

IIMJ

International Islamic Medical *Journal*





Short-Term Evaluation of Hypertonic Dextrose Prolotherapy Intra-Articular Injection on Femoral Cartilage Thickness Among Knee Osteoarthritis Patients with Obesity

Rita Vivera Pane,^{1,2*} Aisyah,¹ Handayani,³ Aufar Zimamuz Zaman Al Hajiri⁴

¹Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya, Surabaya 60237, Indonesia

²Department of Physical Medicine and Rehabilitation, Rumah Sakit Umum Daerah Haji Provinsi Jawa Timur, Surabaya 60116, Indonesia

³Department of Pharmacology, Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya, Surabaya 60237, Indonesia

⁴Medical Doctor, Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya, Surabaya 60237, Indonesia

*Corresponding Author: dr.rita@unusa.ac.id

DOI : 10.33086/iimj.v6i2.6279

ARTICLE INFO

Keywords:
femoral cartilage
thickness, knee
osteoarthritis,
obesity,
hypertonic
dextrose
prolotherapy,
normal saline

Submitted: July
25th 2024

Reviewed: Sept
3rd 2024

Accepted: Oct
27th 2024

ABSTRACT

Introduction: Obesity significantly contributes to higher morbidity rates and increases the risk of knee osteoarthritis (KOA).

Objective: This study evaluated the short-term effect of intra-articular hypertonic dextrose prolotherapy (HDP) injections on femoral cartilage (FC) thickness in obese patients with KOA.

Methods: This quasi-experimental clinical trial included KOA patients with obesity. The intervention group received HDP injections, while the control group received normal saline (NS) injections. FC thickness was measured using musculoskeletal ultrasound (US) before the intervention, 2 weeks, and 6 weeks after the intervention. Mean differences within and between groups were analyzed, with significance at $P < 0.05$.

Results: A total of 38 participants diagnosed with KOA and obesity were included. In the HDP group, FC thickness increased from pre-intervention to 6 weeks post-intervention: in the medial condyle (MC) from 1.33 ± 0.61 mm to 1.48 ± 0.56 mm, in the intercondylar (IC) region from 1.38 ± 0.65 mm to 1.57 ± 0.61 mm, and in the lateral condyle (LC) from 1.57 ± 0.70 mm to 1.78 ± 0.66 mm. Repeated measures of ANOVA revealed significant improvements in FC thickness at all sites (MC, IC, and LC) in the HDP group ($P < 0.05$). No significant changes in FC thickness were observed in the NS group.

Conclusions: HDP injections have a beneficial short-term effect on increasing FC thickness in obese patients with KOA.

Introduction

Obesity is a significant public health issue worldwide, including in Indonesia, where its prevalence continues to rise. Data from the Indonesian Family Life Survey

(IFLS) from 1993 to 2014 showed an increase in the prevalence of overweight and obesity among adults from 17.1% to 33.0%. The study concluded that one-third of Indonesians were overweight in 2014.

The 2018 Indonesian Basic Health Survey revealed a rise in obesity prevalence, with a body mass index (BMI) over 27 kg/m², increasing from 10.5% in 2007 to 21.8% in 2018. Obesity has a significant impact on morbidity and mortality rates, increasing the risk of conditions such as diabetes mellitus, hypertension, stroke, coronary heart disease, dyslipidemia, and knee osteoarthritis (KOA) (Ayuningtyas et al., 2022; Azam et al., 2023; Oddo et al., 2019; Rachmi et al., 2017; Tham et al., 2023).

Obesity is linked to adverse effects on cartilage thickness and joint loading. Evaluating femoral cartilage (FC) thickness using ultrasound (US) scanning may be useful in assessing FC in obese patients at high risk for KOA onset and progression. Obese patients have higher FC echo intensity compared to non-obese individuals, and a high body fat percentage is associated with increased cartilage echo intensity (Pamukoff et al., 2020).

Previous studies have demonstrated that the correlation between joint loads and femoral cartilage (FC) thickness is influenced by body mass index (BMI). Reduced cartilage thickness is associated with both obesity and aging (Blazek et al., 2014). In Indonesia, studies have evaluated FC thickness in patients with knee osteoarthritis (KOA) compared to those without KOA. The KOA group showed thinner FC than the non-KOA group. A

significant difference was observed in medial condyle (MC) thickness on both sides, though no significant difference was found in the intercondylar (IC) or lateral condyle (LC) (Pane et al., 2023). Interestingly, the mean MC thickness was significantly higher in the KOA group compared to the non-KOA group. Another study using a quantitative tridimensional approach showed that the posterior MC was considerably thicker in KOA patients (Omoumi et al., 2018).

Current KOA management generally includes non-steroidal anti-inflammatory drugs (NSAIDs) and physical rehabilitation therapy. However, many patients report recurrent knee pain once the drug effects wear off. Intra-articular injection is an alternative method for KOA management. High-density platelet (HDP) therapy has been proposed as an alternative therapy that may aid tissue regeneration, improve clinical symptoms, and restore damaged tissue structures—pathological issues associated with KOA. A systematic review of 12 studies showed that HDP was more effective in improving functional outcomes compared to other treatments (Waluyo et al., 2023). Although the mechanism of HDP in reducing KOA pain is not fully understood, recent studies suggest a rapid and medium-term analgesic effect after intra-articular HDP injection, accompanied by beneficial changes in synovial fluid

neuro cytokines such as substance P (SP) and neuropeptide Y (NPY) (Topol et al., 2022). The objective of this study was to evaluate the short-term effect of intra-articular HDP injection on FC thickness in obese patients with KOA.

Methods

This quasi-experimental clinical trial evaluated femoral cartilage (FC) thickness using musculoskeletal ultrasound (US) measurements. Participants were KOA patients with obesity, recruited from the Department of Physical Medicine and Rehabilitation (PM&R) at Hajj Regional General Hospital of East Java Province (RSUD Haji Provinsi Jawa Timur), Surabaya, Indonesia. These patients received treatment at the outpatient clinic between May and August 2023.

Inclusion and exclusion criteria

The inclusion criteria were KOA patients with obesity, diagnosed based on clinical and radiological assessments, including grades I-IV of the Kellgren-Lawrence criteria. Grade I shows possible osteophytes and questionable joint space narrowing. Grade II shows definite osteophytes and joint space narrowing. Grade III presents multiple moderate osteophytes, definite joint space narrowing, and possible bone contour deformity. Grade IV shows large osteophytes, definite

joint space narrowing, and bone contour deformity. Obesity was defined using the World Health Organization (WHO) Asia-Pacific standards: underweight ($<18.5 \text{ kg/m}^2$), normal ($18.5 - 22.9 \text{ kg/m}^2$), overweight ($23 - 24.9 \text{ kg/m}^2$), and obese ($\geq 25 \text{ kg/m}^2$). Patients with a history of knee surgery, knee injury, or prior knee intra-articular injection were excluded. Eligible participants were allocated into two groups: the intervention group and the control group.

Intervention

The intervention group received high-density platelet (HDP) injections, while the control group received normal saline (NS) injections. The intervention group was given an intra-articular injection of 25% dextrose (4 ml) at the first visit (week 0) and the second visit (week 2). The control group received a single injection of normal saline and 1% lidocaine, with the volume adjusted for each patient, at the first visit (week 0). Injections for both groups were administered under musculoskeletal US guidance.

Measurements

Basic data such as age, gender, weight, height, BMI, and Kellgren-Lawrence stage were recorded at the initial appointment. The primary outcome was FC thickness, measured three times: before the

intervention, 2 weeks after the intervention, and 6 weeks after the intervention. FC thickness was measured in millimeters using the musculoskeletal US on the knee diagnosed with KOA. Measurements were taken at three sites: the medial condyle (MC), intercondylar (IC) region, and lateral condyle (LC). A Canon Xario 100, a 2D musculoskeletal US device with a 7.2-14 MHz linear transducer (type 18L7; Canon Medical Systems USA, Inc., Tustin, Calif, USA), was used. The evaluation was performed by a certified physiatrist with over five years of experience in musculoskeletal US scanning.

Data analysis

Age, gender, BMI, Kellgren-Lawrence grade, KOA side, and pre-intervention FC thickness were analyzed descriptively, with data presented as mean $\pm$ SD or number (%). Initially, the normality of the primary data, FC thickness, was tested. As the data were normally distributed, a parametric test was used. Between-group analysis was performed using the Mann-Whitney test to compare the mean difference between the two groups, while within-group analysis was conducted using repeated measures analysis of variance (ANOVA) to assess changes in mean FC thickness from pre-intervention to week 6 in each group. A significance level of $p < 0.05$ was considered statistically significant. Data

were collected using Microsoft Excel 365 (Microsoft Corp., Redmond, Washington, USA), and data analysis was performed using IBM SPSS Statistics version 26.0 for Mac (IBM Corp., Armonk, NY, USA).

Results and Discussion

This study involved a total of 38 participants diagnosed with both KOA and obesity, as shown in Figure 1. The average age of participants in the NS and HDP groups was 62.5 ± 7.78 years and 62.4 ± 8.88 years, respectively, with a predominance of females in both groups. The mean BMI in the NS group was higher compared to the HDP group, while the mean Kellgren-Lawrence grade was higher in the HDP group than in the NS group (Table 1). Before the intervention, the FC thickness at the lateral condyle (LC), intercondylar (IC) region, and medial condyle (MC) were 1.47 ± 0.45 mm, 1.23 ± 0.47 mm, and 1.33 ± 0.49 mm, respectively, in the NS group. In the HDP group, the thickness was 1.57 ± 0.70 mm, 1.38 ± 0.65 mm, and 1.33 ± 0.61 mm at the same locations.

Statistical analysis using the Mann-Whitney test showed no significant differences between the two groups ($P > 0.05$) (Table 2). However, within-group analysis using repeated measures ANOVA from pre-intervention to 6 weeks post-intervention revealed significant

improvements in FC thickness at all sites (LC, IC, and MC) in the HDP group ($P < 0.05$), but no significant changes were observed in the NS group ($P > 0.05$) (Table 3).

Before the intervention, the NS group had thinner FC at the LC and IC sites compared to the HDP group, while the average thickness at the MC site was similar. Among the three sites observed, the MC was the thinnest. This finding supports our earlier study, which evaluated 254 adult knees in non-OA individuals from Indonesia, showing average cartilage thicknesses of 1.76 mm in the MC, 1.89–1.92 mm in the IC, and 1.69–1.71 mm in the LC (Pane et al., 2022). Other studies also suggest that the MC is more affected by weight-bearing, with structural damage such as thinning and cartilage defects occurring in obese individuals due to

increased pressure (Lacy et al., 2016). Increased knee flexion during the early ambulation phase, coupled with the heavier load on the medial condyle, is observed in obese patients. A cadaveric study found that weight-bearing in individuals with a $BMI \geq 30$ increased stress, contributing to MC defects (Chen et al., 2020). Obesity is also known to exacerbate KOA in patients with varus malalignment, though this effect is less pronounced in those with valgus malalignment, as genu valgus helps protect the medial condyle.

In contrast, varus malalignment combined with obesity tends to accelerate disease progression, particularly in the medial tibiofemoral joint, suggesting that correcting malalignment may be a therapeutic target in obesity-related KOA (Rogers et al., 2021).

Table 1. General data

Variables	HDP group (20)	NS group (18)
Age (years)	62.4 ± 8.88	62.5 ± 7.78
Sex (female)	19 (95.0%)	15 (83.3%)
BMI (kg/m ²)	28.66 ± 4.52	30.62 ± 3.87
Kallgren-Lawrence Grade	3.05 ± 0.60	2.77 ± 0.65
KOA Side		
Right	7 (35.0%)	5 (27.7%)
Left	13 (65.0%)	13 (72.3%)
FC Thickness (mm) ^a		
Medial Condyle	1.33 ± 0.61	1.33 ± 0.49
Intercondylar	1.38 ± 0.65	1.23 ± 0.47

Lateral Condyle	1.57 ± 0.70	1.47 ± 0.45
-----------------	-------------	-------------

Note: Data are presented as mean ± SD or number of participants.

^a Femoral Cartilage Thickness before intervention

Abbreviations: HDP = hypertonic dextrose prolotherapy; NS = normal saline; BMI = body mass index; KOA = knee osteoarthritis; FC = femoral cartilage.

Table 2. Between-group analysis of FC thickness.

Variable	HDP group	NS group	P-value ^a
Medial Condyle (mm)			
Pre-intervention	1.33 ± 0.61	1.33 ± 0.49	0.961
Week-2	1.39 ± 0.54	1.35 ± 0.46	0.809
Week-6	1.48 ± 0.56	1.34 ± 0.46	0.428
Intercondylar (mm)			
Pre-intervention	1.38 ± 0.65	1.23 ± 0.47	0.421
Week-2	1.45 ± 0.61	1.18 ± 0.48	0.144
Week-6	1.57 ± 0.61	1.22 ± 0.49	0.067
Lateral Condyle (mm)			
Pre-intervention	1.57 ± 0.70	1.47 ± 0.45	0.620
Week-2	1.66 ± 0.67	1.44 ± 0.47	0.258
Week-6	1.78 ± 0.66	1.45 ± 0.46	0.094

Note: Data are presented as mean ± SD.

^aSignificant value was considered P < 0.05

Abbreviations: HDP = hypertonic dextrose prolotherapy; NS = normal saline.

Table 3. Within group analysis of FC thickness.

Variable	Pre-intervention	Week-2	Week-6	P-value ^a
Medial Condyle (mm)				
HDP group	1.33 ± 0.61	1.39 ± 0.54	1.48 ± 0.56	0.015
NS group	1.33 ± 0.49	1.35 ± 0.46	1.34 ± 0.46	0.883
Intercondylar (mm)				
HDP group	1.38 ± 0.65	1.45 ± 0.61	1.57 ± 0.61	0.000
NS group	1.23 ± 0.47	1.18 ± 0.48	1.22 ± 0.49	0.233
Lateral Condyle (mm)				
HDP group	1.57 ± 0.70	1.66 ± 0.67	1.78 ± 0.66	0.000
NS group	1.47 ± 0.45	1.44 ± 0.47	1.45 ± 0.46	0.372

Note: Data are presented as mean ± SD.

^aSignificant value was considered P < 0.05

Abbreviations: HDP = hypertonic dextrose prolotherapy; NS = normal saline.

The evaluation at three-time points—before the intervention, 2 weeks after, and 6 weeks after—revealed that the HDP group

showed significant improvements in FC thickness at all locations (MC, IC, and LC), while the NS group did not show significant

changes. A previous study evaluating HDP injections in KOA patients with musculoskeletal ultrasound over a 12-month follow-up also demonstrated a significant increase in MC and LC thickness compared to baseline (Soliman et al., 2016).

Thinning of femoral cartilage (FC) occurs naturally with aging, and knee osteoarthritis (KOA) accelerates its severity. Throughout life, cartilage undergoes a remodeling process, but in KOA patients, the ability to regenerate is impaired due to the reduced quality of the extracellular matrix and rapid turnover rate (Jeon et al., 2023). FC thickness has become an important biomarker for diagnosing and monitoring KOA progression (Dório et al., 2020). The progressive nature of KOA is associated with gradual cartilage defects and bone degeneration (Keefe et al., 2023). In early-stage KOA, changes in cartilage composition occur before significant cartilage thinning (Küçükakkaş et al., 2022).

FC thickness varies significantly and is influenced by factors such as gender, weight, height, and BMI. A previous study evaluating healthy adults concluded that gender plays a role, with men having thicker FC than women (Pane et al., 2022). Another study involving 100 participants found that men and athletes had significantly thicker FC compared to women and individuals with low physical activity. However, no

significant relationship was found between BMI and articular cartilage (AC) thickness in non-obese adolescents with adequate physical activity (Bedewi, Elsifey, Naguib, Saleh, Nwihadh, et al., 2020; Herrera H et al., 2020). In addition, FC thickness is linked to diabetes mellitus (DM). Previous research indicated that DM affects FC thickness, with ultrasound scans showing that FC in diabetic patients appears thinner and irregular, suggesting cartilage degeneration (Banu Aydın & Köseoğlu, 2023; Bedewi, Elsifey, Naguib, Saleh, Al-Ghamdi, et al., 2020).

Conclusion

In conclusion, HDP injection demonstrated a beneficial effect in increasing femoral cartilage (FC) thickness in obese patients with knee osteoarthritis (KOA) in the short term. The FC thickness was thinnest at the medial condyle (MC) compared to the intercondylar (IC) and lateral condyle (LC) sites. A significant improvement in FC thickness was observed in the HDP group in the within-group analysis.

References

Ayuningtyas, D., Kusuma, D., Amir, V., Tjandrarini, D. H., & Andarwati, P. (2022). Disparities in Obesity Rates among Adults: Analysis of 514 Districts

- in Indonesia. *Nutrients*, 14(16).
<https://doi.org/10.3390/NU14163332>
- Azam, M., Sakinah, L. F., Kartasurya, M. I., Fibriana, A. I., Minuljo, T. T., & Aljunid, S. M. (2023). Prevalence and determinants of obesity among individuals with diabetes in Indonesia. *F1000Research*, 11, 1063.
<https://doi.org/10.12688/f1000research.125549.3>
- Banu Aydın, Z., & Köseoğlu, D. (2023). Ultrasonographic assessment of knee joint in patients with diabetes mellitus: comparison of sonographic changes in distal femoral cartilage and tendon structures with non-diabetics patients. *European Review for Medical and Pharmacological Sciences*, 27(15), 7180–7187.
https://doi.org/10.26355/eurrev_202308_33291
- Bedewi, M. A., Elsifey, A. A., Naguib, M. F., Saleh, A. K., Al-Ghamdi, S., Alhariqi, B. A., Aldossary, N. M., & Gould, E. S. (2020). Ultrasonographic measurement of femoral cartilage thickness in type II diabetic patients. *Medicine*, 99(14).
<https://doi.org/10.1097/MD.00000000000019455>
- Bedewi, M. A., Elsifey, A. A., Naguib, M. F., Saleh, A. K., Nwihadh, N. Bin, Abdelghany, A. A., & Swify, S. M. (2020). Sonographic assessment of femoral cartilage thickness in healthy adults. *The Journal of International Medical Research*, 48(8).
<https://doi.org/10.1177/0300060520948754>
- Blazek, K., Favre, J., Asay, J., Erhart-Hledik, J., & Andriacchi, T. (2014). Age and obesity alter the relationship between femoral articular cartilage thickness and ambulatory loads in individuals without osteoarthritis. *Journal of Orthopaedic Research : Official Publication of the Orthopaedic Research Society*, 32(3), 394–402.
<https://doi.org/10.1002/JOR.22530>
- Chen, L., Zheng, J. J. Y., Li, G., Yuan, J., Ebert, J. R., Li, H., Papadimitriou, J., Wang, Q., Wood, D., Jones, C. W., & Zheng, M. (2020). Pathogenesis and clinical management of obesity-related knee osteoarthritis: Impact of mechanical loading. *Journal of Orthopaedic Translation*, 24(November 2019), 66–75.
<https://doi.org/10.1016/j.jot.2020.05.001>
- Dório, M., Hunter, D. J., Collins, J. E., Asher, R., Eckstein, F., Guermazi, A., Roemer, F. W., & Deveza, L. A. (2020). Association of baseline and change in tibial and femoral cartilage thickness and development of widespread full-thickness cartilage loss in knee osteoarthritis - data from the

- Osteoarthritis Initiative. *Osteoarthritis and Cartilage*, 28(6), 811–818. <https://doi.org/10.1016/J.JOCA.2020.03.011>
- Herrera H, G. A., Llinás, P. J., Flórez, L., Blanco Montes, C., Vernaza Obando, D., Díaz Solorzano, A., Loaiza, D., & Guillen Astete, C. (2020). Ultrasound measurement of femoral cartilage thickness in the knee of healthy young university students. *Revista Espanola de Cirugia Ortopedica y Traumatologia (English Ed.)*, 64(4), 244–250. <https://doi.org/10.1016/J.RECOT.2020.04.001>
- Jeon, H., Donovan, L., & Thomas, A. C. (2023). Exercise-Induced Changes in Femoral Cartilage Thickness in Patients With Patellofemoral Pain. *Journal of Athletic Training*, 58(2), 128–135. <https://doi.org/10.4085/1062-6050-0602.21>
- Keefe, T. H., Minnig, M. C., Arbeeva, L., Niethammer, M., Xu, Z., Shen, Z., Chen, B., Nissman, D. B., Golightly, Y. M., Marron, J. S., & Nelson, A. E. (2023). Patterns of variation among baseline femoral and tibial cartilage thickness and clinical features: Data from the osteoarthritis initiative. *Osteoarthritis and Cartilage Open*, 5(1). <https://doi.org/10.1016/J.OCARTO.2023.100334>
- Küçükakkaş, O., Aydın, T., & Yurdakul, O. V. (2022). Evaluation of the effect of intra-articular platelet-rich plasma and hyaluronic acid injections on femoral cartilage thickness in chronic knee osteoarthritis. *Acta Orthopaedica Belgica*, 88(4), 811–819. <https://doi.org/10.52628/88.4.10243>
- Lacy, K. W., Cracchiolo, A., Yu, S., & Goitz, H. (2016). Medial Femoral Condyle Cartilage Defect Biomechanics: Effect of Obesity, Defect Size, and Cartilage Thickness. *The American Journal of Sports Medicine*, 44(2), 409–416. <https://doi.org/10.1177/0363546515613517>
- Oddo, V. M., Maehara, M., & Rah, J. H. (2019). Overweight in Indonesia: an observational study of trends and risk factors among adults and children. *BMJ Open*, 9(9). <https://doi.org/10.1136/BMJOPEN-2019-031198>
- Omoumi, P., Babel, H., Jolles, B. M., & Favre, J. (2018). Cartilage can be thicker in advanced osteoarthritic knees: A tridimensional quantitative analysis of cartilage thickness at posterior aspect of femoral condyles. *British Journal of Radiology*, 91(1087). <https://doi.org/10.1259/bjr.20170729>
- Pamukoff, D. N., Vakula, M. N., Holmes, S. C., Shumski, E. J., & Garcia, S. A.

- (2020). Body mass index moderates the association between gait kinetics, body composition, and femoral knee cartilage characteristics. *Journal of Orthopaedic Research : Official Publication of the Orthopaedic Research Society*, 38(12), 2685–2695.
<https://doi.org/10.1002/JOR.24655>
- Pane, R. V., Aisyah, Ariani, H., Isparnadi, E., Al Hajiri, A. Z. Z., & Setiawan, A. (2022). Ultrasound assessment of femoral cartilage thickness among healthy Indonesian adults. *Bali Medical Journal*, 11(3), 2013–2016.
<https://doi.org/10.15562/BMJ.V11I3.3667>
- Pane, R. V., Setiyaningsih, R., Widodo, G., Al Hajiri, A. Z. Z., & Salsabil, J. R. (2023). Femoral Cartilage Thickness in Knee Osteoarthritis Patients and Healthy Adults: An Ultrasound Measurement Comparison. *TheScientificWorldJournal*, 2023.
<https://doi.org/10.1155/2023/3942802>
- Rachmi, C. N., Li, M., & Alison Baur, L. (2017). Overweight and obesity in Indonesia: prevalence and risk factors—a literature review. *Public Health*, 147, 20–29.
<https://doi.org/10.1016/j.puhe.2017.02.002>
- Rogers, D. L., Klyce, W., Kajstura, T. J., & Lee, R. J. (2021). Association of Body Mass Index With Severity and Lesion Location in Adolescents With Osteochondritis Dissecans of the Knee. *Orthopaedic Journal of Sports Medicine*, 9(9).
<https://doi.org/10.1177/23259671211045382>
- Soliman, D. M. I., Sherif, N. M., Omar, O. H., & El Zohiery, A. K. (2016). Healing effects of prolotherapy in treatment of knee osteoarthritis healing effects of prolotherapy in treatment of knee osteoarthritis. *Egyptian Rheumatology and Rehabilitation* 2016 43:2, 43(2), 47–52. <https://doi.org/10.4103/1110-161X.181858>
- Tham, K. W., Abdul Ghani, R., Cua, S. C., Deerochanawong, C., Fojas, M., Hocking, S., Lee, J., Nam, T. Q., Pathan, F., Saboo, B., Soegondo, S., Somasundaram, N., Yong, A. M. L., Ashkenas, J., Webster, N., & Oldfield, B. (2023). Obesity in South and Southeast Asia-A new consensus on care and management. *Obesity Reviews : An Official Journal of the International Association for the Study of Obesity*, 24(2).
<https://doi.org/10.1111/OBR.13520>
- Topol, G. A., Pestalardo, I. G., Reeves, K. D., Elias, F., Steinmetz, N. J., Cheng, A. L., & Rabago, D. (2022). Dextrose Prolotherapy for Symptomatic Grade IV Knee Osteoarthritis: A Pilot Study of Early and Longer-Term Analgesia and

Pain-Specific Cytokine Concentrations.

Clinics and Practice, 12(6), 926–938.

[https://doi.org/10.3390/clinpract120600](https://doi.org/10.3390/clinpract12060097)

97

Waluyo, Y., Artika, S. R., Wahyuni, I. N.,

Gunawan, A. M. A. K., & Zainal, A. T.

F. (2023). Efficacy of Prolotherapy for

Osteoarthritis: A Systematic Review.

Journal of Rehabilitation Medicine, 55.

<https://doi.org/10.2340/JRM.V55.2572>



The Effect of Sunscreen Use on The Incidence of Melasma in Police Officers: Meta-Analysis and Systemic Review

Intan Nurmawati Putri^{1*}, Aldo Primananda Putra¹, Nandika Juniano¹, Eko Budi², Winawati Eka Putri³, Renata Mayangsari⁴, Kinanti Prabawaningrum⁴, Julian Andriansyah⁵

¹Police Inspector Bachelor Intake, Police Academy, Semarang, Central Java

²Wahid Hasyim University, Semarang, Central Java

³Department of Dermatology and Venereology, Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya, East Java

⁴Mitra Keluarga Hospital, Surabaya, East Java

⁵Dr Soetomo General Academic Hospital, Surabaya, East Java

*Corresponding Author: intan.dvjul17@gmail.com

DOI: 10.33086/iimj.v6i2.6257

ARTICLE INFO

Keywords:
Melasma, Sun exposure, Police duty

Submitted: July 16th 2024

Reviewed: Aug 19th 2024

Accepted: Oct 14th 2024

ABSTRACT

Introduction: Melasma is a matter of concern for certain individuals due to its ability to cause changes in the visual appearance of the skin, ultimately impacting one's self-esteem and overall quality of life. Exposure to direct sunlight significantly influences the development of melasma. Indonesia's location below the equator results in a tropical environment with high temperatures throughout the year. Police officers are exposed to solar radiation for more than 6 hours every day while on duty. For certain police officers, particularly female officers, this is an issue as it can result in melasma, which affects appearances

Objective: This study aims to estimate the effect of sunscreen usage in the police environment on melasma incidence in police officers.

Methods: Electronic databases such as MEDLINE/PubMed, Cochrane Library, ClinicalTrials.gov, EBSCO, Scopus, ProQuest, Cambridge Core, reference lists, conference proceedings, and researchers in relevant fields of study were searched. The impact of sunscreen application on the prevalence of melasma in police personnel was evaluated using many parameters

Results: Based on the systematic review, police officers continue to have a very high prevalence of melasma because they have a low awareness of the importance of using sunscreen.

Conclusions: Awareness of sunscreen application on the skin is required to prevent the development of melasma in police personnel. Education on the prognosis, propensity, and chronicity of melasma is extremely important. In a police institution, Dermatovenereologists (DVE) play an important role.

Introduction

Melasma, also known as chloasma, is a condition of symmetrical hyperpigmentation of the skin with brownish pigmentation that is usually found

on the face and can sometimes occur in the forearms and back (Aishwarya et al., 2019). Melasma is prevalent among people of Asian, Latin American, and Hispanic descent with Fitzpatrick skin type III-V.

Retrospective study of new patients in Cosmetic Division, Dermatology, and Venereology Outpatient Clinic Dr. Soetomo General Hospital, Surabaya from January 2011 until December 2013. The total number of new patients of melasma in the Cosmetic Division, Dermatology and Venereology Outpatient Clinic, Dr. Soetomo General Hospital, Surabaya from January 2011 until December 2013 (3 years) is 869 patients. The data shows that the incidence of melasma is quite high.

Melasma is a multifactorial disorder that involves an interaction of genetic predisposition, hormonal effects, UV exposure, as well as other environmental variables (Chakraborty et al., 2017).

Indonesia is positioned below the equator, resulting in a tropical environment with high temperatures throughout the year. Police personnel are exposed to the sunlight for more than 6 hours every day while doing their duties. This is a concern for some police officers, particularly female officers because it can produce melasma, which affects their appearance (Mahajan et al., 2022).

Sunlight Exposure

Sunlight is one of the causes of melasma, which results in enhanced pigmentation and photodamaged forms known as solar elastosis. Ultraviolet radiation in melasma

can trigger the production of singlet oxygen and free radicals, which damage lipids and tissues in the skin. These free radicals will stimulate melanocytes to produce excessive melanin (Jirvis et al., 2024). Figure 1 depicts the pathophysiology of melasma caused by ultraviolet light.

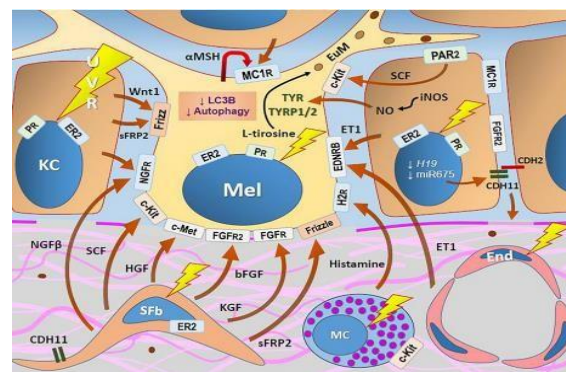


Figure 1. UVR causes melanogenic events, oxidative and inflammatory responses in the epidermis and dermis

Endocrine Stimulation

Luteinizing Hormone (LH), Follicle Stimulating Hormone (FSH), and Melanocyte Stimulating Hormone (MSH) contribute to the development of melasma by stimulating the tyrosinase and dopachrome tautomerase in melanogenesis. These hormones are present in substantial amounts during pregnancy, hence pregnant women have an increased risk of developing melasma (Sheth et al., 2011).

