Ergonomic Risks and Musculoskeletal Pain among Office Workers in a Healthcare Setting: A Cross-Sectional Study

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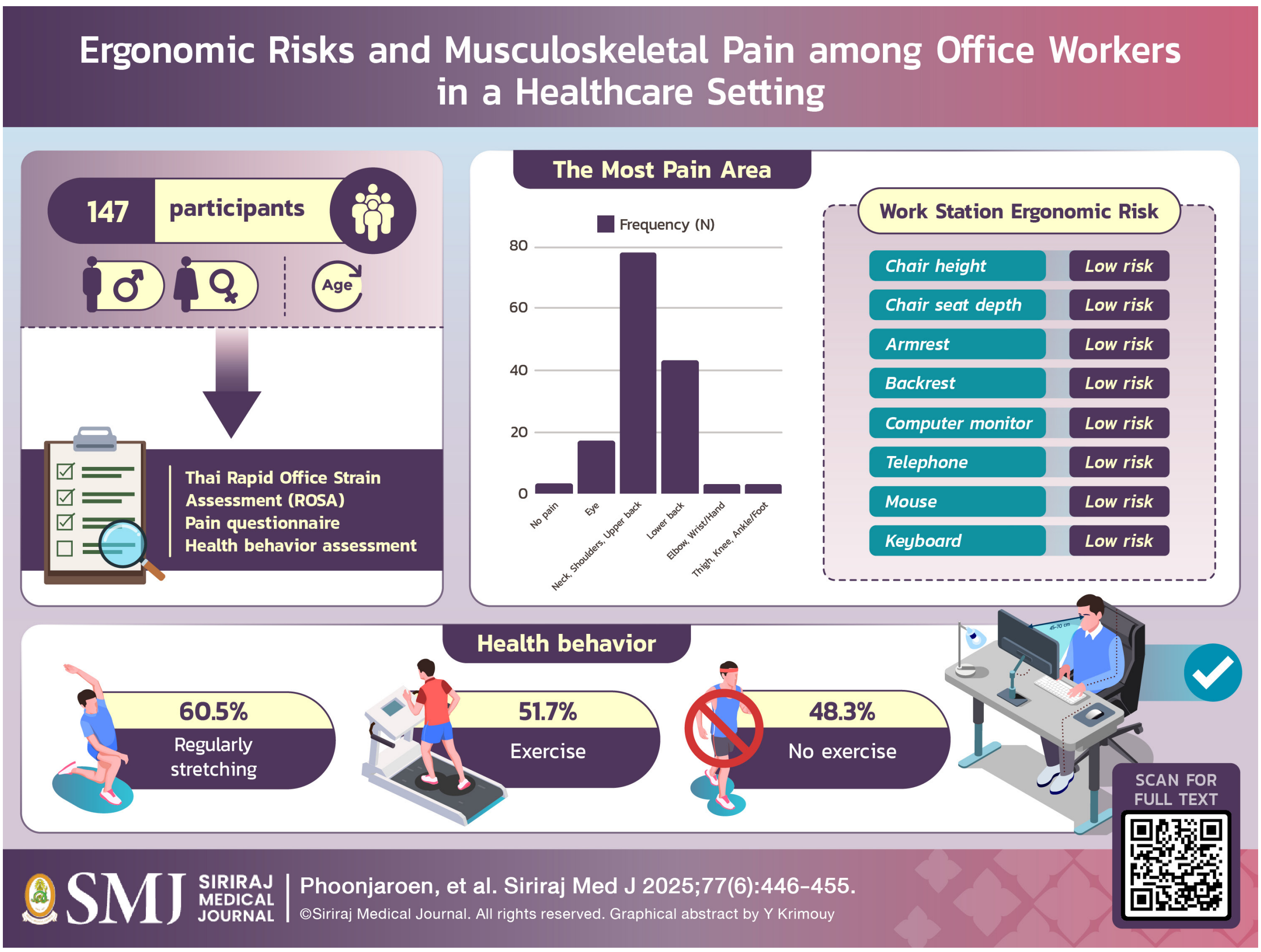

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ABSTRACT

Objective: The primary aim of this study is to assess ergonomic risks among office workers at the Golden Jubilee Medical Center using the Rapid Office Strain Assessment Thai version (Thai ROSA). Additionally, the study explores the relationship between ergonomic risks and pain, considering the multifaceted nature of work-related discomfort.

