a specific health issue in a community. In this paper, it begins with a broad definition an ecological model, and then follow with specific details of Bronfenbrenner's work with a particular reference to its application.

Ecological model

A community-based care is constructed its focus from individuals level to the complex interactions between individual and others within a society. Ecological model, or ecological perspective provides an effective frameworks that allow a researcher to identify the complex phenomenon and create the interventions to address a problem. Several ecological models were developed based on the Bronfenbrenner's ecological model [6-8]. Bronfenbrenner's ecological model [9] provides a concrete conceptual framework to explore environmental factors influence on human health development, and is recognized as a tool to support the understanding of a complex phenomenon by

considering all relevant aspects under a certain surrounding system [10, 11].

The last step of the development of Bronfenbrenner's model define the first concept; dynamic processes or interactions, as proximal processes, which are those interactions occurring between a person and other under certain circumstance. The second concept was an over-arching consideration of the biological, psychological, and behavioral characteristics shaping an individual [12]. Finally, Bronfenbrenner integrated the concepts of ecological environments, time, processes and characteristics into the model described as a "Process-Person-Context-Time (PPCT) Model" or "Bio-ecological Model" [13] or "Bio-ecological Model of Human Development" [14]. However, this paper uses the term Bronfenbrenner's ecological model or more simply "the Model" throughout this paper.

Components of Bronfenbrenner's Ecological Model

This model is used to explain how a person's development can be changed overtime with in certain environments. It defines a person at the center of the system. All the processes will be considered as a supporter in the specific contexts. Time is a major driving factor of the change.

Person

A person is centered in the Bronfenbrenner's model that can shape his/her development by his/her capacity to direct and impact the interactions within his/her environment. Each person consisted of four defined properties. First, it is "disposition" which is the behavior that can set and sustain the interactions between the individual and other people and their environments. Second, it is termed "bio-ecological resources" which refers to a person's ability, experience, knowledge, and skills. These are essential characteristics to sustain environmental interactions. Third, "demand characteristics", refers to a person's capacity to discourage reactions with the social environment [15]. Finally, a person's demographic characteristics (such as age, gender, and ethnicity) [16].

Process

The term "process" refers to the interactions over time between the person, the center of the model and the environment. The most influential of these interactions are called "proximal processes" which are seen as the primary mechanisms for an individual's development [16]. The power of proximal processes varies and depends on the characteristics of the developing person, their environmental context, and the time periods over which such processes take place [15]. In child development, proximal processes include parent-child and child-child activities or group learning of new skills [13].

Context

Context is an important part of Bronfenbrenner's model [15]. It refers to the environment in which the person is located. Bronfenbrenner describes the ecological environment as "nested systems" which is known as—micro-system, meso-system, exo-, and macro-system [15]. The events in each ecological level of the environmental context are potent in their effect on a person's development. The context can also both directly and indirectly determine proximal processes and development outcomes. Just as the characteristics of the central person are more influential than the characteristics of persons in surrounding [16]. The nested environments are described from the innermost level to the outermost level.

Time

The time in Bronfenbrenner's model allows the explanation for changes or consistencies that occur over the time change. Change is not just related to the characteristics of a person but also incorporate the environmental context where individual lives. This also includes the change in family structure over the life course, the change in socioeconomic status, or the change in employment. Transitions can be anticipated as a part of the normative life course (e.g., school entry, marriage, or retirement) or can occur outside the life course which is unplanned or unanticipated (e.g., divorce, death, sudden illness, or acquired disabilities). Both anticipated and unanticipated life events can serve as an impetus for the development of a change or adaptation of a person [17].

Human development outcomes

The term "development" refers to the set of change throughout personal characteristics, and in the social relationships through proximal processes [18]. Developmentally effective proximal processes refer to these influences as bi-directions [14].

Applications of the Bronfenbrenner's Ecological Model

Many studies used the Bronfenbrenner's ecological model to explore and describe a particular phenomena including the study of Washington [19], which described the complex issues surrounding caregivers of a child with a disability. The researchers pointed the caregiver at the center of the model. Several factors and their environmental contexts across all systems affected the caregiver's roles.

Another study, a community-based action research approach [6] which was conducted by using Bronfenbrenner's ecological model as a framework to develop caregiver support to prevent and manage health problems for caregivers of adults with a physical disability reflected that this model was a valuable theoretical framework to describe the complexity of the phenomenon of family caregiving for adults with a

physical disability and to guide the development of an appropriate strategy for caregivers. The model was a key to understanding the complexity and clarifying multi-system levels of the ecological environment. It was used to organize the research activities to ensure that appropriate data were collected. The environments surrounding adults with a physical disability were conceptualized in terms of who, and what they were doing. Understanding the importance of the interactions between caregivers and others helped researcher to investigate the existing supports for family caregivers in the context of community-based care and assess their impact. The key components underpinning of the model "Person-Process-Context-Time" [15], helped researcher to understand how the relationships between different aspects of the environment influenced caregiver health. The use of Bronfenbrenner's ecological model [15] was also beneficial in directing the development of the family caregiver support and determining the types of outcomes. Other researchers have presented their success in use this model particularly in gaining insight into and understanding complex situations. It assisted researchers to conceptualize their research design, and helped to identify the developmental outcomes that might be targeted [20].

Conclusion

The Bronfenbrenner's ecological model demonstrated its use in exploring complex situations, using as the basis for planning and developing an appropriate intervention for action in a community based research with several aspects; 1) creating a simple structure for research activities attempting to describe the complex phenomena based on the four environmental contexts (micro-, meso-, exo-, and macro-systems); 2) providing a useful tool for researchers by introducing a broader picture of a health system and showing how associated policies and health interventions interact; 3) contributing the conceptualization of research agenda for developing the strategies in response to the explored situation within and across different levels of environmental systems affecting individuals, families, and communities; 4) using diverse social support networks to develop people and environment in the community based care. As mentioned above, it suggested that the strength of the Bronfenbrenner's ecological model may be an appropriate theoretical lens for guiding a community-based research in order to enhance people's quality of life.

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Adaptation to Thai Citizenship: A Case Study of Thai-Chinese Yunnan, Mae Fah Laung District, Chiang Rai, Thailand

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ABSTRACT

Introduction: Chinese Yunnan migrated into Thailand through Myanmar for different reasons, and have settled in mountainous areas in northern Thailand especially Mae Fah Luang District, Chiang Rai Province, Thailand. **Objective:** The study aimed to understand the development and adaptation to the new environment and obtaining Thai citizenship among the Chinese Yunnan. **Methods:** A validated question guideline was used for gathering the information and an in-depth interview was done with 24 key informants including male and female of different age categories. **Results:** We found that after passing through the 3rd generation, Chinese Yunnan have become Thai-Chinese Yunnan completely, integrated aspects of Thai culture, education, politics, trade and enjoy the same rights as Thai people. Currently, they feel themselves Thai and proud of to be Thai. However, most of Thai-Chinese Yunnan still maintain some Chinese identity through local language, local food, traditional and cultural patterns. **Conclusions:** After passing for years, the Thai-Chinese Yunnan are completely become Thai but still maintain their cultures and some life styles.

Keywords

Chinese-Yunnan, Adaptation, Citizenship, Culture

Introduction

In 2017, Thailand has approximately 66 million people [1] living in different regions. There are differences in race, religion and culture because different ethnic groups existed on their own prior to the formation of Thailand and ever since, more ethnic groups have moved and settled in Thailand for several reasons [2, 3]. These differences have not engendered conflicts in the Thai society but rather developed to be the new beautiful Thai identity. This really reflects Thai community nowadays.

The difference in identity or characteristics or lifestyle according to regions has its own history. These integrated characteristics are presented in terms of culture, language and life style. Transportation and trade are significant tools that stimulate the interaction among the members. Interaction exists in other activities such as tourism, education, politics and it is the origin of social integration and beauty of Thailand.

The development of identity of northern region of Thailand has passed and cumulated through long and various history including social war, immigration,

belief, motivation, unique geography, and characters of ethnic populations [4]. There are several ethnic groups living in this area; Akha, Lahu, Hmong, Yao, Karen, Lisu, and Yunnan Chinese [4, 5]. Most of them migrated from south China for different reasons and routes to Thailand. Chinese Yunnan migrated into northern Thailand due to civil war in China [6-16], and a large proportion moved to Thailand for economic and agricultural reasons.

The main routes of migration were moving from south China to northern Myanmar and moving down to northern Thailand [3]. Chinese Yunnan, Akha, Lahu, and Lisu used this route for their migration. Finally, they settled in Mae Fah Laung, Mae Sai, and Mae Suai districts, Chiang Rai province. Another group, Hmong, and Yao, moved down to Thailand through the northern part of Laos.

Chinese Yunnan are Chinese who live in south China, Yunnan province [2]. Social and political conflicts were major causes of migration. These have been already documented in several sources of information [17]. Most of the stories regarding the

migration are documented in the first and second generations of the Chinese Yunnan. The first generation is the Chinese army and the second generation is their children, some was born in China, some were born in Myanmar, while some were born in Thailand after they settled in their village. The third generation are the children of the second generation, and most of them were born in Thailand.

Mae Fah Lung is one of the districts in Chiang Rai. Hundred percent of people in Mae Fah Luang are the hill tribe people including Chinese-Yunan. There are 4 different sub-districts; Doi Tung, Mae Sa Long Nok, Mae Sa Long Nai, and Therd Thai sub-district. Almost 80,000 Thai populations are living in Mae Fah Luang district, and 40.5% are Chinese Yunnan. This study aimed to understand the adaptability of Thai-Chinese Yunnan in all generations to develop their own identity to be Thai citizens completely. The objective was also to understand the culture, economics, education, and lifestyle of Thai-Chinese Yunnan particularly in Mae Fah Luang district, Chiang Rai province, Thailand.

Methods

A qualitative method was used to gather the information by in-depth interviews among the key informants. Information regarding history, adaptation, lifestyle, education, trade and economic system, interaction with other ethnic groups, language and culture in the process of becoming Thai citizens were collected and interpreted. The ways to maintain their own culture of Chinese Yunnan in Thailand were also used for interpretation.

Twenty-four key informants were invited for interview, 12 males, 12 females. Four participants aged <25 years (two males and two females), 8 participants aged 26–40 years old (four males and four females), 8 participants aged 41–60 years old (four males and four females), and 4 participants aged >60 years old (two males and two females). All participants were selected from Thai-Chinese Yunnan 4 villages in Mae Fah Luang District, Chiang Rai Province.

Eleven-question guideline was developed and used for data collection. The questions were focused on a history of migration, steps of migration from China to Thailand, trading and economic system, educational system in a village, language and culture while adapting to Thai traditional pattern and religion, transportation, access to health care system, politics and administration system in a village, rights to access public resources and services, and attitude to Thai Royal Institution.

Questions had been tested for validation before use in the field by having comments on the quality of the content of questions from three external experts. Three selected participants were asked the questions in the pilot phase.

Prior to the interview, participants consented to have the conversations recorded. All recorded tapes were translated to text before analysis. Tapes were destroyed once the translation was completed. Steps of

data collection: village heads were contacted for their approval. Key informants were purposively selected from targeted four Chinese Yunnan villages. Five researchers were assigned to interview, two could speak Chinese, and one was a Chinese Yunnan. After passing the first round of the interview, 2 participants were contacted for second round of interview, and another were asked for the third round interview before getting saturated information.

Stages of analysis started from the first round of interview by observing participants' interaction with the researcher including their manner, followed by content analysis which was done by five researchers who had different experiences and educational backgrounds.

