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RESEARCH ARTICLE

Validating the Short-Form Health Literacy Questionnaire (HLS-SF12) and Assessing Health Literacy Among the Temiar Orang Asli

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ABSTRACT

Health literacy is essential for achieving positive health outcomes, particularly in marginalized communities. The Orang Asli, specifically the Temiar sub-tribe in Malaysia, face unique challenges due to geographic isolation and cultural barriers. The research focused on determining health literacy rates among the Temiar Orang Asli through the Health Literacy Short-From 12 (HLS-SF12) while testing its applicability for this population. Research was conducted through a cross-sectional study with 404 Temiar Orang Asli adults from Kuala Kangsar, Perak, Malaysia. The assessment of health literacy utilized the Malay version of the HLS-SF12 measurement tool. The tool's construct validity was evaluated through confirmatory factor analysis (CFA) while internal consistency was measured using Cronbach's alpha. The study explored the relationships between sociodemographic characteristics and health literacy levels by using both simple and multiple linear regression analysis methods. Most participants (53.0%) demonstrated inadequate health literacy, while 31.4% had problematic levels. Only 13.4% had sufficient health literacy, and 2.2% achieved excellent levels. The model fit analysis yielded acceptable results (RMSEA = 0.08, GFI = 0.94, CFI = 0.94) while Cronbach's alpha levels between 0.75 and 0.88 across domains showed that the assessment tool was valid and reliable for this population. Higher education emerged as the only independent predictor of improved health literacy in the multiple regression analysis (β = 4.08, 95%

CI: 2.69 to 5.46, $p < 0.001$). These findings confirm that the HLS-SF12 tool effectively measures general health literacy for the Temiar Orang Asli community and highlight the need for culturally adapted health literacy initiatives, particularly those focused on educational outreach, to improve health outcomes in this vulnerable population.

Contribution/Originality: This study contributes to the existing literature by assessing health literacy among the Temiar Orang Asli and validating the HLS-SF12 for use in this population. It is one of few studies examining indigenous health literacy in Malaysia and documents education as a significant predictor of overall health literacy levels.

1. Introduction

Health literacy represents people's ability to obtain health information and use it effectively to make informed health decisions, as it plays a crucial role in determining health outcomes especially within marginalized populations (Sørensen et al., 2012). It empowers individuals to make informed health choices, manage chronic illnesses, and efficiently navigate healthcare systems. Limited health literacy leads to delayed healthcare-seeking behavior, poor disease management, and an elevated risk of adverse health outcomes, especially in underserved communities (Coughlin et al., 2020). The Orang Asli people of Malaysia encounter multiple obstacle to health information and service access because of socio-cultural and linguistic differences along with geographic isolation which worsens their existing health disparities (Mahmud et al., 2022; Ithnin et al., 2021).

The Orang Asli, comprisingly roughly of 0.8% of Malaysia's population, comprise of 18 sub-tribes categorized into three main groups: Negrito, Senoi, and Proto-Malay (Syed Hussain et al., 2017). Among them, the Temiar sub-tribe, part of the Senoi group and primarily residing in the rural areas of Perak, experiences significant barriers to healthcare access due to geographic isolation and cultural differences. These barriers further exacerbate health disparities, limiting access to essential healthcare services and preventive care (Chew et al., 2022; Ahmad et al., 2018). Health literacy limitations may intensify these issues by reducing people's capacity to interact with healthcare providers and to practice preventive medical behaviors (Chew et al., 2022; Ithnin et al., 2020; Duong et al., 2019b). Improving health literacy in these communities is crucial to empowering individuals to make informed decisions, manage illnesses, and improve their overall well-being (Coughlin et al., 2020).

The HLS-SF12, a concise adaptation of the European Health Literacy Survey Questionnaire (HLS-EU-Q47), is a validated tool intended to assess health literacy in three domains: healthcare, disease prevention, and health promotion (Duong et al., 2019a; Duong et al., 2017a). The HLS-SF12 has been widely applied and validated across several Asian populations, including the general Malaysian population (Duong et al., 2019a; Yunus et al., 2020). However, it has yet to be tested or validated among the Orang Asli. This represents a significant gap in the literature, as indigenous communities often face unique health-related challenges that may not be adequately captured by tools developed for the general population. Evaluating the health literacy of the Orang Asli, specifically the Temiar sub-tribe, through the HLS-SF12 is a chance to bridge this gap and assess the tool's relevance in indigenous settings.