Oxidative Factors

UVB radiation activates the phosphatidylinositol 3-kinase/Akt pathway,

and nuclear factor kappa-light-chain enhancer activated B cells (NF- κ B) increase iNOS production in keratinocytes, resulting in paracrine nitric oxide activating tyrosinase in melanocytes. Fibroblast cell interaction with mast cells in the process of melanogenesis (Oluwatobi et al., 2017). Fibroblast cell interaction in the melanogenesis process is shown in Figure 2.

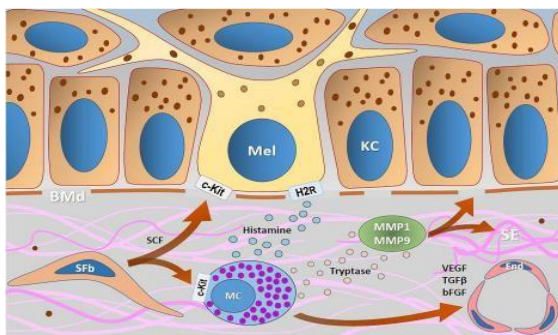


Figure 2. Fibroblast cell interaction with mast cells in the process of melanogenesis

Clinical Manifestation

Melasma is distinguished by the presence of symmetrical, irregular, light brown to dark brown hyperpigmented macules on areas of the body that are frequently exposed to sunlight, particularly the forehead, nose, chin, above the lips, cheeks, upper and lower jaw (Doolan & Gupta, 2021). Melasma can also affect the anterior chest and the dorsal forearm Neagu et al., 2021). Melasma lesions are distributed in three patterns: (1) centrofacial (63%) which covers the forehead, cheeks, nose, upper lip, and chin; (2) malar (21%),

which covers the cheeks and nose; and (3) mandibular (16%), which covers the mandibular ramus and adjacent regions (see Figure 3) (Oluwatobi et al., 2017). Melasma distribution in the facial region is shown in Figure 4 (Neagu et al., 2021).



Figure 3. A. melasma on the cheek with homogeneous pigment, B. melasma on the cheek, C. melasma on the lateral cheek

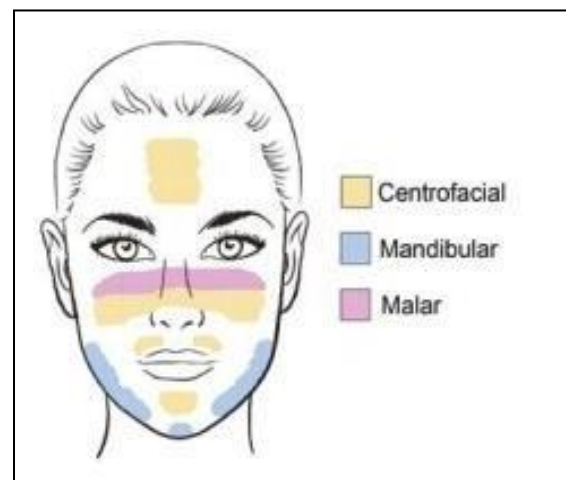


Figure 4. Melasma distribution

Treatment

Melasma treatment remains unsatisfactory due to the numerous factors involved in its etiology. Melasma treatment is time-consuming and may be chronically recurring. Sunscreen and sun protection,

topical treatment, and device therapy are all used to manage the condition (Asditya & Sukanto, 2017; Godse et al., 2023; McKesey et al., 2019).

Topical treatment

Hydroquinone (HQ), which inhibits tyrosinase and is toxic to melanocytes, is the gold standard in melasma therapy. The concentration used is 2-4% and is usually combined with other agents, such as the Kligman formula (HQ 5%, tretinoin 0.1%, and dexamethasone 0.1%), the modified Kligman formula (HQ 4%, tretinoin 0.05%, and hydrocortisone acetate 1%), the Pathak formula (HQ 2% and tretinoin 0.05-0.1%), and the Westerhof formula (N-acetylcysteine 4.7%, HQ 2%, and triamcinolone acetonide 0.1%). The safety of HQ is debatable, and prolonged usage may result in exogenous ochronosis and irreversible depigmentation. Tyrosinase enzyme inhibitors (arbutin, kojic acid, azelaic acid), tranexamic acid (topical or systemic), antioxidants (vitamin C, silymarin, orchid extract, α -tocopherol, hydrocumarin), niacinamide, linolenic acid, linoleic acid, oleic acid, phospholipase D2, glucosamine, tunicamycin, calcium D-pantethein-S-sulfonate, and numerous other topical agents that exhibit anti-melanogenic effects with varying degrees of success can also be used for melasma therapy. Chemical

peeling agents often used in melasma treatment include alpha hydroxy acid, salicylic acid, Jessner's solution, and 10-50% trichloroacetic acid. For the treatment of melasma, several novel peeling agents are also being developed, including tretinoin and Obagi blue peel (Aditya et al., 2020; Aishwarya et al., 2019; Cassiano & Claudia, 2022; Claudia et al., 2022; Ebrahimi & Naeini, 2014; Godsee et al., 2023; Mahajan et al., 2022; Viorizka et al., 2023).

Device assisted treatment

Melasma can be treated using lasers such as Q-switched Nd:YAG (532 and 1064 nm), Q-switched ruby (694 nm), and alexandrite (755 nm). Although melasma has been proven to improve with laser therapy, the laser is only advised for refractory melasma due to its post-inflammatory hyperpigmentation effects. Other treatments include intense pulsed light therapy (IPL), 1,550 nm fractional non-ablative laser, pulsed-dye laser, and copper bromide (Aditya et al., 2020; Doolan & Gupta, 2021; Sheth & Pandya, 2011).

Sunscreen and physical sun protection

Sunscreen and sun protection are essential for preventing melasma from developing, becoming worse, and recurring

back. Patients are recommended to use physical protection, such as wide-brimmed hats, umbrellas, and protective eyewear, and to stay out of direct sunlight. Patients are recommended to use physical protection, such as wide-brimmed hats, umbrellas, and protective eyewear, and to stay out of direct sunlight. For best outcomes, sunscreen must be used both during and after therapy. Figure 5 illustrates how effective sunscreen is against sun exposure (Geoffrey & Mwangi, 2024; Guan & Lim, 2021; Mumtazah et al., 2020; Sander & Burbridge, 2024).

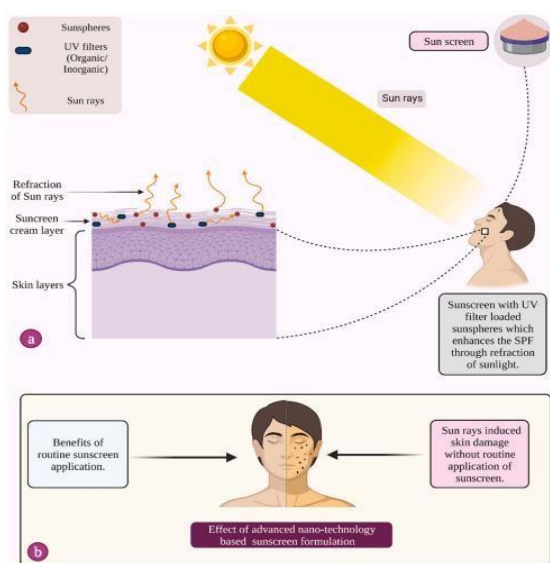


Figure 5. Effectiveness of sunscreen use against sun exposure

Sunscreens are protective cosmetics intended to protect the skin from UV radiation. Sunscreens are classified into two groups (Geoffrey & Mwangi, 2024; Guan & Lim, 2021; Mumtazah et al., 2020; Sander & Burbridge, 2024), namely:

1. Chemical sunscreen

Chemical sunscreens, also known as organic sunscreens, protect the skin by absorbing solar radiation and transforming it into thermal energy. These sunscreens are absorbed by the skin and may cause skin irritation; thus, they should not be used on newborns as young as 6 months. Avobenzone and Octinoxate are a few examples of these sunscreens.

2. Physical sunscreen

Physical sunscreens or sunblock shield the skin by reflecting solar radiation. These sunscreens are broad-spectrum, capable of protecting against UV A and UV B rays, stable, have a minimal allergy potential, and are not absorbed by the skin, making them safe and suitable for children. The Food and Drug Administration (FDA) states that physical sunscreen is the ideal type. Certain cosmetic manufacturers combine chemical and physical sunscreens to maximize the effectiveness of their products (Chavda et al., 2023).

Sun Protection Factor (SPF)

Sun Protection Factor is frequently listed on products intended for skin care. The SPF of sunscreen indicates how well it shields skin from UV rays. The SPF of sunscreen indicates how well it shields skin from UV rays. Sunscreens have different SPF values, ranging from 1 to 50. Ideally, apply a broad-

spectrum sunscreen with SPF 30 or above to protect against UV A and B, however, sunscreens cannot completely protect the skin from UV exposure.

Sunscreen potential

The ability of a sunscreen is not solely dependent on its SPF rating, other aspects influence the potency of sunscreens, namely:

1. The ideal sunscreen is one that protects against both UVA and UVB (broad spectrum), is non-irritating, and is widely accessible. A particular type of carrier material used in sunscreen influences stability features like water resistance as well as the possibility of active chemicals penetrating the skin.
2. Sunscreen application method that impacts the efficiency of sunscreen and must be considered while applying sunscreen, namely:
 - a. Sufficient quantity/thickness, uniformly spread.
 - b. Daily routine usage
 - c. Apply sunscreen 15-30 minutes before leaving the house or being exposed to UV rays and let it dry before applying makeup.
 - d. Reapply the sunscreen every 2-4 hours, depending on the activity. Sunscreen efficacy is diminished when exposed to perspiration or water. If the activity

involves swimming, reapply water-resistant sunscreen in 1 hour.

- e. Before using a new sunscreen for the first time, it's advised to test it on a tiny area to prevent irritation or allergic reactions.

As previously stated, a decent SPF rating is greater than 30, yet many cosmetics on the market indicate SPF but do not specify the type of sunscreen contained. Multiple studies on solar photoprotection have shown that frequent and appropriate usage of topical sunscreen (applied to the skin) helps prevent skin cancer. However, the efficacy of sunscreen is governed by various factors, such as the amount of sunscreen used, the appropriate time of use, reapplication (repetition) of application within 2-3 hours, and routine use every day (Chavda et al., 2023; Geoffrey & Mwangi, 2024; Guan & Lim, 2021; Mumtazah et al., 2020; Sander & Burbridge, 2024).

Various sunscreen types

According to skin type and activities, a variety of sunscreen cosmetics are available on the market. Types of cosmetics with sunscreen include:

1. Lotion

Sunscreen lotion is ideal for normal to oily skin and oily skin due to its low viscosity, non-stickiness, and ease of application.

2. Cream

For dry skin types, a cream sunscreen is recommended.

3. Water-based gel

The gel form is ideal for oily skin and males.

4. Spray

For the past several years, spray sunscreens have been increasingly popular, particularly with kids. Spray is suited for application to wide regions of the body.

5. Stick

Sunscreen in stick form efficiently protects narrow/limited and conspicuous regions such as the lips, nose, and eye circles. Suitable for use during activities since it is long-lasting and does not melt easily, which might irritate the eyes (Sander & Burbidge, 2024).

State Police of the Republic of Indonesia

Principal duties of the police

The concept of police originates from the Ancient Greek term "politeia" which implies the governance of a polis or city. Kamus Besar Bahasa Indonesia defines the police as a government agency responsible for keeping public order, such as arresting persons who break the law, or state officials in charge of ensuring security. Juridically, as stated in the UU No. 2 year 2002 about the Police Force, the main tasks of the Police are clearly defined as law

enforcement, protectors, and community guides, particularly in terms of compliance and obedience to applicable laws. To enforce the law in any part of the world, the police must act as the state's representative while enforcing and upholding the rule of law in all spheres of society. The goal of the Indonesian Police Act's renewal, UU No. 2 year 2002, is to further solidify the police's standing and role in government, including their ability to uphold public safety and order, enforce the law, protect the public, and provide services to the community that upholds human rights (Article 4, UU No. 2 year 2002), must be free from the influence of any party's power, which is exercised independently of the influence of other powers and the authority of the government. The Indonesian National Police is a state instrument that plays a role in maintaining security and public order, enforcing the law, and providing protection, protection, and services to the public in the context of maintaining domestic security (Article 5, UU No. 2, 2002). The police must uphold the rule of law to enforce it. However, the police also perform social and communal obligations for which the community's values must be taken into consideration. Currently, the police face the challenge of upholding the moral standards necessary to fulfill their roles as guardians and enforcers of the law, as well as societal protectors, to

be able to exercise sound judgment when faced with difficult choices related to their role (Anshar & Setiyono, 2020; Tasaripa, 2013).

Sunscreen use and Melasma incidence among police officers

Some livelihoods are usually exposed to excessive sun exposure for a full day such as farmers, construction workers, and some public services such as police. Mustafa et al. surveyed 200 participants (86% men and 14% women) regarding the hazards and protection from excessive sun exposure; most of them were exposed to the sun for 6 hours every day, among whom was a police officer. In the research, 44% of individuals had reddish skin from sunburn, 30% were unaware of the sun's detrimental effects, 72% did not apply sunscreen, and 92% did not utilize an umbrella or other forms of protection (Alfredsson et al., 2020; Lim & Aroman, 2021; Michilot & Tellez, 2020; Mustafa, 2017).

The awareness of sunscreen use in the community is still low due to.

1. There is a lack of awareness and understanding about the need to use sunscreen, particularly among seniors.
2. A misconception that sunscreen is only necessary for outdoor activities; even though UV radiation may pass through clouds and glass, many people still

believe that sunscreen should only be used at the beach or in direct sunshine.

Accessibility and affordability, given that certain people, particularly those from middle-class or lower-class backgrounds, may find the cost of high-quality sunscreen products prohibitive.

Methods

This study used meta-analytic observations, with systematic review and meta-analysis to determine the effect of sunscreen use in the police environment concerning the incidence of melasma in police officers. Electronic databases such as MEDLINE/PubMed, the Cochrane Library, ClinicalTrials.gov, EBSCO, Scopus, ProQuest, Cambridge Core, reference lists, conference proceedings, and a search of researchers in relevant fields of study were the sources of the methods utilized. The relationship between the prevalence of melasma in police officers and the usage of sunscreen in the workplace was associated with various related journals.

Results

Indonesia's location below the equator results in a tropical environment with high temperatures throughout the year. Sunlight is one of the causes of melasma, which results in enhanced pigmentation and photodamaged forms known as solar

elastosis. Ultraviolet radiation in melasma can trigger the production of singlet oxygen and free radicals, which damage lipids and tissues in the skin. UVB radiation activates the phosphatidylinositol 3-kinase/Akt pathway, and nuclear factor kappa-light-chain enhancer activated B cells (NF- κ B) increase iNOS production in keratinocytes, resulting in paracrine nitric oxide activating tyrosinase in melanocytes. Sunscreen and sun protection are essential for preventing

melasma from developing, becoming worse, and recurring back. However, there are several weaknesses in sunscreen applications in the community, Table 1 explains what should be done in sunscreen applications and mistakes in sunscreen applications sufficient quantity/thickness, uniformly spread.

Table 1. Do and don't in sunscreen application

Proper Sunscreen Application (Do)	Mistakes In Using Sunscreen (Don't)
1. Daily routine usage	1. lack of awareness and understanding about the need to use sunscreen, particularly among seniors
2. Apply sunscreen 15-30 minutes before leaving the house or being exposed to UV rays and let it dry before applying makeup.	2. The misconception that sunscreen is only necessary for outdoor activities; even though UV radiation may pass through clouds and glass, many people still believe that sunscreens should only be used at the beach or in direct sunshine
3. Reapply the sunscreen every 2-4 hours, depending on the activity. Sunscreen efficacy is diminished when exposed to perspiration or water. If the activity involves swimming, reapply water-resistant sunscreen in 1 hour.	3. Accessibility and affordability, given that certain people, particularly those from middle-class or lower-class backgrounds, may find the cost of high-quality sunscreen products prohibitive
4. Before using a new sunscreen for the first time, it's advised to test it on a tiny area to prevent irritation or allergic reactions.	

The goal of the Indonesian Police Act's renewal, UU No. 2 year 2002, is to further solidify the police's standing and role in government, including their ability to uphold public safety and order, enforce the law, protect the public, and provide services

to the community that upholds human rights. The Indonesian National Police is a state instrument that plays a role in maintaining security and public order, enforcing the law, and providing protection, protection, and services to the public in the

context of maintaining domestic security. Police officers are usually exposed to excessive sun exposure for a full day. Police officers are exposed to solar radiation for more than 6 hours every day while on duty. The study's findings indicate that while police is one of the professions with the highest daily sun exposure. This can trigger the occurrence of melasma according to the literature which states that excessive sun exposure is one of the factors that cause melasma. There are no publications that expressly address the prevalence of melasma in police officers. According to some studies, one of the risk factors for melasma is excessive sun exposure, thus it is highly conceivable that the prevalence of melasma among police officers is still extremely high. This is due to one of these variables, namely police officers' lack of understanding about sunscreen use (Liew & Anne, 2021). Journal related to the incidence of melasma in police members is still in a small number, so further research is needed on this matter.

Conclusion

Given that Indonesia is a tropical nation with year-round high levels of sun exposure, further investigation is required to determine the prevalence of melasma among police personnel there. Awareness of sunscreen application on the skin is

required to avoid the occurrence of melasma in police personnel. The necessity of education on the prognosis, propensity, and chronicity of melasma is strongly advised. Dermatovenereologists (DVE) play a significant role in the police institution.

References

- Aditya, R., Hoemardani, A., & Bernadette, I. (2020). Validity and reliability of melasma quality of life scale questionnaire in Bahasa Indonesia for female patients. *Journal of Procedural Dermatology and Venereology Indonesia*, 1–10.
- Aishwarya, K., Bhagwat, P. V., & John, N. (2019). Current concepts in melasma: A review article. *Journal of Skin and Sexually Transmitted Diseases*, 1–5.
- Alfian, E. (2020). Tugas dan fungsi kepolisian untuk meningkatkan kepercayaan publik terhadap penegak hukum. *Jurnal Hukum*, 12(1), 27–37.
- Alfredsson, L., Armstrong, B., & Butterfield, A. D. (2020). Insufficient sun exposure has become a real public health problem. *International Journal of Environmental Research and Public Health*, 17(14), 5014–5016.
- Anshar, R., & Setiyono, J. (2020). Tugas dan fungsi polisi sebagai penegak hukum dalam perspektif Pancasila. *Jurnal*

- Pembangunan Hukum Indonesia, 2(3), 359–372.
- Asditya, A., & Sukanto, H. (2017). Studi retrospektif: Profil pasien melasma. *Berkala Ilmu Kesehatan Kulit dan Kelamin – Periodical of Dermatology and Venereology*, 1–9.
- Cassiano, P., & Claudia, A. (2022). Update on melasma—Part II: Treatment. *Dermatology and Therapy*, 1990–2007.
- Chakraborty, S. N., Poojary, S. A., & Rathi, S. (2017). Evidence-based review, grade of recommendation, and suggested treatment recommendations for melasma. *Indian Dermatology Online Journal*, 406–442.
- Chavda, V., Acharya, D., & Hala, V. (2023). Sunscreens: A comprehensive review with the application of nanotechnology. *Journal of Drug Delivery Science and Technology*, 86.
- Claudia, A., Dias, J., & Cassiano, P. (2022). Update on melasma—Part I: Pathogenesis. *Dermatology and Therapy*, 1968–1984.
- Doolan, B. J., & Gupta, M. (2021). Melasma. *Australian Journal of General Practice*, 880–885.
- Ebrahimi, B., & Naeini, F. (2014). Topical tranexamic acid as a promising treatment for melasma. *Journal of Research in Medical Sciences*, 753–757.
- Fleury, N., Geldenhuys, S., & Gorman, S. (2016). Sun exposure and its effects on human health: Mechanisms through which sun exposure could reduce the risk of developing obesity and cardiometabolic dysfunction. *International Journal of Environmental Research and Public Health*, 13(10), 999.
- Geoffrey, K., & Mwangi, A. N. (2024). Sunscreen products: Rationale for use, formulation development and regulatory considerations. *Saudi Pharmaceutical Journal*, 27(7), 1009–1018. <https://doi.org/10.1016/j.jsps.2019.08.003>
- Godse, K., Sarkar, R., Mysore, V., Chatterjee, M., & Damisetty, R. (2023). Oral tranexamic acid for the treatment of melasma: Evidence and experience-based consensus statement from Indian experts. *Indian Journal of Dermatology*, 1–9.
- Guan, L., & Lim, H. (2021). Sunscreens and photoaging: A review of current literature. *American Journal of Clinical Dermatology*, 22(6), 819–828. <https://doi.org/10.1007/s40257-021-00632-5>
- Ioannou, L., & Tsoutsoubi, L. (2021). The impacts of sun exposure on worker physiology and cognition: Multi-country evidence and interventions. *MDPI*, 18(14), 769.

- Jiryis, B., Toledano, O., Avitan, E., & Khamaysi, Z. (2024). Management of melasma: Laser and other therapies—Review study. *Journal of Clinical Medicine*, 1–12.
- Liew, Y., & Anne, E. (2021). Insufficient sun exposure has become a real public health problem. *Australian and New Zealand Journal of Public Health*, 45(5), 462–468.
- Lim, H., & Aroman, M. S. (2021). Sun exposure and protection habits: Self-reported attitudes, knowledge, and behaviors.
- Mahajan, V. K., Patil, V., Blicharz, L., Kassir, M., Konnikov, N., Gold, M. H., Goldman, M. P., & Galadari, H. (2022). Medical therapies for melasma. *Journal of Cosmetic Dermatology*, 3707–3728. <https://doi.org/10.1111/jocd.15242>
- Matts, P., & Fink, B. (2011). Chronic sun damage and the perception of age, health, and attractiveness. *Medical Environmental Sciences*.
- McKeseey, J., Garza, A. T., & Pandya, A. G. (2019). Melasma treatment: An evidence-based review. *American Journal of Clinical Dermatology*, 1–53.
- Michilot, D. C., & Tellez, W. A. (2020). Text message reminders for improving sun protection habits: A systematic review. *Medical Environmental Sciences*.
- Mumtazah, E., Salsabila, S., & Lestari, E. (2020). Pengetahuan mengenai sunscreen dan bahaya paparan sinar matahari serta perilaku mahasiswa teknik sipil terhadap penggunaan sunscreen. *Jurnal Farmasi Komunitas*, 7(2), 63–68.
- Mustafa, F. H. (2017). A survey on awareness of sun exposure among farmers, construction workers, and traffic policemen in Erbil. *Zanco Journal of Pure and Applied Sciences*, 29(3), 159–169.
- Neagu, N., Conforti, C., Agozzino, M., Marangi, G. F., Morariu, S. F., Pellacani, G., Persichetti, P., Piccolo, D., Segreto, F., & Zalaudek, I. (2021). Melasma treatment: A systematic review. *Journal of Dermatological Treatment*, 1–40.
- Oluwatobi, A., Godec, O., & Elbuluk, N. (2017). Melasma: An up-to-date comprehensive review. *Dermatology and Therapy*, 1–14. <https://doi.org/10.1007/s13555-017-0194-1>
- Passeron, T., Dreno, B., & Puig, S. (2024). Outdoor workers and sun exposure: Results of an international survey on sun exposure behaviours and knowledge among 17 countries, the HELIOS project. *Journal of the European Academy of Dermatology and*

Venereology.

<https://doi.org/10.1111/jdv.20001>

- Sander, M., & Burbidge, T. (2024). The efficacy and safety of sunscreen use for the prevention of skin cancer. National Library of Medicine, 1802–1808.
- Sheth, V. M., & Pandya, A. (2011). Melasma: A comprehensive update. *Journal of the American Academy of Dermatology*, 689–697.
- Suka, I., Gunarto, & Ma'ruf, U. (2022). Peran dan tanggung jawab Polri sebagai penegak hukum dalam melaksanakan restorative justice untuk keadilan dan kemanfaatan masyarakat. *Jurnal Hukum Khaira Ummah*, 17(3), 1–8.
- Tasaripa, K. (2013). Tugas dan fungsi kepolisian dalam perannya sebagai penegak hukum menurut undang-undang nomor 2 tahun 2002 tentang kepolisian. *Jurnal Ilmu Hukum Legal Opinion*, 1(2), 1–9.
- Viorizka, P., Setyaningrum, T., Qurnianingsih, E., & Damayanti. (2023). The profile and triggering factors of melasma patients: A retrospective study. *Jurnal Berkala Ilmu Kesehatan Kulit dan Kelamin*, 142–146.
- Wahyono. (2011). Dinamika fungsi kepolisian dan hubungannya dengan program perpolisian masyarakat. *Perspektif*, 16(3), 1–13.



Multivariate Analysis of Personal Hygiene, Residential Density, Socioeconomic Status, and Knowledge Toward Scabies Prevalence at the Serang City Islamic Boarding School

Reggi First Trasia,^{1*} Azzam Faruqi², Rawina Winita³, Sakura Muhammad Tola⁴, Intan Keumala Dewi⁴

¹Division Parasitology, Faculty of Medicine, University of Sultan Ageng Tirtayasa, Serang, Indonesia

²Faculty of Medicine, University of Sultan Ageng Tirtayasa, Serang, Indonesia

³Parasitology Department, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

⁴Faculty of Medicine, Universitas YARSI, Jakarta, Indonesia

*Corresponding Author: reggi.first@untirta.ac.id

DOI: 10.33086/iimj.v6i2.6345

ARTICLE INFO

Keywords:
Scabies,
parasitology,
mites, neglected
tropical disease,
personal hygiene

Submitted: Aug
12th 2024

Reviewed: Sept
22th 2024

Accepted: Oct
22th 2024

ABSTRACT

Introduction: Scabies is an infectious disease of the skin caused by the mite *Sarcoptes scabiei* var. *hominis*. This disease is often ignored because it is not life-threatening, but the itching that occurs can interfere with daily life. Scabies is often found in densely populated environments such as Islamic boarding schools, places where students study. Borrowing each other's personal items, living in rooms with high occupancy rates, and having poor habits regarding personal hygiene are risk factors for contracting scabies among students.

Objective: Through this background, this research aims to determine the relationship between the level of personal hygiene, housing density, socioeconomic status, and the level of knowledge about scabies among students at the Islamic Boarding School, Serang, Banten.

Methods: The research was carried out at the Islamic Boarding School, Serang, Banten with a sample size of 167 respondents. The research design used was a cross-sectional analytical design with a sampling technique using the simple random sampling method. Univariate analysis was carried out by assessing frequencies and percentages. Bivariate analysis of variables was carried out using the chi-square test. Multivariate analysis was performed using multiple linear regression.

Results: Respondents in this study totaled 167 respondents. The results of the analysis show that the prevalence of scabies in Islamic boarding schools in Serang City is 47.3%. There is no significant relationship between personal hygiene and scabies prevalence ($P = 0.603$), and there is a significant relationship between housing density ($P = 0.018$), socioeconomic status ($P = 0.002$), and level of knowledge ($P = 0.035$) on scabies prevalence. at the Serang City Islamic Boarding School. Based on multivariate analysis, a relationship was found between residential density, socioeconomic status, and level of knowledge on scabies prevalence simultaneously.

Conclusions: These research results show that factors such as housing density, socioeconomic status, and level of knowledge play an important role in the spread of scabies in Islamic boarding schools even though the students show good results in personal hygiene.

Introduction

Scabies is a very common dermatological condition, occupying a large proportion of skin diseases that occur in developing countries. Scabies is caused by infestation with the parasitic mite *Sarcoptes scabiei* var. *hominis* with symptoms in the form of unbearable itching with various types of severity of skin lesions that arise. Scabies often do not receive attention because it is not life-threatening, but the result is that itching can cause discomfort in sufferers (Tri H, et al. 2017). Scabies can easily spread through direct skin-to-skin contact with infested individuals and also indirectly through the use of shared items such as clothing, towels, bedding, and sheets (Casulli A, 2021).

Scabies spread globally, estimated to reach a population of 200 million with a prevalence ranging from 0.2% to 71%. The spread of scabies is most common in countries with hot tropical climates, densely populated environments such as schools, orphanages and Islamic boarding schools, areas with low socioeconomic conditions, and areas with limited health resources (WHO, 2020). In Indonesia, scabies is still commonly found because Indonesia is a country with a tropical climate. According to the Indonesian Ministry of Health, the prevalence of scabies in Indonesia has decreased from

5.60% - 12.96% in 2008 to 4.9% - 12.95% in 2009 (Ridwan AR, et al. 2017). The prevalence of scabies in Serang City is still not fully known.

Banten is the province with the second-largest number of Islamic boarding schools in Indonesia. The densely populated environment in Islamic boarding schools makes it a risk factor for disease transmission, such as scabies, which can spread quickly from one individual to another through direct means, such as shaking hands with sufferers, or indirectly related to poor personal hygiene. such as exchanging or borrowing clothes, sarongs, towels, and even exchanging pillows, bolsters, and mattresses with fellow friends. Students also often ignore unhealthy behavior such as hanging clothes in their rooms, not immediately washing clothes that have been worn, and rarely drying mattresses or other sleeping equipment below the sun (Krisdiyanto G, et al. 2019).

Based on previous research regarding the relationship between the level of knowledge, personal sanitation, and residential density on scabies symptoms at the Darul Muklisin Islamic Boarding School, Kendari, the results showed that there was no relationship between the level of knowledge and scabies symptoms, but there was a relationship between self-sanitation and residential density and

symptoms of scabies (Ridwan AR, et al. 2017). Another study regarding risk factors for individual *santri* (students at Islamic boarding school) hygiene on the incidence of scabies skin disease in Islamic boarding schools, found that there was a relationship between poor personal sanitation, such as not paying attention to the cleanliness of hands, nails, skin, and genitals, on the incidence of scabies (Parman et al. 2017). Regarding socioeconomic status, there is research on the relationship between socioeconomic status and the prevalence of scabies, and the results show that there is a relationship between low socioeconomic status and the prevalence of scabies, which is caused by the activity of borrowing personal items from fellow friends due to a lack of adequate personal hygiene facilities and infrastructure (Afriani B. 2017).