Results

Several factors presented below, reflect the ability of Chinese Yunan to adapt to Thai-Chinese Yunan among those living in Mae Fah Luang district.

a) Reasons for migration and settling in Thailand

There are three waves of migration to Thailand of the Chinese Yunnan. The first wave was forced by the civil war in China. The second wave was the migration of the relative of the people from the first wave. Bad weather and difficulty in trade in China caused the last wave then they had personal intension to move into the new place for settling and farming.

An 80 years old woman said "I was born in China, and moved to Myanmar at 18 years old, and at 40 years old had settled at Therd Thai sub-district, Mae Fah Luang district, Chiang Rai, Thailand. At the beginning, we had a small number of households, just a bit more than 10 families. Currently, many people here, including other tribes.

An old women gave more information;

"...most people here are the hill tribe Thai Yai, Akha, and Chinese-Yunnan".

Another woman said,

"My original family came from China, but I was born in Myanmar. I have both Thai and Myanmar ID card. I moved here, Thailand, while I was 19 years old. I heard that in Thailand, they had a better job and money. These were the reasons for moving to Thailand".

An old women said that,

"I moved to Thailand because we had a civil war in China, I moved from China to Myanmar and then moved to Thailand. In China, we had a very difficult living condition during the civil war. We could not find food. It is similar with other children, in any places they could provide food, we went there."

The woman further revealed that some families moved to Thailand under the help of Mr. Chan (Mr. Chan was known as "Khun Sa" (The king of heroin).

She said that her husband was in Mr. Chan's army. Mr. Chan supported her family a lot and provided the land that is used by her family. She has now a small coffee shop, Khun Sa Coffee Shop. Before moving into Thailand, Khun Sa fought with the army of Myanmar.

She said that after settling at Mae Fah Luang, she feels happy and safe every day. She has been settled at Mae Fah Luang almost 40 years. She speaks a little Thai but she is fluent in Thai yai.

She said,

"While I first moved to Thailand, I already got old. I have never been schooling, but I support all my 6 children to attend both Thai and Chinese schools. They all are good in Thai and Chinese communication."

An old woman added,

"When I was young, I sold SALAPAO (Chinese food). Now, I do nothing. My kids support and take care of me".

An old man said,

"I moved to Thailand long time ago by walking. At the beginning, I had it difficult because I could not speak Thai. I worked as a Chinese teacher in this village, but no longer. I also brought Chinese herbs from China to sell to the people living here."

b) Adaptability and getting Thai national identification card (ID card)

The adaptations of Chinese Yunnan in Thailand were found in several forms in different age categories. Among those aged > 60 years old, there was little adaptation or little difference with those people in China. Those aged 41-60 years know Thai culture better than those aged >60 years. Those aged >40 years old, understood and practice as general Thai people. However, those aged <25 years old, have little understanding of Chinese traditional practices and culture especially those that passed through a Thai school. However, we found that a family relationship and structure are major factors to maintain the Chinese's cultures such as cooking, chopsticks use, and religious rituals.

Those who had Thai ID card were regarded as Thai citizens. 100% of those aged < 25 years old have Thai ID card, and everyone has the right to access all public services in Thailand such as educational and health care systems, and right to vote for any politician. However, some of those aged >60 years old do not have Thai ID card as such lack the right to access or participate in public activities, except access to the health care system which is free of charge.

An old man said,

"I have no Thai ID card, but whenever I visit a doctor in a hospital, I got exception of paying a fee. I applied to get a small allowance for elderly people from the government office; they told me that I will get a right

shortly. I feel very happy. However, all my kids, they have Thai ID card."

An old man added,

"Even I have no Thai ID card but I can visit many places. I visited my old family and friends at Beijing, China many years ago."

c) Social, cultural, and traditional patterns

Most Chinese families in Mae Fah Luang have maintained Chinese tradition and culture. Many new families still follow the traditional patterns through the yearly festivals such as respect for the elderly people in their family and community, and praying for their predecessors, cracker use for religious rituals, grave cleaning and praying festival.

An old woman said,

"I am similar to other Chinese. I have to pray in several traditional celebrations. All my family members will come back in Chinese New Year festival, I know everything in Chinese traditional patterns and celebrations. However, many of my kids do not clearly understand. They are now working in big cities. They know little!"

Many of original traditional patterns and celebrations have been more and more ignored and less practiced and remembered. It is going to end when the old Chinese people pass on.

A middle aged man said,

"Many traditional patterns have long gone, some patterns are very complicated, and little kids do not like it. Most children have been sent to good schools in the city, they will come back to the village once a year and so do not understand these patterns."

Many Chinese traditional patterns have been integrated with other tribal pattern in a village. A middle aged woman said,

"I always join in praying in Buddhist temple with my friends."

d) Occupation, tourism and trade

Most Chinese Yunnan work in the trading section with their own small grocery in the village. However, many of them plant tea tree. Tea had been brought from China while moving down. All families tea visitors.

Trading food is common among the Chinese Yunnan, starting with selling noodle which is made by them. Chinese bun is famous in the villages.

A large proportion of Chinese Yunnan prefer to work in rice and corn farms. In the beginning after settling in Thailand, families used horses as a major vehicle. Currently, a car or a pickup is used for transportation.

Long time ago, a specific currency called "TAAB" was used in all trade sectors. It was kept in a

private place or buried under the ground if they had got a large amount.

Currently, Mae Fah Luang district has been promoted as one of the significant places for tourist activities. Many kinds of tea have been planted in this area and are major sources of tea exporting from Thailand.

e) Education and Educational system

Today, all new age-generations of Chinese Yunnan are educated in both Thai and Chinese school system. Chinese junior high school is available in Mae Fah Luang district, Chiang Rai province. The children from all ethnic groups who are living in this area have access to Chinese schools which is appreciated by the parents. The children attend Thai school from 8:00 am to 4:00 pm Monday to Friday, and in the evening they attend Chinese school from 5:00 pm to 8:00 pm. All infrastructures in the Chinese school were provided with support from the people from People's Republic of China and Taiwan PROC. All Chinese teachers come from People's Republic of China with the support of Chinese government. 8-10 teachers are provided as support from China each year. As for the children, the major objective of studying Chinese is to use it for their future businesses.

A young man said,

"I am now studying in the university and major in Chinese business, I am very happy!"

f) Access health system

A 30-bed Mae Fah Luang hospital and more than 5 health promoting hospitals are available for people in the villages. Accessing health care system is very much better than previous days. It is highly convenient and easy access to health care services free of charge.

In early days, untrained Chinese doctor provided care for people in these areas. Nobody knew about the doctor, but they had no choice. These days people prefer to get care and treatment from Thai health system.

A middle-age woman said,

"I was diagnosed with hypertension, and have to meet a doctor every month. However, I do not pay for care and treatment."

g) Rights and participation in politics

Chinese Yunnan have equal rights in all public services including politics. They participate freely from village to national levels. Chinese Yunnan also have the right to use land for any purpose.

An old man said,

"Even I have no Thai ID card, I have the right to buy land for farming, but you know many years ago, we do not need to buy land but you can occupy land freely".

All Chinese Yunnan have the right to participate in politics from the local or village to the national levels.

A woman said,

"I voted my favorite person while we had election."

However, a middle-age woman said,

"I have no Thai ID card. I married a Thai person, and all two kids of mine have Thai ID card. They have full rights to access educational system; the first one had already graduated with a university degree."

h) Perception to Thai citizen and loyalty in Thai Royal Institution

Mae Fah Luang district is located in the most remote areas in Thailand. Therefore, many projects under the support Thai Royal Family particularly from King Bhumibol Adulyadej Rama 9 and from Somdet Phra Srinagarindra Boromarajajonnani or Somdet Ya have been introduced for improving health, economic and wellbeing for people living in these areas.

The Chinese Yunnan present their loyalty to Thai Royal Family through many occasions. While anyone from the Thai Royal Family visits these areas, many people present to their beloved king and family.

An old man said,

"I was so sad when I heard the news of passing away of our beloved king last year. I went to Bangkok to pray for our beloved king earlier this year with many people from our villages and many people from villages nearby".

An old man added,

"I was supported with a big land from the king when I arrived in Thailand. We love him very much."

Discussion

Chinese-Yunnan people in Thailand moved down from south China and settled in northern Thailand along the border areas. After three generations, they completely adapted to Thai society and obtained Thai citizenship. They become Thai citizens both physically and otherwise.

Most Thai-Chinese Yunnan have been certified Thai citizen but there remain a few who do not have Thai identification card. Thai Act "Certifying for Thai Citizenship" No.10 states that those who were originally born outside Thailand and those who are holding Chinese citizenship will not be granted Thai citizenship [19].

Due to living in remote areas in Thailand, access to public services including educational and health care systems are still difficult. Apidechkul, et al. [20] reported that many hill tribe people including Thai-Chinese Yunnan faced a difficulty in access to health care system. They are also facing many health problems including some serious diseases such as tuberculosis

(TB), and HIV/AIDS [21, 22]. Moreover, major non-communicable diseases are also acting as causes of morbidity and mortality in these population currently [23].

Conclusion

Thai-Chinese Yunnan at Mae Fah Laung district, Chiang Rai province, Thailand have a great adaptability to be Thai citizen completely after 3 generations. Nowadays, everyone has equal access to all public resources including health care service, participating in political activities, and freedom in choosing their job. However, they still maintain their own culture, traditional patterns, and language throughout the family and community structure and system from old to new generation.

The most significant point is they have got support and kindness from all Thai Royal families especially the king Rama IV. All Thai-Chinese Yunnan love him and his family. This reflects the identity of Thai nationality and Thai citizen eventually.

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The Influence of Proprioceptive Training in Foot and Ankle Disability with Chronic Ankle Sprain

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ABSTRACT

Introduction: Chronic ankle sprain is an injury to the lateral complex ligament long lasting with complaints of pain. The chronic inflammation and instability in carrying out activities are caused by ligamentous weakness and decreased function including sensorimotor deficits. It can cause a decrease in proprioception and disability. Meanwhile, foot and ankle disability are characterized by inability to carry out movements and functional activities. **Objective:** This study is aimed at comparing the effect of proprioception exercise with wobble board that has the same effect with elastic resistance band and to strengthen the ankle muscle in decreasing foot and ankle disability caused by chronic ankle sprain condition. **Methods:** The study design is true experimental with randomized pre and post-test group design for 20 patients (12 men, 8 women, age 21.70±4.90, weight 56.20±5.43, height 158.90±5.15, BMI 20.761±1.86), the training group was done 18 times over 6 weeks using Foot And Ankle Disability Index (FADI) for its measurement. **Results:** This study reported parametric between statistical analysis and paired sample-test. Hypothesis test showed that the two groups had significant results in decreasing foot and ankle disability, the pre-A group result is 25.90±15.56 and the post group 6.60±5.03. Meanwhile, pre B group averaged 44.90±18.80 and the post group 13.10±10.304 with p-value=0.001 and p-value<0.05. Different test with independent sample t-test produced significant differences from the two groups which are in A group 19.30±12.59, B group 31.10±12.19 and p-value=0.047 in p-value<0.05. **Conclusion:** In order to provide appropriate treatment, clinicians can use any of the two significant measures with their associated Foot And Ankle Disability Index scores to identify those who could benefit from rehabilitation of chronic ankle sprain according to needs with regards to age, network conditions, workload, and position at work.