Materials and Methods: A cross-sectional study was conducted, involving 147 office workers who regularly use desktop computers. The Thai ROSA tool was employed for ergonomic risk assessment. Self-report questionnaires, including a pain questionnaire and health behavior assessment, were utilized. Statistical analyses, including descriptive statistics and bivariate analyses, were applied to interpret the data.

Results: While the majority of participants reported low ergonomic risk, the prevalence of musculoskeletal pain, particularly in the neck and lower back, was noteworthy. Surprisingly, discrepancies were observed between Thai ROSA-assessed ergonomic risks and reported pain levels.

Conclusion: The study highlights the pervasive issue of musculoskeletal pain among office workers, urging comprehensive strategies beyond conventional ergonomic assessments. Despite low Thai ROSA-assessed risks, a substantial portion reported discomfort, emphasizing the need for refined ergonomic tools and workplace interventions. Encouraging healthy behaviors is crucial for overall well-being, and future research should explore the intricate interplay between physical and mental factors contributing to work-related pain.

Keywords: Work-related musculoskeletal disorders; ergonomics; rapid office strain assessment (Siriraj Med J 2025; 77: 446-455)

INTRODUCTION

In the modern era, desktop and portable computers have become essential tools in the office, enabling efficient task completion and time savings.[1] Many office workers rely on computers as their primary work tool, with work durations often exceeding four hours per day.[2] Despite the common perception that office work may not require substantial physical exertion, it can lead to Work-Related Musculoskeletal Disorders (WMSDs), often resulting from poor posture.[3] Prolonged periods of maintaining the same posture, such as sitting at a computer with the head inclined toward the screen and fingers and wrists held in static positions, can adversely affect muscles, ligaments, joints, and bones, increasing the risk of injury.[4,5] Risk factors for WMSDs can be categorized into three main groups: physical, psychosocial, and personal factors.[6,7] Physical factors include repetitive tasks, prolonged static positions, joint pressure, and significant physical effort. Psychosocial factors include motivation to work, time constraints, and stress, while personal factors include age, gender, body proportions, and daily life activities.[6,7] The impact of WMSDs extends beyond individual discomfort, significantly impacting work performance and overall quality of life.[8] These conditions often require medical attention, diverting time and resources away from work and ultimately affecting organizational productivity.

Ergonomics, the discipline of human interactions within occupational contexts across various dimensions[9], is a crucial discipline that focuses on addressing ergonomic risks faced by office workers. It specifically focuses on office environments, and ergonomic principles involve optimizing working conditions by considering the positioning and utilization of office equipment directly linked to tasks.[10] Applying ergonomic principles in the office not only prevents WMSDs but also enhances comfort and efficiency, reducing the risk of injury.[11] To effectively assess and address ergonomic risks, it is essential to identify and prioritize high-risk factors in the workplace.[11] Various assessment tools have been developed to assess ergonomic risks, each tailored to the nature of work being performed. For instance, the Rapid Upper Limb Assessment (RULA) is commonly employed for manual tasks, while the Rapid Office Strain Assessment (ROSA) is designed to identify ergonomic risks associated with desktop computer use.[12] In Thailand, ROSA is used to evaluate ergonomic risks in office settings.[13] Previous research has shown that hospital staff face ergonomic risks related to computer use, with almost all participants experiencing discomfort in at least one area due to poor posture, particularly in the neck, lower back, and upper back. The surveyed postures were found to pose medium to high ergonomic risks, with administrative staff exhibiting the highest frequency of risky postures. Although most of these risks were linked to sitting, a significant portion of computer-related postures were also found to be non-ergonomic.[14] However, studies using Thai ROSA to assess ergonomics risks among healthcare workers in Thai hospital settings remain scarce.

Occupational therapists play a pivotal role in preventing work-related injuries by applying ergonomics to support workplace health through analyzing work, work activities and styles, making environmental adjustments, and conducting physical assessments.[15,16] The ROSA, an efficient, evidence-based tool, offers a comprehensive evaluation of both the individual and their work environment, making it particularly suitable for bustling hospital settings in Thailand where quick identification of musculoskeletal disorders are essential. The ROSA outcomes provide actionable insights, guiding interventions that reduce strain and injury risk and align with the holistic approach of occupational therapy. Therefore, ROSA stands out as a practical tool for studying ergonomic risks among healthcare workers. This research aimed to study ergonomic risks among office workers using desktop computers through Thai ROSA and to explore the relationship between ergonomic risks and pain in these workers.