Based on preliminary observations carried out by researchers in one of the student rooms at the Serang City Islamic Boarding School, Banten, it was observed that as many as 27 students occupied a room measuring 7.5 m x 7.5 m with the habit of spreading mattresses on the floor at night to sleep and stacking mattresses on top of them in the middle of the room during the day. In these observations, the author saw several things related to risk factors for transmitting scabies, such as the habit of sharing mattresses and high housing density, so this encouraged

researchers to conduct research on the relationship between personal hygiene, housing density, socioeconomic status, and level of knowledge on the prevalence of scabies in students of the Islamic Boarding School, Serang City, Banten.

Methods

This research uses an observational analytical method with a cross-sectional research design, namely a one-time data collection technique using a research instrument in the form of a questionnaire. This research measures the relationship between personal hygiene factors, residential density, socioeconomic status, and level of knowledge on the prevalence of scabies in Serang City Islamic Boarding School, Banten. This research was carried out in August–December 2023. The population covered in this study were all MA-level students at the Serang City Islamic Boarding School who met the inclusion criteria.

The research sample was obtained using the Slovin formula because the population of Serang City Islamic Boarding School MA-level students who met the inclusion criteria was known for certain, namely 167 respondents. The sampling technique used in this research is simple random sampling, which is a technique for taking random samples from members of the population using a random method or lottery. In this

research, the lottery was determined using a list of student attendance numbers in each class, and the lottery was carried out using a random sampling lottery page.

The research tool used in this study was a questionnaire consisting of a scabies diagnosis status sheet (Engelman D, et al. 2020) personal hygiene, a socioeconomic status questionnaire, and a knowledge level questionnaire regarding scabies that had been tested for validity in previous research (Wandira NA. 2022) as well as an observation sheet regarding residential density adapted from Minister of Health Decree no. 829 of 1999 (Mar'ati F. 2018). Research material was obtained from the results of a questionnaire survey on students and direct observation at the Serang City Islamic Boarding School. Details of the materials used for this research are primary data obtained from a questionnaire survey among students related to personal hygiene, socioeconomic status, and level of knowledge. Primary data for occupancy density was obtained by directly observing the size of the respondent's room relative to the population in that room. Secondary data is data used to support research, namely in the form of the number of students in the Serang City Islamic Boarding School in the 2023/2024 academic year, Islamic boarding school profiles, as well as data on dormitory facilities and infrastructure

obtained from the Islamic boarding school management.

The researcher will explain the purpose and benefits of the research to respondents and provide instructions for completing the questionnaire directly to respondents who have agreed to be research samples using an informed consent sheet with the help of the homeroom teacher as a guide. Next, the researcher will randomize each class by drawing lots using the randomization page, and after that the researcher will distribute questionnaire sheets to respondents and give a deadline for filling in the questionnaire sheet. The researcher will accompany the respondent while filling out the questionnaire to help the respondent if they experience difficulties when filling it out. Respondents who have filled out the questionnaire will then be examined by a doctor to see whether the respondent has clinical symptoms that lead to scabies. The data obtained will be collected, entered into SPSS, given a score, then categorized into groups according to the measurement results.

Univariate analysis in the study was used to measure the prevalence of scabies as the dependent variable and the level of personal hygiene, housing density, socioeconomic status, and level of knowledge about scabies as independent variables using a frequency distribution table for each variable and its percentage.

In this study, bivariate analysis was used to determine whether there was a relationship between independent factors, namely level of personal hygiene, housing density, socioeconomic status, and level of knowledge on the dependent variable, namely scabies prevalence.

This cross-sectional study was answered by a total of 167 respondents. In multivariate analysis, significant associations were observed regarding residential density (p-value 0.018), socioeconomic status (p-value 0.002), and also knowledge level (p-value 0.035),

about the prevalence of scabies. The multivariate analysis used is multiple linear regression.

Result and Discussion

The number of respondents in this study was 167 respondents. Discussion of the characteristics of respondents is used to find out a general description of respondents based on gender, age classification, classes, and incidence of scabies. The characteristics of respondents based on gender can be seen in Table 1 as follows.

Table 1. Characteristics of respondents at Islamic Boarding School, Serang City, Banten

No	Respondent Characteristic	Frequencies (N)	Percentage (%)
Gender			
1	Boys	92	55.1
2	Girls	75	44.9
Age Classification			
1	14-15 y.o	10	6.0
2	16-17 y.o	95	56.9
3	18-19 y.o	62	37.1
Grade			
1	Class of X	21	12.6
2	Class of XI	61	36.5
3	Class of XII	85	50.9

In this study it was found that male students who experience scabies more than female students. These results are in line with Samosir's research in 2020, which concluded that male students often do not pay attention to their personal hygiene and

environment well, in contrast to women who tend to be more concerned about personal hygiene (Samosir K, et al. 2020). The incidence of scabies is more common in 11th grade and 12th grade students, which may be related to the sense of

solidarity that arises after living together for more than 2 years with the same fate. The students have eliminated awkwardness among their fellow friends, so borrowing personal items such as clothing, towels, worship tools, and beds has become a habit carried out by the students (Aliffiani S, et al. 2020).

An overview of scabies prevalence, personal hygiene, housing density,

socioeconomic status, and level of knowledge at the Islamic Boarding School, Serang, Banten was obtained from the results of interviews and skin examinations of respondents. The results obtained regarding the prevalence of scabies, personal hygiene, housing density, socioeconomic status, and level of knowledge at the Islamic Boarding School, Serang, Banten can be seen in Table 2.

Table 2. Prevalence of scabies, personal hygiene, residential density, socioeconomic status and knowledge level in Islamic Boarding Schools, Serang City, Banten

No	Characteristic	Frequencies (N)	Percentage (%)
Prevalence of Scabies			
1	Non Scabies	88	52.7
2	Scabies	79	47.3
Personal Hygiene			
1	Good	164	98.2
2	Bad	3	1.8
Residential Density			
1	Proper	11	6.6
2	Not proper	156	93.4
Socioeconomic Status			
1	High	47	28.1
2	Moderate	82	49.1
3	Low	38	22.8
Level of Knowledge			
1	Good	82	49.1
2	Bad	85	50.9

The results of bivariate analysis using the Fisher's Exact Test show that personal hygiene has no significant relationship to the prevalence of scabies in the Al-Rahmah Walantaka Islamic Boarding School ($p = 0.603$), of which 77 students with good personal hygiene (47%) experience scabies

and 2 students with poor personal hygiene (66.7%) experiences scabies. This result is not in line with research conducted by Ridhwan et al. in 2017 which shows that 80% of students with bad personal habits experience scabies, so it was concluded that there was a significant relationship

between poor personal hygiene and scabies events in Islamic boarding school (Ridhwan et al. 2017). Lack of maintaining personal hygiene, such as bathing once a day, using a private toiletry such as a towel

alternately, and using sleeping utensils such as pillows, bolsters, or mattresses simultaneously with fellow friends, is the cause of students experiencing scabies (Table 3).

Table 3. The relationship between personal hygiene and the prevalence of scabies at the Islamic Boarding School, Serang City, Banten

Personal hygiene	Prevalence of Skabies				Total		P-Value
	Scabies		Non Scabies				
	N	%	N	%	N	%	
Bad	2	66.7%	1	33.3%	3	100%	0.603
Good	77	47%	87	53%	164	100%	
Total	79	47.3%	88	52.7%	167	100%	

The same research was conducted by Aliffiani, et al in 2020 and the results obtained were that 51% of students who maintain their personal hygiene well experience scabies, with the results of the value of $P = 1$, so it was concluded that there was no significant relationship between personal hygiene to the prevalence of scabies in the Islamic boarding school. This happens even though students have maintained their personal hygiene well, there are other factors such as the attitudes and knowledge of students who are lacking in scabies (Aliffiani, et al. 2020).

Personal hygiene is one of the most important factors in the transmission of scabies. The level of personal hygiene reflects a person's health condition consciously. Personal hygiene consists of

skin hygiene, hand cleanliness and nails, cleanliness of clothing and towels, as well as the cleanliness of the bed (Nasution SA, et al. 2022). In this study, the indicator of skin cleanliness was found that almost all students have maintained the cleanliness of their skin well, namely by bathing twice a day using soap and bathing after exercising or activities, although it is found that there are still many who do the activity of borrowing soap from their friend.

Furthermore, on indicators of cleanliness of towels and clothing, it was found that there are still many students who wear towels that are not their own, wearing towels in a humid state, and not drying towels that have been used to bath in the hot sun, but only hung in the bedroom. Some students also have bad habits related to the cleanliness of clothing, namely not

changing clothes that have been used all day and not changing clothes after sweating. This is in line with research conducted by Afriani (2017) that there is a significant relationship between the cleanliness of towels and clothing to the prevalence of scabies in boarding schools. Towels and clothing are one way of indirect transmission of scabies. Towels and clothing that are left in humid conditions can increase the life span of scabies mites outside the host, and with the borrowing activity of towels or clothing, the risk of transmission of scabies will be higher (Sungkar S. 2016). These results are also in line with the results of the Efendi et al research that concluded that risk factors for transmission of scabies in the form of exchanging clothes and towels and not paying attention to the cleanliness of the bed are still habits that are often done by students (Efendi R, et al. 2020).

In addition, the mattress cleaning indicator found that some students did not sleep in their own beds, did not dry the

mattress every 2 weeks, and had a habit of piling up a mattress in the middle of the room in the morning. This is in line with research conducted by Indriani et al which states that there is a significant relationship between the cleanliness of the mattress and the prevalence of scabies (Indriani F, et al. 2021). The mattress that is not dried in at least 2 weeks can cause a buildup of dust in the mattress and become a place to breed organisms such as mites that can cause scabies. Mattresses that are not routinely dried can also increase the humidity of the mattress, which is an ideal condition for the mites of scabies living outside the host. Scabies can last longer in furniture such as humid mattresses (Sungkar S, 2016). This is also strengthened by research conducted by Parman et al that students who do not maintain the cleanliness of the mattress and bed linen have a risk of 13.9 times higher of suffering from scabies compared to students who maintain the cleanliness of the mattress and bed linen well (Parman, et al. 2017).

Table 4. The relationship between residential density and the prevalence of scabies in the Serang City Islamic Boarding School, Banten

Residential density	Prevalence of Skabies				Total		P-Value
	Scabies		Non Scabies				
	N	%	N	%	N	%	
Not proper	70	44.9%	86	55.1%	156	100%	0.018
Proper	9	81.8%	2	18.2%	11	100%	
Total	79	47.3%	88	52.7%	167	100%	

Based on the results of bivariate analysis regarding the density of lifelong with the prevalence of scabies, the P value was obtained of 0.018 which shows that there is a significant relationship between the density of lower and the prevalence of scabies in the Islamic Boarding School. In this study it was known that 70 students (44.9%) who lived in a room with a density of lure did not meet the requirements of experiencing scabies, and 9 students (81.8%) who lived in a room with habitation density that met the requirements to experience scabies.

These results are in line with research conducted by delicating, which shows that the density of life lives has a significant effect on the incidence of scabies in boarding schools, with a value of $p = 0.031.51$ referring to the Ministry of Health

NO. 829 of 1999, the ideal room area is $> 8 \text{ m}^2$ for 2 people. High density in a room can facilitate the spread of disease to each of its residents.

In this study, it is known that the students live in each room with an average area of 36 m^2 rooms and are inhabited by 20 to 30 students. The relatively small room causes students to sleep closely with their roommates, which is one of the scabies transmission methods from one student to another. Students who slept close together and shared mattresses with fellow friends in their rooms allowed scabies to spread in direct contact from one student to another. It takes 15-20 minutes for scabies to move from one student to another when the students sleep on the same mattress as his friend who experienced scabies (Sungkar S, 2016).

Table 5. The relationship between socioeconomic status and the prevalence of scabies at the Islamic Boarding School, Serang City, Banten

Socioeconomic status	Prevalence of Scabies				Total	P-value	
	Scabies		Non scabies				
	N	%	N	%	N	%	
Low	27	71.1%	11	28.9%	38	100%	0.002
Moderate	30	36.6%	52	63.4%	82	100%	
High	22	46.8%	25	53.2%	47	100%	
Total	79	47.3%	88	52.7%	167	100%	

Based on the results of bivariate analysis of the relationship between the socioeconomic status variable and the prevalence of scabies, the P value was 0.002, which showed that there was a significant relationship between socioeconomic status and the prevalence of scabies. These results are in line with the research conducted by Afriani et al which concluded that there is a significant

relationship between the socioeconomic status and the prevalence of scabies in the boarding school (Afriani B., 2017). Students with low socioeconomic status tend to experience scabies because of the lack of meeting the needs of personal hygiene facilities and infrastructure, so students often borrow towels, clothing, as well as toiletries from their friends.

Table 6. Relationship between knowledge level and prevalence of scabies at the Islamic Boarding School, Serang City, Banten

Level of Knowledge	Prevalence of Scabies				Total		P-value
	Scabies		Non scabies				
	N	%	N	%	N	%	
Bad	47	55.3%	38	44.7%	85	100%	
Good	32	39.0%	50	61%	82	100%	0.035
Total	79	47.3%	88	52.7%	167	100%	

Based on the results of bivariate analysis regarding the level of knowledge with the prevalence of scabies, a P value of 0.035 was obtained, which shows that there is a significant relationship between the variable level of knowledge and the prevalence of scabies in the Islamic Boarding School. In this study it was found that 47 students with less knowledge levels (55.3%) experienced scabies and 32 respondents with good levels of knowledge (39%) experienced scabies.

These results are in line with Nisa et al (2019) research, which concludes that there is a significant relationship between the level of knowledge and the prevalence of scabies. Students with low levels of knowledge tend to suffer from scabies because of their ignorance of scabies, what causes scabies, and how to overcome them. This is also strengthened by research conducted by Sari et al (2017) that the incidence of scabies in Islamic boarding schools can occur due to student's lack of knowledge regarding scabies transmission,

so that students are ignorant of exchanging clothes with their friends. The higher the knowledge of students regarding personal hygiene, the higher the possibility of students in preventing various diseases, one of which is scabies (Sungkar S, 2016).

In this study, it is known that many students still consider that scabies disease is caused by germs, and students still do not understand how to break the chain of scabies transmission in Islamic boarding school, which may be the reason why scabies transmission continues to occur within the boarding school environment.

While students who have good knowledge about scabies but are still infected with scabies allegedly due to high-density factors in one room, because scabies are community diseases that cannot only be individually prevented (Sungkar S. 2016).

After a bivariate analysis, multivariate analysis is performed on variables with p-values < 0.05 . Of all the variables assessed, there are 3 variables that can be analyzed by multivariate analysis, namely residential density, socioeconomic status, and level of knowledge.

Table 7. Multivariate analysis results of scabies risk factors

Variable	p-value	Exp B (OR)	95% CI
Residential density	<0.001	1.2	2.5 – 10.7
Socioeconomic status	0.002	1.5	3.4 – 11.5
Knowledge	0.034	1.7	1.7 – 9.9

After a multivariate test with multiple linear regression, the value of p-value is obtained for residential density variables, socioeconomic status, and the level of knowledge <0.05 . This means that the three variables have statistically meaningful relationships. Student knowledge increases 1.7 times greater for the occurrence of scabies cases in Islamic boarding schools with CI values that do not cut the number 1.

Conclusion

Based on the results of observations and data analysis, it was concluded that the prevalence of scabies in Islamic boarding schools in Serang City, Banten was 47.3%. This research results conclude that factors such as housing density, socioeconomic status, and level of knowledge play an important role in the spread of scabies in Islamic boarding schools even though the students show good results in personal hygiene.

References

- Abdillah KY. Hubungan tingkat pengetahuan dengan kejadian skabies di pondok pesantren. *J Med Utama*. 2020;02(01):261–5.
- Adnan Mahdi. Sejarah dan Peran Pesantren dalam Pendidikan di Indonesia. *Islam Rev J Ris dan Kaji Keislam*. 2013;2(1):1–20.
- Afriani B. Hubungan Personal Hygiene dan Status Sosial Ekonomi dengan Kejadian Skabies di Pondok Pesantren. *J Aisyah J Ilmu Kesehat*. 2017;2(1):1–10.
- Aliffiani S, Mustakim M. Pengetahuan, Sikap, Personal Hygiene Dengan Kejadian Skabies Di Pondok Pesantren Ar-Rofi'I. *J Publ Kesehat Masy Indones*. 2020;7(1):41.
- Astuti SA. Pesantren dan Globalisasi. *J Tarbawiyah*. 2014;11(1):16–35.
- Bashori B. Modernisasi Lembaga Pendidikan Pesantren. *J Ilmu Sos Mamangan*. 2017;6(1):47.
- Casulli A. New global targets for ntds in the who roadmap 2021–2030. *PLoS Negl Trop Dis*. 2021;15(5):1–10.
- Delyuzir RD. Analisa Rumah Sederhana Sehat Terhadap Kenyamanan Ruang (Studi Kasus: Rumah Tipe 18/24, 22/60, 36/72 di DKI Jakarta). *Arsitekta J Arsit dan Kota Berkelanjutan*. 2020;2(02):15–27.
- Dewi SSS, Siregar N. Hubungan Personal Hygiene Dengan Kejadian Skabies di Panti Asuhan Hayat Sabungan Jae. *J Kesehat Ilm Indones*. 2019;4(2):113–20.
- Efendi R, Adriansyah AA, Ibad M. Hubungan Personal Hygiene dengan Kejadian Scabies Pada Santri di Pondok Pesantren. *J Kesmas Indonesia*. 2020;15(2):25–8.
- Engelman D, Marks M, Steer AC, Beshah A, Biswas G, Chosidow O, et al. A framework for scabies control. *PLoS Negl Trop Dis*. 2021;15(9).
- Engelman D, Yoshizumi J, Hay RJ, Osti M, Micali G, Norton S, et al. The 2020 International Alliance for the Control of Scabies Consensus Criteria for the Diagnosis of Scabies. *Br J Dermatol*;183(5):808–20.
- Fitriani ES, Astuti RDI, Setiapiarung D. Systematic Review: Hubungan Personal Hygiene dengan Kejadian Skabies di Pondok Pesantren. *J Integr Kesehat Sains*. 2021;3(1):54–8.
- Gilson RL, Crane JS. Scabies (Sarcoptes Scabiei) [Internet]. Nih.gov. StatPearls Publishing; 2019. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK544306/>
- Hairil Akbar. Faktor Yang Berhubungan Dengan Personal Hygiene Pada Remaja Putri Di Sma Negeri 1 Kotamobagu. *Bina Gener J Kesehat*. 2020;11(2):23–8.

- Husna R, Joko T, Nurjazuli. Faktor Risiko Yang Mempengaruhi Kejadian Skabies Di Indonesia. *J Kesling*. 2021;11(1):29–39.
- Ibadurrahmi H, Veronica S, Nugrohowati N. Faktor-Faktor yang Berhubungan dengan Kejadian Penyakit Skabies pada Santri di Pondok Pesantren Qotrun Nada Cipayung Depok Februari Tahun 2016. *J Prof Med*. 2016;10(1):33–45.
- Indramaya DM, Andre Y, Yuri W, Citrashanty I, Sawitri, Zulkarnain I. Treatment and Management of Scabies Patient with Secondary Infection in a 3-Year-Old Girl: A Case Report. *J Dermatol Res Ther*. 2021 Oct 29;7(2).
- Indriani F, Guspianto, Putri FE. Hubungan Faktor Kondisi Sanitasi Lingkungan dan Personal Hygiene dengan Gejala Skabies di Pondok Pesantren Darul Hikam Kecamatan Rimbo Ulu Kabupaten Tebu tahun 2021. *e-SEHAD*. 2021 Jun;1(2):63–75
- Krisdiyanto G, Muflikha M, Sahara EE, Mahfud C. Sistem Pendidikan Pesantren dan Tantangan Modernitas. *TarbawiJ Ilmu Pendidik*. 2019;15(1):11–21.
- Manalu M. Korelasi Status Sosial Ekonomi Keluarga Terhadap Gaya Hidup Remaja Di Kota Pekanbaru. Pengaruh Harga Disk Dan Persepsi Prod Terhadap Nilai Belanja Serta Perilaku Pembelian Konsum. 2015;7(9):27–44.
- Mar’ati F. Pengaruh Status Sosial Ekonomi Orang Tua dan Motivasi Belajar terhadap Minat Melanjutkan Studi ke Perguruan Tinggi Siswa Kelas XII SMA Muhammadiyah 1 Bantul Tahun Ajaran 2017/2018 [Skripsi]. Yogyakarta: Program Studi Pendidikan Ekonomi Universitas Negeri Yogyakarta; 2018
- Marshall D. Hygiene. In: Potter PA, Perry AG, Stockert PA, Hall AM. *Fundamental of Nursing*. 8th ed. Missouri: Mosby; 2013. p. 770-1
- Maruwae A, Ardiansyah A. Analisis Kondisi Sosial Ekonomi Masyarakat Daerah Transmigran. *Oikos Nomos J Kaji Ekon dan Bisnis*. 2020;13(1):39–53.
- Mendila I. Faktor-faktor yang Berhubungan dengan Kejadian Skabies di Pondok Pesantren Hidayatullah Samarinda tahun 2022 [Skripsi]. Samarinda: Fakultas Kesehatan Masyarakat Unmul; 2022
- Motswaledi HM. Clinical diagnosis and treatment of scabies, a neglected tropical disease. *South African Family Practice*. 2021 Jul 9;63(1).
- Nandira AA. Hubungan Tingkat Pengetahuan dan Personal Hygiene dengan Kejadian Penyakit Skabies di Lingkungan Pondok Pesantren Kabupaten Jember [Skripsi]. Jember: Fakultas Kedokteran Universitas Jember; 2018

- Nasution SA, Asyary A. Faktor Yang Berhubungan Dengan Penyakit Skabies Di Pesantren: Literature Review. 2022;6(3):1516-7
- Natalia D, Fitriangga A, Rosa S. Hubungan antara Tingkat Pengetahuan Skabies dan Personal Hygiene dengan Kejadian Skabies di Puskesmas Selatan 1, Kecamatan Singkawang Selatan. 2020;47(2):97–102.
- Nisa FR, Rahmalia D. Faktor-faktor yang Berhubungan dengan Kejadian Skabies pada Santri Putra di Pondok Pesantren Darrurahmah Gunung Putri Bogor. Jukmas Urindo. 2019;3(1):
- Nurudeen ASN, Toyin A. Knowledge of Personal Hygiene among Undergraduates. J Heal Educ. 2020;5(2):66–71.
- Parman, Hamdani, Rachman I, Pratama A. Faktor Risiko Hygiene Perorangan Santri terhadap Kejadian Penyakit Kulit Skabies di Pesantren Al-Baqiyahtushshalihat Tanjung Jabung Barat Tahun 2017. J Ilmiah UNBARI. 2017;17(3): 243-252
- Puspita SIA, Ardiati FN, Adriyani R, Harris N. Factors of Personal Hygiene Habits and Scabies Symptoms at Islamic Boarding School. J PROMKES. 2021;9(2):91.
- Putri YY, Dewi R, Astuti I, Bhatara T. Karakteristik Tanda Kardinal Penyakit Skabies pada Santri di Pesantren. J Integ Kes Sains. 2020;2(3):126–9.
- Ridwan AR, Sahrudin, Ibrahim K. Hubungan Pengetahuan, Personal Hygiene, Dan Kepadatan Hunian Dengan Gejala Penyakit Skabies Pada Santri Di Ponpes Muklisin Kota Kendari Tahun 2017. 2017;2(6):1–8.
- Riyanto S, Hatmawan AA. Metode Riset Penelitian Kuantitatif di Bidang Manajemen, Teknik, Pendidikan, dan Eksperimen. 1st ed. Sleman: Penerbit Deepublish; 2020. 12-3
- Samosir K, Sitanggang HD, MF MY. Hubungan Personal Hygiene dengan Kejadian Skabies di Pondok Pesantren Madani Unggulan, Kabupaten Bintan. J Ilmu Kesehat Masy. 2020;9(03):144–52.
- Saputra R, Rahayu W, Putri RM. Hubungan Perilaku Hidup Bersih Dan Sehat (PHBS) Dengan Timbulnya Penyakit Scabies Pada Santri. Nurs News (Meriden). 2019;4(1):41–53.
- Sari NP, Mursyida S. Analisis Personal Hygiene dan pengetahuan dengan kejadian skabies pada santri di Pondok Pesantren Al-Ikhwan kota Pekanbaru tahun 2017. KESKOM. 2018;4(2):63-67
- Shofiyyah NA, Ali H, Sastraatmadja N. Model Pondok Pesantren di Era Milenial. BELAJEA J Pendidik Islam. 2019;4(1):1.

- Sofiana NN. Hubungan Personal Hygiene dan Kepadatan Huni dengan Kejadian Skabies pada Santri di Pondok Pesantren Yayasan Islam Daud Kholifa Semen Magetan [Skripsi]. Madiun: Program Studi S1 Kesehatan Masyarakat STIKES Bhakti Husada Mulia; 2017
- Sunderkötter C, Wohlrab J, Hamm H. Scabies: Epidemiology, Diagnosis, and Treatment. *Dtsch Arztebl Int*. 2021 Oct 15;118(41):695-704.
- Sungkar S. Skabies: Etiologi, Patogenesis, Pengobatan dan Pencegahan: Badan Penerbit FK UI. 2016:48-57
- Syafei, I. Pondok Pesantren: Lembaga Pendidikan Pembentukan Karakter. *Al-Tadzkiyyah J Pendidik Islam*. 2015;8:85–103.
- Trasia RF. Scabies in Indonesia: Epidemiology and Prevention. *Insights Public Heal J*. 2021;1(2):30.
- Trasia RF. Scabies: Treatment, Complication, and Prognosis. *CDK*. 2021;48(12):705–6.
- Tri Handari SR. Analisis Faktor Kejadian Penyakit Skabies di Pondok Pesantren An-Nur Ciseeng Bogor 2017. *J Kedokt dan Kesehat*. 2018;14(2):74.
- Veraldi S, Schianchi R, Nazzaro G. Scabies and nocturnal pruritus: Preliminary observations in a group of African migrants. *J Infect Dev Ctries*. 2021;15(6):889–91.
- Wandira NA. Hubungan Perilaku Personal Hygiene dengan Kejadian Penyakit Kulit Skabies Santri di Pondok Pesantren Darul Ulum Kabupaten Kotawaringin Barat Provinsi Kalimantan Tengah [Skripsi]. Pangkalan Bun: Program Studi Keperawatan STIK Borneo Cendekia Medika; 2022
- Wang X, Cheng Z. Cross-Sectional Studies. *Chest Journal*. 2020. 158(1):S65–71.
- Welch E, Romani L, Whitfeld MJ. Recent advances in understanding and treating scabies. *Fac Rev*. 2021 Mar 11;10:28.
- WHO. Scabies [Internet] World Health Organization: WHO; 2020 [cited 2022 Nov 15]. Available from: <https://www.who.int/news-room/fact-sheets/detail/scabies>
- Yusup F. Uji Validitas dan Reliabilitas Instrumen Penelitian Kuantitatif. *J Tarbiyah*. 2018;7(1):17-22



Evaluation of The Rate of Microbial Activity in Coconut (*Cocos Nucifera* L.) Milk When Stored at Different Time Intervals

Ebisintei,^{1*} P Onyida A¹, Hotimah Masdan Salim²

¹Department of Biological Sciences, Faculty of Basic and Applied Sciences, University of Africa Toru Orua, Bayelsa State

²Department of Biochemistry and Biologimolecular, Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya, Indonesia

*Corresponding Author: sinteiprecious@gmail.com

DOI: 10.33086/iimj.v6i2.6480

ARTICLE INFO

Keywords:
coconut milk,
microbial activity,
fermentation

Submitted: Sept
21th 2024

Reviewed: Sept
30th 2024

Accepted: Dec
11th 2024

ABSTRACT

Introduction: Coconut milk is a very nutritional milk or drink. The processor of coconut into milk using various forms has been of serious risk and health hazard.

Objective: This study aims to describe or evaluate the rate of microbial activity in coconut milk when stored.

Methods: The coconut milk was extracted from the coconut meat using an aseptic technique.

Results: The initial pH value was 6.10, it was observed that fermentation started from the 12th hour, and at the 24th hour, the pH of the coconut milk was 4.48. After 48 hours, the pH was 4.20 and at the 72nd hour time, the pH value was 3.99. It was also observed that the 24 hours stored coconut milk sample has the highest Bacterial growth rate of 4.12×10^2 and a fungal growth rate of 1.2×10^2 .

Conclusions: Biochemical test carried out on the bacterial isolate showed *Bacillus spp*, *Staphylococcus aureus*, and *Bifidobacterium bifidum* were observed to be present at 24 hours and 48 hours of the coconut milk sample and at the 72nd hours of the coconut milk sample *Pseudomonas spp*, *Lactobacillus spp*, and *Aeromonas caviae* were observed to be present. A drop of pH value to 3.99 at the 72nd hour was observed due to the activity of *Lactobacillus spp*.

Introduction

The coconut (*Cocos nucifera* L.), a member of the palm family (Arecaceae), is a tropical plant typically found within latitudes 20°N to 20°S (Alfred, 2010). It produces a large, oval nut with a hard shell and a fibrous outer husk, containing thick white flesh surrounding a cavity filled with nutrient-rich liquid, known as coconut water or milk. Despite being classified as a

fruit, it is often mistaken for a nut and is technically a one-seeded drupe. Coconut is widely valued for its versatility, serving as a key ingredient in coconut oil, milk, cream products, and is consumed fresh or processed into desiccated coconut, coconut water, and coconut milk. Additionally, the immature coconut has a range of uses, including applications in food production, animal feed, and the manufacture of soaps,

detergents, and cosmetics (Alyaqoubi et al., 2015).

Coconut production and processing have been a dominant economic activity in rural areas of many tropical regions, particularly in Southeast Asia, the South Pacific, and to a lesser extent, along Africa's west coast. The traditional method of producing coconut oil from "copra" (dried coconut meat) represents the largest segment of the coconut industry (Alfred, 2012). Although copra contains proteins of relatively good nutritional value, its use as food is limited due to factors such as lipid oxidation and microbial contamination, which result from high temperatures and unsanitary conditions during drying and storage (Alfred, 2010).