Keywords

Proprioceptive training, Wobble board, Elastic resistance, Chronic ankle sprain

Introduction

Chronic ankle sprain is caused by frequent ankle sprain. Recently, a prevalence study among high school and collegiate athletes identified chronic ankle sprain in 23.4% of all participants based on questionnaires [1]. The high prevalence of chronic ankle sprain is caused by an unclear multifactorial underlying mechanism, which complicates accurate treatment [2]. The functional ankle instability has been attributed to a combination of disability in proprioception, neuromuscular control, strength and postural control [3]. Different treatment protocols aim at improving these inadequacies by using a variety of exercise types (e.g.,

proprioceptive, balance, strength and functional training). However, there is a lack of consensus [4,5]. One of the aforementioned mechanisms associated with chronic ankle sprain is an impaired postural control. It has been repeatedly demonstrated in subjects with chronic ankle sprain [6] and is believed to be the result of a combination between impaired proprioception and neuromuscular control [3]. In literature, studies on chronic ankle sprain have investigated both static and dynamic in order to measure and evaluate proprioception, while dynamic measures have proven to be more consistent in identifying postural control disability in subjects with chronic ankle instability [7].

Proprioception can be impaired in gradual-onset of musculoskeletal pain disorders following trauma. Thus, understanding of the role of proprioception in sensorimotor dysfunction and methods for assessment and interventions is a vital importance in musculoskeletal rehabilitation. Proprioception is an essential for well-adapted sensorimotor control. Proprioception fulfills roles in feedback and feedforward sensorimotor control and regulation of muscle stiffness that is very important for movement acuity, joint stability, coordination, and balance. Furthermore, cervical proprioception is so important for head-eye co-ordination and movement control. It can be disturbed in musculoskeletal disorders due to pain, effusion, trauma, and fatigue. A variety of assessment procedures and interventions have been developed to specifically test and enhance proprioception, respectively. It is presented by an overview of clinical assessment and intervention methods for proprioception of the spine and extremities. Reference is made for research where interventions have been reported to demonstrate positive effects on proprioception especially on exercise therapy.

According to the World Conference for Physical Therapy (WCPT), disability is when individuals cannot afford to pursue social and cultural activities in work, community, or hobby-related categories. Foot and ankle disability can be measured through the physiotherapy procedure on the ankle and foot and its intensity can be measured by (Foot / Ankle Disability index). FADI is a questionnaire that contains 26 items of patient activities such as 4 pain intensity and 24 daily activities [8], FADI reports the measurement of disability related to certain conditions and body parts with special steps. FADI was first described by [8], was used to assess daily activities. Based on Hale and Hartel [9], the average results of FADI was $\mu_1 = 87.1$, Standard deviation $\sigma = 12.1$ mean, $\mu_2 = 104.52$. Patients are asked to choose one of the statements marking N/A, in the box provided. Each item is on a scale of 0-4 and results 0 (able to do) to 4 (unable to do at all)/4 pain items from FADI that print 0 (no pain) to 4 (unbearable pain). Researchers who designed this scale, reported that this measurement was more accurate and valid in patients with musculoskeletal conditions of the lower limb [9].

Functional approaches are needed in daily activities comprehensively. In dealing with chronic ankle sprain, the physiotherapy approach is needed too in line with the criteria of ICF (International Classification of Functioning, Disability and Health), namely the impairment-based category of stability and the complement of ICD (International Classification of Disease and Related Problems), namely category of sprain of ankle [10]. Exercise therapy is intervention to handle foot and ankle disability in chronic ankle sprain which is one of the modalities of physiotherapy to restore muscles, ligaments, tendons, bones and nerves for increasing ROM and muscle strength, enhancing proprioceptive abilities, restoring postural balance and

control, and reducing foot and ankle disability so the daily activity will return to normal [11].

Proprioceptive training using the wobble board is the provision of training using a wobble board. Wobble board training is a dynamic stabilization exercise in static body position, namely the body's ability to maintain stabilization in a fixed position by standing one or two feet above the wobble board [12]. The advantages of proprioceptive training with the wobble board are that they train the muscles of the lower extremities from the pelvis to the foot and ankle simultaneously in increasing muscle strength of the foot and ankle, proprioceptive stability, balance so, the foot and ankle disability decreases into normal daily activities [11]. The principle of this exercise is to improve the function of the body's balance controller. When the exercise takes place stimuli received intrafusal fibers and extrafusal enrich sensory input that will be sent and processed in the brain to be processed so that it can determine how much muscle contraction can be given. Some responses sent back to extrafusal will activate Golgi tendon then there will be improved coordination of intrafusal fibers (myofibrils) and extrafusal fibers (organ Golgi tendons) with afferent nerves that are in muscle spindles so that good proprioceptive forms are achieved [13].

Training in strengthening the ankle muscles using elastic rubber resistance aims to increase the strength of the driving muscles of the foot and ankle, so as to be able to maintain anatomical position, increase muscle tone, increase stretch reflexes that can prevent re-injury, and improve foot stability [5]. Muscle strengthening training using elastic rubber resistance, in the form of isotonic exercises can help and improve muscle weakness caused by damage to the complex lateral ligament. Increased muscle strength is obtained through continuous training so that tonic muscle strength can increase capillary blood circulation which can increase phasic muscle strength which will result in the addition of a motor unit recruitment in the muscle that will activate the Golgi body so that the muscles will work optimally, resulting in stability both in the ankle, in decreasing foot and ankle disability in cases of chronic ankle sprain [5].

Proprioceptive training can consider any active exercise because it will generate a barrage of afferent impulses to the CNS from joint and muscle-tendon mechanoreceptors [14,15]. Thus, active exercises would seem a vital component in augmenting proprioception [15]. There is, however, the goal of our study of proprioceptive training using a wobble board which is different from ankle muscle strengthening training using elastic rubber resistance in lowering the foot and ankle disability in cases of chronic ankle sprain.

The hypothesis of our study was to assess 1) For group comparisons of those involved in chronic ankle sprain to the control involving ankle proprioceptive training using the wobble board can reduce foot and ankle disability in cases of chronic ankle

sprain; but due to the exploratory nature of this study, we do not know which variables these will be. 2) For group comparisons of those involved in chronic ankle sprain to the control involving ankle training in strengthening ankle muscles using elastic rubber resistance can reduce foot and ankle disability in cases of chronic ankle sprain; but due to the exploratory nature of this study we do not know which variables these will be and 3) For the correlation analyses, proprioceptive training using wobble board is different from ankle muscle strengthening training using elastic rubber in reducing foot and ankle disability in cases of chronic ankle sprain; but due to the exploratory nature of this study we do not know which correlations these will be.

Methods

This study was a true experimental with randomized pre and post-test group. There were two groups, first is treatment group with wobble board training and second is the group with elastic resistance training. In case of chronic ankle sprain, the most unstable ankle was selected for screening and analysis based on medical history. This study used 20 subjects (participants) with chronic ankle sprain (12 men, 8 women range age 21.70 ± 4.90 , weight 56.20 ± 5.43 , height 158.90 ± 5.15 , BMI 20.761 ± 1.86) who volunteered to participate in our repeated measure design. To be eligible, subjects had to meet all of the following inclusion criteria: having a history of a severe ankle sprain resulting in prohibiting participation in sports, recreational or other activities for at least 3 weeks; episodes of giving way; repetitive ankle sprains; subjects filled out an ankle instability questionnaire [16], which contained the criteria for chronic ankle sprain classification of instability and weakness around the ankle joint ; being recreationally active defined by a minimum of 1.5 h of cardiovascular activity a week. Exclusion criteria were ankle fracture or surgery, lower limb complaints at the moment of testing (not related to chronic ankle sprain), and equilibrium disorders. All subjects gave their written informed consent. Foot and Ankle Disability Index (FADI) was scored on a scale of 0-4 for each question in regards to the participants' left and right ankle, with higher scores indicating increased levels of instability. Participants were classified into 2 groups: A group (having a history of sprain and FADI ≤ 13 with wobble board training) and B group (having history of ankle sprain within the past year and FADI ≥ 13 with elastic resistance training).

Wobble board training

Proprioceptive training with a wobble board is a dynamic stabilization exercise in a static body position that is the body's ability to maintain stabilization in a fixed position by standing one or two feet above the wobble board. The principle of this exercise is to improve the body's balance control function. Stabilization exercises using a wobble board involves the patient standing in one position with one or both

legs. Proprioceptive training with a wobble board is performed with a frequency of exercises 3 times a week at 1-day interval, for 6 weeks, and 6 types of training: Side-to-side Edge Taps, Side-to-side Edge Front Taps, Front-to-back Edge Taps, Edge Circles, Static Standing Exercises, Partial Squat Exercises.

Elastic rubber resistance training

Training for strengthening ankle muscles with elastic rubber resistance aims to maintain muscle mass, rehabilitate and restore muscle and body functions, increase strength dynamic, increasing stability, using prisoners from external force. The ankle muscle strengthening exercises with elastic rubber resistance involves movement of ankle to dorsal and resistance with elastic rubber resistant to plantar flexion, movement of the ankle into the plantar flexion and resistance of elastic rubber resistant to dorsal flexion, ankle inversion movement and elastic rubber resistance eversion, ankle eversion movement and resistance to elastic rubber resistance inverse.

Outcome measures

The primary outcome was the Foot and Ankle Disability Index (FADI; [8] which is a region-specific self-reported measure of function based on 2 components: activities of daily living, and the more difficult sport-related tasks, and has been shown to be reliable in the ankle-sprain population. Secondary outcomes included: functional outcomes such as recurrent injury for twelve months, to provide insight into the potential effectiveness of proprioceptive exercise as a preventative measure for future injury.

Table 1 Characteristics of participants

Characteristic	Range	Kelompok A		Kelompok B	
		n	%	n	%
Age	16-25	9	45	9	45
	26-35	1	5	1	5
Gender	Man	6	60	6	60
	Women	4	40	4	40
BMI	17.00-18.40	0	0	1	5
	18.50-25.00	8	4	9	45
	25.1-27.00	1	5	1	5
Occupation	Student	0	0	1	5
	Staff	8	4	9	45
	Lecturer	1	5	1	5
Hobby	Soccer	2	10	0	0
	Futsal	4	20	4	20
	Volleyball	1	5	1	5
	Basketball	1	5	0	0
	Tennis	1	5	1	5
	Badminton	0	0	1	5

Results

Table 1 shows the characteristics of respondents related to age, body weight, height, and body mass index both in the proprioceptive training

group with the wobble board, as well as in the muscle strengthening training group with elastic resistance in the highest percentage of age in this study. That is around 16-25 years. This age is the final age group of teens who have high physical activity.

position by standing one or two feet above the shake board. The principle of this exercise is to improve the body's balance control functions, namely sensory information systems, central processors, and effectors to be able to adapt to environmental changes. When the

Table 2 Before and after foot and ankle disability index intervention

FADI	Mean±SD		Mean±SD		Homogenitas <i>Levene's Test</i>
	Group I	p-value	Group II	p-value	
Normalitas and Homogenitas test (before)	25.90±15.57	0.041*	44.90±18.80	0.867	0.517
Normalitas and Homogenitas test (after)	6.60±5.04	0.330	13.80±10.30	0.578	0.039*
Range	19.30±12.57	0.083	31.10±12.19	0.452	0.984
Pre-test	25.90±15.57	0.024*	44.90±18.78	0.024*	
Post-test	19.30±12.57	0.047*	31.10±12.19	0.047*	
t-test	6.60±5.03	0.063	13.80±10.30	0.063	

We found that the group with proprioceptive training with a wobble board could reduce Foot and Ankle Disability in cases of chronic ankle sprain with a significant value of $p\text{-value}=0.063$ ($p\text{-value}<0.05$) as well as those who practiced elastic rubber resistance (Table 2). The decrease in the foot and ankle disability values of the two groups showed no significant difference in cases of chronic ankle sprain but we found that there was a significant difference between proprioceptive training using a wobble board group (19.30 ± 12.57) and muscle strengthening training with elastic rubber resistance group (31.10 ± 12.19) in cases of chronic ankle sprain ($p\text{-value}=0.047$ ($p\text{-value}<0.05$)).