MATERIALS AND METHODS

Study design

A cross-sectional study was conducted to assess ergonomic risk factors among office workers at the Golden Jubilee Medical Center. This design allowed for the simultaneous collection of data on ergonomic factors and participants' health status at a single time point.[17] The study was carried out at the Golden Jubilee Medical Center and involved various office spaces in the facility, with participants recruited from different departments, such as administrative offices, medical records, and other divisions.

Participants

The study population consisted of office employees at the Golden Jubilee Medical Center, Thailand, who use desktop computers. As of October 2022, the center had 237 employees, according to the human resources division. The sample size was determined based on a study by *Krusun and Chaiklieng* (2017)[18], which evaluated ergonomic risks among university office employees in northeastern Thailand using the ROSA assessment. The study found that 66.23% of office workers faced high ergonomic risk from computer use, while 19.48% faced moderate risk. Based on these findings, the researchers estimated that 60% of computer users would face high ergonomic risk. With a 5% acceptable error level and a 95% confidence level, the required sample size was estimated to be 147 participants using G-power calculations. The sample group was divided into two departments, comprising 24 divisions, in line with the hospital's structure. Proportional stratified sampling was used to select representative office employees from each division.

Inclusion Criteria

1. Full-time office employees of the Golden Jubilee Medical Center with a minimum continuous employment period of six months.
2. Regularly perform work-related tasks using a desktop computer as their primary workstation.
3. Use a desktop computer for at least four hours per workday on average during the past month.

Exclusion Criteria

1. Employees who use a desktop computer for less than four hours per workday.
2. Individuals diagnosed with musculoskeletal disorders due to congenital conditions, accidents, or other non-work-related causes (verified by medical records).
3. Individuals diagnosed with neurological disorders due to congenital conditions, genetic disorder, accidents, infections, or other non-work-related causes (verified by medical records).
4. Individuals diagnosed with psychological disorders includes those listed in DSM-5 and ICD-10, or other non-work-related causes (verified by medical records).
5. Employees undergoing treatment (e.g., physical therapy) for musculoskeletal conditions during the study period.
6. Employees with prior ergonomic interventions or modifications at their workplace related to the study objectives.

The study protocol was approved by the institutional IRB (number: Si 298/2023). Informed consent was obtained from all participants before data collection. Confidentiality and anonymity were ensured throughout the study.

Measurements

Self-report questionnaire

This questionnaire was developed by researchers and comprises two parts: (1) demographic information and pain questionnaire (Numeric Rating Scale: NRS), and (2) health behavior questionnaire. The NRS evaluates pain on a scale from 0 to 10, where 0 indicates no pain and 10 indicates the worst pain imaginable. For the purposes of categorizing pain levels, scores ≤5 indicate mild pain, scores of 6–7 represent moderate pain, and scores ≥8 signify severe pain.[19]

ROSA Thai version[13]

The Thai version of the ROSA's scoring is based on evaluating three main sections, including the chair (section A), screen and phone (section B), keyboard and mouse (section C).[20] Risk factors were scored according to each subsection. Each subsection has a scoring chart, and a corresponding value due to the combination of partitions. Within section A, factors like armrests, back support, and seat pan height/depth were calculated to compose the horizontal and vertical axes of the chart, respectively. Then, chart values for sections B and C were combined into another chart, resulting in monitor and peripheral scores. In the final chart, chair, screen, and peripheral scores (A, B and C) are combined for risk classification.[20] The final ROSA score ranged from 1 to 10, with a higher score indicating a greater risk of musculoskeletal disorders. A score of five or more suggests an immediate need for intervention.[13,20] This assessment is designed as an observation tool and further validated for use as a self-assessment by office workers.[21] The ROSA Thai version used in this research was translated according to international standards, had universal agreement calculation method (S-CVI/UA) = 0.80, scale-level content validity index (S-CVI/Ave) = 0.95 and very high inter- and intra-rater reliability values, with inter-rater ICC = 0.99 and intra-rater ICC = 0.91.[13]

Data collection

After explaining the research objectives to the employees and obtaining their written consent to participate in the study, the self-report questionnaire, along with the Thai version of ROSA, which included detailed instructions for recording data and providing contact information for the researcher, was distributed to participants for self-completion. Additionally, trained assessors were available to clarify questions and ensure proper understanding of the instructions during data collection. This research was performed in accordance with the ethical standards of the Declaration of Helsinki.