In many coconut-producing countries, local animal milk production is minimal, and most dairy products are manufactured using imported milk. The significant reliance on imported milk to meet consumer demand has raised concerns among governments, producers, and consumers due to its high cost and the impact on foreign exchange reserves.

Recent innovations in coconut-based products have shown potential for providing essential nutritional benefits, particularly due to their low cholesterol-inducing fat levels. The saturated fats in coconut milk are considered beneficial as they are easily metabolized, providing

quick energy (Ekanayaka, 2013). Moreover, coconut possesses anti-carcinogenic, antibacterial, and antipathogenic properties and is less likely to contribute to weight gain compared to polyunsaturated oils (Ekanayaka, 2024).

Most previous studies have focused on coconut milk's preparation and stability maintenance. Asiri *et al.*, (2020) studied the antioxidant and nutritional properties of domestic and commercial coconut milk preparations. Alyaqoubi *et al.*, (2015) studied the antioxidant activity and physicochemical properties of coconut milk (pati santan) in Malaysia. Coconut possesses many health benefits due to its fibre and nutritional benefits because of its fat, and coconut oil (DebMandal and Mandal, 2011).

Coconut meat is rich in essential minerals, including magnesium, iron, fiber, copper, calcium, and phosphorus, all of which are vital for maintaining a healthy muscular and skeletal system. While the magnesium content in coconut meat is relatively modest (32 mg per 100 g), it surpasses the levels found in all animal-based foods, such as meat, fish, milk, and eggs (Pamplona-Roger, 2007).

Coconut water is made from the clear liquid inside green coconuts. It's not to be confused with coconut milk, which is made from the water and the flesh inside of a mature coconut. Over 95 per cent of

coconut water is water. In most cases, coconut water comes from small and scarce coconut tree plantations more related to “gardens”. Consequently, coconut water remains a traditional and under-used resource that could thus be considered an exotic beverage by most people living far from the coconut production area (Mat, 2022).

Coconut milk is a key ingredient in many Asian cuisines and is gaining popularity in the functional food market due to its health benefits, particularly its lauric acid content, which boosts immunity against bacterial diseases. This growing market has attracted health-conscious consumers, especially from Europe and the USA, who seek functional foods that promote health and well-being (Sethi, 2016).

However, coconut milk is highly susceptible to contamination and supports the growth of spoilage microorganisms, which can be introduced through contaminated shells, utensils, processing equipment, or handlers (Mabesa and DelRosario, 1979; Hafidh et al., 2010). During natural fermentation, extracted coconut milk undergoes microbial fermentation, often facilitated by lactic acid bacteria (LAB) (Omobayonle, 2020).

LAB, widely used as starter cultures in fermented foods and beverages, enhance nutritional value, sensory properties, and shelf life. They are known to produce

compounds like ethanol, bacteriocins, aroma components, exopolysaccharides, and enzymes, contributing to the desired sensory characteristics and microbiological safety of fermented products (De Vuyst and Leroy, 2004). LAB in coconut milk offers health benefits by improving gastrointestinal function and acting as antimicrobial agents through the production of organic acids, hydrogen peroxide, and bacteriocins (Hafidh et al., 2010).

Methods

Sample collection and identification

Three (3) mature Coconut samples were obtained from Angalabiri community market, sagbama, Bayelsa State. The coconuts were identified by the Department of Crop and Pest Management, Faculty of Agriculture, University of Africa.

Preparation of coconut milk

The coconut was cracked open into halves. The split nuts were de-shelled to separate the coconut „meat“ (kernel). Coconut meat of 500 g was washed and comminuted using an electric blender (Sanyo SM-B12M) with 700 ml of distilled water. This was then pressed through a sterilized linen cloth and strained to obtain coconut „milk“ (Nevin and Rajamohan, 2006).

Microbiology analysis

One gram (1g) of each of the various hours (24hrs, 48hrs, 72hrs) of stored coconut milk samples were put in nine millilitres (9ml) of sterile water contained in a sterile beaker and allowed to stand for 30mins, to dislodge any microorganism in the sample. One (1ml) of the water mixture was serially diluted. The water mixture was serially diluted using ten-fold serial dilution in ten test tubes. After the serial dilution, 0.1ml aliquots of the 10^{-3} , 10^{-5} , 10^{-8} dilution were inoculated onto sterile plates of Nutrient agar and Saboraud dextrose agar respectively, using the spread plate inoculation method. The plate was incubated at 37°C for 24 hours while the Saboraud dextrose agar plates were incubated at room temperature (27°C) for 72 hours. The microorganisms enumerated on the culture plate were counted using a colony counter. The microbial isolation obtained was further identified using cultural morphology, gram staining, and biochemical tests in the case of the bacterial isolates and the lactophenol cotton blue staining technique were employed in the case of the fungal isolates (cheesbrough, 2005).

Identification of Bacterial Isolates

The bacterial isolates from the plates were identified by gram staining and another biochemical test.

Gram Staining Techniques

A smear was prepared from each bacterial isolate and fixed through air drying. The smear was then stained with crystal violet for 60 seconds, followed by a quick rinse with water. Next, Lugol's iodine was applied to the smear for 60 seconds and washed off with water. Decolorization was performed using acetone alcohol for 10 seconds, after which the smear was rinsed with water again. Finally, the smear was counterstained with safranin for 2 minutes and washed with clean water. The back of the slide was wiped, and the slide was placed in a drying rack to air-dry before being observed under a microscope using a x100 oil immersion objective lens (Cheesbrough, 2005). Gram-positive bacteria appeared purple, while gram-negative bacteria showed a pink coloration.

Motility Test

A smear of each bacterial isolate was prepared on a glass slide, covered with a coverslip (wet mount preparation), and observed under a microscope to assess bacterial motility (Fawole and Oso, 2004).

Catalase Test

This test distinguishes bacteria capable of producing the enzyme catalase, such as staphylococci. Approximately 2 ml of hydrogen peroxide solution was dispensed

into separate test tubes for each bacterial isolate. Using a sterile wooden stick, a colony of each bacterial isolate was introduced into the hydrogen peroxide solution. The presence of active bubbling within 10 seconds indicated a positive result, while the absence of bubbling indicated a negative result (Cheesbrough, 2005).

Citrate Utilization Test

This test is used to identify members of the Enterobacteriaceae family. Each test organism was inoculated into a sterile Simon citrate agar slope using the stab inoculation technique. The inoculated agar slopes were incubated at 37°C for 24 hours. A bright blue color signified a positive result, while no color change indicated a negative result (Cheesbrough, 2005).

Coagulase Test

A drop of distilled water was placed on each end of a slide for the test organisms. A colony of each test organism was emulsified in the drops to create two suspensions. A loopful of plasma was added to one suspension for each test organism and mixed gently. Clumping within 10 seconds indicated a positive result, while the absence of clumping indicated a negative result (Cheesbrough, 2005).

Indole Test

Certain microorganisms hydrolyze the amino acid tryptophan, producing indole as a byproduct. This biochemical reaction aids in microbial characterization. Test organisms were suspended in 3 ml of sterile peptone solution in test tubes and incubated at 37°C for 48 hours. After incubation, 0.5 ml of Kovac's reagent was added and gently shaken. The appearance of a red color in the surface layer within 10 minutes signified a positive result, while the absence of color change indicated a negative result (Cheesbrough, 2005).

Oxidase Test

Following the method of Cheesbrough (2005), a piece of filter paper was placed in a clean petri dish, and three drops of freshly prepared oxidase reagent were added. A sterile stick was used to transfer a colony of each test organism onto the reagent-soaked filter paper. The appearance of a purple coloration indicated a positive result, while the absence of color change indicated a negative result.

Sugar Fermentation Test

Each test organism was inoculated into a sterile agar slope of triple sugar iron agar using the stab inoculation technique. The inoculated agar was incubated at 37°C for 24 hours. Changes in color, gas production, and hydrogen sulfide (H₂S) blackening

were observed, providing information about the type of bacteria present (Cheesbrough, 2005).

Lactophenol Cotton Blue Staining Technique

Fungal isolates were identified based on their morphology on Sabouraud Dextrose Agar (SDA) and microscopic examination using the lactophenol cotton blue staining technique. Each fungal isolate was collected using a sterile wooden stick, teased onto a drop of lactophenol cotton blue stain on a clean glass slide, and prepared as a wet mount. The sample was then examined under a microscope to observe branched and unbranched hyphae (Fawole and Oso, 2004).

Results and Discussion

The result below shows the different PH of the stored coconut milk on the different

days (24hours, 48hours, and 72hours) which are represented in Table 1. The result also shows the microbial load of the stored coconut milk sample represented in Table 2. The total viable bacteria count ranges from 2.4×10^1 to 4.12×10^2 cfu/g. No coliform count was detected. Table 3 shows the bacteria isolate from the stored coconut milk, the total of six bacteria were isolated from the stored coconut milk sample on different days and include *Bacillus spp*, *Staphylococcus aureus*, *Bifidobacterium bifidum*, *Pseudomonas aeruginosa*, *Lactobacillus spp* and *Aeromonas caviae* the result for the identification of bacterial isolates while table 4 is the result for the identification of the fungal isolates. The fungal isolated from the stored coconut milk sample include *Aspergillus niger*, *Trichophyton metagrophyts*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Acremonium spp* and *Candida spp*.

Table 1. PH values of the stored coconut milk on the various days

Number of days sample	Morning PH value/time: 10:00 am	Evening PH value/time: 4:00 pm	Average PH value for the day/hours	Temperature of sample
Coconut milk actual PH	0.00	6.10	6.10	26°C
Day 1(24hours) coconut milk sample	4.60	4.37	4.48	26°C
Day 2(48hours) coconut milk sample	4.40	4.01	4.20	28.5°C
Day 3(72hours) coconut milk sample	4.21	3.77	3.99	26°C

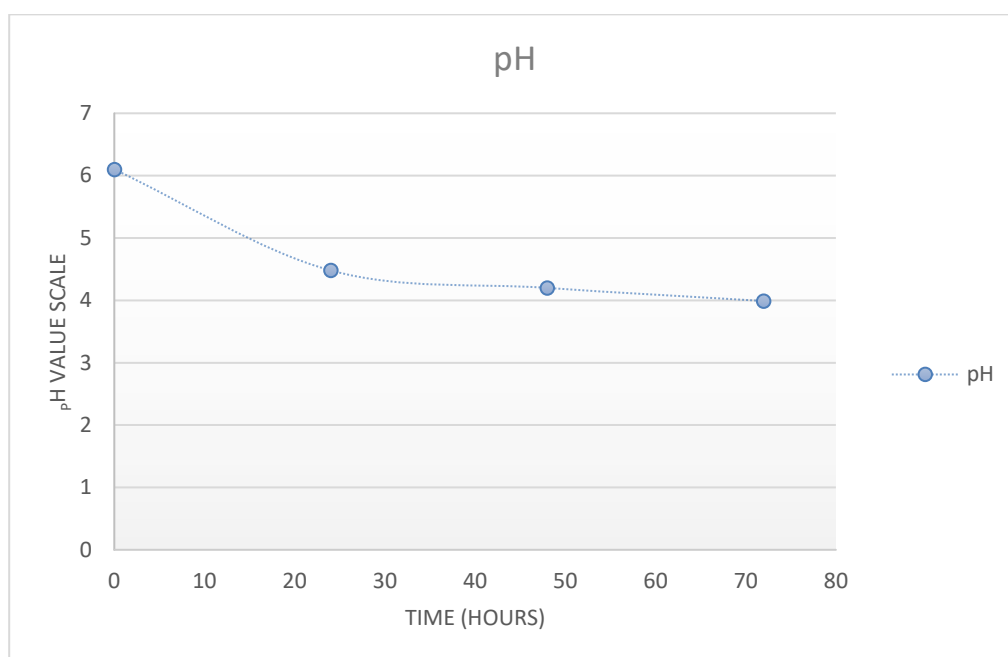


Figure 1. A graphical representation of the PH of the coconut milk sample of the various hours (24hrs, 48hrs, and 72hrs)

Table 2. Total microbial load of coconut milk sample of the various days (24hrs, 48hrs, and 72hrs)

Sample code	TVC (cfu/g)	TCC (cfu/g)	TFC (cfu/g)
Day 1 (24hrs) coconut milk sample	4.12×10^2	-	1.2×10^2
Day 2 (48hrs) coconut milk sample	6.0×10^1	-	1.0×10^1
Day 3 (72hrs) coconut milk sample	2.4×10^1	-	1.0×10^2

Note: TVC = Total viable count, TCC = total coliform count, TFC = total fungal count

Table 3. Biochemical characteristics of bacterial isolates

Sample	Morphology	Oxidase	Indole	Catalase	Coagulase test	citrate	TSI TEST					Gram stain	Motility	Probable microorganism
							G	L	S	G	H ₂ S			
Day1:Na1, Na2, Na3 and Day2: Na2, Na3	Milk flat dry smooth edges	+	-	+	+	+	+	+	+	-	-	+	+	<i>Bacillus spp.</i>

Sample	Morphology	Oxidase	Indole	Catalase	Coagulase test	citrate	TSI TEST					Gram stain	Motility	Probable microorganism
							G	L	S	G	H ₂ S			
Day1: Na4, Day2: Na1, Na5	Milkish raised no mucoid colour	-	-	+	-	+	+	+	+	-	-	+	-	<i>Staphylococcus aureus</i>
Day2: Na4	Milkish flat rough dry edge	-	-	-	+	-	+	+	+	-	-	+	-	<i>Bifidobacterium bifidum</i>
Day3: Na1	Milkish raised rough dry edge	+	-	+	+	+	-	-	-	-	-	-	+/-	<i>Pseudomonas spp.</i>
Day3: Na2, Na3, Na4	Milkish raised rough dry edge	-	-	-	+	-	+	+	+	-	-	+	-	<i>Lactobacillus spp</i>
Day3: Na5	Milkish raised smooth dry edge	+	+	+	-	+	+	-	+	-	-	-	+/-	<i>Aeromonas caviae</i>

Note: + = positive, - = negative, G= glucose, L= Lactose, S= Sucrose, G= Gas production, H₂S= Hydrogen Sulphide production, Na_{1,2,3,4,5} = nutrient Agar (subculture)

Table 4. Identification of fungal isolates

Sample code	Macroscopic appearance	Microscopic appearance	Possible fungi
Day 1(24hrs), Day 2 (48hrs) coconut milk sample	Whitish brown like a cottony colony with a white edge and yellow on the reverse plate	Septate Hyphae with conidia bearing sterigmata	<i>Aspergillus niger</i>
Day 1(24hrs) coconut milk sample	Colonies are generally flat, white to cream in colour, with a powdery to the granular surface and a yellow-brown on the reverse plate.	No conidial, only hyphae	<i>Trichophyton mentagrophytes</i>
Day 1(24hrs) coconut milk sample	White cottony colony with yellow on the reverse plate	Conidial with visible Hyphae	<i>Aspergillus flavus</i>
Day 1(24hrs) and Day 3(72HRS) coconut milk sample	Blue-green cottony colony with white edge and yellow on the reverse plate	Smooth conidial with visible hyphae	<i>Aspergillus fumigatus</i>

Sample code	Macroscopic appearance	Microscopic appearance	Possible fungi
Day 1(24hrs) and Day 3(72hrs) coconut milk sample	Raised, circular, white, and pale yellow on the reverse plate	Yeast form unicellular cells measuring 2-4 micrometre in diameter	<i>Candida spp</i>
Day 2(48hrs) coconut milk sample	White orange cottony colony with yellow-orange on the reverse	Joint septate hyphae visible and no conidia	<i>Acremonium spp.</i>

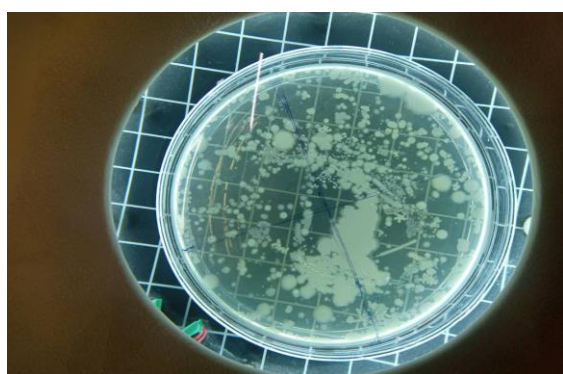


Figure 2. Plate 1: microbial growth of the coconut milk sample on the Nutrient agar plate

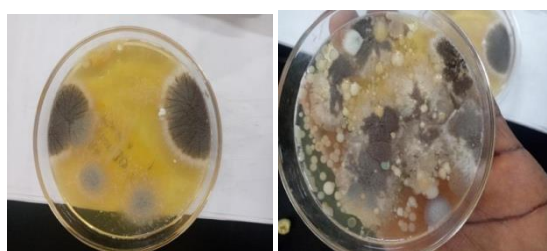


Figure 3. Plate 2: fungi growth in the culture plate

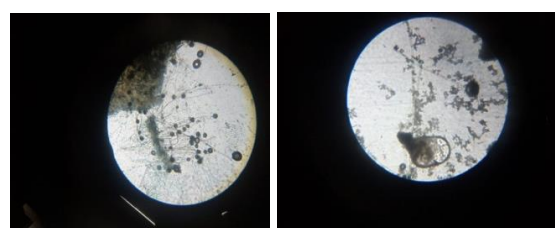


Figure 4. Plate 3: microscopic appearance of fungi growth

Coconut milk is very nutritious and has an increasing role in the fast-developing functional food market as they provide a key essential element that helps increase the immunity of the body system. Coconut milk also contains nutrients necessary for microbial growth and metabolism which makes it susceptible to microbial contamination. It is therefore necessary that this liquid food must be free from contamination as much as possible to ensure safety from health problems after consumption and to promote or enhance quality assurance of food consumable products. From the result of the analysis carried out, the bacteria isolate includes *Bacillus spp*, *Staphylococcus aureus*,

Bifidobacterium bifidum, *pseudomonas* spp, *Lactobacillus* spp and *Aeromonas Caviae*, and the fungi isolated include *Aspergillus niger*, *Trichophyton mentagrophytes*, *Aspergillus Flavus*, *Aspergillus fumigatus*, *Acremonium* spp, *Candida* spp. The 24hours (Day 1) and the 48hours (Day 2) coconut milk sample for the bacteria and the 24hours (Day 1) and 72hours (Day3) for fungi has the highest microbial load. According to Nurul et al. (2017), the source of contamination happened along the milking chain and it was mostly due to the unhygienic milking environment and contaminated milking equipment. These can be attributed to the level of exposure of the sample to the environment or practice of handling the material as well as the raw materials and equipment. Sari and Muhlisin, (2019) detected *Staphylococcus aureus* in traditional coconut milk Drinks and their report is similar to these studies. The presence of *Staphylococcus aureus*, *Bacillus* spp, and *Aeromonas caviae*, suggests the possibility of fecal contamination of the product (coconut milk) due to sanitation practices. The presence of *Pseudomonas aeruginosis* in coconut milk is contaminated due to the environment (Becerra,2014).

The presence of *Lactobacillus* is an important bacteria that serves as a probiotic and is used for the fermentation of food.

According to Satheesh and Prasad, (2013) *Lactobacillus* can convert sugars in coconut milk into lactic acid which decreases the pH of fermenting milk to acidic which is in line with the value of 4.48 to 3.99 which we observed in the low pH of the coconut milk in the cause of the store hours. In acidic conditions, coconut milk undergoes denaturation and destabilization of proteins, causing the release of water and clusters of oil droplets (Pathil, 2018)

Thanuja et al., (2016) reported that the fermentation of coconut cream occurred when the enzymatic starter had been employed for processing. The presence of *Aspergillus* spp in coconut milk has been attributed to the microbial activity of the production of a toxin known as aflatoxin which is poisonous when consumed (Yoon et al., 2014). *Aspergillus* spp is associated with the ability to produce cellulase enzymes.

Contamination of coconut milk can be due to cross contaminations from the soil, water, air, human activities, storage, and distribution facilities. As earlier reported by Benyagoub et al., (2013) that high ambient temperatures also can lead to the growth of bacteria during the sales and transport of milk.

Many people had experienced sickness caused by the consumption of food produced under unsafe conditions. Other factors that lead to food contamination

include lack of hygiene, education, improper food storage condition and lack of clean environment, etc. several hazards are known to associate with food which includes microbiological, nutritional, food additives, and environmental (Fleetwood et al., 2019).

Conclusion

In conclusion, different bacteria and fungi isolated from coconut milk samples are members of the family Enterobacteriaceae namely *staphylococcus aureus*, *Bacillus spp*, and fungi such as *Aspergillus niger*, *Trichophyton mentagrophytes*, *Aspergillus Flavus*, *Aspergillus fumigatus*, *Acremonium spp* and *Candida spp*. The presence of *staphylococcus aureus* could be the fact that it is a skin microflora. *Staphylococcus aureus* is known to cause Enterotoxigenicity due to the production of enterotoxin.

Some *Bacillus spp* are food poisoning bacteria. Therefore, the presence of these organisms in coconut milk is of public health significance since these food products are marketed without proper supervision by the regulatory authorities like National Agency for Food and Drug and Control (NAFDAC), Standard Organization of Nigeria (SON), National Codex Committee, Federal Ministry of Agriculture and Nigeria Institute of standard (NIS).

Furthermore, it is more advisable that coconut milk made should be consumed within 24hours, and if to be preserved for further consumption or use it should be added or preserved with preservative and should be stored in a very cold condition to avoid microbial influence.

References

- Alfred, K. O. (2012). Development of Cheese product from coconut milk; Department of Biotechnology, Faculty of Bioscience, College of Science and Technology Kumasi, Ghana, 1(1).
- Alyaqoubi, S., Abdullah, A., Samudi, M., Abdullah, N., Addai, Z. R., & Musa, K. H. (2015). Study of antioxidant activity and physicochemical properties of coconut milk (Pati santan) in Malaysia. *Journal of Chemical and Pharmaceutical Research*, 7(4), 967-973.
- Asiri N. karunasiri, Mahendra Gunawardane, Chathuri M. Seunayake, Nimanthi Jayathilaka and Kapila N. Seneviratne. (2020). Antioxidant and Nutritional Properties of Domestic and Commercial Coconut milk preparation. *International Journal of Food Science*. <https://dio.org/10.1155/2020/3489605>
- Benyagoub Elh., Ayat, M., Dahan, T. and Smahi, K. (2013). Level of control of the hygienic quality of camel milk (*Camelus dromedarius*) in south west

- Algeria and its impact on security. *Peak Journal of Food Science and Technology* 1(4): 53-60.
- Cheesbrough, M. (2005). *District laboratory practice in tropical countries, part 2*. Cambridge university press.
- DebMandal, M., & Mandal, S. (2011). Coconut (*Cocos nucifera* L.: Arecaceae): in health promotion and disease prevention. *Asian Pacific journal of tropical medicine*, 4(3), 241-247
- De Vuyst L, Leroy F (2004). Fermented food in the context of a healthy diet: How to produce novel functional food? *Journal of Current Opinion in Clinical Nutrition and Medical Care* 17:574-581.
- Ekanayaka RA, Ekanayaka NK, Perera B, De Silva PG. Impact of a traditional dietary supplement with coconut milk and soya milk on the lipid profile in normal free living subjects. *J Nutr Metab.* 2013;2013:481068. doi: 10.1155/2013/481068. Epub 2013 Oct 24. PMID: 24282632; PMCID: PMC3824402.
- Ekanayaka RAI, de Silva PGSM, Ekanayaka MKI, Jayathilake WMM, Pathirana RPMMR, Amaratunga YN, De Silva PJD, Perera B. Effect of different forms of coconut on the lipid profile in normal free-living healthy subjects: A randomized controlled trial (Phase II). *Glob Epidemiol.* 2024 Feb 2;7:100138. doi: 10.1016/j.gloepi.2024.100138. PMID: 38357247; PMCID: PMC10864760.
- Fawole, M. O., & Oso, B. A. (2004). Biochemical test. Laboratory manual of microbiology. Femi Ibirogbu. (2019), Demand for Coconut has Increased by 500% (Business Agro). *The Guardian Newspaper*.
- Fleetwood, J., Rahman, S., Holland, D., Millson, D., Thomson, L., & Poppy, G. (2019). As clean as they look? Food Hygiene inspection scores, microbiological contamination, and foodborne illness. *Food Control*, 96, 76–86. <https://doi.org/10.1016/j.foodcont.2018.08.034>
- Grosso-Becerra MV, Santos-Medellín C, González-Valdez A, Méndez JL, Delgado G, Morales-Espinosa R, Servín-González L, Alcaraz LD, Soberón-Chávez G. *Pseudomonas aeruginosa* clinical and environmental isolates constitute a single population with high phenotypic diversity. *BMC Genomics*. 2014 Apr 28;15:318. doi: 10.1186/1471-2164-15-318. PMID: 24773920; PMCID: PMC4234422.
- Hafidh, R. R., Abdulmir, A. S., Law, S. V., & Fatimah, A. B. (2010). The inhibition of human pathogens: *Trichophyton rubrum* and *Trichoderma harzianum* by a natural product. *American Journal of*

- Biochemistry and Biotechnology*, 6(1), 40-46.
- Jordana, J. (2000). Traditional foods: challenges facing the European food industry. *Food Research International*, 33(3-4), 147-152.
- Mabesa, R. C., & del Rosario, R. R. (1979). Quality control in coconut milk processing, 2: microbial contaminants [study conducted in the Philippines]. *Philippine Agriculturist*.
- Mat K, Abdul Kari Z, Rusli ND, Che Harun H, Wei LS, Rahman MM, Mohd Khalid HN, Mohd Ali Hanafiah MH, Mohamad Sukri SA, Raja Khalif RIA, Mohd Zin Z, Mohd Zainol MK, Panadi M, Mohd Nor MF, Goh KW. Coconut Palm: Food, Feed, and Nutraceutical Properties. *Animals* (Basel). 2022 Aug 17;12(16):2107. doi: 10.3390/ani12162107. PMID: 36009697; PMCID: PMC9405385.
- Nurul, F.M, Noorlis, A, Nurul Ain, H. and Suwaibah, M. (2017). Enumeration of *Escherichia coli* from fresh Coconut milk in Negeri Sembilan: *International Food Research Journal* 24(1): 445-458.
- Omobayonle, A. (2020). Lactic acid bacteria fermentation of coconut milk and its effect on the nutritional, phytochemical, antibacterial and sensory properties of virgin coconut oil produced. *African Journal of Biotechnology*, 19(6), 362-366
- Pamplona-Roger, G. (2007). Foods and their healing power; a guide to food science and diet therapy. Vol 2. Nexo Grafico, Spain. pp 325-328.
- Patil U, Benjakul S. Coconut Milk and Coconut Oil: Their Manufacture Associated with Protein Functionality. *J Food Sci*. 2018 Aug;83(8):2019-2027. doi: 10.1111/1750-3841.14223. Epub 2018 Jul 13. PMID: 30004125.
- Rethinam, P. (2006). Asian and Pacific Coconut Community activities, achievements and future outlook. In *ACIAR PROCEEDINGS* (Vol. 125, p. 15). ACIAR; 1998.
- Satheesh, N., & Prasad, N. (2013). Optimization of parameters for fermentative production of virgin coconut oil by *Lactobacillus* sp. *Food Sci. Technol*, 14, 312-317.
- Sari, P. M., & Muhlisin, A. (2019). *Staphylococcus aureus* in traditional coconut milk drinks *Tropical Health and Medical Research*, 1(1), 33–38. <https://doi.org/10.35916/thmr.v1i1.1>
- Sethi S, Tyagi SK, Anurag RK. Plant-based milk alternatives an emerging segment of functional beverages: a review. *J Food Sci Technol*. 2016 Sep;53(9):3408-3423. doi: 10.1007/s13197-016-2328-3. Epub 2016 Sep 2. PMID: 27777447; PMCID: PMC5069255.
- Timmen, H. and S. Patton (1989): Milk fat globules: fatty acid composition, size

and in vivo regulation of fat liquidity.

Lipids 23:685-689.

Thanuja T. T., G.S.Sreekala and Meenakumari.(2016). Isolation of microorganisms from the Fermented coconut milk and comparison of quality parameters of virgin coconut oil Recovered by induced fermentation. *International Journal of Advanced Research (2016), Volume 4, Issue 6, 1927-1934.*

Yoon, L. W., Ang. T. N., Ngoh, G.C., Chua, A. S. M. (2014). Fungal solid- state fermentation and Various methods of enhancement in Cellulase production, *Biomass Bioenerg.* 67, 319.



Factors Affecting Patient Satisfaction and Patient Loyalty in Hospitals: Systematic Literature Review

Anang Dwi Parmana,^{1*} Vip Paramarta,¹ Yafanita Izzati Nurina²

¹ Master of Hospital Management, Faculty of Pascasarjana, Sangga Buana University, Bandung, Indonesia

² Department of Internal Medicine, Dr. Soedono Hospital, Madiun, Indonesia

*Corresponding Author: doktergigianang@gmail.com

DOI: 10.33086/iimj.v6i2.6535

ARTICLE INFO

Keywords:
Hospital image,
Patient loyalty,
Patient
satisfaction,
Service quality

Submitted: Oct
14th 2024
Reviewed: Oct
16th 2024
Accepted: Nov
24th 2024

ABSTRACT

Introduction: In response to the demand for high-quality services, healthcare providers are faced with an increasing number of hospitals in Indonesia, which encourages competition to offer these services. Patient satisfaction, influenced by their expectations and experiences of the services received, is a key indicator in evaluating service quality. Additionally, patient loyalty is established through their trust in the hospital and contributes to the sustainability of healthcare services.

Objective: This literature review aims to identify factors that play a role in influencing patient loyalty and satisfaction.

Methods: The inclusion criteria are articles published between 2020 and 2024, research conducted in hospitals, with open access and full text. The article selection process resulted in seven articles that will be examined further.

Results: Service quality (tangible, reliability, responsiveness, assurance, and empathy), trust, and hospital image have a positive influence on patient satisfaction and loyalty. Furthermore, patient satisfaction plays a crucial role in directly reinforcing patient loyalty. Therefore, improving service quality and establishing a good hospital image is essential not only to satisfy patients but also to ensure the sustainability and competitiveness of the hospital amid increasingly fierce competition in healthcare service provision.

Conclusions: The findings of this study indicate that hospital image and service quality have a positive influence on patient loyalty and satisfaction.