Discussion

This study reported that the difference in mean before and after the treatment obtained an average reduction in foot and ankle disability data was obtained before treatment 25.90 ± 15.56 and after treatment 6.60 ± 5.04 in A Group treatment with a value of $p\text{-value}=0.063$ ($p\text{-value}<0.05$). This explains that the decrease in the foot and ankle disability values of the two groups showed no significant difference in the case of a chronic ankle sprain. Proprioceptive training using a sway board can significantly reduce foot and ankle defects in patients with chronic ankle sprain, foot and ankle imbalances because the exercise program is carried out progressively from week 1 to week 6, with a frequency of 3 times per week.

This research finding supports the finding of the research by Hale et al., [9], 34 male and female subjects were divided into two groups, group A was given training with sway boards and group B completed the study with wobble board training interventions with a frequency of 2x per week for 4 weeks. The results showed significant improvements in the treatment group with a value of $p\text{-value}<0.005$.

According to Hupperets et al, [17] proprioceptive training with a sway board is a dynamic stabilization exercise in a static body position, that is, the body's ability to maintain stabilization in a fixed

exercise takes place, stimulation receives intrafusal fibre and extrafusal sensory input that will be sent and processed in the brain to be processed so that it can determine how much muscle contraction can be given. Some responses sent back to the extrafusal will activate the Golgi tendon then there will be increased coordination of intrafusal fibres (myofibrils) and extrafusal fibres (Golgi tendon organs) with afferent nerves in the spindle muscles so that good proprioceptive forms are achieved. Inconsistent stimulation due to surface instability received by muscles and joints has a very fast effect in capturing sensory information and is more efficiently processed in the central nervous system, so as to stimulate the mechanoreceptors in the joints. The result of deformed leg and ankle defects in patients with chronic ankle sprains because of practicing on the board by shaking the muscles of the lower extremities from the pelvis to the ankle simultaneously will contract, thereby increasing the work of the muscles and ligaments which can increase awareness of stability of the body movements that hold firm to maintain body position to remain stable. In subjects who do sway board training according to the physiotherapy program, they will avoid repeated injuries and will return to normal activities without complaints of pain due to chronic ankle sprain [14].

Decreasing the value of foot and ankle disability can be seen in Table 2. The value of $p\text{-value}=0.001$ where $p\text{-value}<0.05$ means that H_0 is rejected, and H_a is accepted which shows that there is a difference before and after treatment of B group. The chronic ankle sprain occurs due to muscle weakness and ligament weakness with muscle strengthening training using elastic rubber resistance, in the form of isotonic exercises can help and correct muscle weakness caused by damage to the complex lateral ligaments. Increasing muscle strength obtained with training with a frequency of 3x/week for 6 weeks by increasing tonic muscle strength can increase capillary blood circulation. It also can increase phasic muscle strength which will result in

the addition of a motor unit recruitment in the muscle and it will activate the Golgi body, so that the muscles will work optimally. With the increase in ankle muscle strength, the ankle function as a support for the body will work more efficiently so that it is more stable and lowers the foot and ankle disability, which is capable of carrying out normal daily activities [5].

This research finding supports the study of Han and Ricard [4]. This study explains that training with elastic resistance to the ankle for 6 weeks at a dose of 3x per week, as many as 3 sets with 10 repetitions, can increase the muscle strength of the foot and ankle. Table 2. Obtained values using the Independent t-test shows the value of $p\text{-value} = 0.047$ where $p\text{-value} < 0.05$, It means that there is a significant decrease in the value of foot and ankle disability in both A group and B group. Whereas, in the test of Hypothesis III, it shows differences in effects between A group and B group that the muscle strengthening treatment using elastic rubber is better at lowering foot and ankle disability compared to proprioceptive training using a wobble board in cases of chronic ankle sprain. The results of the data analysis of the two groups were significantly affected by the dose. The measurements in this study indicate a difference in exercise intensity of A group and B group. In A group, week 1: 1 set: done for 15 seconds, week 2-3: 1 set: done for 30 seconds, week 4: 1 set: done for 45 seconds, week 5-6: 1 set: done for 1 minute by minute dosage. In B group, the intensity and dose of frequency training were given three times a week, the intensity of 3 sets of exercises was 30 minutes with 10 repetitions. It is viewed by the intensity in both groups that the training using a wobble board did not show a clear amount of repetition (in seconds), the progress of the exercise that is done using a wobble board cannot be observed properly. Therefore, it is assumed that training using a wobble board does not show progression as in muscle training using elastic rubber resistance. This shows that muscle strengthening training using elastic resistance is better than proprioceptive training using wobble board. It is seen based on the benefits and principles of training in the provision of proprioceptive training using the wobble board, the principle of exercise to improve proprioception and balance so that coordination of the work of the muscles and ankle and foot ligaments may improve. This will improve stability, balance, and functional movements in the foot and ankle. Besides, the same effect is obtained from the ankle muscle strengthening training using an elastic rubber with the principle of increasing ankle muscle strength when the muscles in the foot and ankle become stronger, the ligaments in the joints will be stable, so that the ankle function as a buffer can maintain the body position while moving. This can decrease the foot and ankle disability, so that the subject can return to normal activities.

From this, it means that the average sample of the category for the first and second-degree ankle sprain, namely the presence of muscle weakness and ligamentous weakness, with the oldest age of 16–25

years at that age level of balance disorders is very minimal. In addition, the level of activity or work that is less controlled in each individual can also affect the occurrence of repeated injuries that slows down the repair process of the injured tissue. According to Hyeyoung, [18] prevention of chronic ankle sprain injury requires special training to avoid re-injury because in general, the injury that occurs to the ankle is a sprain. Through proprioceptive training and training in strengthening ankle muscles with elastic resistance, neuromuscular balance and control will improve and result in a decrease in foot and ankle disability with the return of movement efficiency and normal activity.

Conclusions

Proprioceptive training methods using a wobble board and ankle muscle strengthening training with rubber elastic resistance can be used in cases of chronic sprain ankles, for physiotherapists need to consider the patient's socio-economic condition.

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Quality of Life Among HIV/AIDS Patients in a Secondary Thailand Border Hospital: A Cross-Sectional Study

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ABSTRACT

Introduction: AIDS (Acquired Immunodeficiency Syndrome) has been long recognized as a major public health threat for humankind. In 2018, there were 36.9 million people living with HIV and 1.8 million people becoming newly infected globally. **Objective:** The study aimed to assess the quality of life and determine factors associated with a good quality of life among HIV/AIDS patients in Chiang Sean hospital, Thailand. **Methods:** A cross-sectional study was conducted. All HIV/AIDS patients who were attending antiretroviral (ARV) clinic at Chiang Sean hospital in 2017 were invited to participate in the study. A questionnaire and WHO quality of life BREF (WHOQOL-BREF) form were used for collecting data. Chi-square test was used to determine the associations between variables. **Results:** Totally, 246 HIV/AIDS patients enrolled into the study; 53.3% were females, 44.3% were aged 41-50 years, 92.3% hold Thai nationality. The overall quality of life was in a moderate level (96.3%). Nearly two thirds scored moderately in psychological, social relationship and environment domains. No Thai nationality and low CD4 level had statically significant associations with a low quality of life (p-value<0.05). **Conclusion:** HIV/AIDS patients at Chiang Sean hospital have moderate quality of life. A specific public health intervention should be developed to improve quality of life among the HIV/AIDS patients.

Keywords

Quality of life, HIV/AIDS, CD4 level, Thai nationality

Introduction

Acquired Immunodeficiency Syndrome (AIDS) is caused by the human immune deficiency virus (HIV) which has become a major threat for human population today. World Health Organization (WHO) reported that more than 35 million died from HIV/AIDS since the first case report [1] and 940,000 people died from HIV-related causes globally in 2017 alone [1]. There were approximately 36.9% million people living with HIV at the end of 2017 with 1.8 million people becoming newly infected in 2017 globally [1]. Countries in Africa and Asia are the most affected regions of HIV/AIDS [1]. Thailand is one of the countries with the highest HIV prevalence in Asia and the Pacific accounting for 9.0% of the region's total population of people living with HIV [2]. In 2017, approximately 440,000 people were living with HIV, and 6,400 were new HIV infections [3]. Chiang Rai

province has been one of the top rank provinces of HIV/AIDS affected areas in Thailand [4].

Antiretroviral therapy (ART) is one of the most significant treatments for HIV/AIDS eradication [5]. There are several regimens that have been implemented in saving lives among HIV/AIDS patients [5]. 59.0% of adults and 52.0% of children living with HIV were receiving lifelong antiretroviral therapy (ART) in 2017 [1]. Global ART coverage for pregnant and breastfeeding women living with HIV is high at 80.0% [1]. It is estimated that currently only 75.0% of people with HIV know their status. In 2017, 21.7 million people living with HIV were receiving ART globally [1]. In Thailand, 72.0% adults and 84.0% children were on antiretroviral treatment in 2017 [3].

Quality of life (QOL) is one major concern among HIV/AIDS patients who are receiving ART. Even though ART has a great positive result in longer life among the users, it has several side effects including

poor quality of life. According to the WHO, quality of life has been divided into physical, psychological, social relationship, and environment domains. It has been used as the key assessment in all public health intervention particularly for those who are suffering with health conditions. The study aimed to assess the quality of life and to determine factors associated with quality of life among HIV/AIDS patients who were receiving ART in a hospital.

Methodology

Study design

Analytic cross-sectional study design was applied to gather and analyze the information from the study samples.

Study Setting

The study was conducted at the ARV clinic, Chiang Sean hospital, Chiang Rai, Thailand.

Study population

All HIV/AIDS patients who were attending the ARV clinic at Chiang Sean hospital in 2017 were the study population.

Study sample

All HIV/AIDS patients who were attending antiretroviral clinic (ARV) clinic at Chiang Sean hospital, Chiang Rai province in 2017 between January and December 2017 were the study sample. However, those HIV/AIDS patients who were not able to provide essential information regarding the research protocols were excluded from the study.

Research instruments

Questionnaire was used to ask questions regarding sex, age, nationality, education level, underlying disease, medical condition, income, complication, access to service, living with HBV-infected patient in family, sharing personal objects in family, history of tattooing, history of piercing, alcohol drinking, smoking, history of being commercial sex worker, age at first sexual intercourse, history of STDs, history of sexual orientation, oral sex, anal sex and number of partners. The information regarding the CD4 level and viral load were collected from a medical record after getting written agreement from the participants. The questionnaire was tested for reliability and validity by piloting among 10 subjects who were similar with the study population. Afterward, all questions were revised before use in the field.

Detection of quality of life of the participants was assessed by using the WHOQOL-BREF from [6] which is the most relevant to access the quality of life among HIV/AIDS patients [7]. This instrument contains 26 questions which refers to four domains: physical health, psychological, social relationships, and environment. Each domain was scored on a 5-scale.

Then, those who scored >59% were defined as “poor” quality of life, scores between 60-79% were defined as moderate level, and ≤80% were defined as good quality of life.