This study aims to evaluate the Temiar sub-tribe's general health literacy levels with the HLS-SF12 while validating the instrument for this specific population. Additionally, the study aims to identify key determinants of health literacy among the Temiar, with the goal of informing culturally appropriate health interventions. These interventions are vital to addressing health disparities and enhancing health outcomes among marginalized groups. This research provides new insights to indigenous health and public health literacy fields through the validation of HLS-SF12 and the assessment of health literacy in the Temiar sub-tribe.

2. Materials And Methods

2.1. Study Design and Setting

This is a cross-sectional study, aimed at assessing health literacy levels among the Orang Asli communities, specifically focusing on the Temiar sub-tribe in Kuala Kangsar, Perak. The Short-Form Health Literacy Questionnaire (HLS-SF12) in the Malay language was employed to measure health literacy, and the study also sought to evaluate the tool's reliability and validity within this population. Kuala Kangsar was selected as the study site because it hosts one of the region's largest Temiar populations who belong to the Orang Asli sub-tribes. Additionally, the familiarity of local healthcare workers with the community and the area's relative accessibility facilitated the logistics of conducting the study.

The study population comprised of adult Orang Asli individuals aged 18 years and older, belonging to the Temiar sub-tribe, and residing in Kuala Kangsar, Perak. Participants were required to be fluent in Bahasa Melayu and capable of providing informed consent. Individuals with significant cognitive impairments or mental health issues that may hinder their capacity to complete the questionnaire were removed to maintain response quality.

2.2. Data Collection Instrument and Procedure

The Health Literacy Short-Form 12 (HLS-SF12) which is a validated adaptation of the European Health Literacy Survey Questionnaire (HLS-EU-Q47) served as the measurement tool for health literacy. The HLS-EU-Q47 was initially created in Europe to assess health literacy in three primary domains: healthcare, illness prevention, and health promotion. The assessment includes 47 items which examine how people find, comprehend, evaluate, and use health information in the specified domains (Duong et al., 2017a). Given the length of the original HLS-EU-Q47, the HLS-SF12 was developed to provide a more concise assessment tool while retaining the core dimensions of the original questionnaire, with a focus on efficiency and practicality (Duong et al., 2017b).

The HLS-SF12 includes 12 items that are distributed across three domains, with the first four questions measuring the healthcare domain, the next four measuring disease prevention, and the final four measuring health promotion. Each item is rated on a four-point Likert scale ranging from 1 (very difficult) to 4 (very easy), and the total score is normalized to a scale from 0 to 50 using the formula: 'Index score = (Average score – 1) × (50/3)'. Higher scores indicate better health literacy.

To provide a comprehensive validation, both the overall health literacy score and the three domains were validated. However, the primary focus of this study is on assessing

the general health literacy levels of the Temiar Orang Asli. The overall health literacy score is categorized into four levels: Inadequate (0–24), Problematic (25–33), Sufficient (34–42), and Excellent (43–50) (Duong et al., 2019a).

For this study, the Malay version of the HLS-SF12 was used, ensuring linguistic and cultural appropriateness for the Orang Asli population. Data collection took place from May 2024 to August 2024. Trained health staff distributed self-administered paper questionnaires, which participants completed independently. In addition to the health literacy assessment, sociodemographic data were also collected, including age, gender, education level, income, employment status, and marital status. These variables were analyzed to explore their associations with health literacy levels, serving as potential determinants of health literacy among the Temiar sub-tribe.

2.3. Sample Size and Sampling Method

The sample size for this study was determined using the formula: $n = Z^2 \times p \times (1-p) / e^2$, where Z denotes the z-value for a 95% confidence level (1.96), p signifies the estimated population proportion (50%), and represent the margin of error (5%). The required sample size was 362 participants for a population of 6,232 adult Orang Asli living in Kuala Kangsar as reported by Jabatan Kemajuan Orang Asli (JAKOA) (2021), the required sample size was determined to be 362 participants. To account for potential non-responses or dropouts, a 10% attrition rate was applied, resulting in a final required sample size of 398 participants.