Introduction

Hospitals serve as one of the healthcare facilities that have the main task of providing health services to the community in the form of integrated care and recovery for patients (Novitasari, 2022). Quality health services in this era and in the future have become essential requirements for society in finding solutions to various health

issues (Alfarizi et al., 2022). Data from the Central Statistics Agency regarding the total number of hospitals in Indonesia from 2014 to 2015 indicate a significant increase of 227.45% in the number of general hospitals (Badan Pusat Statistik, 2015). This increase has intensified competition among healthcare institutions in delivering quality services (Wu, 2011).

Healthcare institutions have progressively encountered numerous social, cultural, regulatory, financial, and political challenges associated with the demands for better, superior, and cost-efficient services (Alghamdi, 2014). As one of healthcare service providers, hospitals have the opportunity to meet patients' demands for quality service, which is intrinsically linked to patient loyalty and overall satisfaction with the services provided (Safitri et al., 2020). To achieve a level of service quality that aligns with patient expectations, assessing or measuring patient satisfaction regarding the services provided by hospitals becomes fundamental and essential. Satisfied patients are more likely to seek further healthcare services (Darti et al., 2018).

Patient satisfaction refers to patients' evaluations of the services received from healthcare providers, influenced by their expectations and experiences (Zun et al., 2018). It can also be viewed as a response to the healthcare services received, allowing hospitals to evaluate service quality from the perspective of users or patients (Schoenfelder et al., 2011).

Quality and patient satisfaction can be assessed using a questionnaire based on the SERVQUAL instrument (SERV- Service, QUAL- Quality). This instrument has been widely used in patient satisfaction studies and has proven to be appropriate in

healthcare settings with some modifications to suit specific environments. SERVQUAL is often used to detect discrepancies between the quality of services provided and patient expectations. It consists of five dimensions: (1) tangible: the appearance of the hospital, available equipment, and healthcare staff; (2) reliability: the consistency of the hospital in delivering appropriate and accurate services; (3) responsiveness: related to the speed of service and staff responsiveness in serving patients; (4) assurance: related to the courtesy of hospital staff, the competence and skills of doctors, and staff communication skills that increase patients' trust in the services; (5) empathy: the level of care and attention given to patients (Zun et al., 2018).

Patient loyalty is defined as the relationship based on patients' trust in the hospital regarding the healthcare services they need, as evidenced by patients' willingness to continue using the services of a particular hospital to address their health problems. Patient loyalty has a positive economic and social impact on hospitals, reduces development and maintenance costs, and brings health value to patients; thus, decreasing the risk of patients seeking services from other healthcare providers (Liu et al., 2021).

Patient satisfaction and loyalty can serve as a foundation for hospitals to enhance

service quality and improve the aspects perceived as lacking by patients. The objective of this research is to describe the factors that may influence patient satisfaction and loyalty toward hospitals.

Methods

This research employs a literature review methodology for article writing. Article searches were conducted using the following sources, namely Google Scholar, ResearchGate, and Science Direct, utilizing the keywords ‘determinant factor,’ ‘patient satisfaction,’ ‘patient loyalty,’ ‘hospital,’ ‘service quality,’ ‘health care,’ *‘faktor yang berpengaruh,’ ‘tingkat kepuasan pasien,’ ‘loyalitas pasien,’ ‘rumah sakit,’ ‘kualitas layanan,’ and ‘layanan kesehatan.’* Articles published between 2020 and 2024 in the form of full-text, original articles, and open access with the theme of health services in hospitals were the inclusion criteria for this study.

The aim of this literature review is to identify the factors that may influence patient satisfaction and loyalty in hospitals across various regions in Indonesia. The search yielded 126 articles, with 121 sourced from Google Scholar, 3 from Science Direct, and 2 from ResearchGate. The next step involved the elimination of 8 duplicate articles. Following this, selection was carried out based on the abstracts that met the study criteria, yielding 36 suitable

articles. Subsequently, articles that did not discuss factors or aspects influencing patient satisfaction and loyalty, were not fully accessible, or were not original articles were excluded from this study. The final selection process yielded a total of 7 articles meeting the inclusion criteria (articles published between 2020 and 2024, research conducted in hospitals, open access, and full text). The following figure illustrates the article search prism (Figure 1).

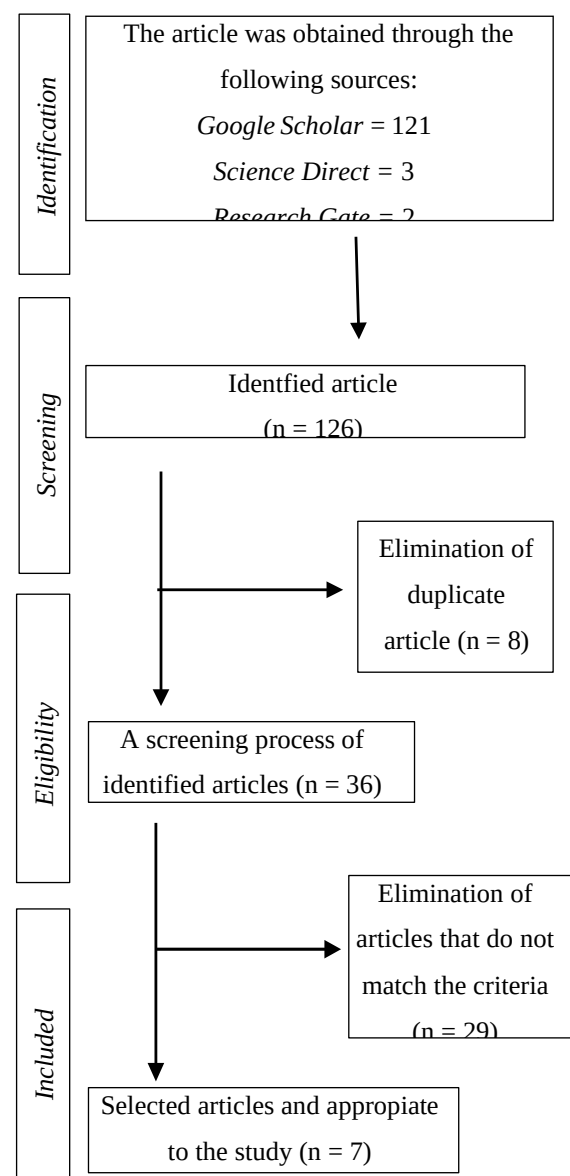


Figure 1. Article search prism diagram

Results and Discussion

Patient satisfaction and loyalty are influenced by several factors. Based on the articles referenced in this study, the results are presented in Table 1. Several studies indicated that various factors can influence patient satisfaction and loyalty. Service quality (whether in terms of tangibles, reliability, responsiveness, assurance, or empathy) and trust have a direct impact on patient satisfaction. Among these factors, the dimension of reliability is identified as the most dominant factor affecting patient satisfaction. Furthermore, service quality, followed by patient satisfaction, trust, commitment, brand equity, gender, cost, hospital image, and reliability, are all related to patient loyalty. Patient satisfaction plays a crucial role in reinforcing loyalty, particularly through service quality, with increasing patient satisfaction being the most significant factor influencing patient loyalty, especially from the perspective of the empathy variable, supported by improvements in hospital image and service quality.

With the advancement of time, patients are becoming increasingly critical, and the growing number of healthcare service

providers underscores the importance of patient satisfaction and loyalty (Harmen et al., 2020). Patient satisfaction and loyalty play vital roles in determining healthcare service users' decisions to make repeat visits to hospitals. This is what makes hospitals competitive, allows them to lower their service prices, and helps retain patients within their services (Roy, 2021; Liu et al., 2021). Given these circumstances, it is imperative for hospitals to understand and identify the factors influencing patient satisfaction and loyalty. The results of this literature review indicate that service quality, trust, and hospital image emerge as the primary factors influencing patient satisfaction and loyalty, which will be discussed further to evaluate their respective contributions to patient satisfaction and loyalty at the hospital.

Table 1. Research results of patient satisfaction and loyalty

Author (year)	Research title	Research population/sample	Research results
Mappanganro et al. (2020)	<i>Analisis kualitas pelayanan keperawatan dengan loyalitas pasien di RSU Bahagia Makassar</i>	The population consisted of the average number of inpatients per month over a five-month period, with a sample size of 77 respondents.	There was a relationship between responsiveness, assurance, and empathy with patient loyalty. Service quality and empathy variables were the most closely related to patient loyalty.
Aryawati et al. (2020)	Analysis of factors relating to loyalty of patients in Pertamina Bintang Amin Hospital Lampung in 2019	The population of this research comprised inpatients with a sample of 196 respondents at Amin Hospital Lampung in 2019.	Factors associated with patient loyalty were gender, cost, empathy, reliability, and hospital image.
Anastasia (2021)	<i>Pengaruh kualitas pelayanan, kepuasan, trust, brand equity, hospital image dan komitmen terhadap loyalitas pasien umum</i>	The study population included outpatients at Kesdam Cijantung Hospital, with a sample of 80 patients during the period from January to March 2019.	Service quality, patient satisfaction, trust, brand equity, hospital image, and commitment positively influenced patient loyalty. Service quality emerged as the most dominant factor affecting patient loyalty.
Purba et al. (2021)	<i>Pengaruh kualitas pelayanan, kepercayaan terhadap kepuasan dan loyalitas pasien rawat jalan di poliklinik bedah saraf RSUD dr. Doris Sylvanus Palangkaraya</i>	The population included outpatients at Dr. Doris Sylvanus General Hospital Palangkaraya, with a sample size of 120 respondents.	The higher levels of service quality and trust were, the higher patient satisfaction would be. As patient satisfaction rose, patient loyalty also increased. Service quality and trust indirectly influenced patient loyalty, primarily by first affecting patient satisfaction to subsequently impact loyalty.
Triono, B. S., Penawan, A., & Haryanto, A. T. (2021)	<i>Membangun kepuasan dan loyalitas pasien dari aspek kualitas pelayanan, citra di rumah sakit umum PKU Muhammadiyah Surakarta</i>	The population consisted of outpatients at PKU Muhammadiyah General Hospital Surakarta, with a sample size of 100 outpatient respondents.	Service quality and hospital image had a direct impact on both patient satisfaction and loyalty, while patient satisfaction influenced patient loyalty. Therefore, to enhance loyalty effectively, it was more beneficial to utilize factors that can improve service quality.

Table 1. Research results of patient satisfaction and loyalty (continued)

Author (year)	Research title	Research population/sample	Research results
Lampus et al. (2023)	<i>Analisis faktor-faktor yang memengaruhi tingkat kepuasan pasien di instalasi rawat inap RSUP Prof. Dr. R. D. Kandou Manado</i>	The population consisted of all inpatients from October to November 2022, with a sample size of 419 respondents.	The tangible, reliability, responsiveness, assurance, and empathy aspects significantly affected patient satisfaction, with reliability being the most dominant factor influencing patient satisfaction.
Zebua et al. (2024)	<i>Pengaruh kualitas pelayanan dan Kepercayaan terhadap loyalitas pelanggan dengan kepuasan pelanggan sebagai variabel Intervening pada rumah sakit Estomihi Medan</i>	The research population included inpatients during August 2023, comprising 30 individuals.	Service quality and trust had a direct and significant impact on customer satisfaction. Service quality and trust directly influenced customer loyalty through customer satisfaction which directly affected customer loyalty.

Service Quality

According to the referenced data above, service quality has a significant positive effect on both direct patient satisfaction and loyalty. This is in accordance with research conducted by Nurlitasari in 2016, which demonstrated that service quality has a significant positive influence on patient satisfaction and an indirect influence on patient loyalty through satisfaction measurements that directly impact patient loyalty.

Ideal service not only enhances patient satisfaction but also directly affects patient loyalty, as articulated by Arianto (2017). A study by Guspianto et al. (2023) confirms

that service quality shows a significant positive relationship with patient satisfaction. Service quality also has a direct influence on patient loyalty. The five dimensions of service quality in this study include the physical environment or appearance of the hospital (tangible), staff capability or competence (reliability), administrative processes (responsiveness), communication between staff and patients (empathy), and privacy and security (assurance), all of which influence both satisfaction and loyalty.

The significant positive impact of service on patient loyalty is further supported by research by Rahmiati &

Temesveri (2020). The dimensions that have the most influence in this study are responsiveness, reliability, and empathy. Responsiveness is evaluated through indicators such as the speed of service provided by doctors and nurses in addressing patient complaints, as well as the promptness of payment services. Responsiveness reflects the hospital's ability to deliver timely healthcare services. A study conducted at Muhammadiyah Hospital Palembang indicated a 53% gap between expectations and reality in the responsiveness dimension, highlighting the need for the improvement of response services to increase patient satisfaction (Herudiansyah et al., 2020).

Empathy, demonstrated by staff members from administrative personnel to healthcare providers, is evident through interpersonal communication between patients and hospital staff (Zarowitz et al., 2018). Empathy is evaluated using indicators such as the ease of the systems employed, clarity of the information provided, staff friendliness, and the absence of service quality gaps across all patients (Mappanganro & Hidayat, 2020). Empathy is a key factor and a primary predictor in enhancing patient satisfaction, supported by a meta-analysis concluding that empathetic service results in patient satisfaction being 2.56 times higher compared to service with insufficient empathy (Yanto et al., 2018).

The reliability dimension is also a significant factor influencing patient satisfaction. It can be observed through timely doctor visits, accurate and easily understandable information, and appropriate healthcare services (Sesrianty et al., 2019). Another study analyzing service quality in relation to patient satisfaction corroborates that timely service is an essential aspect of patient satisfaction (Erpurini, 2021).

Hospital Image

Image is an intangible asset that holds significant value for a company. A positive company image is essential, as it can influence perceptions of value, quality, and levels of satisfaction. With a strong image, a hospital will remain competitive and maintain a positive reputation (Yunida, 2016). A positive image fosters confidence, strengthens trust, and serves as a primary consideration for patients when selecting a hospital to address their health issues (Lydia & Endang, 2020).

Based on the literature in this study, a positive hospital image correlates with increased patient satisfaction and loyalty. Several prior studies have indicated that hospital image has a statistically significant relationship with patient satisfaction and loyalty (Ni'am, 2021). Research by Triono et al. (2021) also supports this finding, stating that hospital image has both a direct

and indirect impact on patient outcomes. Other studies have similarly concluded that hospital image influences patient satisfaction and indirectly enhances patient loyalty to the hospital (Lydia et al., 2020; Harmen et al., 2020).

Conclusion

The findings of this literature review affirm that two primary factors namely service quality and hospital image significantly influence patient satisfaction and loyalty in hospitals. Hospitals need to enhance their service quality to meet patients' expectations and cultivate a positive image to improve both satisfaction and loyalty. One effective way to improve service quality and loyalty is to provide excellent service training for all hospital employees.

References

- Alfarizi, M., & Ngatindriatun., 2022. Determinant factors of hospital service quality and patient satisfaction: Hospital logistics management approach. *Asian Management and Business Review*, 2(2): 121-138.
- Alghamdi, FS., 2014. The impact of service quality perception on patient satisfaction in government hospitals in southern Saudi Arabia. *Saudi Med J*, 35(10): 1271-1273.
- Anastasia, Y., 2021. Pengaruh kualitas pelayanan, kepuasan, trust, brand equity, hospital image dan komitmen terhadap loyalitas pasien umum. *Jurnal Ayurveda Medistra*, 3(2): 1-11.
- Aryawati, W., Prasetyo, BNE., Yulyani, V., 2020. Analysis of factors relating to loyalty of patients in Pertamina Bintang Amin Hospital Lampung in 2019. *Indian Journal of Public Health Research and Development*, 11(2): 1759-1764.
- Badan Pusat Statistik., 2015. Jumlah rumah sakit umum, rumah sakit khusus, dan puskesmas. Accessed on 21 September 2024, from <https://www.bps.go.id/id/statistics-table/2/MjMyIzI=/jumlah-rumah-sakit-umum-rumah-sakit-khusus-dan-puskesmas.html>
- Darti, Suhermin, Ujianto., 2018. Effect of service quality and hospital image on satisfaction, trust, and word of mouth. *International Journal of Economics, Business and Management Research*, 2(4): 1-15.
- Erpurini, W., 2021. Analisa kualitas pelayanan pasien pada klinik umum pratama kasih bunda yanti rajamandala. *Jurnal Manajemen Unsera*, 7(1): 75-88.
- Harmen, EL., Semiarty, R., Lita, RP., 2020. Model keterkaitan persepsi nilai, citra merek, kepuasan dan loyalitas pelanggan rumah sakit model

- keterkaitan persepsi nilai, citra merek, kepuasan dan loyalitas pelanggan rumah sakit. *Jurnal Manajemen dan Kewirausahaan*, 8(2): 216-225.
- Herudiansyah, G., Candra, M., Haminsyah, K., 2020. Analisis pengaruh kualitas pelayanan kesehatan terhadap kepuasan pasien pada Rumah Sakit Muhammadiyah Palembang. *Jurnal Ekonomi, Manajemen, Bisnis, Auditing, dan Akuntansi*, 5(1): 1-11.
- Lampus, CSV., Umbah, A., Manampiring, AE., 2023. Analisis faktor-faktor yang mempengaruhi tingkat kepuasan pasien di instalasi rawat inap RSUP Prof. Dr. R. D. Kandou Manado. *Medical Scope Journal Manado*, 4(2): 150-160.
- Liu S., Li, G., Liu, N., Hongwei, W., 2021. The impact of patient satisfaction on patient loyalty with the mediating effect of patient trust. *The Journal of Health Care Organization, Provision, and Financing*, 58: 1–11.
- Lydia, LP., Endang, EMS., 2020. Pengaruh lokasi, citra rumah sakit, dan kualitas pelayanan terhadap keputusan memilih RSUD pasar minggu. *Jurnal Ikraith - Ekonomika*, 3(2): 64-73.
- Mappanganro A., Hidayat, R., 2020. Analisis kualitas pelayanan keperawatan dengan loyalitas pasien di RSUD Bahagia Makassar. *Bina Generasi; Jurnal Kesehatan*, 12(1): 77–93
- Ni'am, MK., 2021. Pengaruh brand image dan kualitas pelayanan terhadap loyalitas pasien melalui kepuasan pasien sebagai variabel mediasi (studi pada Rumah Sakit Ibu dan Anak Fatimah Lamongan). Lamongan: Institut Teknologi dan Bisnis Ahmad Dahlan Lamongan, 21(5): 1-15.
- Novitasari, D., 2022. Hospital quality service and patient satisfaction: How the role of service excellent and service quality. *Journal of Information Systems and Management*, 1(1): 1–12.
- Nurlitasari, L., Syah, TYR., 2016. Kualitas layanan berpengaruh terhadap kepuasan dan loyalitas pasien di rumah sakit medika permata hijau Jakarta Barat. *Journal Article Media Studi Ekonomi*, 19(1): 95-110.
- Purba, L., Halim, EH., Widayatsari, A., 2021. Pengaruh kualitas pelayanan, kepercayaan terhadap kepuasan dan loyalitas pasien rawat jalan di poliklinik bedah saraf RSUD dr. Doris Sylvanus Palangkaraya. *Jurnal Ekonomi KIAT*, 32(2): 1-16.
- Rahmiati, R., Temesveri, NA., 2020. Hubungan dimensi kualitas pelayanan dengan minat kunjungan ulang pasien di instalasi rawat jalan rumah sakit umum Kabupaten Tangerang tahun 2019. *Jurnal Kesehatan*, 13(1): 13–21.
- Roy, S., 2011. Brand loyalty measurement

- a framework. *SCMS Journal of Indian Management*, 8(2): 112-122.
- Safitri, T., Lita, PR., Putta, AS., 2020. Loyalitas Pasien. *Human Care Journal*, 5(1): 250–264.
- Schoenfelder, T., Klewer, J., Kugler, J., 2011. Determinants of patient satisfaction: A study among 39 hospitals in an in-patient setting in Germany. *International Journal for Quality in Health Care*, 23(5): 503-509.
- Sesrianty, V., Machmud, R., Yeni, F., 2019. Analisa kepuasan pasien terhadap mutu pelayanan keperawatan. *Jurnal Kesehatan Perintis*, 6(2): 116-126.
- Triono, BS., Penawan, A., Haryanto, AT., 2021. Membangun kepuasan dan loyalitas pasien dari aspek kualitas pelayanan, citra di Rumah Sakit Umum PKU Muhammadiyah Surakarta. *Buletin Ekonomi Manajemen, Ekonomi Pembangunan, Akuntansi. Jurnal Universitas Pembangunan Nasional Veteran Yogyakarta*, 2(17): 203-210.
- Wu, CC., 2011. The impact of hospital brand image on service quality, patient satisfaction and loyalty. *African Journal of Business Management*, 5(12): 4873–4882.
- Yanto, A., Wuryanto, E., Surwanti, S., 2018. Peningkatan kepuasan pasien bpjs melalui peningkatan empati perawat. *Jurnal Kepemimpinan dan Manajemen Keperawatan*, 1(2): 21-28.
- Yunida, ME., Wijaya, T., 2016. Pengaruh citra rumah sakit dan kualitas pelayanan terhadap loyalitas pelanggan melalui kepuasan pelanggan di Rumah Sakit Amal Sehat Wonogiri. *Jurnal Manajemen Bisnis Indonesia*, 5(3): 287–297.
- Zarowitz, BJ., Resnick, B., Ouslander, JG., 2018. Quality clinical care in nursing facilities. *Journal of the American Medical Directors Association*, 19(10): 833–839.
- Zebua, E., Tanjung, YT., 2024. Pengaruh kualitas pelayanan dan kepercayaan terhadap loyalitas pelanggan dengan kepuasan pelanggan sebagai variabel intervening pada rumah sakit Estomihi Medan. *Jurnal Review Pendidikan dan Pengajaran*, 7(2): 3905-3910.
- Zun, AB., Ibrahim, MI., Hamid, AA., 2018. Level of satisfaction on service quality dimensions based on SERVQUAL model among patients attending 1 Malaysia clinic in Kota Bharu, Malaysia. *Oman Med J*, 33(5): 416-422.



Parasagittal Meningioma: A Comprehensive Case Series and Systematic Review

Renindra Ananda Aman^{1*}, Fitrie Desbassarie¹, Arief Purwodito¹, Ricky Rusidy Syarif¹,
Nicholas Calvin², Bipatra Einstein Yacobus Paat¹

¹ Department of Neurosurgery, Faculty of Medicine, Universitas Indonesia – Dr. Cipto Mangunkusumo National General Hospital, Jakarta, Indonesia

² Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

*Corresponding Author: reninananda.aman@ui.ac.id

DOI: 10.33086/iimj.v6i2.6509

ARTICLE INFO	ABSTRACT
Keywords: clinical characteristics, intracranial tumor, outcomes, parasagittal meningioma, treatment modalities	Introduction: This case series included seven patients diagnosed with parasagittal meningioma, presenting their clinical histories, management, and outcomes. In parallel, a systematic review synthesized the existing literature on parasagittal meningioma. This comprehensive analysis combined the findings from both the case series and the systematic review to provide a holistic understanding of these tumors. This case series included seven patients diagnosed with parasagittal meningioma, presenting their clinical histories, management, and outcomes. In parallel, a systematic review synthesized the existing literature on parasagittal meningioma. This comprehensive analysis combined findings from both the case series and the systematic review to provide a holistic understanding of these tumors.
Submitted: Oct 2 nd 2024 Reviewed: Oct 5 th 2024 Accepted: Nov 20 th 2024	Results: This case series highlights the clinical heterogeneity of parasagittal meningiomas and presents cases with various clinical presentations, treatment approaches, and outcomes. The systematic review consolidates existing knowledge and reveals gaps in the understanding of optimal management for these tumors. The combination of case series and systematic reviews provides valuable insights into the clinical behavior, treatment strategies, and prognostic factors associated with parasagittal meningioma.
	Conclusions: Parasagittal meningioma presents unique diagnostic and therapeutic challenges. This comprehensive study offers a multifaceted perspective on these tumors, enhancing our understanding of their clinical characteristics and management options. These findings can guide clinicians in making informed decisions and improving patient outcomes in the field of neuro-oncology.

Introduction

Parasagittal meningioma represents a subset of intracranial tumors that arise in proximity to the sagittal sinus. These tumors, characterized by their location along the cerebral falx, present a unique challenge in both diagnosis and treatment

due to their anatomical intricacies and potential for complex clinical manifestations. As meningiomas are among the most common primary brain tumors, understanding the distinct features and management strategies for parasagittal variants is of paramount importance. This

comprehensive case series and systematic review aim to provide a thorough exploration of parasagittal meningiomas by synthesizing available data from clinical cases and existing literature, offering insights into their clinical characteristics, diagnostic methods, treatment modalities, and outcomes (Mathiesen, 2020).

Parasagittal meningioma is a rare subtype of brain tumors that originates in the meninges and protective layers surrounding the brain and spinal cord. They typically arise along the parasagittal region, which is the area adjacent to the superior sagittal sinus. These tumors account for approximately 10.0-15.0% of all meningiomas. Despite their relatively low incidence, parasagittal meningiomas present unique challenges due to their proximity to critical structures and the potential for neurological deficits (Ricci et al., 2017).

Meningiomas, which account for approximately 30.0% of all primary brain tumors, have been extensively studied; however, parasagittal meningiomas have received relatively less attention in the literature compared to their intracranial counterparts. This challenge arises from their unique anatomical location adjacent to the sagittal sinus and the potential involvement of critical neurovascular structures. Accurate diagnosis and appropriate management of parasagittal

meningiomas are essential to achieving favorable patient outcomes. Therefore, this study aims to consolidate and analyze the existing knowledge on these tumors to improve our understanding of their clinical behavior and therapeutic options (Ricci et al., 2017).

The management of parasagittal meningiomas requires a multidisciplinary approach involving neurosurgeons, neurologists, radiologists, and radiation oncologists. Treatment options include surgical resection, radiation therapy, and observation, depending on the tumor size, location, and clinical condition of the patient. However, the optimal management strategy remains a subject of debate, and the decision-making process often relies on individual case reports and small case series (Ricci et al., 2017).

To address the gaps in knowledge and provide a comprehensive understanding of parasagittal meningiomas, this study aimed to present a case series and a systematic review. By analyzing a larger cohort of patients and synthesizing the existing literature, we aimed to elucidate the clinical characteristics, treatment outcomes, and potential prognostic factors associated with parasagittal meningioma. This comprehensive analysis will contribute to a better understanding of these tumors and guide clinicians in making evidence-based

decisions regarding their management (Antunes & Winter, 2023).

The findings of this study have several clinical and research implications. Clinically, a comprehensive analysis of parasagittal meningiomas will shed light on optimal treatment strategies, including surgical techniques, adjuvant therapy options, and long-term follow-up protocols. Additionally, the identification of potential prognostic factors can aid in risk stratification and individualized treatment planning. From a research standpoint, this study consolidates the existing literature on parasagittal meningioma, highlighting gaps in knowledge and areas for future investigation. Ultimately, the aim is to improve patient outcomes and contribute to ongoing advancements in the field of neuro-oncology.

Case Series

Clinical Profiles and Demographics

In this case series, we present seven diverse cases of parasagittal meningioma, each with unique clinical characteristics and management challenges. Medical records were used as the source of the clinical data. Only adult patients (≥ 18 years) were included. Parasagittal meningiomas were confirmed by histopathology performed by an experienced neuropathologist. We included all patients with parasagittal meningioma who underwent surgery at our

center between 2019 and 2024. None of our patients were diagnosed with genetically inherited syndromes such as Neurofibromatosis Type 2.

Table 1. Patients included for case series

Case Age Sex	CNS WHO Grade	TTM (Years)	Primary Location	Further Details	Initial Management	After Surgery Conditions
45, Female	2	2 years	1/3 medial right parasagittal	Weakness in left leg, intermittent headaches, nausea, vomiting, and decreased consciousness	Craniotomy for tumor removal	Improved motor function, no significant deficits
52, Female	2	1 year	1/3 medial left parasagittal	Seizures, right-sided limb weakness, speech difficulties	Craniotomy for tumor removal	Improved seizures and motor function. Still have speech difficulties
68, Female	1	5 months	1/3 medial right parasagittal	Weakness in left arm and leg, worsening condition over time	Craniotomy for tumor removal	Improved motor function.
47, Female	1	4 months	1/3 anterior left parasagittal	Recurrent headaches, worsening condition with seizure	Craniotomy for tumor removal	Improved seizure. No headaches.
39, Female	1	2 months	1/3 anterior right parasagittal	Severe headaches, vomiting, weakness in left arm and leg	Craniotomy for tumor removal	Improved headache, no change in left body weakness
61, Female	1	3 months	1/3 medial right parasagittal	Headaches, left hemiparesis	Craniotomy for tumor removal	Improved headache and motor function
45, Female	1	5 months	1/3 anterior left parasagittal	Recurrent headaches, dysphagia	Craniotomy for tumor removal	Improved headache. Still have dysphagia

Descriptive analysis

The descriptive analysis in this study encompassed a detailed examination of the present case series of parasagittal meningiomas. This case series provides comprehensive clinical histories, management details, and outcomes for seven patients diagnosed with parasagittal meningioma. These cases illustrate the diverse clinical presentations, treatment approaches, and outcomes associated with parasagittal meningiomas, emphasizing their clinical heterogeneity. The case series will then be further analyzed with the results from a systematic review to offer a holistic perspective on parasagittal meningiomas, providing insights into their clinical complexities, diagnostic challenges, and therapeutic options.

Systematic review

Literature search

The systematic review conducted in this study followed a rigorous methodology to synthesize and analyze the existing literature on parasagittal meningiomas. The process began with a comprehensive search of relevant medical databases, including PubMed, Web of Science, and the Cochrane Library, covering the period from January 1, 2014, to April 30, 2024. Specific search terms and MeSH descriptors, such as

‘parasagittal meningioma,’ ‘clinical characteristics,’ ‘treatment modalities,’ and ‘outcomes,’ were used to ensure targeted and comprehensive retrieval of relevant studies. To enhance the thoroughness of our search, we examined the reference lists of the included studies to identify additional relevant studies. Two authors independently screened the abstracts and assessed the full-text articles for eligibility, ensuring an unbiased selection and evaluation. This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, guaranteeing a transparent and standardized approach (Moher et al., 2009).