Steps of data collection

Access to data and ARV clinic were granted by Chiang Sean hospital director and the head of ARV clinic. All HIV/AIDS patients who were attending the hospital clinic were asked for approval in accessing their individual clinical information before providing all essential information regarding the study. Afterward, an appointment was made for interview. Before the interview, informed consent form was obtained on voluntary basis. Interviews were done in a private and confidential room at the ARV clinic. Each interview lasted for 25 minutes.

Statistical analysis

Data were double-entered into excel spreadsheet. All analyses were done by using the Statistical Package of the Social Science (SPSS) version 20 (IBM, Armonk, NY). Descriptive statistics were used for explaining the general characteristics and QOL of the participants. QOL was calculated in each domain. The associations between variables and level of quality of life were detected by Chi-square at $\alpha=0.05$.

Ethical consideration

All research protocols and instruments were approved by the Human Research Ethics Committee for School of Health Science (No.13/2017) before the study commenced.

Results

Totally, 246 HIV/AIDS patients enrolled into the study; 53.3% were female, 44.3% were aged 41-50 years, 92.3% hold Thai nationality, and 67.1% earned ≤ 5,000 baht/month as income (Table 1).

Regarding the medical history, 8.1% had underlying disease, 8.9% had a medical condition, 6.5% had health complication. 16.3% had CD4 less than 200 cell/cm³, 96.7% had viral load less than 40 copies/mL (Table 2).

Regarding individual risk behaviors among the participants; 34.6% were sharing personal items with family members, 17.1% tattooed, 27.2% pierced, 49.6% used alcohol, and 26.8% smoked. Two people (0.8%) had worked as commercial sex workers, 15.4% had their first sexual intercourse while aged less than 15 years, 20.7% had STIs history, 66.3% had sexual partners 2-9 persons (Table 3).

Quality of life

The overall quality of life among HIV patients was moderate (96.3%). When considered on each domain; 94.3% were moderate in physical health domain, 92.3% were moderate in psychological domain,

78.9% were moderate in social relationship, and 79.7% were moderate in environment domain (Table 4).

Table 1 General characteristics and medical history of participants

Characteristic	n	%
Total	246	100.0
Sex		
Male	115	46.7
Female	131	53.3
Age (years)		
≤ 20	4	1.6
21-30	9	3.7
31-40	50	20.3
41-50	109	44.3
51-60	64	26.0
> 60	10	4.1
Income (baht/month)		
No income	23	9.3
≤ 5,000	165	67.1
5,001-10,000	48	19.5
> 10,000	10	4.1
Attending school		
No	61	24.8
Yes	185	75.2
Nationality		
Thai	227	92.3
Non-Thai	19	7.7

Table 2 Medical history of the participants

Factor	n	%
Underlying disease		
Yes	20	8.1
No	226	91.9
Medical conditions		
Yes	22	8.9
No	224	91.1
Health complications		
Yes	16	6.5
No	230	93.5
CD4 level (cell/cm³)		
<200	40	16.3
>200	206	83.7
Viral load level (copies/mL)		
< 40	238	96.7
> 40	8	3.3

Factors associated with quality of life among HIV patients

Two variables were found to be associated with poor quality of life among the HIV/AIDS patients who attended ARV clinic at Chiang Sean hospital, Chiang Rai province; Nationality and CD4 level. Non Thai nationals had a greater proportion of poor quality of life compared to Thai nationals at a statistically significant level (p-value=0.036). Those who had CD4 level ≤ 200 cell/cm³ had a greater proportion of poor quality of life than those who had CD4 level >200 cell/cm³ statistically significant level (p-value=0.053) (Table 5).

Table 3 Risk behavior of the participants

Risk behavior	n	%
Tattooed		
Yes	42	17.1
No	204	82.9
Pierced		
Yes	67	27.2
No	179	72.8
Alcohol drinking		
Yes	122	49.6
No	124	50.4
Smoking		
Yes	66	26.8
No	180	73.2
History of sex worker		
Yes	2	0.8
No	244	99.2
Age at first sexual intercourse (years)		
≤ 15	38	15.4
> 15	208	84.6
History of STDs		
Yes	51	20.7
No	195	79.3
Oral sex		
Yes	42	17.1
No	204	82.9
Anal sex		
Yes	5	2.0
No	241	98.0
Number of partner (persons)		
No partner	2	0.8
1	48	19.5
2-9	163	66.3
≥ 10	33	13.4
Sharing personal objects in family		
Yes	85	34.6
No	161	65.4
Living with HBV infected patient in family		
Yes	5	2.0
No	241	98.0

Discussion

Majority of HIV/AIDS patients receiving ART were female Thai nationals, aged 41-50 years. Alcohol and smoking were very common risk behaviors among the HIV/AIDS patients including ear piercing. A large proportion had their first sexual intercourse while less than 15 years, and had STIs. Quality of life among the HIV/AIDS patients receiving ART were in moderate levels in all four domains; physical, psychological, social relationship, and environment. The overall quality of life is also in a moderate level. Non-Thai nationality and lower CD4 were significantly associated with poor quality of life.

Under the Thailand universal coverage scheme, all Thai citizens have the rights to access health care services without charging including access to ARV [8]. Therefore, those Thai people who are suffering with HIV and AIDS can voluntarily get ART at any ARV clinic in a hospital. Both general and

Table 4 Number and percentage of quality of life among HIV/AIDS patients

Domain	Level of QOL					
	Poor		Moderate		Good	
	n	%	n	%	n	%
Physical health	8	3.3	232	94.3	6	2.4
Psychological	18	7.3	227	92.3	1	0.4
Social relationship	7	2.8	194	78.9	45	18.3
Environment	6	2.4	196	79.7	44	17.9
Overall quality of life	7	2.8	237	96.3	2	0.8

Table 5 Factors associated with quality of life

General Characteristic	QOL Level				χ^2	p-value
	Poor		Moderate-to- Good			
	n	%	n	%		
Nationality						
Thai	5	2.2	222	97.8	4.39	0.036*
Non-Thai	2	10.5	17	89.5		
CD4 level (cell/cm³)					3.74	0.053*
≤ 200	3	7.5	37	92.5		
> 200	4	1.9	202	98.1		

private channels are commonly provided to access ARV clinics. However, it is not a guarantee that Thai people could access these services effectively. Some marginalized populations are not having equal access to care even if they hold Thai citizenship especially the hill tribe and stateless populations who are living in border areas in northern Thailand [9]. In 2018, there were 6 hill tribe groups accounting for 30.0% of the whole population of people living in Chiang Rai province [10]. A large proportion of the hill tribe people are suffering with HIV/AIDS and also TB currently and need to access ARV clinic [11].

A cross-sectional study conducted among the HIV/AIDS patients in Ghana reported that religion and personal belief mostly affected their quality of life [12]. This is different from the HIV/AIDS patients in northern Thailand. Pozniak [13] reported that getting ARV had significant association with a better quality of life among the HIV/AIDS patients. This coincides with our study.

A study in China reported that age, CD4 level and adherence to ARV clinic were associated with a good quality of life among the HIV/AIDS patients [14]. Bunjongmanee, et al. reported that HIV/AIDS patients who were on ART and in good compliance with ART were associated with a good quality of life among the HIV/AIDS patients in Thailand [15]. Moreover, studies in Jakarta [16], Nigeria [17], Brazil [18], and India [19] also presented that CD4 level and attending ARV were associated with a good quality of life among the HIV/AIDS patients. These coincides with our study that CD4 level was a significant factor for a good quality of life among the HIV/AIDS patients in northern Thailand.

There are some limitations in this study. Samples were collected from one hospital which might not be generalized for all HIV/AIDS patients in Chiang Rai province. However, the study was done in the

hospital located in border area and non-Thai HIV/AIDS populations were extracted as a key variable related to poor quality of life. The wide range of participants' age would be another impact on the analysis, it should be controlled in the analysis in the next study.

Conclusion

HIV/AIDS patients who are receiving ART are living in moderate level of quality of life. Nationality and CD4 level impacted their quality of life. The intervention for improving quality of life among the HIV/AIDS patients receiving ART should focus on non-Thai population. It may need interventions which require inter-country collaboration to improve access to ARV among non-Thai HIV/AIDS population. Moreover, a closer clinical investigation to improve the CD4 level among the HIV/AIDS patients receiving ART is also needed to be considered to improve CD4 level which will improve quality of life among the HIV/AIDS patients eventually.

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Quality Evaluation and Pectolarigenin Contents Analysis of Harak Remedy in Thailand

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ABSTRACT

Introduction: Harak remedy is a Thai traditional medicine for anti-pyretic treatment. Some researchers reported that crude drugs and capsules of Harak remedy, which were distributed throughout Thailand, have been adulterated with the upper ground parts. Moreover, there is no recent report of quality control of the Harak products after marketed. **Objective:** Thus, aim of our research was to investigate the quality of marketed Harak capsules following requirements of Thai Herbal Pharmacopoeia (THP). **Methods:** The hierarchical cluster analysis (HCA) and principal component analysis (PCA) reported the similarity of samples to authentic Harak. The 18 samples were purchased from 6 regions of Thailand, 3 samples in each region (HR01-HR18). The authentic plants were collected from Surin province and provided as capsule drug (HR19). In addition, the powder of authentic remedy was extracted by aqueous and ethanol then the chemical constituents were analyzed by GC-MS. **Results:** As the result of standard specifications, 15 samples were standard medicines (83.33%) while 3 samples had high levels of total aerobic bacteria, total yeast, and molds. The chemical fingerprint and quantification of pectolarigenin of 19 samples were investigated by TLC and RP-HPLC. The pectolarigenin content of HR19 was 25.3±0.31 mg/g drug powder and the most correlated with were 3 samples as HR08, HR10, and HR16. **Conclusion:** According to HCA and PCA, most of the samples showed similar data patterns except HR17. The result provides essential information for identification of the Harak remedy for the purpose of quality control.

Keywords

Harak, Quality evaluation, Pectolarigenin, RP-HPLC

Introduction

Harak remedy is a Thai traditional herbal recipe which Thai traditional doctors have prescribed for the treatment of pyretic symptom in both children and adults. The remedy is recorded in a Thai scripture called Tak-Ka-Si-La as an antipyretic herbal drug. Nowadays, the remedy is registered as the National List of Essential Medicines A.D. 2013 of Thailand (List of Herbal Medicinal Products) by National Drug Committee. The remedy has several names such as Ben-Cha-Lo-Ka-Wi-Chian, Keaw-Ha-Duang and Petch-Sa-Wang. The recipe consists of five herbal roots in equal proportion by weight as follow *Harrisonia perforata* (Khon-Thaa: HP), *Ficus racemosa* (Ma-Dueo-Chumporn; FR), *Capparis micracantha* (Ching-Chee;

CM), *Clerodendrum petasites* (Mai-Tao-Yai-Mom; CP), and *Tiliacora triandra* (Ya-Nang; TT).