Statistical analysis

Descriptive statistics were used to summarize demographic characteristics, pain areas and levels, health behaviors, and ergonomic risk levels. Bivariate analyses, including Fisher's exact test and Chi-squared test, were conducted to examine the relationship between ergonomic risk factors and pain among office workers using desktop computers.

RESULTS

Demographic data

A total of 147 participants completed the questionnaire, with the majority being female (n=112, 76.2%) and the remainder male (n=35). The predominant age group was 31-41 years old (n=70), followed by participants aged 30 or younger (n=38). In terms of health conditions, 78.2% of participants reported having no medical issues (n=115). Most participants had a normal body mass index (BMI) according to the Asia-Pacific classification[22], with 68 individuals falling within the range of 18.5-22.9. However, 38 participants had a BMI over 25.0, indicating obesity. Regarding computer usage, over 80% of participants spent 4-8 hours working on computers (n=118), with 19.7% dedicating more than 9 hours to computer-related activities (n=29). Additional details can be found in Table 1.

Pain

The areas with the highest discomfort were the neck, shoulder, and upper back 53.1% (n=78), followed by the lower back 29.3% (n=43) and eyes 11.6% (n=17). The average pain level was 6.37 ± 1.68. Specifically, the average pain level for the neck, shoulder, and upper back was 5.72 ± 2.15, while for the eye area, it was 4.88 ± 2.18 (Table 2). Notably, the lower back reported the highest average pain level. Among participants reporting the highest pain levels in the neck, shoulder, upper back, and eye areas (a total of 138 cases), 97 cases (70.3%) described pain as a slight obstacle to work, while in 23 cases (16.7%), it did not hinder work. Additionally, for sleep, 80 cases (58.0%) reported pain as a slight obstacle to sleeping, while in 36 cases (26.1%), it did not affect sleep (Table 3).

Health behavior

Regarding health behaviors of the participants, the majority performed muscle stretching during work, accounting for 89 participants (60.5%). There were 76 participants (51.7) who exercised, with most exercising 1-2 days per week 52 participants (35.4%), followed by those exercising 3-5 days per week, 20 participants (13.6%). The most common type of exercise was running, 29 participants (19.7%), followed by playing sports, 20 participants (13.6%), as shown in Table 4.

Ergonomics risks

An assessment of the working conditions of office employees at the Golden Jubilee Medical Center using the Thai ROSA tool revealed that all employees fell into the low-risk category. The computer screen presented the highest risk factor, with an average score of 2.20 ± 0.91, followed by mouse usage with an average score of 2.01 ± 1.02. Keyboard usage had a lower average risk factor assessment score of 1.80 ± 0.90, as indicated in Table 5.

TABLE 1. Demographic data (n=147).

General information	n (%)
Sex	
Male	35 (23.8)
Female	112 (76.2)
Age (years)	
≤ 30	38 (25.9)
31-41	70 (47.6)
41-50	35 (23.8)
> 50	4 (2.7)
Medical conditions	
Do not have	115 (78.2)
Have	32 (21.8)
Body mass index (kg/m²)	
Under-weight (<18.5)	9 (6.1)
Normal (18.5-22.9)	68 (46.3)
Over-weight (23.0-24.9)	32 (21.8)
Obese (>25.0)	38 (25.9)
Time spent working on the computer per day at work (hours)	
4-8	118 (80.3)
≥ 9	29 (19.7)
Devices used on Social Media outside of work hours	
Desktop computer (PC)	4 (2.7)
Portable computer (Notebook / Laptop)	6 (4.1)
Smart phone (SmartPhone)	126 (85.7)
Tablet (Tablet/ iPad /Galaxy Tab)	11 (7.5)
Time spent on Social Media outside of work (hours)	
≤ 1	16 (10.9)
2-3	91 (61.9)
≥ 4	40 (27.2)

TABLE 2. Information about pain (n=147).