Inclusion and Exclusion Criteria

After retrieving the initial pool of articles, a systematic screening process was used to assess their eligibility. Studies were included if they met the following criteria: written in English, published within the last decade, conducted on human populations, focused primarily on parasagittal meningiomas, and discussed clinical characteristics, treatment modalities, and patient outcomes. To maintain a high level of evidence, the exclusion criteria included review articles, case reports, case series, and conference abstracts.

Study selection

Two independent reviewers meticulously evaluated the titles and abstracts of each article based on the predetermined inclusion and exclusion criteria. Following this initial screening, the full texts of potentially eligible studies were retrieved and reassessed to ensure that they met the inclusion criteria. Discussions were held to reach a consensus in cases of disagreement between the reviewers. If consensus could not be reached, a third reviewer was consulted to make a final decision, ensuring the integrity and impartiality of the selection process.

Data extraction

The selected studies underwent data extraction, which involved the collection of information on patient demographics, clinical presentations, treatment strategies, and outcomes. The data were systematically organized into a comprehensive database for further analysis. Subsequently, qualitative synthesis was performed, highlighting the key findings and trends across the selected studies. The clinical heterogeneity of parasagittal meningiomas, as well as variations in treatment approaches and outcomes, were thoroughly examined. This systematic review also aimed to identify gaps in the existing literature and pinpoint areas where further research is needed to improve the

understanding and management of these tumors.

Assessment of study quality

The articles included in the systematic review underwent quality assessment using the Newcastle-Ottawa Scale (Lo et al., 2014). This process was independently performed by two reviewers.

Synthesis with case series

The findings of the systematic review were then integrated with those of the case series presented in this study, providing a holistic view of parasagittal meningiomas. By combining the systematic review results with detailed patient cases, this study offers a multifaceted perspective on rare intracranial tumors. The integration of broad literature insights with specific patient experiences enriched the analysis, highlighting both common trends and unique challenges in managing these tumors. This comprehensive approach enhances the understanding of clinical characteristics, treatment options, and prognostic factors, ultimately contributing valuable insights into the field of neuro-oncology.

The systematic review methodology involved a systematic search, rigorous screening, data extraction, and qualitative synthesis of relevant studies to complement the case series used in this study. This

approach facilitated a comprehensive analysis of parasagittal meningiomas, emphasizing their clinical heterogeneity and the importance of tailored treatment strategies and interdisciplinary collaboration for optimal patient care.

Results

Case 1

A 45-year-old female underwent craniotomy for removal of a right-sided WHO grade I meningioma. Postoperatively, she experienced leg weakness and intermittent headaches but showed significant improvement over time. The symptoms escalated a year prior to the current assessment, with severe headaches and decreased consciousness. Re-evaluation confirmed the initial diagnosis of the meningioma and indicated successful surgical outcomes, as demonstrated by improved motor functions and no significant neurological deficits. This case emphasizes the benefits of precise surgical intervention and the importance of ongoing monitoring and supportive care in meningioma management.

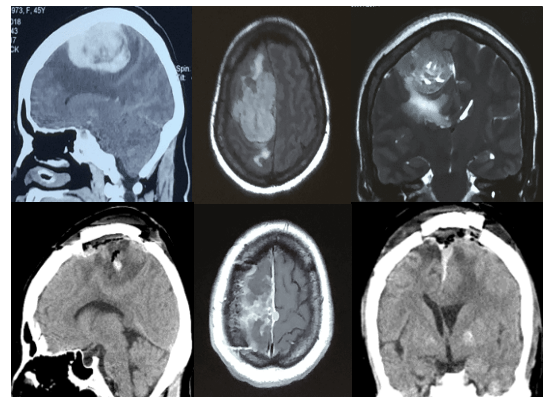


Figure 1. Pre-Op and post-op imaging comparison in sagittal, axial, and coronal views of case 1

Case 2

A 52-year-old patient with a parasagittal meningioma underwent craniotomy followed by radiotherapy. During the initial surgery, the tumor was removed from the medial left falx. The patient later experienced seizures, limb weakness, speech difficulties, and radicular pain, which led to the diagnosis of L4/5 disc herniation, although she declined further surgery. The development of a new tumor necessitated re-craniotomy. The current symptoms include speech difficulties, seizures, visual disturbances, and motor deficits. MRI findings suggested malignant transformation, adding complexity to the patient's condition. When scheduled for the removal of another tumor, the patient underscores the importance of continuous personalized care in managing recurrent meningiomas.

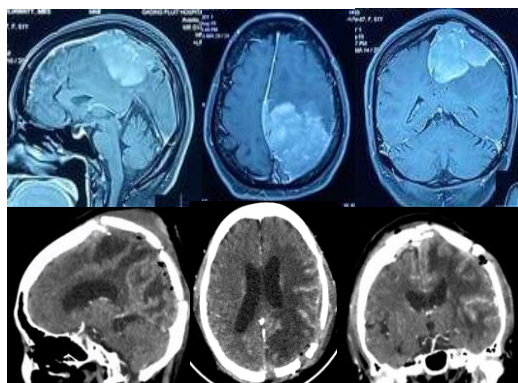


Figure 2. Comparison of pre-operative (contrast MRI) and post-operative (non-contrast CT) imaging in sagittal, axial, and coronal views for case 2

Case 3

A 68-year-old patient presented with left hemiparesis and was diagnosed with a right medial parasagittal meningioma with significant perifocal edema and midline shift. The patient underwent successful surgery for tumor removal. Postoperative outcomes included intensive care management, highlighting effective treatment and recovery from a substantial meningioma. This case emphasizes the need for clear documentation of patient outcomes, particularly for complex surgical recoveries.

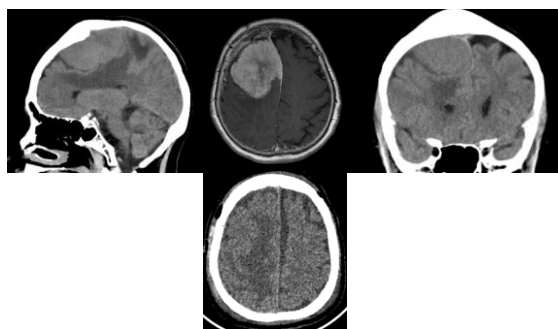


Figure 3. Pre-operative and post-operative imaging comparison in sagittal, axial, and coronal views for case 3. The pre-operative axial view was obtained using contrast MRI, while the remaining images were acquired using non-contrast CT scans.

Case 4

A 47-year-old patient with a left frontal parasagittal meningioma underwent successful craniotomy. Before the surgery, the patient experienced seizures and was managed with phenytoin, along with persistent headaches. Imaging revealed a midline shift with calcification, necessitating detailed surgical planning. The operation, which lasted 4 hours with an expected blood loss of 500 cc, was well prepared with the necessary blood products. Postoperatively, the patient was closely monitored in the ICU to manage complications, diabetes, and hypertension, which led to a successful recovery. This case highlights the importance of meticulous preoperative planning and careful postoperative care.

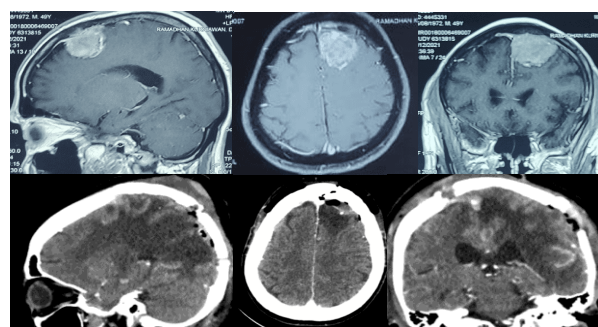


Figure 4. Comparison of pre-operative (MRI) and post-operative (non-contrast CT) imaging in sagittal, axial, and coronal views for case 4.

Case 5

A 39-year-old patient presented with severe headaches that began three days prior to evaluation. Initial contrast-enhanced magnetic resonance imaging (MRI) indicated a tumor, leading to craniotomy. Despite the surgical history, documentation discrepancies were noted, which were clarified postoperatively. Postoperatively, the patient experienced severe headaches that escalated in intensity; however, postoperative imaging showed promising results with significant headache relief, reducing the VAS score to 1-2. Persistent left-sided weakness was also observed. This case highlights the effectiveness of surgical treatment for parasagittal tumors and emphasizes the need for precise medical documentation.

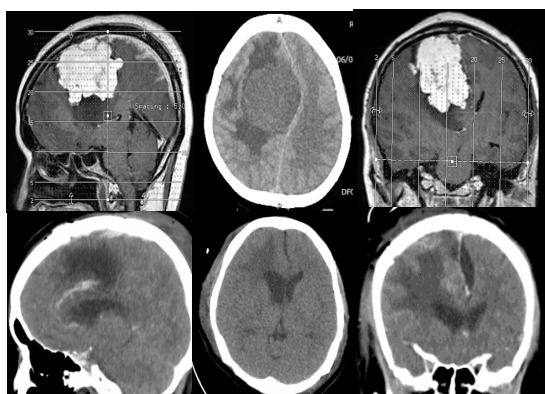


Figure 5. Pre-operative and post-operative imaging comparison in sagittal, axial, and coronal views for case 5.

Case 6

A 61-year-old patient presented with worsening left-sided body weakness and intermittent headaches of increasing intensity over 15 months. Symptoms initially appeared 25 months ago and escalated to difficulty walking and handling objects. A computed tomography (CT) scan identified a tumor, leading to further assessment and a contrast magnetic resonance imaging (MRI) brain scan, which confirmed a right parasagittal meningioma. The patient underwent successful craniotomy for tumor removal. Postoperatively, there was a significant improvement in strength and a reduction in headache intensity. Recovery includes physical therapy and medication, enhancing quality of life and managing residual symptoms.

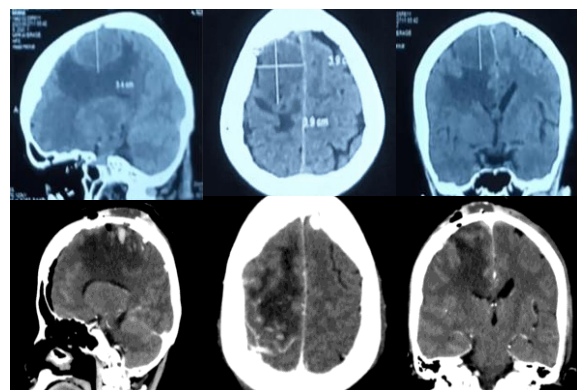


Figure 6. Pre-operative and post-operative non-contrast CT imaging comparison in sagittal, axial, and coronal views for case 6

Case 7

A 45-year-old patient experienced intermittent headaches and difficulty swallowing seven months prior to diagnosis. Computed tomography revealed a frontal sinus tumor, which was initially managed with Mestinon for swallowing issues. Contrast-enhanced magnetic resonance imaging confirmed a parasagittal meningioma. Despite treatment for dysphagia, the symptoms persisted with medication adjustments, leading to a decision to perform craniotomy. Postoperatively, the patient showed a marked improvement in swallowing and headache management. Ongoing medication effectively controlled the symptoms, demonstrating a successful response to the combined treatment.

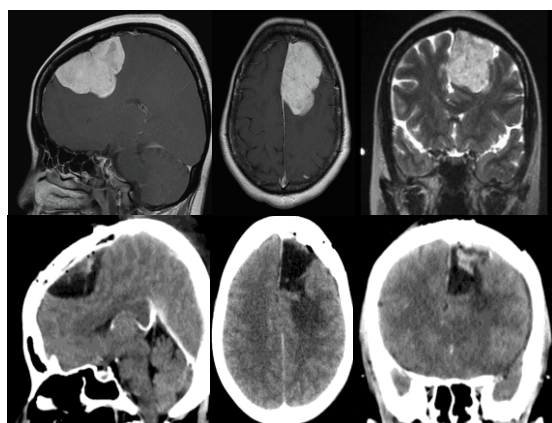


Figure 7. Pre-operative and post-operative imaging comparison in sagittal, axial, and coronal views for case 7

The case series presented here highlights the diversity of clinical presentations and management challenges posed by parasagittal meningiomas. Case 1 underscores the diagnostic complexity, as the patient initially presented with vague symptoms that were mistaken for migraines. This case emphasizes the importance of considering brain tumors in the differential diagnosis of severe headaches, even in the absence of typical neurological deficits. Case 2 exemplifies the challenges of managing recurrent parasagittal meningiomas, including their potential for malignant transformation. The patient's history of treatment adds complexity to current management. Case 3 illustrates the rapid progression of symptoms in some patients with parasagittal meningioma, necessitating timely surgical intervention. Case 4 emphasizes the need to consider comorbidities, such as diabetes and hypertension, when planning the management of these tumors. Case 5 highlights the diagnostic and therapeutic considerations for a patient with a parasagittal meningioma and a history of contraceptive use. Case 6 discusses the treatment and recovery from a right

parasagittal meningioma, which resulted in improved strength and reduced headaches after craniotomy. Finally, case 7 focuses on the management of dysphagia and a frontal sinus tumor, leading to improved symptoms following surgery and medication for suspected myasthenia gravis.

Systematic review

Results of search strategy

Figure 3 outlines the article selection process. The search identified 821 records, of which 440 were screened after duplicates were removed. Of the screened records, 381 were excluded from the study. Twenty-nine titles and abstracts of the screened articles were excluded. Of the full texts, 22 were also excluded. Seven studies met the predefined criteria and were included in the review, totaling 1,005 patients with parasagittal meningioma.

Characteristics of eligible studies

This systematic review consists of seven eligible studies, including five retrospective cohort studies and two comprehensive literature reviews (Figure 2). The five retrospective cohort studies discussed the outcomes of surgical resection for the treatment of parasagittal meningiomas. Some studies provided valuable insights into the integration of various advanced techniques such as intraoperative neuronavigation and conformal radiation

therapy, which have been employed alongside surgical resection to enhance treatment efficacy and precision. All included cohort studies were deemed "good" in quality based on NOS scoring for observational studies.

Clinical characteristics

Each surgical intervention described in these cohort studies was meticulously guided using the Sindou classification system. This system categorizes parasagittal meningiomas based on the extent of SSS invasion. Sindou Class I tumors have minimal invasion, as they only attach to the outer surface of the sinus wall. In contrast, Sindou Classes V and VI indicate severe invasion, leading to significant narrowing or complete occlusion of the sinus. Furthermore, the extent of tumor removal was evaluated and categorized using the Simpson grading (SG) system, a widely recognized framework that correlates the completeness of tumor resection with the likelihood of recurrence. In this grading system, SG I represents total resection of the tumor along with its dural attachment and any involved bone, aiming for the highest likelihood of cure and the lowest risk of recurrence. On the other end of the spectrum, SG V indicates more limited resections, where the primary goal might be to decompress pressure caused by the tumor and alleviate

symptoms without achieving complete removal, often due to the high surgical risks associated with extensive resection (Sindou & Alvernia, 2006).

The integration of advanced techniques, such as intraoperative neuronavigation, provides real-time, precise guidance during surgery, enabling surgeons to navigate complex brain structures and achieve more accurate resections. Conformal radiation therapy is often used postoperatively to target residual tumor cells, thereby enhancing the overall treatment outcome and reducing the risk of recurrence (Sindou & Alvernia, 2006).

On the other hand, one literature review explored the promising potential of stereotactic radiotherapy and radiosurgery as alternative treatments to conventional surgical methods. This review highlights notable improvements in patient outcomes and reduced toxicity reported in several studies, suggesting that these advanced techniques could offer significant benefits. Intriguingly, this review also posits that radiotherapy could potentially serve as an exclusive treatment, eliminating the need for surgery in certain cases. This literature review provides a comprehensive and detailed examination of the current standards and practices in the management of parasagittal meningiomas, including surgery and radiotherapy.

The systematic review conducted in this study complements this case series by synthesizing existing literature on parasagittal meningiomas. This review revealed the clinical heterogeneity of these tumors, as reported in various studies, as well as variations in treatment approaches and outcomes. It also identified gaps in the literature, indicating the need for further research to optimize the management of parasagittal meningiomas.

The integration of case series and systematic review findings provides a comprehensive understanding of parasagittal meningiomas. Clinically, this study offers insights into optimal diagnostic and treatment strategies for these tumors. It emphasizes the importance of interdisciplinary collaboration, individualized patient management, and the consideration of comorbidities in decision-making. From a research perspective, this study highlights the need for large-scale studies and standardized approaches to improve evidence-based management of parasagittal meningiomas.

Treatment options and outcomes

Each surgical intervention described in these cohort studies was meticulously guided by the Sindou classification system. This system categorizes parasagittal meningiomas based on the extent of their invasion of the SSS. Sindou Class I tumors

have minimal invasion, as they only attach to the outer surface of the sinus wall. In contrast, Sindou Classes V and VI indicate severe invasion, leading to significant narrowing or complete occlusion of the sinus (Sindou & Alvernia, 2006).

Furthermore, the extent of tumor removal was evaluated and categorized using the SG system, which is a widely recognized framework that correlates the completeness of tumor resection with the likelihood of recurrence. In this grading system, SG I represents total resection of the tumor along with its dural attachment and any involved bone, aiming for the highest likelihood of cure and the lowest risk of recurrence. On the other end of the spectrum, SG V indicates more limited resections, where the primary goal might be to decompress pressure caused by the tumor and alleviate symptoms without achieving complete removal, often due to the high surgical risks associated with extensive resection (Cho et al., 2000).

The integration of advanced techniques, such as intraoperative neuronavigation, provides real-time, precise guidance during surgery, enabling surgeons to navigate complex brain structures and achieve more accurate resections. Conformal radiation therapy is often used postoperatively to target residual tumor cells, thereby enhancing the overall treatment outcome and reducing the risk of recurrence.

On the other hand, one literature review explored the promising potential of stereotactic radiotherapy and radiosurgery as alternative treatments to conventional surgical methods. This review highlighted notable improvements in patient outcomes and reduced toxicity reported in several studies, suggesting that these advanced techniques could offer significant benefits. Intriguingly, this review also posited that radiotherapy could potentially serve as an exclusive treatment, eliminating the need for surgery in certain cases. The literature review provides a comprehensive and detailed examination of the current standards and practices in the management of parasagittal meningiomas, including surgery and radiotherapy.

The systematic review conducted in this study complements this case series by synthesizing the existing literature on parasagittal meningiomas. This review revealed the clinical heterogeneity of these tumors, as reported in various studies, as well as variations in treatment approaches and outcomes. It also identified gaps in the literature, indicating the need for further research to optimize the management of parasagittal meningiomas.

The integration of case series and systematic review findings provides a comprehensive understanding of parasagittal meningiomas. Clinically, this study offers insights into optimal diagnostic

and treatment strategies for these tumors. It emphasizes the importance of interdisciplinary collaboration, individualized patient management, and consideration of comorbidities in decision-making. From a research perspective, this study highlights the need for larger-scale studies and standardized approaches to improve the evidence-based management of parasagittal meningiomas.

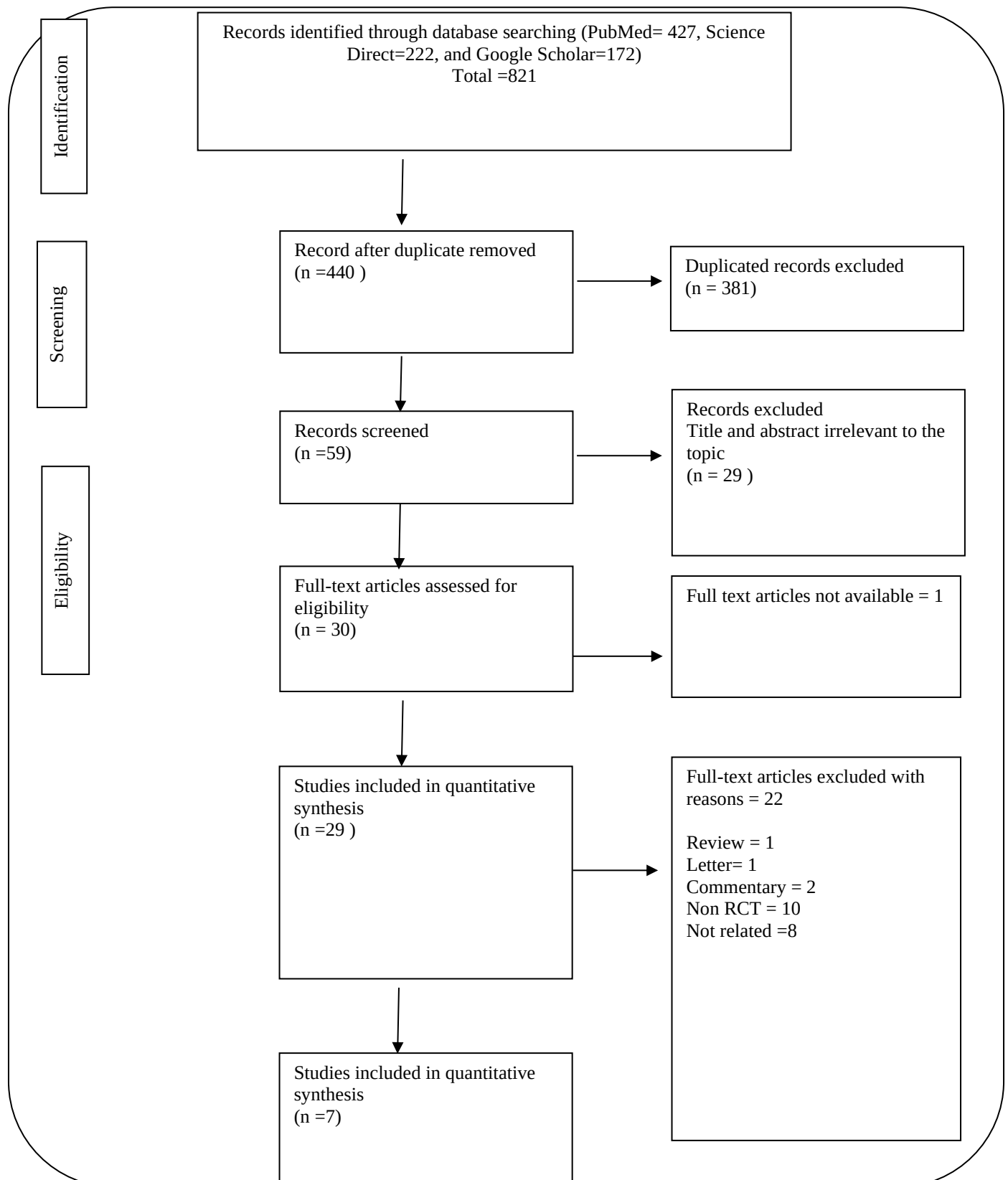


Table 2. Study characteristics of included studies

Characteristics	Pinzi (2019) ^[12]	Ricci (2017) ^[2]	Wang (2021) ^[13]
Number of Patients	388 PSM patients	75 PSM patients	165 PSM patients
Study Design	Literature review	Retrospective cohort	Retrospective cohort
Intervention	Combination of SRT and single-session radiosurgery	Radical resection with SSS reconstruction, aided with ICGV	Surgical resection with various techniques
Clinical Characteristics	NA	Anterior-third SSS: mental disorder and personality changes; Middle-third: hemiparesis, akinesia, brain swelling, venous infarction, CSF leak; and Posterior third: septicaemia	Headache, upper or lower limbs weakness, seizure, dizzy, sensation disturbances, hyposmia, somnolence
Treatment Options	SRT Radiosurgery	Total surgical resection (SG I-II) ICGV	Surgical resection
Study Conclusion	Combination of SRT and single-session radiosurgery serve as an alternative to conventional surgery, as it shows improvement in outcomes and reduced toxicity (e.g. edema, motor weakness, headache)	Preservation of cortical veins and anterior-third of the SSS (to avoid changes in personality or mental disorders) are the key factors to successful surgery	Surgery is the key treatment for PSM, with aggressive resection leading to higher KPS score

PSM parasagittal meningioma, SRT stereotactic radiotherapy, SSS superior sagittal meningioma, ICGV indocyanine green video-angiography, NA not available, CSF cerebrospinal fluid, SG Simpson grading, KPS Karnofsky performance scale

Table 2. Continued

Characteristics	Aguiar (2022) ^[9]	Chen (2023) ^[10]	Kalfas (2019) ^[11]	Mathiesen (2020) ^[11]
Number of Patients	65 PSM patients with the invasion of SSS	212 PSM patients	100 PSM/FM patients with >2.0 cm in the largest diameter	NA
Study Design	Retrospective cohort	Retrospective cohort	Retrospective cohort	Literature review
Intervention	Total surgical resection using SG I technique or surgical resection with preservation of the SSS wall (SG II)	Maximal safe resection. Sindou I-II: radical resection Sindou III-IV: GTR Sindou V-VI: STR	Advanced microsurgical technique using image guidance and conformal radiation treatments	Surgical resection using SG and adjuvant radiosurgery
Clinical Characteristics	Headache, neurological deficit, intracranial hypertension, seizures, no symptoms	NA	Headache, seizure, ataxia, unilateral weakness, lower extremity weakness, psychosis, palpable mass, asymptomatic	Focal neurological deficit, epilepsy, increased ICP
Treatment Options	Surgical resection	Surgical resection	Surgical resection Intraoperative neuronavigation Radiosurgery	Surgical resection Radiosurgery
Study Conclusion	SG II resection is better for PSM with invasion of SSS, as it diminishes vascular risks, lowering the frequency of severe postoperative deficit, and reduces mortality	The main predictors of increased perioperative complications were Sindou invasion classes V-VI and peritumoral edema ≥ 1 cm Sindou invasion classes III-IV and V-VI were the independent predictors for tumor recurrence	Advanced microsurgical technique using image guidance and conformal radiation treatments can optimize outcomes with minimal complication and mortality	Surgery is the main therapy for PSM and techniques have improved over the years, however tumor recurrence is not uncommon. Adjuvant radiosurgery and long-term follow-up are important to be considered

PSM parasagittal meningioma, SSS superior sagittal meningioma, FM falcine meningioma, NA not available, SG Simpson grading, GTR gross total resection, STR subtotal resection, ICP intracranial pressure

Table 3. Newcastle-Ottawa Scale quality appraisal for retrospective cohort studies

No.	Author	Year	Selection				Comparability		Outcome		Result quality
			Representativeness of the exposed cohort	Selection of the nonexposed cohort	Ascertainment of exposure	Incident disease	Comparability of cohorts based on the design or analysis	Outcome assessment	Follow up long enough for outcomes to occur	Adequacy of follow-up for cohort	
1	Aguiar ⁹	2022	1	1	1	0	1	1	1	1	Good
2	Chen ¹⁰	2023	1	1	1	0	1	1	1	1	Good
3	Kalfas ¹¹	2019	1	1	1	0	1	1	1	1	Good
4	Pinzi ¹²	2019	1	1	1	0	1	1	1	1	Good
5	Ricci ²	2017	1	1	1	0	1	1	1	1	Good

Result quality: Good: 3 or 4 in selection, and 1 or 2 in comparability, and 2 or 3 in outcome; Fair: 2 in selection, and 1 or 2 in comparability, and 2 or 3 in outcome; Poor: 0 or 1 in selection, or 0 in comparability, or 0 and 1 in outcome.

Table 2. Study characteristics of included studies

Characteristics	Aguiar et al. (2022)	Chen et al. (2023)	Kalfas & Scudieri (2019)	Mathiesen (2020)
Number of Patients	65 PSM patients with the invasion of SSS	212 PSM patients	100 PSM/FM patients with >2.0 cm in the largest diameter	NA
Study Design	Retrospective cohort	Retrospective cohort	Retrospective cohort	Literature review
Intervention	Total surgical resection using SG I technique or surgical resection with preservation of the SSS wall (SG II)	Maximal safe resection. Sindou I-II: radical resection Sindou III-IV: GTR Sindou V-VI: STR	Advanced microsurgical technique using image guidance and conformal radiation treatments	Surgical resection using SG and adjuvant radiosurgery
Clinical Characteristics	Headache, neurological deficit, intracranial hypertension, seizures, no symptoms	NA	Headache, seizure, ataxia, unilateral weakness, lower extremity weakness, psychosis, palpable mass, asymptomatic	Focal neurological deficit, epilepsy, increased ICP
Treatment Options	Surgical resection	Surgical resection	Surgical resection Intraoperative neuronavigation Radiosurgery	Surgical resection Radiosurgery
Study Conclusion	SG II resection is better for PSM with invasion of SSS, as it diminishes vascular risks, lowering the frequency of severe postoperative deficit, and reduces mortality	The main predictors of increased perioperative complications were Sindou invasion classes V-VI and peritumoral edema $\geq$ 1cm Sindou invasion classes III-IV and V-VI were the independent predictors for tumor recurrence	Advanced microsurgical technique using image guidance and conformal radiation treatments can optimize outcomes with minimal complication and mortality	Surgery is the main therapy for PSM and techniques have improved over the years, however tumor recurrence is not uncommon. Adjuvant radiosurgery and long-term follow-up are important to be considered
PSM parasagittal meningioma, SSS superior sagittal meningioma, FM falcine meningioma, NA not available, SG Simpson grading, GTR gross total resection, STR subtotal resection, ICP intracranial pressure				

Characteristics	Pinzi et al. (2019)	Ricci et al. (2017)	Wang et al. (2022)
Number of Patients	388 PSM patients	75 PSM patients	165 PSM patients
Study Design	Literature review	Retrospective cohort	Retrospective cohort
Intervention	Combination of SRT and single-session radiosurgery	Radical resection with SSS reconstruction, aided with ICGV	Surgical resection with various techniques
Clinical Characteristics	NA	Anterior-third SSS: mental disorder and personality changes; Middle-third: hemiparesis, akinesia, brain swelling, venous infarction, CSF leak; and Posterior third: septicaemia	Headache, upper or lower limbs weakness, seizure, dizzy, sensation disturbances, hyposmia, somnolence
Treatment Options	SRT Radiosurgery	Total surgical resection (SG I-II) ICGV	Surgical resection
Study Conclusion	Combination of SRT and single-session radiosurgery serve as an alternative to conventional surgery, as it shows improvement in outcomes and reduced toxicity (e.g. edema, motor weakness, headache)	Preservation of cortical veins and anterior-third of the SSS (to avoid changes in personality or mental disorders) are the key factors to successful surgery	Surgery is the key treatment for PSM, with aggressive resection leading to higher KPS score
PSM parasagittal meningioma, SRT stereotactic radiotherapy, SSS superior sagittal meningioma, ICGV indocyanine green video-angiography, NA not available, CSF cerebrospinal fluid, SG Simpson grading, KPS Karnofsky performance scale			

Discussion

Each surgical intervention in these cohort studies followed the Sindou classification system, categorizing parasagittal meningiomas by their invasion of the SSS. Sindou Class I tumors attach minimally to the sinus wall, while Classes V and VI show severe invasion, causing significant narrowing or complete occlusion of the sinus. Tumor removal extent was assessed using the SG system, which correlates resection completeness with recurrence likelihood. SG I involves total resection, including dural attachment and any affected bone, aiming for high cure rates and low recurrence risk. Conversely, SG V entails limited resections to decompress tumor pressure and alleviate symptoms, often due to high surgical risks (Sindou & Alvernia, 2006).