Numerical pharmacological activities supporting the indication of this remedy have been reported. The mixed of roots powder showed antipyretic efficacy by using Baker's yeast-induced fever in a rat model [1]. In addition, all doses of mixed powder significantly (p-value<0.05) attenuated the increased rectal temperature produced by lipopolysaccharide (LPS) injection as potent as acetylsalicylic acid, positive control [2]. Furthermore, The ethanolic extract of Harak remedy possessed the highest nitric oxide (NO) inhibitory activity on the release of inhibitory activities against LPS in RAW 264.7 cell lines with an IC₅₀ value of 40.4 µg/ml, which was lower than Indomethacin (IC₅₀=20.32 µg/ml), and the ethanolic extract of

Clerodendrum petasites, *Harrisonia perforata*, *Tiliacora triandra* and *Capparis micracantha* showed moderate inhibition activity ($IC_{50} < 60 \mu\text{g/ml}$), while the *Ficus racemosa* extract showed no inhibition activity ($IC_{50} > 100 \mu\text{g/ml}$) [3]. The observation of the traditional medicine market discovered that Harak ingredients have been adulterated with the upper ground parts [4]. As the same results, the sample of crude drugs and capsules distributed throughout Thailand were also stem adulteration [5]. Individual plants had many reports of their constituents for example; bergenin, triterpenes polydatetraene, α -amyrin acetate, gluanol acetate, lupeol acetate, beta-sitosterol, cycloartenol, and euphorbol from barks and roots of *F. racemosa* [6,7]; aromatic glycoside from roots of *C. micracantha* [8]; hispidulin, taraxerol, lupeol, 22-dehydroclerosterol, stigmaterol from roots of *C. petasites* [9]; tiliacolinine, tiliacorine and nortiliacorinine A from roots of *T. triandra* [9]; peucenin-7-methyl ether, O-methylalloptaeroxylin, perforamone A-D, pectolarigenin, perforatinolone, harristone A-E, haperforine A-E, harrisonol A, harperforatin, harperfolide and harperamone from branches, stems, leaves, fruits and roots of *H. perforata* [11–14].

The ethanolic of Harak extract was found pectolarigenin and O-methylalloptaeroxyrin which were related to *H. perforata* based on its chemical constituents. Two compounds exhibited anti-allergic activity [15]. In addition, pectolarigenin was isolated from several plants as *Millingtonia Hortensis* [16], *C. setidens* [17], *Hemistepta lyrata* [18] and including *Clerodendron siphonanthus* which is belongs to family VERBANACEAE as same as *C. petasites* [19]. Method validation for determine pectolarigenin in Harak extract by a reversed-phase high performance liquid chromatography (RP-HPLC) were evaluated, the content of pectolarigenin was 18.50 mg/g of extract [20]. However, there are some reports of standard specifications of Thai herbal medicine remedy such as Hom-na-wa-khot, Hom-in-ta-juck, Chan-ta-lee-la and Leung-pid-sa-mud for consumer's safety [21], but there has not been studied on standard specifications and quality control of Marketed Harak remedy. Thus, the present research investigated quality of Marketed Harak Remedy in Thailand which were followed Thai Herbal Pharmacopoeia [22, 23] such as organoleptic, loss on drying, ethanol soluble extractive value, water soluble extractive value, total aerobic bacteria, total yeast and molds, total ash, acid-insoluble ash. The chemical constituents were inspected by GC-MS and TLC, the quantitative analysis of pectolarigenin was studied by HPLC technique. Then, the statistical analysis also examined.

Methods

Samples

Harak remedy has generally marketed throughout Thailand as capsule which is the most common dosage form. Eighteen samples of the Harak capsules were purchased from 6 regions of Thailand. Total 18 samples (3 samples per region) were named as HR01-HR18. Only 8 samples of 18 samples were officially registered by FDA Thailand (Table1). All samples were stored at room temperature and avoided exposure to light and moisture until further use.

Preparation of authentic Harak remedy

Roots of five plant species were collected from Surin province in 2017 for using as authentic Harak remedy (HR19). The voucher specimens were deposited at the herbarium of Southern Center of Thai Medicinal Plants at Faculty of Pharmaceutical Science, Prince of Songkla University, Songkhla, Thailand. The roots of five plant species were authenticated by specialist and compare with Reference herbarium as follows: *Harrisonia perforata* (SKP 178081601), *Ficus racemosa* (SKP 117061801), *Capparis micracantha* (SKP 391031301), *Clerodendrum petasites* (SKP 202030901) and *Tiliacora triandra* (SKP 114202001). All plants were cleaned and dried at 45–50°C before combining in equal proportion (by weight) and ground as coarse powder. The powder was refined using 100 mesh sieves then the fine powder was compressed into capsule number 1 and packed in aluminum foil. Each capsule contains 250 mg of Harak remedy powder. The authentic capsule was stored at room temperature and avoided exposure to light and moisture until further use.

Analysis of chemical constituents in the authentic Harak remedy by using Gas Chromatography - Mass Spectrometry (GC-MS)

The coarse powder was divided into two parts. The mixed powder was boiled in water, filtered through Whatman No. 1 filter paper and dried by lyophilizer to obtain water extract. In the second part, the powder was macerated in 95% ethanol for 3 days, filtered then repeated 3 times and evaporated to obtain ethanolic extract. The percentage yield of the water and ethanolic extracts were 6.68% and 2.86%, respectively. Each extract was dissolved in methanol to produce 10 mg/ml of sample solution before filtered through 0.45 microliters nylon membrane filter.

GC-MS analyses of the aqueous and ethanolic extracts were carried out by using Thermo Focus GC (Thermo®, USA). One microliter of the extract solution was injected into GC system with split ratio of 1:50. The injector temperature was set at 200°C. The chemical components of extract were separated along a Thermo® TG-5silms column (30 m x 0.25 mm x 0.25 micron). Column oven temperature was started at temperature of 60°C and raised to 300°C by temperature increment of 5°C /min. The interface temperature was set at 275°C.

Mass spectrum was detected by using scan mode from 100 to 500 m/z. Compounds presented in GC-MS chromatogram were identified by comparing to NIST libraries.

Evaluation of quality of Harak capsules

Quality of Harak capsules were evaluated following requirements of THP including description organoleptic, loss on drying, ethanol soluble extractive value, water soluble extractive value, total aerobic bacteria, total yeast and molds, total ash, acid-insoluble ash [22]. Moreover, chemical profiles of Harak capsule was investigated by thin layer chromatography (TLC) and high-performance liquid chromatography (HPLC). An important marker, pectolinarigenin, which expressed potent anti-inflammatory related antipyretic was determine quantitatively by a validated HPLC method of previous research [20].

Quantitative HPLC analysis of pectolinarigenin and HPLC fingerprint of Harak capsules

Chemicals and reagents

Standard pectolinarigenin (Purity>98%) was purchased from ChemFaces (Wuhan, China). HPLC reagents such as acetonitrile, methanol and phosphoric acid were purchased from RCI Labscan (Bangkok, Thailand). Purified water was prepared by Milli Q® system from Millipore (Bedford, MA, USA).

Preparation of samples for HPLC analysis

Powder from Harak capsules was accurately weighed for 200 mg and dissolved in 5 ml methanol. The sample mixture was sonicated for 15 minutes and filtered through a 0.45-micron membrane filter. The filtrate (20 mL) was injected into the HPLC system.

Preparation of standard solutions

The stock solution of pectolinarigenin was prepared by diluting the accurate weight of standard pectolinarigenin in methanol to produce concentration of 1.0 mg/mL. The working standard solutions were prepared by serially diluted the stock solution to produce concentration 0.1, 0.4, 0.8, 1.6, 2.4 and 3.2 µg/mL. The standard curve was constructed by plotted between concentration and peak area of the serial working standard solutions.

HPLC system

Studies of chemical fingerprint and quantitative analysis of active compound were carried out using our previous validated HPLC method described by of previous research [20]. HPLC system (Agilent® 1200, USA) composed of a quaternary pump (G1311A), photodiode array detector (G1315D) and automatic injector (G1329A). A reversed-phase column was ZORBAX Eclipse XDB-C18 column (4.6 x 250 mm, 5 micron) protected by Eclipse XDB-C18 analytical guard cartridge (4.6 x 12.5 mm, 5 micron).

The mobile phase was a mixture of 0.1% ortho-phosphoric acid (A) and acetonitrile (B). Gradient elution was programmed as follows: 0–30 min: 95%A–5%A, 30–35 min: 5%A and 35–40 min: 95%A. The flow rate was 1 mL/minute with detection at UV 331 nm. The operating temperature was maintained at room temperature (25°C). Data were analyzed by ChemStation® software.

Data analysis

The similarity of HPLC fingerprints of Harak from difference sources were analyzed by using the hierarchical cluster analysis (HCA) and principal component analysis (PCA). Peak areas of common peaks found in chromatogram were subjected to the analyses. Heat map and HCA were performed by using Heatmap Illustrator (Heml) version 1.0 software [24]. PCA was performed by using MATLAB software (MathWorks®, USA).

Results

Physical appearances of sample and authentic Harak

The 18 samples were purchased from 6 regions including Central, Northern, Northeast, Western, Eastern and Southern part of Thailand. Only 8 samples of 18 samples were officially registered by FDA Thailand (Table 1). All samples contained in capsule number 1. The appearance of authentic powder (HR19) performed light brown color as same as samples except HR17 showing red color.

Table 1 The sources of manufacturing and drug registration of Harak capsules

Sample codes	The sources of manufacturing (provinces)	Regions	Drug registration
HR01	Nakhon Pathom	Central	Registered medicine
HR02	Nakhon Pathom	Central	-
HR03	Bangkok	Central	Registered medicine
HR04	Chiang Mai	North	-
HR05	Chiang Mai	North	-
HR06	Roi Et	Northeast	Registered medicine
HR07	Sakon Nakhon	Northeast	-
HR08	Buriram	Northeast	-
HR09	Trang	Southern	-
HR10	Tak	Western	-
HR11	Prachinburi	Eastern	Registered medicine
HR12	Prachinburi	Eastern	Registered medicine
HR13	Chachoengsao	Eastern	Registered medicine
HR14	Prachuap Khiri Khan	Western	-
HR15	Petchaburi	Western	Registered medicine
HR16	Phatthalung	Southern	Registered medicine
HR17	Trang	Southern	-
HR18	Phitsanulok	North	-
HR19	Authentic Harak capsule		

Chemical constituents of authentic Harak remedy by GC-MS

There are 18 constituents found in the aqueous extract of Harak remedy consisting of 14 compounds and 4 unknown compounds (Table 2). The ethanolic

extract performed 31 compounds and 4 unknowns compounds (Table 3).

Table 2 The chemical and unknown constituents of aqueous extract of authentic Harak remedy

RT	Text name	% Area
13.75	2-Naphthalenol	15.17
15.95	3-Nonanol	7.98
22.86	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-HEXADECAMETHYL-OCTASILOXANE	4.80
23.71	2,4-Di-tert-butylphenol	2.12
25.65	Cedrenol	2.91
26.01	Unknown 1	6.91
26.70	Cyclooctasiloxane, hexadecamethyl	10.48
27.75	Methyl linolelaidate	2.65
30.01	Cyclononasiloxane, octadecamethyl	8.57
31.48	Lucenin	1.19
32.38	7,9-di-tert-butyl-1-oxaspiro[4.5]deca-6,9-diene-2,8-dione	8.78
33.49	Isopropyl Myristate	2.96
35.30	Unknown 2	1.44
36.12	Unknown 3	2.69
36.61	Stearic acid	3.19
36.78	Unknown 4	4.20
37.27	9,12,15-Octadecatrienoic acid	7.06
40.80	1,3,5-CYCLOHEPTATRIEN,7,7-DIMETHYL-2,4-DIPHENYL	6.89

Quality of samples

The quality control according to THP showed that 15 of 18 samples passed criteria of the requirements (83.33%). Three samples (16.66%) failed the requirements of total aerobic bacteria and total yeast and molds which were higher than standard level. The results of standard specifications of HR01-HR19 shown in Table 4. The TLC fingerprint represented the chemical compounds of samples which showed in three different solvent systems order of increasing polarity. HR17 which showed red powder performed the most different pattern when compare to the others (Figure 1).