Pain area	n (%)	Pain score (Mean ± SD.)
No pain	3 (2.0)	-
Eye	17 (11.6)	4.88 ± 2.18
Neck, shoulders, upper back	78 (53.1)	5.72 ± 2.15
Lower back	43 (29.3)	6.37 ± 1.68
Elbow, wrist/hand	3 (2.0)	2.33 ± 1.76
Thigh, knee, ankle/foot	3 (2.0)	3.11 ± 1.95

TABLE 3. Information about pain and areas of pain (n=138).

	Neck, shoulders, upper back (n=78) n (%)	Lower back (n=43) n (%)	Eye (n=17) n (%)	Total (n=138) n (%)
Duration of pain (months)				
≤ 3	36 (46.2)	15 (34.9)	12 (70.6)	63 (45.7)
4-6	18 (23.1)	12 (27.9)	4 (23.5)	34 (24.6)
7-9	7 (9.0)	4 (9.3)	1 (5.9)	12 (8.7)
10-12	2 (2.6)	2 (4.7)	0	4 (2.9)
≥ 12	15 (19.2)	10 (23.3)	0	25 (18.1)
Pain is a hindrance to work				
Not at all	13 (16.7)	5 (11.6)	5 (29.4)	23 (16.7)
A little	51 (65.4)	35 (81.4)	11 (64.7)	97 (70.3)
A lot	14 (17.9)	3 (7.0)	1 (5.9)	18 (13.0)
Pain is an obstacle to sleeping				
Not at all	19 (24.4)	11 (25.6)	6 (35.3)	36 (26.1)
A little	44 (56.4)	26 (60.5)	10 (58.8)	80 (58.0)
A lot	15 (19.2)	6 (14.0)	1 (5.9)	22 (15.9)
The pain caused me to take time off from work				
No	70 (89.7)	40 (93.0)	16 (94.1)	126 (91.3)
Yes	8 (10.3)	3 (7.0)	1 (5.9)	12 (8.7)

TABLE 4. Information about health behavior of the participant (n=147).

Health behavior	n (%)
Muscle stretching during work (n=147)	
No	58 (39.5)
Yes	89 (60.5)
Do you do any exercise (n=147)	
No	71 (48.3)
Yes	76 (51.7)
How often do you exercise (days per week) (n=76)	
1-2	52 (35.4)
3-5	20 (13.6)
> 5	4 (2.7)
Type of exercise (n=76)	
Aerobic exercise	5 (3.4)
Running	29 (19.7)
Yoga	8 (5.4)
Weight training	7 (4.8)
Fitness	7 (4.8)
Playing Sports	20 (13.6)

TABLE 5. Assessment of the working environment of office employees at the Golden Jubilee Medical Center By Thai ROSA (n=147).

Working environment	Risk factor assessment score (Mean ± SD.)	Risk level
Chair height	1.48 ± 0.71	Low level of risk
Chair seat depth	1.51 ± 0.64	Low level of risk
Armrest	1.44 ± 0.82	Low level of risk
Backrest	1.58 ± 0.71	Low level of risk
Computer monitor	2.20 ± 0.91	Low level of risk
Telephone	1.22 ± 1.03	Low level of risk
Mouse	2.01 ± 1.02	Low level of risk
Keyboard	1.80 ± 0.90	Low level of risk

Relationships between ergonomic risks and pain

The analysis explored the connection between maximal pain level of each participant and body posture assessments in an office work setting. The Thai ROSA assessment revealed no significant relationship between ergonomic risks and reported pain levels. Out of 147 office employees at the Golden Jubilee Medical Center, 119 participants met the ergonomic low risk criteria (Final score <5)[13], while 28 did not, as indicated in Table 6.

DISCUSSION

Musculoskeletal pain is highly prevalent among office workers, yet the relationship between ergonomic risks assessed by the Thai ROSA and self-reported pain remains unclear. This study found that although ROSA classified all participants as low-risk for ergonomic issues, 29.3% reported low back pain, with the maximal pain level score of 6.37 ± 1.68, categorized as moderate pain.[19] This discrepancy highlights the limitations of static ergonomic assessments, which may not account for dynamic interactions between workers and their environments.[20] For instance, compensatory behaviors such as slouching or leaning forward during prolonged tasks are not captured by ROSA, despite their significant role in contributing to musculoskeletal strain.[23]

Unlike previous studies that reported stronger correlations between ergonomic risk scores and pain[24-26], our findings suggest that these relationships may depend on additional factors such as psychosocial stressors and individual behaviors. Methodological differences, such as broader inclusion of psychosocial dimensions in other studies, may also account for this divergence.[24-27] For example, high psychological stress or multitasking demands, often unmeasured by static assessments, may exacerbate pain perception, further complicating the ergonomic risk-pain relationship.[28]

TABLE 6. Relationship between pain level and Rapid Office Strain Assessment (ROSA) final score.