The incorporation of intraoperative neuronavigation offers real-time, precise surgical guidance, allowing for accurate navigation of complex brain structures and improved resection accuracy. Postoperative conformal radiation therapy targets residual tumor cells, enhancing treatment outcomes and reducing recurrence risk (Cho et al., 2000). Conversely, a literature review examined the potential of stereotactic radiotherapy and radiosurgery as alternatives to conventional surgery, noting improved patient outcomes and reduced

toxicity in several studies. The review also suggested that radiotherapy could potentially replace surgery in certain cases (Pinzi et al., 2019). This comprehensive review details current standards and practices in the management of parasagittal meningiomas, encompassing both surgical and radiotherapy approaches.

This systematic review complements the case series by synthesizing existing literature on parasagittal meningiomas, revealing clinical heterogeneity and variations in treatment and outcomes. It identifies gaps in the literature, indicating a need for further research to optimize management strategies. Integrating the case series and review findings offers a comprehensive understanding of parasagittal meningiomas, providing insights into optimal diagnostic and treatment strategies. This underscores the importance of interdisciplinary collaboration, individualized patient management, and consideration of comorbidities in decision-making. It also highlights the necessity for larger-scale studies and standardized approaches to enhance evidence-based management.

Clinical heterogeneity and diagnostic challenges

Parasagittal meningioma, a rare intracranial tumor originating from the

meninges, presents a complex clinical landscape. This case series illustrates the extensive clinical heterogeneity of these tumors, showing patients with a diverse array of symptoms and diagnostic challenges. Symptoms range from severe headaches and limb weakness to recurrent seizures, speech difficulties, and neurological deficits, complicating timely and accurate diagnosis due to their overlap with other neurological conditions (Kondziolka et al., n.d.).

The diagnostic complexity is further underscored in this study. Case 1 highlights the challenge of recognizing parasagittal meningiomas when initial symptoms, like intermittent headaches, are misattributed to common conditions such as migraines. In Case 2, the recurrence and malignant transformation of the tumor added diagnostic complexity, necessitating a nuanced management approach. These cases exemplify the intricate interplay between symptoms and the diagnostic hurdles encountered by clinicians.

A critical aspect of this study is the importance of considering brain tumors, including parasagittal meningiomas, in the differential diagnosis of severe headaches, even without overt neurological deficits. Delayed diagnosis can significantly impact treatment outcomes. Therefore, healthcare providers must maintain a high index of

suspicion and pursue comprehensive evaluations when confronted with severe headaches, leading to earlier detection and more effective management of parasagittal meningiomas.

In conclusion, the clinical heterogeneity and diagnostic challenges associated with parasagittal meningiomas emphasize the need for a multifaceted approach to their recognition and treatment, improving the prospects of patients affected by these rare intracranial tumors (Zheng et al., 2022).

Treatment approaches and outcomes

This study outlines various treatment approaches, including surgical resection, radiation therapy, and observation, depending on factors such as tumor size, location, and patient condition. This comprehensive approach ensures that each patient receives personalized care tailored to their specific situation. Surgical resection aims to remove the tumor entirely, while radiation therapy can be used when complete surgical removal is challenging or risky. Observation may be suitable for small asymptomatic tumors that do not pose an immediate threat to patient health. Considering these treatment options, clinicians can make informed decisions to optimize patient outcomes.

Surgical Technique of Parasagittal Meningioma

Resection of parasagittal meningiomas presents unique challenges owing to their proximity to the sagittal sinus, a major venous structure in the brain. Craniotomy involving the sagittal sinus requires meticulous planning and execution to minimize the risk of venous damage, which can lead to significant complications such as brain swelling, hemorrhage, or even fatal outcomes.

The surgical technique begins with a precise craniotomy that allows optimal exposure of the tumor while preserving critical vascular structures. Neurosurgeons often use neuronavigation systems to enhance the accuracy of tumor localization and delineate the boundaries between the tumor and the sinus. The surgical approach may vary depending on the degree of sinus encasement. For tumors that partially encase the sinus, careful debulking is performed to reduce tumor volume and relieve pressure on the sinus. Advanced microsurgical instruments and techniques are employed to meticulously dissect the tumor from the sinus wall, preserving venous integrity as much as possible (Zabolotny et al., 2019).

When the tumor involves the sagittal sinus, surgeons may need to decide between partial resection and sinus reconstruction. In

cases where the sinus is extensively encased, partial resection is often performed to avoid compromising venous outflow. If the tumor infiltrates a segment of the sinus that can be safely removed, techniques such as direct suturing, patch grafting, or venous bypass may be employed to reconstruct the sinus and restore venous circulation (Zabolotny et al., 2019).

One of the critical considerations during surgery is the extent to which the tumor encases the sagittal sinus. When the tumor involves the sinus, complete resection becomes more complex and riskier. Surgeons must balance the goal of maximal tumor removal with the preservation of venous outflow. This often results in a higher rate of incomplete resections, as removing the entire tumor might necessitate sacrificing portions of the sinus, thereby increasing the risk of serious complications. In such cases, adjuvant therapies, such as radiation, may be employed postoperatively to manage residual tumor tissue, ensuring comprehensive treatment while mitigating surgical risks. Additionally, intraoperative monitoring of brain function and venous pressure can guide surgical decisions and help prevent complications (DeMonte et al., 2011; Sacko et al., 2007).

Furthermore, the importance of a multidisciplinary approach involving neurosurgeons, neurologists, radiologists,

and radiation oncologists in the management of parasagittal meningiomas cannot be overstated. These tumors are complex and often require a combination of surgical and non-surgical interventions. Neurosurgeons play a central role in tumor resection, whereas neurologists are essential in managing neurological symptoms and comorbidities. Radiologists provide crucial imaging expertise for diagnosis and treatment planning, while radiation oncologists offer expertise in delivering radiation therapy when necessary. Collaborative decision-making and ongoing communication among these specialists are vital for providing the best possible care to patients with parasagittal meningiomas (Chen et al., 2023).

This study highlights the need for individualized treatment plans, considering factors such as comorbidities and history of previous treatments, as demonstrated in the case series. Each patient's unique clinical presentation and medical history should guide treatment decisions. For example, comorbidities such as diabetes and hypertension may influence the choice of treatment and perioperative management. Additionally, patients with recurrent tumors, as seen in Case 2, may require different approaches than those with newly diagnosed tumors. By tailoring treatment plans for individual patients, healthcare

providers can optimize outcomes and improve the overall quality of care for individuals with parasagittal meningiomas.

Gaps in existing literature and research implications

This study, which includes a series of cases and a systematic review of parasagittal meningiomas, reveals deficiencies in the current literature on this condition and emphasizes crucial areas for future research. The systematic review points out significant gaps in understanding the clinical characteristics, treatment strategies, and patient outcomes of parasagittal meningiomas. Future research should focus on addressing these gaps with large-scale studies and standardized management approaches. Additionally, the study stresses the need to investigate novel diagnostic techniques, assess the role of additional therapies like radiation or targeted therapy, and identify predictive factors for treatment response and prognosis. By exploring these areas, future research can significantly advance our knowledge of rare intracranial tumors and improve patient outcomes, thereby impacting both clinical practice and advancements in neuro-oncology.

Conclusion

Parasagittal meningiomas present a distinct challenge in neuro-oncology. This study provides critical insights into their clinical characteristics, diagnostic challenges, treatment strategies, and outcomes. The heterogeneity and diagnostic complexities of these tumors necessitate a multifaceted approach for effective recognition and management. It underscores the importance of personalized treatment plans developed by a multidisciplinary team, considering factors such as comorbidities and previous treatments. Additionally, the study identifies gaps in the current literature, highlighting the need for further research to optimize management and improve patient outcomes. This research enhances our understanding of these rare intracranial tumors, guiding clinicians in making informed decisions to advance patient care in neuro-oncology.

References

- Aguiar, P. H. P., Dos Santos, R. R. P., Marson, F. A. L., Dezena, R. A., & Rampazzo, A. C. M. R. (2022). What is the ideal grade of resection for parasagittal meningiomas with the invasion of superior sagittal sinus? Simpson I or Simpson II resection? A retrospective observational study. *Surgical Neurology International*, 13, 423.
https://doi.org/10.25259/SNI_436_2022
- Antunes, A., & Winter, R. (2023). Parasagittal Meningiomas: Prognostic Factors for Recurrence. In *Advances and Technical Standards in Neurosurgery* (pp. 277–289).
https://doi.org/10.1007/978-3-031-36785-4_10
- Chen, W.-W., Wang, Y., Hu, Y.-C., & Zhao, Y.-L. (2023). Analysis of the common complications and recurrence-related factors of superior parasagittal sinus meningioma. *Frontiers in Surgery*, 9.
<https://doi.org/10.3389/fsurg.2022.1023021>
- Cho, T. H., Chung, Y. G., Kim, C. Y., Kim, H. K., Lee, N. J., Chu, J. W., & Choi, M. S. (2000). Intraoperative radiation therapy as an adjunctive therapy for huge and highly vascular parasagittal meningiomas. *Journal of Korean Medical Science*, 15(6), 718.
<https://doi.org/10.3346/jkms.2000.15.6.718>
- DeMonte, F., McDermott, M. W., & Al-Mefty, O. (2011). *Al-Mefty's Meningioma (2nd ed.)*. Thieme.
- Kalfas, F., & Scudieri, C. (2019). Neurosurgical management of parasagittal and falcine meningiomas:

- Judicious modern optimization of the results in a 100-case study. *Asian Journal of Neurosurgery*, 14(04), 1138–1143.
https://doi.org/10.4103/ajns.AJNS_245_18
- Kondziolka, D., Flickinger, J. , & Pérez, B. (n.d.). *Judicious resection and/or radiosurgery for parasagittal meningiomas: Outcomes from a multicenter review.*
- Lo, C. K.-L., Mertz, D., & Loeb, M. (2014). Newcastle-Ottawa Scale: comparing reviewers' to authors' assessments. *BMC Medical Research Methodology*, 14(1), 45. <https://doi.org/10.1186/1471-2288-14-45>
- Mathiesen, T. (2020). Parasagittal meningiomas. *Handbook of Clinical Neurology*, 170, 93–100.
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine*, 6(7), e1000097.
<https://doi.org/10.1371/journal.pmed.1000097>
- Pinzi, V., Fariselli, L., Marchetti, M., Scorsetti, M., & Navarria, P. (2019). Stereotactic Radiotherapy for Parasagittal and Parafalcine Meningiomas: Patient Selection and Special Considerations. *Cancer Management and Research*, 11, 10051–10060.
<https://doi.org/10.2147/CMAR.S187371>
- Ricci, A., Di Vitantonio, H., De Paulis, D., Del Maestro, M., Gallieni, M., Dehcordi, S., Marzi, S., & Galzio, R. (2017). Parasagittal meningiomas: Our surgical experience and the reconstruction technique of the superior sagittal sinus. *Surgical Neurology International*, 8(1), 1.
<https://doi.org/10.4103/2152-7806.198728>
- Sacko, O., Sesay, M., & Roux, F. E. (2007). Intracranial meningioma surgery in the ninth decade of life. *Neurosurgery*, 61(5), 950–954.
- Sindou, M. P., & Alvernia, J. E. (2006). Results of attempted radical tumor removal and venous repair in 100 consecutive meningiomas involving the major dural sinuses. *Journal of Neurosurgery*, 105(4), 514–525.
<https://doi.org/10.3171/jns.2006.105.4.514>
- Wang, B., Zhang, G.-J., Wu, Z., Zhang, J.-T., & Liu, P.-N. (2022). Surgical outcomes and prognostic factors of parasagittal meningioma: a single-center experience 165 consecutive cases. *British Journal of Neurosurgery*,

36(6), 756–761.

[https://doi.org/10.1080/02688697.2020.](https://doi.org/10.1080/02688697.2020.1867825)

1867825

Zabolotny, R. A., Fedyanin, A. V., Yulchiev, U. A., Galkin, M. V., & Kozlov, A. V. (2019). Comprehensive treatment of patients with parasagittal meningiomas. *Voprosy Neurokhirurgii Imeni N.N. Burdenko*, 83(4), 121. <https://doi.org/10.17116/neiro201983041121>

Zheng, Z., Jia, L., Zhang, P., Tian, Y., & Chen, X. (2022). Effectiveness of Super-selective Embolization for Parasagittal Meningiomas and Its Effect on the Level of Inflammatory Factors. *Evidence-Based Complementary and Alternative Medicine*, 2022, 1–6. <https://doi.org/10.1155/2022/2466007>



The Effect of Cigarettes on Schizophrenia Patients

Mira Lovita Maylia^{1*}, Nur Azizah¹ Hafid Algristian¹

¹Departemen / SMF Mental Health Sciences, Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya, Indonesia

*Corresponding Author: miralovita01@gmail.com

DOI: 10.33086/iimj.v6i2.6250

ARTICLE INFO

Keywords:
Cigarettes,
Patients,
Schizophrenia

Submitted: July
13th 2024

Reviewed: Aug
19th 2024

Accepted: Dec
12th 2024

ABSTRACT

Introduction: The prevalence of smoking in patients with schizophrenia is still high around 70-80%. While studies indicate that smoking may increase the risk of developing schizophrenia, the exact role of smoking in this connection still needs further exploration. The purpose of the study was to explain schizophrenia, dopamine, the etiology of cigarette use in patients with schizophrenia, the mechanism of action, the relationship between schizophrenia cases and cigarettes, the management of patients with schizophrenia and the relationship between the administration of antipsychotics to patients with schizophrenia and active smokers. The data collection method used is data derived from literature studies obtained from journals, books, and dissertations of Google Scholar and PubMed. The data collection tool used is documents.

Results: The nicotine in cigarettes interacts with nicotinic receptors in the brain, affecting the release of dopamine and serotonin. This can affect negative symptoms in schizophrenic patients, although the effect on positive symptoms still needs more research to be fully understood. Although the exact mechanism is not yet fully understood, some hypotheses indicate that smoking may play a role in managing negative symptoms and influencing impaired dopamine regulation in schizophrenia. Schizophrenia patients who are also active smokers face challenges in treatment with antipsychotics such as clozapine and olanzapine. Appropriate adjustment of antipsychotic doses is needed to optimize the management of schizophrenic symptoms without increasing the risk of unwanted side effects.

Conclusion: In patients with schizophrenia the production of the neurotransmitter dopamine is excessive. When dopamine levels are unbalanced, excessive or reduced, sufferers can experience both positive and negative symptoms. Although smoking may provide some benefits in reducing negative symptoms of schizophrenia, the overall impact is still complex and requires more research. Future studies are expected to better understand the mechanism of interaction between smoking and schizophrenia and develop better treatment strategies.

Introduction

The rate of smoking among individuals with schizophrenia remains high. Smoking is prevalent in psychotic disorders, with schizophrenia affecting around 70-80% of smokers. While some studies propose that smoking may raise the likelihood of

developing schizophrenia, the precise role of smoking in this connection still requires further exploration. Smokers with schizophrenia tend to experience more severe positive symptoms and cognitive impairments, although the intensity of extrapyramidal side effects is lower in

comparison with schizophrenia patients who are non-smokers (Mu et al., 2024).

Schizophrenia (SCZ) Schizophrenia (SCZ) is a long-term and serious mental illness that impacts 1% of the global population. Individuals with schizophrenia often have hallucinations, disorganized thoughts, and are susceptible to delusions and paranoia. The symptoms of schizophrenia are categorized into positive and negative symptoms (Mu et al., 2024).

Negative symptoms refer to a reduction in typical behaviors linked to everyday activities, including social interactions, motivation, and self-expression. These symptoms may be primary, arising from the underlying pathophysiology of schizophrenia, or secondary, arising from psychiatric or medical conditions, or the side impacts of medication.

Symptoms include reduced normal behaviors related to social interactions, motivation, and self-expression. These symptoms may be primary, arising from the underlying pathophysiology of schizophrenia, or secondary, arising from psychiatric or medical conditions, or the side impacts of medication. Negative symptoms consist of 5 main components: blunt affect, alogia (decrease in speech output), avolition (reduction in activities that lead to goals because of weakened motivation), asociality, and anhedonia (reduction in pleasure experiences). These

symptoms are central to Schizophrenia and are closely linked to chronic disability and unfavorable functional outcomes in patients. While available antipsychotic medications can frequently provide effective management of positive symptoms, the current approaches to treating negative symptoms are generally ineffective and continue to represent an unaddressed medical necessity. Interestingly, some studies show evidence of fewer negative symptoms of Schizophrenia patients who smoke, thus contributing to self-treatment of negative symptoms (Mu et al., 2024).

The study intends to explain schizophrenia, schizophrenia and dopamine, the etiology of cigarette use in patients with schizophrenia, the mechanism of action, the relationship between schizophrenia cases and cigarettes, the management of patients with schizophrenia and active smokers, the relationship between the administration of antipsychosis to patients with schizophrenia and active smokers.

This study uses a descriptive qualitative method that utilizes secondary data sources. This method aims to describe the phenomenon being studied without trying to test or measure certain variables statistically. The data used in this study were obtained from scientific articles, books, dissertations, and other academic

literature relevant to the research topic. In collecting data, researchers conducted searches through academic databases such as Google Scholar and PubMed, and used keywords related to smoking and schizophrenia. After the data was collected, researchers conducted a literature review to analyze the themes that emerged and conclude the impact of smoking on people with schizophrenia.

Inclusion and exclusion criteria were used to ensure that only relevant and high-quality data were used in this study. Inclusion criteria include data sources that are relevant to the research topic, such as journal articles and books that discuss the impact of smoking on people with schizophrenia. In addition, only literature published in the last five years will be considered to ensure that the data used is current and relevant. Exclusion criteria include articles or sources that are not relevant to the research topic, such as sources that discuss schizophrenia in general without linking it to smoking habits, or sources that are too old and not relevant to current phenomena.

In this study, the data collection tool used is documents. The documents used include journal articles, books, and dissertations that are relevant to the research topic. These documents provide systematic information and can be analyzed to find certain patterns or themes.

Data analysis is carried out by coding relevant information, looking for emerging themes, and interpreting the meaning of the data found. The results of the analysis are then presented in descriptive form to provide a clear picture of the relationship between smoking and its impact on schizophrenia sufferers. To obtain quality data sources, researchers use various leading academic databases such as Google Scholar, PubMed, and Scopus. Keywords used in the search include "smoking in schizophrenia", "the impact of smoking on mental health", and "schizophrenia and smoking habits". In addition, filters such as year of publication and type of publication are used to ensure that only current and credible sources are included in the study.

Results

Schizophrenia

Positive and Negative Symptoms of Schizophrenia

Schizophrenia is a severe mental disorder with manifestations in the form of disorders of the content of the mind, language, and perception (Fitri et al., 2022). Schizophrenia symptoms can be broadly categorized into two main types, which are positive and negative symptoms. Positive symptoms include delusions, hallucinations, confusion of mind, restless rows, and strange or hostile behavior. Negative symptoms are characterized by a

decrease in usual functions linked to interests such as anhedonia, asociality, avolition, or expressive functions i.e. blunt affective and alogia (Schooler, 2020).

Schizophrenia Diagnostic Guidelines and Symptom Criteria

According to PPDGJ-III, the diagnostic guideline for schizophrenia (F 20) is that there must be at least one of the following symptoms that are noticeable (and typically two or more symptoms if they are less sharp or less clear) including *thought echo*, *delusion of control*, auditory hallucinations and other types of persistent hallucinations or at least two of the following symptoms that must always be displayed including persistent hallucinations from Any sense, broken or *interpolated* thought flow, catatonic behavior, such as *excitement*, posture, or eccentric flexibility, negativism, mutism, and stupor, "negative" symptoms, such as extreme apathy, infrequent speech, and dull or unnatural emotional responses, usually result in Withdrawal from social associations and decreased social performance but it must be clear that all of these things are not caused by depression or neuroleptica medication (Maslim, 2019).

The existence of these typical symptoms has persisted for at least one month or longer. There must be a

consistent and consistent shift in the *overall quality* of various aspects of personal behavior, including a loss of interest, a lack of purpose in life, not doing something, *a tendency toward self-absorption*, and withdrawal from social interactions (Maslim, 2019).

Schizophrenia and Dopamine

Definition and Function of Dopamine

Dopamine is a neurotransmitter associated with RDS (*reward depletion syndrome*) and is formed from the amino acid tyrosine at the synaptic end of a neuron. This substance is then released into the synaptic slit to affect communication between neurons. Dopamine is a neurotransmitter that belongs to the catecholamine group. The function of Dopamine itself plays an important role in regulating motor control, arousal, cognition, and satisfaction as well as other functions. Dopamine is related to providing a feeling of pleasure and a source of motivation for a person to proactively do certain activities (Fitri et al., 2022).

Dopaminergic Pathways in the Central Nervous System

Important dopaminergic pathways that have been known in the central nervous system, especially the brain, include (Maslim, 2019): 1. The mesocortical

pathway connects the ventral tegmental area to the prefrontal cortex. 2. The mesolimbic pathway carries dopamine from the ventral tegmental region to the nucleus of the accumbens through the amygdala and hippocampus. 3. The nigrostriatal pathway runs from the substantia nigra to the neostriatum. Soma in substantia nigra projects axons into the nucleus of caudatus and putamen. This path is involved in the motor loop of the basal ganglia. 4. The tuberoinfundibular pathway from the hypothalamus to the dopamine glands.

Dopamine Theory in Schizophrenia

The theory of dopamine pathways that are influential in schizophrenia is

1. The hypoactivity pathways of dopamine pathways from this area cause negative symptoms and cognitive impairment.
2. Mesolimbic dopamine pathways. Hyperactivity in this area causes positive symptoms of schizophrenia.

Etiology of Cigarette Use in Patients with Schizophrenia

The underlying factors for the high rate of smoking in schizophrenic patients are still unclear, although there are several hypotheses. One of them is the self-treatment hypothesis:

1. The self-treatment theory proposes that nicotine affects central nicotinic

acetylcholine receptors (nAChRs), leading to the release of dopamine and serotonin. This results in a secondary stimulant effect driven by dopaminergic activity, which in turn reinforces the person's urge to smoke. (Ding & Hu, 2021).

2. Alternative Theory Alternative theories state that smoking plays a role in the development of schizophrenia. This theory is in line with the high prevalence of smoking in first-generation psychosis patients of 58%. An Israeli cohort study of 14,248 military recruits without severe mental illness was followed over a period of 4 to 16 years (Ding & Hu, 2021).
3. Genetic predisposition is the same in smoking and the development of schizophrenia. A study investigated genetic variants associated with tobacco use and schizophrenia with data taken from genome association studies (Ding & Hu, 2021).

Nicotine Working Mechanism

Effect of Nicotine on nAChR (Nicotinic Acetylcholine Receptor)

Nicotine is a highly addictive substance and helps people start and continue their smoking habits. Nicotine's ability to quickly reach the brain after being inhaled from cigarettes may explain its benefits. Nicotine works through nAChRs, which

are ion channels made up of α and β subunits, regulating the flow of ions such as calcium, sodium, and potassium.

In the brain, nAChR is involved in triggering the release of neurotransmitters like norepinephrine, dopamine, serotonin, glutamate, GABA, and acetylcholine before nerve impulses pass through synapses.

Desensitization and Antagonism at nAChR

The sensitivity of nAChRs to desensitization varies, which can affect the release of different neurotransmitters such as glutamate and GABA. The increased release of dopamine in the nucleus accumbens may affect the tendency to use tobacco.

High doses or prolonged exposure to nicotine can turn nAChR into an antagonist, reducing its effectiveness. Although the effects of nicotine on nAChR regulation and desensitization are well known, their impact on cognition is still complex and poorly understood. Nicotine appears to have the opposite effect depending on the dose. Low doses may improve cognitive function, while high doses may have the opposite effect (Spasova et al., 2022).

The Relationship between Schizophrenia Cases and Cigarettes

Barriers to Quitting Smoking in Schizophrenia Patients

Patients with schizophrenia face additional barriers in achieving smoking cessation goals compared to patients without schizophrenia. A study showed that dopamine D2 receptor antagonists attenuate the effects of nicotine rewards. These pharmacological interactions may partly explain why schizophrenic patients smoke more and inhale more deeply than other patients. There is also evidence that there is an increase in the connection from the nucleus accumbens to the middle temporal gyrus and precuneus amid episodes of smoking cravings (Ding & Hu, 2021).

The Role of Nicotine in Increasing Schizophrenia Symptoms

Schizophrenia patients tend to smoke more because nicotine can increase the release of dopamine and serotonin, providing a stimulant effect that encourages the desire to smoke. In addition, nicotine also inhibits the activity of monoamine oxidase (MAO) A and B, thereby decreasing dopamine degradation and increasing dopaminergic activity. Another theory states that patients try to alleviate the negative symptoms of schizophrenia by taking nicotine which can increase dopamine and glutamate in the prefrontal cortex. Smoking has also been

found to reduce extrapyramidal symptoms caused by antipsychotic treatment, which is believed to be related to the interaction of nicotine with nicotinic receptors in the ventral tegmental area, leading to an increase in dopamine levels in the striatum. Overall, smoking behavior in schizophrenia patients is their effort to improve the symptoms and side effects of the treatment experienced.

Although the treatment hypothesis itself states that schizophrenia patients smoke to alleviate negative symptoms, some studies show the opposite results. Cross-sectional studies found that patients with mild-moderate nicotine dependence, rather than heavy dependence, had higher PANSS (*Positive and Negative Syndrome Scale*) scores, indicating worse negative symptoms compared to non-smokers. However, the design of cross-sectional studies is limited in determining the direction of the relationship, whether smoking causes more severe negative symptoms or patients with negative symptoms are more likely to smoke. In addition, a systematic review concluded that smoking was associated with an increase in the severity of psychiatric symptoms in schizophrenia, contrary to the self-medication hypothesis. Therefore, further longitudinal studies comparing negative symptoms when patients quit smoking versus when smoking is needed to

strengthen the evidence related to the self-treatment hypothesis.

Self-medication hypothesis and research showing that smoking relieves symptoms of schizophrenia

The self-medication hypothesis and research showing that smoking worsens schizophrenia symptoms reveal two conflicting views:

- a) The self-medication hypothesis argues that some individuals with schizophrenia smoke to reduce anxiety or as a way to cope with their symptoms, with smoking thought to provide a temporary calming effect due to the increase in dopamine (Hilmy et al., 2018).
- b) Conversely, research shows that smoking causes symptoms and has negative long-term impacts, such as decreased effectiveness of treatment and increased risk of cognitive impairment, which can improve the quality of life of schizophrenia sufferers (Kurniasih, et al., 2017).

Nicotine can provide a temporary relaxing effect, especially in increasing dopamine levels associated with feelings of euphoria or satisfaction, the long-term effects of smoking on cognitive and mental function tend to be detrimental.

Nicotine can also interfere with antipsychotic medications, reducing their

effectiveness, and worsening the long-term condition. In addition, smoking is associated with biological and psychological factors that vary widely between individuals, making responses to smoking different, depending on the severity of schizophrenia symptoms and factors such as stress, social support, or the presence of appropriate treatment.

The Role of Nicotine in Increasing Schizophrenia Symptoms

Prospective studies provide strong evidence that tobacco smoking raises the risk of developing schizophrenia, with the risk increasing with smoking intensity. These studies show that heavy smokers have a 2-4 times higher risk of developing schizophrenia than those who do not smoke. However, there are still limitations because it has not adjusted to the use of marijuana as a potential disruptive factor.

Another theory argues that smoking and the development of schizophrenia may be influenced by genetic factors. Although some studies found a causal effect of smoking on schizophrenia or genetic overlap, other studies showed a decreasing association between smoking and schizophrenia in identical twins, indicating genetic factors alone do not fully explain this link. More research is needed to understand the interaction between

genetics, smoking, and the risk of schizophrenia (Ding & Hu, 2021).

Management of Patients with Schizophrenia and Active Smokers

Types of Antipsychotics in the Treatment of Schizophrenia

Management of pharmacotherapy in patients with schizophrenia by means of the use of antipsychotics, either alone or in combination. Antipsychotics are clarified into atypical antipsychotics and typical antipsychotics. Both groups of antipsychotics have the same pharmacological activity, namely blocking dopamine D2 receptors. First-generation antipsychotics can improve positive symptoms but generally do not improve negative symptoms. Meanwhile, second-generation antipsychotics can improve positive and negative symptoms and more effectively treat resistant patients (Rissa & Darmawan, 2021).

Antipsychotic Side Effects

Typical and atypical antipsychotics, both have the potential to cause side effects in the form of sedation, autonomic disorders, extrapyramidal disorders, and disorders of the metabolic system (Meilina et al., 2022).

Antipsychotics are divided into two first-generation Antipsychotics (Typical) and also second-generation antipsychotics

(Atypical). Typical antipsychotics have a better effect on positive symptoms and have side effects. Examples of first-generation or typical antipsychotics, such as haloperidol, trifluoperazine, chlorpromazine, and fluphenazine, have greater side effects compared to second-generation or atypical antipsychotics. Examples of atypical antipsychotics include risperidone, aripiprazole, quetiapine, and olanzapine, which are known to have a lower risk of side effects (Putra et al., 2023).

The Role of CYP Enzymes in Drug Metabolism and the Effects of Smoking

Cytochrome P450 enzyme (CYP) is a family of enzymes that are heavily involved in drug metabolism, accounting for up to 75% of these processes. CYP1A2 members play an important role in the metabolism of antipsychotic drugs such as clozapine and olanzapine used for the treatment of schizophrenia.