Pectolarigenin quantification of samples

HPLC fingerprint and determination of pectolarigenin were conducted according to our

Table 3 The chemical and unknown constituents of ethanolic extract of authentic Harak remedy

RT	Text name	% Area
13.89	Camphor	0.85
14.96	Terpinene-4-ol	0.16
15.97	2-Hexanol	0.32
16.38	Laurine	0.15
19.79	Eugenol	0.18
20.46	Junipene	0.10
21.10	n-Docosane	0.08
21.59	Isolongifolene	0.20
21.80	(-)-Spathulenol	0.12
21.89	Isolatedene	1.12
22.04	1(10),4-aromedenedradiene	0.20
22.50	Nipagin	0.04
25.43	Strophanthidin	0.05
25.56	Caryophyllene oxide	0.68
25.66	Azulene	0.61
25.96	n-Dotriacontane	0.60
27.36	Curcumene	0.29
29.46	2-Propen-1-one, 1-cyclohexyl	0.50
30.83	Cembrene	0.09
32.19	Sclarene	0.19
32.38	7,9-di-tert-butyl-1-oxaspiro[4.5]deca-6,9-diene-2,8-dione	0.20
33.57	Palmitic acid	0.91
34.16	Palmitic acid ethyl ester	4.82
36.94	Methyl linoleate	2.52
37.21	Linoleic acid	11.12
37.35	Oleic acid	32.50
37.73	17-Octadecen-14-yn-1-ol	23.99
37.82	Stearic acid	6.42
40.77	Hydroxynaphthazepinetriene	2.52
42.84	Unknown 1	0.52
44.27	Methyl tricosanoate	0.35
47.16	Unknown 2	0.25
47.39	Unknown 3	0.41
55.67	Unknown 4	1.35
56.45	Lupeol acetate	5.59

previous validated HPLC method [20]. The calibration curve of standard pectolarigenin is shown in figure (2). Retention Time (RT) of pectolarigenin was 20.9 mins, which was a small peak whereas some peaks were higher than pectolarigenin peak (Figure 3). Content of pectolarigenin constituted in HR19 was 25.3±0.31 mg/g of drug powder. HR08, HR10 and HR16 showed the most equal % content to the authentic HR19 while the content pectolarigenin in HR15 and HR17 cannot be detected (Table 5).

Table 4 The results of standard specifications of samples

Sample	% Total ash	% Acid-insoluble Ash ± SD	% Ethanol soluble Extractive value ± SD (N=3)	% Water soluble Extractive value ± SD (N=3)	% Loss on Drying ± SD (N=3)	Total aerobic microbial (CFU/g)	Total yeasts and molds (CFU/g)
HR01	4.43	0.48	2.515 ± 0.312	6.770 ± 0.077	6.51 ± 2.97	<10	<10
HR02	4.10	0.40	3.557 ± 0.041	7.908 ± 0.569	6.19 ± 2.82	<10	<10
HR03	4.03	0.44	2.780 ± 0.142	7.737 ± 0.179	8.75 ± 4.19	2.2 x10 ⁵	8.5 x10 ^{3****}
HR04	4.98	0.72	5.599 ± 0.079	7.687 ± 0.905	7.00 ± 2.90	2.1 x10 ⁴	2.0 x10 ¹
HR05	3.92	0.48	5.200 ± 0.078	6.888 ± 0.449	9.74 ± 4.20	2.5 x10 ⁵	1.1 x10 ³
HR06	4.85	1.05	5.278 ± 0.094	9.125 ± 0.013	8.36 ± 3.46	<10	<10
HR07	4.46	0.60	3.869 ± 0.076	10.956 ± 0.039	6.84 ± 2.66	<10	<10
HR08	4.30	0.45	2.924 ± 0.160	8.152 ± 0.359	7.82 ± 3.11	<10	<10
HR09	3.57	0.06	6.509 ± 0.288	7.784 ± 0.089	5.01 ± 0.65	1.4 x10 ^{6****}	<10
HR10	3.81	0.42	5.352 ± 0.370	8.467 ± 0.027	6.69 ± 0.33	1.09 x10 ⁵	<10
HR11	4.36	0.61	4.777 ± 0.121	4.586 ± 3.681	8.47 ± 2.01	4.2 x10 ³	<10
HR12	4.30	0.43	6.336 ± 0.360	8.091 ± 0.612	6.27 ± 0.80	<10	<10
HR13	4.60	0.67	3.643 ± 0.132	11.266 ± 0.072	8.66 ± 3.85	<10	<10
HR14	4.32	0.91	5.696 ± 0.235	9.888 ± 0.343	6.79 ± 4.00	<10	<10
HR15	3.79	0.62	4.561 ± 0.763	7.248 ± 0.331	7.83 ± 3.18	2.9 x10 ⁴	2.5 x10 ³
HR16	3.87	0.18	2.670 ± 0.070	9.345 ± 0.134	5.93 ± 2.09	1.0 x10 ³	<10
HR17	6.03	0.67	7.925 ± 1.860	11.802 ± 1.215	9.90 ± 0.51	1.5 x10 ^{6****}	7.6 x10 ^{5****}
HR18	4.44	0.73	6.918 ± 0.389	10.077 ± 0.142	8.05 ± 0.51	6.6 x10 ¹	1.4 x10 ¹
HR19	4.94	1.20	3.464 ± 0.142	10.872 ± 0.648	8.45 ± 3.30	3.8 x10 ⁴	5.3 x10 ²
Mean ± SD of 19 samples	4.374 ± 0.562	0.585 ± 0.273	4.714 ± 1.572	8.666 ± 1.827	7.54 ± 1.32	-	-
Criteria	≤10%	≤2%	-	-	≤10%	≤5.0x10 ⁵	≤5.0x10 ³

***These results were not passed criteria of the Thai herbal pharmacopoeia requirements

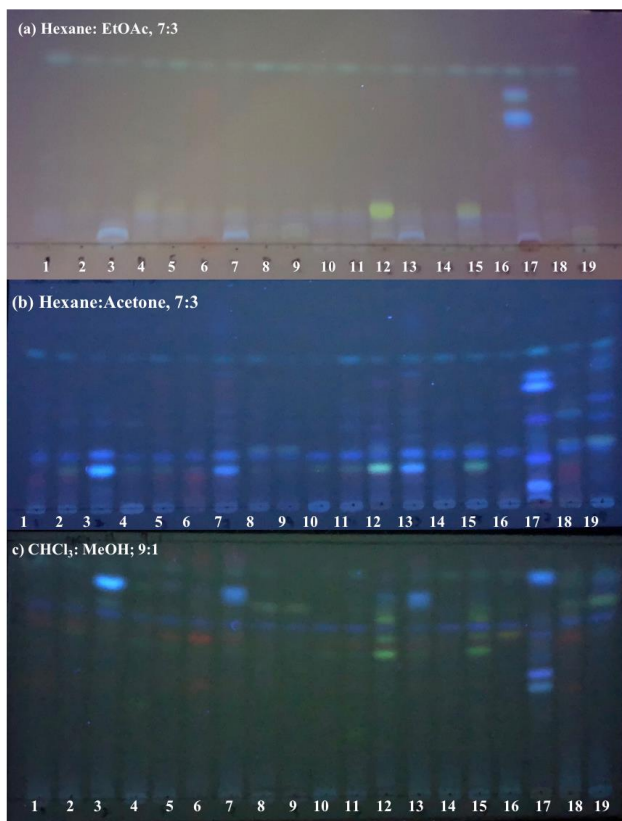


Figure 1 TLC fingerprint of HR01-19 in different 3 solvent systems (a) Hexane: EtOAc; 7:3 (b) Hexane: Acetone; 7:3 and (c) CHCl₃: MeOH; 9:1

HPLC fingerprint for similarity analysis of samples

Similarity of HPLC fingerprints were analyzed by using HCA and PCA. Peak area at retention time between 10.0 min to 30.0 min which almost found in chromatogram of all Harak samples were selected as the common peaks subjecting to HCA and PCA. Each sample was analyzed for three replicates to ensure that same sample can be grouped in same group by using the selected method. For HCA, average linkage was selected as between group linkage method. Manhattan distance method was selected to establish cluster due to it can distinguish HR17 which known as negative control from other clusters. Heatmap and HCA (Figure 4) clustered samples into four groups. Cluster A (12 samples) was the most related to HR19 consisting of HR01, HR02, HR03, HR04, HR05, HR07, HR10, HR11, HR13, HR14, HR15 and HR16. Cluster D composes of only one sample, HR17, which was the most different sample distinguished from the authentic Harak. PCA separated sample into 5 groups shown in Figure 5. Group A (HR01, HR02, HR03, HR04, HR05, HR07, HR10, HR11, HR13, HR14, HR15, HR16) consisted of 12 samples as same as the results of HCA. HR18 was the most correlated to authentic Harak HR19. Group B (HR06) and D (HR09) were also following HCA while group C was HR08 and HR12. Lastly,

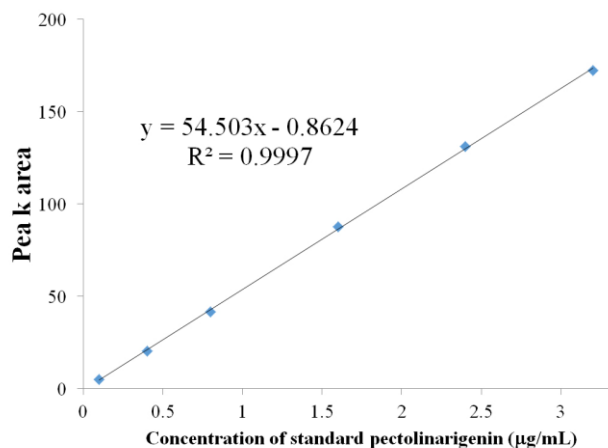


Figure 2 Calibration curve of standard pectolarigenin

Table 5 Pectolarigenin content in different samples of Harak powder and % difference between authentic and samples.

Samples	Pectolarigenin content (mg/g drug powder) (Mean ± SD)	% Difference between authentic and samples
HR01	2.4±0.09	-90.5
HR02	22.1±0.09	-12.6
HR03	14.6±0.38	-42.2
HR04	19.7±0.88	-22.4
HR05	12.9±0.40	-49.1
HR06	30.0±0.53	18.5
HR07	16.4±0.66	-35.4
HR08	24.5±0.20	-3.2
HR09	18.1±0.09	-28.4
HR10	24.9±0.69	-1.5
HR11	11.8±0.07	-53.6
HR12	21.4±0.41	-15.3
HR13	15.3±1.09	-39.4
HR14	70.8±2.15	179.7
HR15	ND*	NT**
HR16	27.3±0.73	7.8
HR17	ND*	NT**
HR18	18.3±0.63	-27.9
HR19	25.3±0.31	0

(Authentic)

*ND = cannot be detected

**NT = No Test

group E (HR17) was the most different from HR19 and other groups.

Discussion

There are some reports of standard specifications of Thai herbal medicine remedy such as Hom-na-wa-khot, Hom-in-ta-juck, Chan-ta-lee-la and Leung-pid-sa-mud [21]. Thai Herbal Pharmacopoeia (THP) is a standard method for inspected standard specifications of herbal medicine in Thailand which is used to study standard specifications in many researches.