	Rapid Office Strain Assessment (ROSA Final Score)		
	Low risk (n=119)	High risk (n=28)	P - value
Maximal pain level of each participant	5.6 ± 2.3	5.3 ± 2.0	0.512

Additionally, this study observed a 19% ergonomic non-compliance rate, despite low-risk ROSA scores. This suggests that barriers such as limited ergonomic training[29,30], lack of awareness[29,30], or organizational constraints—like insufficient resources or time for adjustments[29,31]—continue to challenge the implementation of effective ergonomic practices. Addressing these gaps requires workplace interventions that prioritize regular training, tailored workstation adjustments, and ongoing ergonomic evaluations.

In this study, participants reported moderate discomfort, predominantly in the neck, shoulders, upper back, and lower back, with lower back pain being the most intense. Despite this, most participants indicated minimal interference with work and sleep, suggesting a degree of adaptation or tolerance. Interestingly, the areas most affected by pain align with the high levels of smartphone usage reported, with 61.9% of participants spending 2-3 hours daily on social media. This aligns with prior research linking prolonged digital device use to neck and upper back discomfort[32,33], emphasizing the importance of ergonomic strategies for mitigating screen-related strain.

While over half of the participants engaged in health-promoting behaviors such as stretching or exercise, the study did not explore the relationship between these activities and pain levels. However, consistent with prior research, such behaviors likely alleviate musculoskeletal strain by improving flexibility, muscle strength, and circulation.[34,35] The effectiveness of these practices depends on their frequency and consistency[36], suggesting a need for structured workplace programs that integrate regular physical activity[37], such as micro-breaks, guided exercises[38], or standing desks, to counteract prolonged static postures.[39]

This study also highlights the limitations of the Thai ROSA as a self-assessment tool. Sonne[21] demonstrated discrepancies between worker-reported and observer-reported ROSA scores, particularly for mouse and keyboard assessments, with workers often underestimating risk factors. Despite these limitations, self-assessment using tools like ROSA shows promise in helping workers identify and reduce risk factors for musculoskeletal discomfort over time.[21] However, static tools like ROSA do not account for dynamic workplace factors, such as posture variability, fatigue, or individual differences like height or pre-existing conditions. Future iterations of ergonomic tools should address these gaps by incorporating real-time posture tracking, psychosocial stress assessments, and modules for contextual factors such as lighting, noise, and workload demands.

Overall, this study underscores the complex interplay between physical, behavioral, and psychosocial factors contributing to workplace pain. Future research should aim to refine ergonomic assessment tools, explore alternative pain management strategies, and develop holistic interventions that address both physical and mental aspects of worker health.

CONCLUSION

Although this study did not establish a direct link between ROSA-assessed ergonomic risks and pain, it highlighted the widespread issue of pain among office workers. The findings emphasize that pain is multifaceted, extending beyond ergonomics. This calls for comprehensive strategies to improve workplace ergonomics, promote healthy behaviors like stretching and exercise, and address both physical and mental factors contributing to pain. A holistic approach to pain management is essential, focusing on both physical comfort and mental well-being to prevent work-related issues and safeguard workers' health.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy or ethical restrictions.

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DECLARATIONS

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Conflict of Interest

The authors declare that they have no competing interests.

Registration Number of Clinical Trial

Not applicable.

Author Contributions

Conceptualization and methodology, P.P., and N.U. ; Investigation, P.P., and N.U. ; Formal analysis, P.P, N.U., and C.T. ; Visualization and writing – original draft, P.P., and C.T. ; Writing – review and editing, P.P., N.U., and C.T. ; Supervision, C.T. All authors have read and agreed to the final version of the manuscript.

Use of Artificial Intelligence

The manuscript is not produced using artificial intelligence.

Human ethics approval declaration

This study was approved by the Siriraj Institutional Review Board, Bangkok, Thailand (IRB No. Si 298/2023).

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