Tobacco contains polycyclic aromatic hydrocarbons that have been shown to increase CYP1A2 activity, thereby increasing the metabolism of clozapine and olanzapine. This causes a decrease in plasma concentrations of these drugs in smoking patients. Meta-analyses showed the need for a 30% and 50% reduction in olanzapine and clozapine doses, respectively, in non-smoking

schizophrenia patients compared to smokers.

In addition, smoking also increases caffeine metabolism through CYP1A2 induction. The combination of smoking and high coffee consumption was associated with reduced effectiveness but increased safety of olanzapine. In smoking cessation, it is recommended to reduce the dose of clozapine and olanzapine by 30-40% to restore serum concentrations to previously stable levels (Ding & Hu, 2021).

The Relationship Between Administering Antipsychotics to Patients with Schizophrenia and Active Smokers

The Effect of Smoking on Schizophrenia Treatment

Smoking in individuals with schizophrenia can impact the treatment process, potentially hindering the reduction of symptoms or behavioral changes in people with the condition (Kurniasih et al., 2017). This is crucial in clinical practice because without dose adjustment, smokers may face the risk of undergoing subtherapeutic psychopharmacological management. A meta-analysis of seven studies conducted in 2014, indicated a 30% and 50% reduction in olanzapine and clozapine doses, respectively, in non-smoking schizophrenia patients compared to smokers (Ding, 2021).

The Role of CYP1A2 Enzymes in Antipsychotic Drug Metabolism

Schizophrenia patients who are also active smokers have particular challenges in treatment with antipsychotics. This is because cytochrome P450 enzymes (CYP), especially CYP1A2, play an important role in the metabolism of antipsychotic medications like clozapine and olanzapine.

Compounds in tobacco, namely polycyclic aromatic hydrocarbons, have been demonstrated to enhance CYP1A2 activity. This increase in CYP1A2 activity results in an enhanced metabolism of clozapine and olanzapine in smoker patients. As a result, plasma concentrations of these drugs are lower in smoking patients than in non-smokers.

Antipsychotic Dose Adjustment in Schizophrenia Patients Who Are Active Smokers

The meta-analysis study found that non-smoking patients required higher doses of olanzapine and clozapine by about 30% and 50% than smoking patients to achieve the same therapeutic effect. This is crucial in clinical practice because, without proper dose adjustment, smoking patients are at risk of subtherapeutic psychopharmacological management.

In addition, smoking also increases caffeine metabolism through CYP1A2

induction. The combination of high coffee consumption and smoking is associated with reduced effectiveness but enhanced safety profile of olanzapine.

At the time of smoking discontinuation, it is necessary to reduce the dose of clozapine and olanzapine by about 30-40% to restore the concentration of the drug to a stable previous level. So, strict monitoring and adjustment of antipsychotic doses are essential in schizophrenia patients who are also active smokers to ensure the effectiveness and safety of treatment (Ding & Hu, 2021).

Conclusion

The pervasiveness of smoking in schizophrenic patients reaches 70-80%. Smoking appears to reduce negative symptoms such as low motivation in schizophrenia patients, although its effects on positive symptoms and cognitive function are still unclear. The interaction of nicotine with brain receptors such as nAChRs and dopamine pathways provides the basis for the hypothesis of self-medication, in which smoking may be used to reduce symptoms.

The management of schizophrenia in active smokers poses challenges in terms of pharmacotherapy due to interactions with antipsychotic drugs such as clozapine and olanzapine. Drug metabolism is affected by smoking, so it is necessary to

adjust the dosage to maintain optimal therapeutic efficacy.

Overall, although smoking appears to provide some benefits in managing schizophrenia symptoms, the overall effects are still complex and more research is needed to better understand the mechanisms and treatment strategies.

References

- Ding, J. B., & Hu, K. (2021). Cigarette Smoking and Schizophrenia: Etiology, Clinical, Pharmacological, and Treatment Implications. *Schizophrenia Research and Treatment*, 2021. <https://doi.org/10.1155/2021/7698030>
- Fitri, F., Saleh, I., & Theodorus, T. (2022). Polimorfisme Gen DRD2 rs1799732 (-141c) Terhadap Terapi Aripiprazole pada Pasien Skizofrenia. *Jurnal Sains Dan Kesehatan*, 4(2), 214–221. <https://doi.org/10.25026/jsk.v4i2.783>
- Hilmy, N, Mardijana, A, & Rachmawati, DA. (2018). Hubungan Derajat Ketergantungan Nikotin dengan Gejala Negatif pada Pasien Skizofrenia di Poli Psikiatri RS PTPN XI Djatiroto Lumajang. *Journal of Agromedicine and Medical Sciences*, Vol. 4 (1). 25–30.
- Kurniasih, P. T., Saminan, S., & Saragih, J. (2017). Hubungan Derajat Merokok dengan Perubahan Perilaku Penderita Skizofrenia di Rumah Sakit Jiwa Aceh. *Jurnal Ilmiah Mahasiswa (JIM) Kedokteran Medisia*, 2, 1–6. www.jim.unsyiah.ac.id/FKM
- Maslim, R. (2019). *Diagnosis Gangguan Jiwa PPDGJ III, DSM5, ICD-11*.
- Meilina, N. A., Cahaya, N., & Putra, A. M. P. (2022). Analisis Trend Peresepan Golongan Antipsikotika Tipikal dan Atipikal di Tiga Puskesmas di Kota Banjarmasin Periode 2019-2021. *Jurnal Sains Dan Kesehatan*, 4(4), 393–400. <https://doi.org/10.25026/jsk.v4i4.1269>
- Mu, X., Wu, W., Wang, S., Su, X., Guan, H., Guan, X., Lu, X., & Li, Z. (2024). Smoking affects symptom improvement in schizophrenia: a prospective longitudinal study of male patients with first-episode schizophrenia. *Schizophrenia*, 10(1). <https://doi.org/10.1038/s41537-024-00449-1>
- Putra, D. E. W. S., Wahyudi, E. D., Permata, A., & Ardianto, N. (2023). Ketepatan Penggunaan Antipsikotik pada Pasien Skizofrenia di Rumah Sakit Jiwa Dr. Radjiman Wediodiningrat. *Indonesian Journal of Pharmaceutical Education*, 3(3), 2775–3670. <https://doi.org/10.37311/ijpe.v3i3.23235>
- Rissa, M. M., & Darmawan, E. (2021). Nilai PANSS–EC Dan GAF Pada Pasien Gangguan Mental Psikotik Yang Diterapi Atypical-Atypical Dan Atypical-Typical Di Rumah Sakit Jiwa

Grhasia Yogyakarta. *Pharmaceutical Journal of Islamic Pharmacy*, 5(1), 15.
<https://doi.org/10.21111/pharmasipha.v5i1.3941>

Schooler, N. R. (2020). Persistent Negative Symptoms in Schizophrenia.pdf. *Neuro*, 519–534.

Spasova, V., Mehmood, S., Minhas, A., Azhar, R., Anand, S., Abdelaal, S., Sham, S., Chauhan, T. M., & Dragas, D. (2022). Impact of Nicotine on Cognition in Patients With Schizophrenia: A Narrative Review. *Cureus*, 14(4).
<https://doi.org/10.7759/cureus.24306>



Implementation of Professionalism of Medical Faculty Students During Small Group Discussions in Qualitative Study

Paramita Sari,^{1*} Marselli Widya Lestari¹

¹ Department of Bioethics and Medicolegal, Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya

² Department of Public Health and Preventive Medicine, Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya

*Corresponding Author: mitasari798@unusa.ac.id

DOI: 10.33086/iimj.v6i2.6361

ARTICLE INFO

Keywords:
Implementation
professionalism,
small group
discussion,
qualitative study

Submitted: Aug
17th 2024
Reviewed: Sept
21st 2024
Accepted: Nov
13th 2024

ABSTRACT

Introduction: Medical science is developing very rapidly. One of the efforts to keep up with the development of medical science is to improve the quality of human resources in the health sector, especially in the medical field. However, efforts to improve the quality of human resources in the medical field are hampered because the implementation of professionalism in the field of medical education has not been achieved optimally. One of the basic foundations of the implementation of professionalism in medical students is professionalism during the teaching and learning process.

Objective: This study aims to determine the implementation of the professionalism of medical faculty students during small group discussions in a qualitative study.

Method: This study uses a qualitative method with a descriptive-analytical approach at the Faculty of Medicine, Nahdlatul Ulama University, Surabaya. Conducted for 3 weeks from June 25, 2024, to July 15, 2024, with 5 research respondents using purposive sampling. Data collection was carried out through in-depth interviews. Data analysis used a coding system with thematic analysis.

Result: The Implementation of Professionalism of Medical Faculty Students during Small Group Discussions in Qualitative Study is influenced by two factors, namely supporting factors such as student personality, student environment, and supervisor, while less supportive factors such as limited facilities and infrastructure, certain students who have a negative influence on the learning environment, and students' readiness to receive courses.

Conclusion: The implementation of student professionalism during small group discussions is influenced by several factors, so continuous holistic improvement is needed so that the values of professionalism as a doctor are possessed as early as possible.

Introduction

Medical science is undergoing very rapid changes in the world (Kanter et al., 2013). Indonesia is a developing country that continues to compete with developed countries. One effort is to improve the quality of human resources in the health sector, especially in the medical field.

However, efforts to improve the quality of human resources in the medical field are hampered because the implementation of professionalism in the field of medical education has not been achieved optimally.

Professionalism is the core of a doctor's practice. Over the past few decades, professionals and professional

organizations have proposed various concepts of professionalism in Medical Education where the curriculum, teaching approach methods and assessment methods have been designed in accordance with the professionalism that has been determined by an educational institution (Song & Elftman, 2023). One of the basic foundations of implementing professionalism in medical students is professionalism during the teaching and learning process. Currently, the curriculum used by the Faculty of Medicine is dominated by the Competency-Based Curriculum. Based on the Competency-Based Curriculum, medical students have three aspects of assessment, namely, cognitive, psychomotor and affective (Rizvan, 2021). The implementation of professionalism in medical education can be achieved optimally if the three aspects have a good and maximum value composition.

One of the learning methods used in a competency-based curriculum is Small Group Discussion (SGD). Student professionalism can be interpreted as the ability of students to understand and follow academic standards, have a friendly, polite attitude, good personality, and have the abilities and skills needed in their field of study (Hamidah, 2015; Purnamasari & Faisal, 2021). The implementation of student professionalism can affect student

behavior and performance in the context of education. Although the definition of student professionalism can vary depending on the context and field of study, basically student professionalism involves the abilities and attitudes needed to become a professional in their field of study (Hamidah, 2015; Kanter et al., 2013).

Small Group Discussion (SGD) is one of the active learning methods in which a small group of students meets to discuss a particular topic. The role of SGD in measuring student professionalism can include several aspects, including:

1. Active involvement: SGD allows direct observation of students' active involvement in discussions, including their ability to convey ideas, listen well, and contribute productively (Hamidah, 2015; Meo, 2013).
2. Social interaction: Through SGD, students can be assessed in terms of social interactions that reflect professional attitudes, such as respecting the opinions of others, working together, and showing an open attitude towards diversity of opinions (Meo, 2013).
3. Communication skills: The role of SGD in measuring student professionalism is also related to communication skills, where students can be evaluated in terms of their ability to convey ideas clearly, argumentatively, and persuasively (Rizvan, 2021).

Thus, SGD can be an effective forum for observing and evaluating various aspects of student professionalism, including engagement, social interaction, and communication skills.

Methods

This study uses a qualitative research design with a descriptive-analytical approach. The study was conducted from June 25, 2024, to July 15, 2024, after receiving an ethical certificate from the UNUSA Research Ethics Committee in 2024. The subjects of this study were tutors (lecturers), course coordinators, and study programs from the UNUSA Faculty of Medicine for the 2023-2024 academic year, a total of 5 people who were selected using purposive sampling techniques.

The data collection technique was taken through in-depth interviews. In-depth interview sessions were conducted in each lecturer's office. During the interview session, the research team used a prepared interview guide. The research team asked permission from the research respondents to record the interview session using an audio recorder for the purposes of data collection and transcription of research data. The interview was conducted in one day, namely one research respondent. The duration of each interview session with the research respondent varied, approximately 15-18 minutes.

After completing the interview session, the researcher conducted a member checking and triangulation process by matching the perceptions between what was meant by the research respondent and the researcher himself from each answer that had been given by the research respondent.

Next, the research team transcribed the interview data sequentially starting from the introduction of the research respondents, the first question to the last question by writing down the list of questions in the respondent interview guideline along with all the respondents' answers on the computer worksheet. Furthermore, the data reduction process was carried out, namely Coding, where data that did not contain information could not be used. In this Coding process, the researcher has grouped information in the form of important sentences that are used to support the research information data. After the coding process, there is a category where the category section is a more specific section to represent each coding that has been written. After the category section is complete, it is continued to the theme section, where in this section the researcher can conclude the research results.

Result and Discussion

This study identifies seventh key variable influencing the implementation of professionalism among medical students

during small group discussions in the Integrative Module at FK UNUSA. The findings are categorized based on emerging themes from respondents' feedback. The research data was obtained from the answers given by the respondents. However, not all data obtained is included in the research results. The data listed is the result of reducing the data that has been reviewed and in the form of coding from each question asked.

Effectiveness of Small Group Discussion

The interviews showed that the SGD is functioning well, but requires continuous evaluation and improvement. The respondents agreed that the small group discussions were working well, but they stated that improvements were still needed.

"MI di FK UNUSA menurut saya sudah berjalan dengan baik ya dok namun butuh perbaikan terus." R1

"Sudah baik sih dok tapi tetep butuh penyesuaian terus serta evaluasi lebih lanjut." R5

SGD is highlighted by Burgess et al. (2020) as one of the most effective pedagogies in medical education, which prioritizes collaborative learning, critical thinking and problem solving. However, our respondents put more emphasis on

assessment and continuous improvement. This is similar to the findings of Modi et al. (2014), who believe that professionalism in small group learning can only be guaranteed by structured facilitation and continuous feedback mechanisms. Therefore, it is imperative to regularly check the effectiveness of tutorial methods.

Active Engagement and Understanding

Furthermore, referring to the second question, it was found that professionalism is active participation in discussions and the ability to understand and apply knowledge appropriately. Professional students are students who participate in discussions, master the material, and place themselves well in an academic environment.

"Menurutku mahasiswa yang profesional itu dia aktif saat berdiskusi."
R2

"Buat saya cara mengukur mahasiswa profesional atau tidak dilihat mahasiswa itu paham atau tidak saat tutorial, paham dalam arti bisa menerapkan ilmu dengan baik saat di forum dan paham ketika menempatkan diri di depan dosen dan bersama teman-temannya yang satu kelompok." R3

Medical students are expected to actively participate in discussions and articulate the

subject matter clearly. According to Song and Elftman, 2023, professionalism is manifested in small groups through active participation, respect for fellow students, and the ability to express knowledge clearly. This is in line with our findings, where respondents stated that it is important to engage in discussions and get properly placed in academia. These behaviors contributed to the overall learning experience and prepared them for future interactions in clinical settings.

Understanding of Discussion Rules

In addition, students know the tutorial rules early on. This is because students generally do not have a poor understanding of the tutorial rules as they have been introduced since the first year.

"Adik-adik ini sudah paham kok dok cara berjalannya diskusi pas tutorial jadi itu memudahkan buat saya dan jadi nilai plus." R1

"Mahasiswanya sudah paham gimana-gimananya tutorial karena sudah dipaparkan sejak dini mulai jadi maba dok." R3

Our research shows that, in general, students have a good understanding of procedural guidelines in small group discussions, perhaps due to the early

exposure given to tutorial structures. Curran et al.'s (2020) research emphasizes how clear communication of institutional expectations and guidelines can significantly improve adherence to professional standards among students. When these expectations are set early, students are more likely to engage in responsible and constructive learning behaviors.

Supporting and Hindering Factors for Professionalism

Research findings have identified two main challenges: inadequate infrastructure and delays in LO distribution are major barriers to maintaining professionalism during SGD. These barriers hinder student participation, preparedness and learning effectiveness.

"Buat saya sarana dan prasarana kurang mendukung dok, iya memang sudah ada ruang tutor tapi sempit, harusnya ada LCD tiap-tiap ruangan untuk presentasi mahasiswa supaya mempermudah pembelajaran." R1

"LO MI nya kenapa harus dibagikan mepet-mepet harapannya mahasiswa bisa lebih matang saat tutorial." R4

Inadequate Infrastructure

A significant concern identified was the lack of adequate tutorial space and multimedia support, which hindered the efficiency of small group learning. In medical education, effective SGD requires an environment conducive to discussion, including adequate seating, noise control, and access to instructional technology (Meo, 2013). If these elements are lacking, students may become disinterested and less motivated to actively participate in discussions.

Inadequate tutorial space and lack of LCD projectors or digital materials further render the learning process ineffective. Poor learning environments contribute to frustration and poor academic performance among students, according to research (Burgess et al., 2020). If these infrastructural limitations are addressed by expanding tutorial rooms and incorporating multimedia facilities, then students will be better equipped to express their ideas, present cases in a more effective manner, and hold discussions more interactively.

Late distribution of Learning Objectives (LOs)

Timely distribution of LOs is essential for systematic and productive tutorials. However, one problem that keeps recurring in most of the respondents is the issue of late LO distribution, thus limiting students from getting enough time to prepare themselves

before the discussion. Research by Darmayani (2023) details that late allocation of key learning materials results in poor learner participation and low comprehension, hence the importance of early allocation.

When LOs are provided well in advance, students can refresh their knowledge of related concepts, identify important discussion points, and develop questions to ask, thus making small group discussions more effective. On the contrary, if the LOs are given at the last minute, students will be passive and only skim the surface during the discussion due to the lack of time to understand complex topics. Timing the LO distribution in accordance with best practices in PBL can facilitate better understanding, critical thinking, and professionalism in medical education (Modi et al., 2014).

Professional Attitude and Ethics

From the interview, we took some key points of professional attitude and ethics which are good ethics, discipline, active participation, and effective communication. Professionalism in medical education is manifested through punctual student behavior, respect for colleagues and faculty, active participation, and effective communication which are critical to fostering a positive learning environment

and ensuring constructive engagement in small group discussions.

"Anak-anak ini saya bilang profesional ya menghormati dan menghargai dosen sama teman-temannya." R1

"Buatku disiplin, datang tepat waktu sebelum tutorial dan aktif saat berdiskusi."
R2

"Hmm, bisa berkomunikasi baik saat di forum ilmiah tutorial dan menempatkan diri saat tutorial." R3

Research by Rizvan (2021) identified professionalism as a multi-dimensional construct that incorporates elements such as ethical behavior, responsibility, and teamwork. Therefore, professionalism is not only limited to individualistic behavior but also includes interactional and organizational dimensions. Similarly, Hamidah (2015) noted that professionalism in universities should be developed systematically; it should be supported by institutional policies that encourage ethical behavior and should also be taught directly by faculty who act as role models.

Indeed, role modeling has been considered as one of the core strategies to instill professionalism among medical students. According to Cruess et al. (2008), students imitate their mentors; therefore,

educators must continuously model professionalism in their interactions. When faculty members model discipline, ethical integrity, and effective communication, students will gain greater insight into professional expectations and norms in the practice of medicine.

Unprofessional Conduct

Professionalism is a core competency in medical education, yet maintaining it in small group discussion (SGD) remains a challenge. Some students exhibit unprofessional behaviors, such as excessive mobile phone use, tardiness, and negative peer influence, which disrupt the learning process and hinder the development of professional attitudes. These behaviors not only affect individual learning but also affect group dynamics, reducing overall engagement and collaboration.

"Masih banyak yang pegang HP dok saat pertemuan pertama padahal di kontrak kuliah sudah tegas aturannya." R4

"Terlambat ya dok, cerminan nggak disiplin saat tutorial termasuk melanggar kontrak kuliah." R2

"Kating-kating yang patol bisa jadi sumber oknum yang nggak bener buat adik tingkatnya, jadi bikin gampangin nanti."

R5

The impact of external influences and unclear institutional policies on student professionalism has been well documented. Ginsburg et al. (2000) found that peer behavior, institutional culture, and leniency in policy enforcement contributed to professionalism violations. Negative role models, especially senior students, may encourage a relaxed attitude towards professional expectations, leading to the normalization of tardiness, rule violations, and disengagement in learning activities (Hodges et al., 2011). Research by Al Gahtani et al. (2021) also emphasizes that students who perceive a lack of accountability in their academic environment are more likely to exhibit unprofessional behavior.

Cell phone use during academic sessions, especially in SGD, is an increasing problem. While technology can enhance learning if used appropriately, excessive and inappropriate use can lead to distraction, reduced participation, and lack of engagement (Curran et al., 2020). Tardiness, another frequent problem, signals a lack of discipline and respect for peers and lecturers, thus undermining the collaborative learning experience (Song & Elftman, 2023).

Consequences for Unprofessional Behavior

The results of the study state that the consequences of disciplinary action are Reporting the offense to the course coordinator or course coordinator, with the consequence of an attendance record.

"Kalau saya sih saya laporkan ke koordinator atau PJMK mata kuliah, yang bersangkutan diapakan ini." R1

"Lapor PJMK dan Koordinator dan izinkan masuk mahasiswa tersebut namun saya alfakan absensinya, paling tidak dia masih dapat ilmunya walau terhitung absen." R5

Faculty members play an important role in upholding professionalism by implementing clear disciplinary actions against students who fail to adhere to ethical and academic expectations. Holding students accountable for unprofessional behavior, such as tardiness, cell phone use, and disruptive behavior, is critical to fostering a professional learning environment (Al Gahtani et al., 2021).

Enforcing attendance-related penalties serves as an effective deterrent against misconduct. Institutions should ensure that policies are clearly communicated and consistently applied, as unclear or inconsistently enforced rules can contribute to professionalism violations (Hodges et al., 2011). Papadakis et al. (2005) found that

students who commit professionalism violations repeatedly have a higher risk of facing disciplinary action later in their careers.

Effective disciplinary actions include:

- Formal warnings: Issuing a formal notice for minor offenses.
- Attendance Penalties: Flagging students who are absent due to tardiness or repeated offenses.
- Guidance & Remediation: Providing guidance to students experiencing professionalism issues (Cruess et al., 2008).

While law enforcement is necessary, institutions should also provide mentorship programs to guide students towards professional growth (Curran et al., 2020). A balanced approach between strict law enforcement and educational interventions can help create a culture of accountability and professionalism, allowing students to develop into competent healthcare workers.

Based on the research data, a student is called a professional and the factors that support professionalism within the student if the student has good intentions in themselves for all aspects of education by being able to position themselves well in their environment, both the learning environment and the community environment. Then actively participate in scientific forums and activities. Understand and respond to what to do when faced with

a problem or case of illness during the SGD. Comply with the regulations that have been enforced during the SGD. Respect and appreciate the scientific forum by being able to discuss scientifically, communicatively and politely in front of students and lecturers. Appearing neatly when the SGD begins, it gives respect to the student himself and respects the ongoing scientific forum because the scientific forum is part of the learning and teaching process in an educational institution.

The Small Group Discussion (SGD) sessions in the integrative module course at FK UNUSA have been implemented effectively. However, continuous improvement is necessary due to challenges that affect student professionalism during the discussions. These challenges include the diverse personal characteristics of students, which can influence peer interactions, and the limited availability of university facilities and infrastructure, which need enhancement to better support the teaching and learning process. The findings emphasize the importance of addressing both interpersonal dynamics and institutional support to improve professionalism in small group discussions. Professionalism is a critical competency in medical education, as it underpins effective teamwork and patient care (Babiker et al, 2014). The diversity in students' personal characteristics reflects the need for tailored

approaches to teaching professionalism, recognizing that individual differences can impact group dynamics. Research suggests that diverse personality traits among students can either enhance or hinder collaborative learning environments, depending on how well differences are managed. Structured interventions, such as team-building activities and conflict resolution training, could help students better navigate these differences and foster a more professional learning atmosphere. In addition, the limited availability of facilities and infrastructure highlights a broader issue in medical education: the alignment of institutional resources with curricular demands. Studies have shown that adequate physical and technological resources are essential for the effective implementation of active learning strategies, such as SGDs (Frenk et al., 2010). Enhancing facilities—such as creating dedicated spaces for SGDs and providing reliable technological support—can significantly improve the learning experience. The diversity in students' personal characteristics reflects the need for tailored approaches to teaching professionalism, recognizing that individual differences can impact group dynamics.

There are consequences in the learning and teaching process during SGD when the integrative module course is taking place, namely that students receive a warning from the lecturer who acts as a facilitator, then the

student concerned is reported to the course coordinator, given an E grade, given a penalty to leave the ongoing scientific forum and the lecturer has the right to write an alpha absence for students who are late more than once during SGD. To enhance the effectiveness of these measures, institutions might consider implementing professionalism workshops or peer mentoring programs that address common challenges faced during SGD.

Conclusion

The conclusion of this study is that the practice of student professionalism in small group discussions is shaped by multiple factors. Therefore, a comprehensive and ongoing enhancement process is essential to instill the values of professionalism from the early stages of medical education, ensuring the development of professional doctors who embody these principles throughout their careers. This finding holds implications for the future design of medical education curricula.

References

- Al Gahtani, H.M.S., Jahrami, H.A. and Silverman, H.J. (2021) 'Perceptions of medical students towards the practice of professionalism at the Arabian Gulf University', *BMC Medical Education*, 21(1), pp. 1–9. Available at:

- <http://dx.doi.org/10.1186/s12909-020-02282-3>.
- Babiker, A., El Husseini, M., Al Nemri, A., Al Frayh, A., Al Juryyan, N., Faki, M.O., Assiri, A., Al Saadi, M., Shaikh, F. and Al Zamil, F. (2014) 'Health care professional development: Working as a team to improve patient care', *Sudan Journal of Paediatrics*, 14(2), pp. 9-16. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4949805/>.
- Burgess, A., van Diggele, C., Roberts, C. and Mellis, C. (2020) 'Facilitating small group learning in the health professions', *BMC Medical Education*, 20(Suppl 2), pp. 1–6. Available at: <http://dx.doi.org/10.1186/s12909-020-02282-3>.
- Cruess, R.L., Cruess, S.R. and Steinert, Y. (2008) 'Role modelling—making the most of a powerful teaching strategy', *BMJ*, 336(7646), pp. 718-721. Available at: <https://doi.org/10.1136/bmj.39503.757847.BE>.
- Curran, V.R., Fairbridge, N.A. and Deacon, D. (2020) 'Peer assessment of professionalism in undergraduate medical education', *BMC Medical Education*, 20(1), pp. 4–11. Available at: <https://doi.org/10.1186/s12909-020-02282-3>.
- Darmayani, I.G.A.S. (2023) 'Effectiveness of Small Group Discussions (SGD) to Improve Learning Outcome and Critical Thinking in Medical Student: A Literature Review', *Bali Medical Journal*, 12(1), pp. 1179–1182. Available at: <https://doi.org/10.15562/bmj.v12i1.3723>.
- Epstein, R.M. and Hundert, E.M. (2002) 'Defining and assessing professional competence', *JAMA*, 287(2), pp. 226-235. Available at: <https://doi.org/10.1001/jama.287.2.226>.
- Frenk, J., Chen, L., Bhutta, Z.A., et al. (2010) 'Health professionals for a new century: transforming education to strengthen health systems in an interdependent world', *The Lancet*, 376(9756), pp. 1923-1958. Available at: [https://doi.org/10.1016/S0140-6736\(10\)61854-5](https://doi.org/10.1016/S0140-6736(10)61854-5).
- Ginsburg, S., Regehr, G. and Lingard, L. (2000) 'The disavowed curriculum: understanding students' reasoning in professionally challenging situations', *Academic Medicine*, 75(10), pp. S84-S86.
- Hamidah, S. (2015) 'Sikap Profesional Mahasiswa Boga Ptbb Ft Uny Sebagai Perwujudan Profesi Tenaga Kerja Boga', *Jurnal Penelitian Humaniora*, 20(1).
- Hodges, B.D., Paul, R. and Ginsburg, S. (2011) 'Assessment of professionalism:

- Recommendations from the Ottawa 2010 Conference', *Medical Teacher*, 33(5), pp. 354-363. Available at: <https://doi.org/10.3109/0142159X.2011.577300>.
- Meo, S.A. (2013) 'Basic steps in establishing effective small group teaching sessions in medical schools', *Pakistan Journal of Medical Sciences*, 29(4), pp. 1071–1076. Available at: <https://doi.org/10.12669/pjms.294.3920>.
- Modi, J.N., Anshu, Gupta, P. and Singh, T. (2014) 'Teaching and assessing professionalism in the Indian context', *Indian Pediatrics*, 51(11), pp. 881–888. Available at: <https://doi.org/10.1007/s13312-014-0517-4>.
- Papadakis, M.A., Teherani, A., Banach, M.A., Knettler, T.R., Rattner, S.L., Stern, D.T., Veloski, J.J. and Hodgson, C.S. (2005) 'Disciplinary action by medical boards and prior behavior in medical school', *New England Journal of Medicine*, 353(25), pp. 2673-2682. Available at: <https://doi.org/10.1056/NEJMsa052596>.
- Rizvan, M. (2021) 'Implementasi Profesionalisme Kemampuan Guru dalam Mengelola Kelas di SDN 003 Tembilahan Hulu', *Jurnal Pendidikan*, Available at: <https://repository.staitbh.ac.id/handle/123456789/100>.
- Song, X. and Elftman, M. (2023) 'Professionalism in small group learning between face-to-face and virtual settings: a mixed-methods study', *International Journal of Medical Education*, 14, pp. 36–42. Available at: <https://doi.org/10.5116/ijme.63b9.8d1e>.

The International Islamic Medical Journal (IIMJ) is the official journal of Faculty of Medicine, University of Nahdlatul Ulama Surabaya, Indonesia. It serves primarily as a forum for education and intellectual discourse for health professionals namely in clinical medicine but covers diverse issues relating to medical ethics, professionalism as well as medical developments and research in basic medical sciences. It also serves the unique purpose of highlighting issues and research pertaining to the Islamic medical in the world.

E-ISSN 2716-2389 P-ISSN 2716-2370

Published by Faculty of Medicine Universitas Nahdlatul Ulama Surabaya