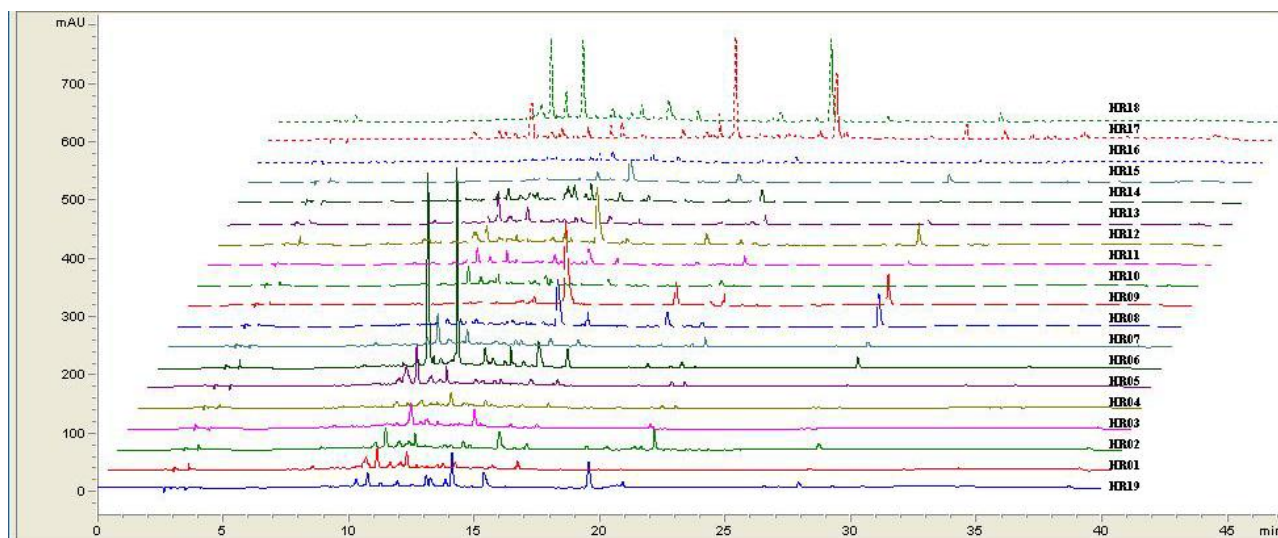


Figure 3: The HPLC chromatogram of the authentic specimen and the sample specimens; *** Retention Time (RT) of Pectolarigenin=20.9 min.

Eighteen samples were collected from 14 provinces of Thailand, most of powder were a light brown which contained in colorless capsules no.1 as same as authentic. Only HR17 powder was red so it might be adulterated by another plant. The individual plant of Harak remedy has previously reported the morphological and histological characters (macroscopic and microscopic) of their roots [25]. Identification of crude drugs and capsule drugs based on morphological, anatomical and chemical fingerprint using TLC showed all commercial crude drugs and product capsules contained stem adulteration [5]. All samples passed the criteria of %total ash, %acid insoluble ash, %loss on drying. The mean of water soluble extractive value was 8.67% which was two times of the ethanol soluble (4.71%). Obviously, HR17 showed highest percentage of total ash, ethanol soluble and water soluble extractive value, and loss on drying which were 6.03, 7.93, 11.80, 9.90, respectively. Total aerobic microbial of HR09 and HR17 were 1.4×10^6 and 1.5×10^6 CFU/g which is higher than standard criteria ($\leq 5.0 \times 10^5$ CFU/g). Moreover, HR17 and HR03 also contaminated by yeasts and molds which was 7.6×10^5 and 8.5×10^3 CFU/g while it should be less than 5.0×10^3 CFU/g. The results of standard specifications found that 15 samples were standard medicines (83.33%), three samples (16.66%) were non-standard because of the contamination.

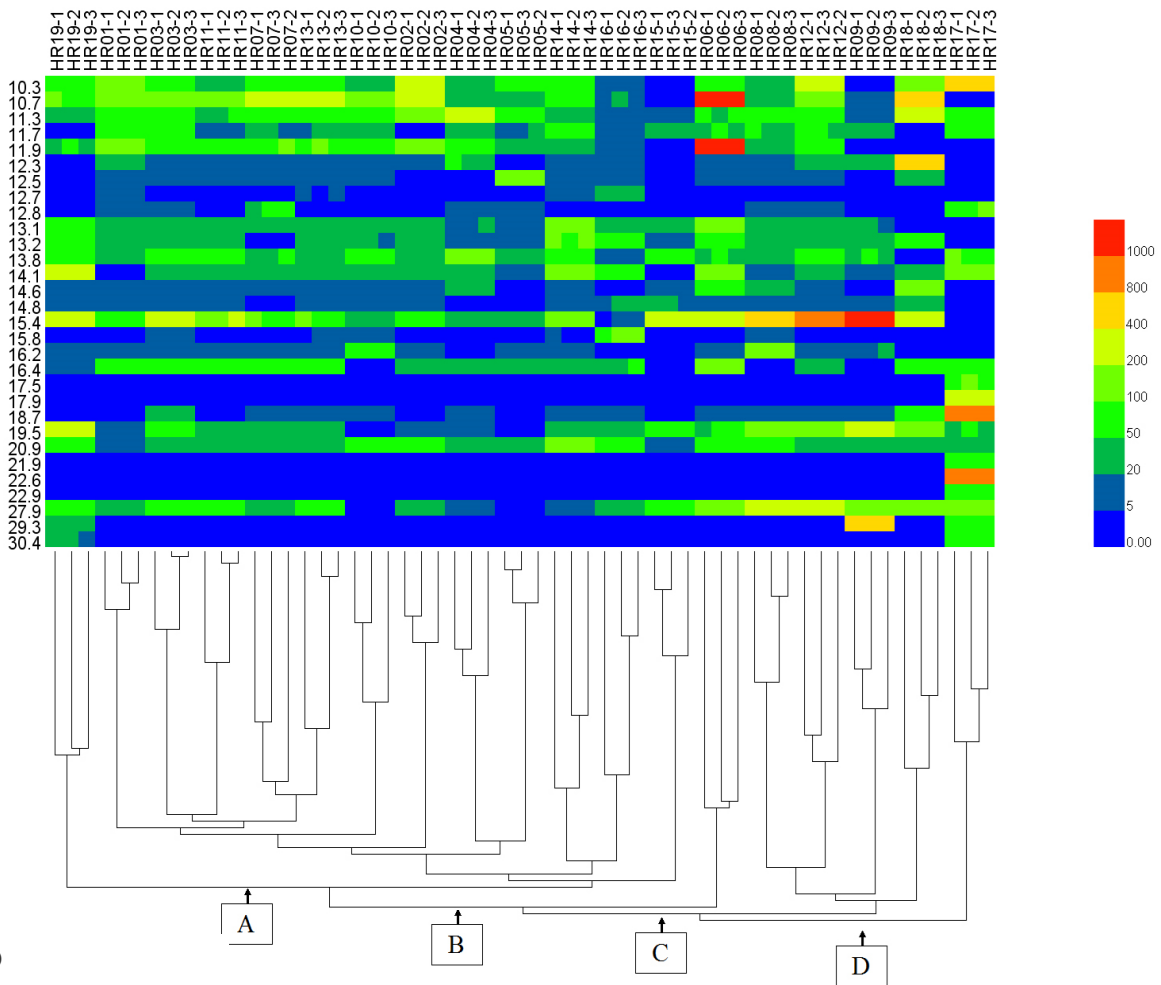
The chemical constituents of aqueous extract and ethanolic extract of authentic by GC-MS were totally different. The ethanolic extract found that top three were oleic acid (32%), 17-Octadecen-14-yn-1-ol (23.99%) and Linoleic acid (11.12%). There are 25 compounds of ethanolic extract which were less than 1%. The highest percentage of aqueous extract was 2-naphthalenol (15.17%) followed by cyclooctasiloxane or hexadecamethyl (10.48%) whereas the lowest was lucenin 1.44%. The chemical fingerprints of 19 samples

were investigated by TLC and HPLC. It is reasonable to have a difference color, TLC fingerprints of HR17 revealed the divergent bands when compare with authentic and others. Pectolarigenin was used to evaluate the quality control by HPLC technique, authentic were 25.3 ± 0.31 mg/g drug powder. HR16, HR10, and HR08 showed the similar content of pectolarigenin to authentic (% differences less than 10). Following the previous report, pectolarigenin was 18.50 mg/g of extract or 0.18% w/w [20]. The powders definitely have lower concentrate constituents than the extracts and some samples might have small amount of pectolarigenin. So, it possible that HR15 and HR17 were not detected. However, it is necessary to finding the other active compound which is more abundant for being a good marker. Additionally, the correlation of each sample under the HPLC peaks was examined by HCA and PCA. Twelve samples (66.67%) were the most related to authentic. HR17 was certainly different contamination, TLC bands and HPLC fingerprints which were effect on HCA and PCA, respectively. From these results, the pectolarigenin should not be appropriate for a marker compound of this remedy because it was found in a small amount, whereas some other peaks represented a higher quantity. Thus, the dominant peak which is interesting should be further studies on compound isolation and biological activity for finding a marker compound before development of quality control. Moreover, other major chemical compounds that can be found in HPLC chromatogram such as O-methylalloptaeroxylin should be investigate for their antipyretic related activities.

Conclusion

Harak remedy consists of five root plants, so it might be adulterated by the others. Although there have only 44.44% were registered, 83.33% of them were standard. The contamination by microorganism is the main cause of non-standard medicine (16.66%).

(a)



(b)

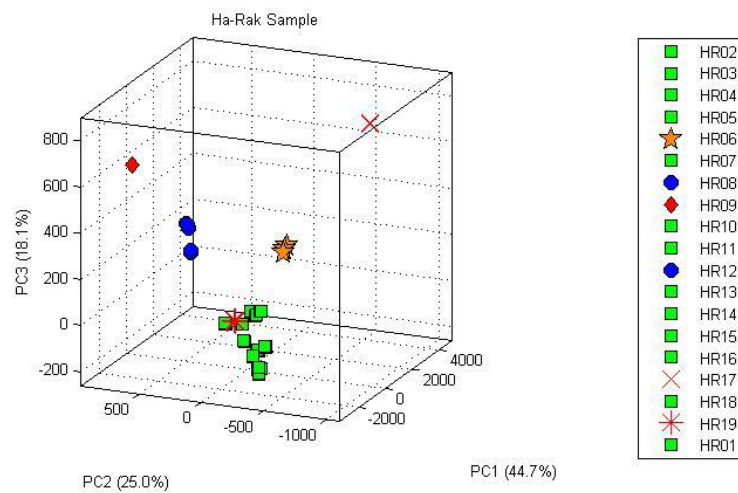


Figure 4 (a) Hierarchical clustering analysis (HCA) of Harak powder samples. Samples HR01-HR19 are performed using HemI statistics software, Heatmap Illustrator, Version 1.0; (b) Principal component analysis (PCA) of Harak powder samples. Samples HR01-HR19 are evaluated using MATLAB software

Discriminating color of drug powder is the first things to identify the others plant adulteration. However, there are many plants which have the same colors. So, the chemical fingerprint is also necessary to determine their components. Analytical techniques including TLC, HPLC, HCA and PCA showed the similar results. The most of samples were correlate to authentic whereas one of them was certainly different. The pectolarigenin can be a chemical marker in *Harrisonia perforata*, but not appropriate to the formulary. Its content in the formulary does not represent the identity and the purity of the formulary. Nevertheless, this study gives the preliminary information for standardization and quality control of Harak remedy.

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