The structural equation modeling (SEM) and confirmatory factor analysis (CFA) necessitates at least 120 participants where this numbers represent ten times the quantity of questionnaire items according to Kline (2011). However, this study required 398 participants for robust analysis and improved understanding of health literacy factors.

Given the geographical dispersion and isolation of the Orang Asli population, convenient and snowball sampling methods were employed. Initial contacts within various villages, including Pos Kuala Mu, Pos Bawong, Pos Yum, Pos Lasah, and Pos Perwor, facilitated participant recruitment. Snowball sampling allowed for reaching additional participants through referrals from these initial contacts, ensuring representation of the Temiar sub-tribe in the Kuala Kangsar district.

2.4. Statistical Analysis

The analysis of data was performed with IBM SPSS software version 28 and AMOS software version 29. Descriptive statistics summarised participants' socio-demographic characteristics and health literacy scores, which were categorised into four levels: inadequate (0–24), problematic (25–33), sufficient (34–42), and excellent (43–50), according to the 'Index score' (Duong et al., 2019). To evaluate the validity of the HLS-SF12, confirmatory factor analysis (CFA) was conducted using maximum likelihood estimation, focusing on the three domains: healthcare, disease prevention, and health promotion. Model fit was evaluated using indices such as RMSEA, GFI, AGFI, CFI, IFI, NFI, and the χ^2/df ratio. Cronbach's alpha determined reliability while corrected item-total correlations were used to assess convergent validity. For bivariate analysis, simple linear regression was used to explore associations between socio-demographic factors and health literacy scores. Factors that showed significant associations ($p < 0.05$) in

these bivariate analyses were subsequently included in a multiple linear regression to identify independent predictors of health literacy, adjusting for potential confounders. The study results included 95% confidence intervals while establishing statistical significance at a threshold of $p < 0.05$.

3. Result

3.1. Socio-demographic Profile and Health Literacy Levels of Participants

Overall, 404 adult Temiar Orang Asli participated in the study. The mean age of participants was 38.28 years (SD = 12.98), with the majority being female (66.58%) and residing in rural areas (75.74%). Most participants were married (84.16%), and 41.34% had completed primary school. The mean monthly income was RM 617.95 (SD = 630.59), with 44.8% earning less than RM 500. Additionally, 29.95% of participants reported having at least one health comorbidity. Table 1 provides a summary of the complete socio-demographic characteristics.

Table 1: Sociodemographic Characteristics of Adult Orang Asli (Temiar) in Kuala Kangsar, Perak (n=404)

Variable	Mean (SD)	Frequency	Percentage
Age	38.28 (12.98)	N/A	N/A
18-29		119.0	29.46
30-39		115.0	28.47
40-49		88.0	21.78
50-59		52.0	12.87
60 and above		30.0	7.43
Gender			
Female		269.0	66.58
Male		135.0	33.42
Village			
Rural		306.0	75.74
Suburban		98.0	24.26
Marital status			
Married		340.0	84.16
Single		40.0	9.90
Widowed		20.0	4.95
Divorced		4.0	0.99
Educational level			
Primary School		167.0	41.34
Secondary School		126.0	31.19
No Education		107.0	26.49
University/College		4.0	0.99
Income	617.95 (630.59)	N/A	N/A
Below RM 500		181.0	44.80
RM 500 - RM 1000		174.0	43.07
Above RM 1000		49.0	12.13
Work status			
Government		9.0	2.23
Private		51.0	12.62
Self-employed		113.0	27.97
Unemployed		43.0	10.64
Housewife		188.0	46.53
Health comorbid			

No	283	70.05
Yes	121	29.95

Note: N/A = Not Applicable. Income is reported in Malaysian Ringgit (RM). Health comorbid refer to participants reporting at least one chronic health condition.

Table 2 presents the general health literacy levels among the 404 adult Temiar Orang Asli participants. The majority of participants (53.0%) were classified as having inadequate health literacy, while 31.4% were identified as having problematic health literacy. Only 13.4% of participants had sufficient health literacy, and a very small proportion (2.2%) exhibited excellent health literacy.

Table 2: General Health Literacy Levels Among Adult Orang Asli (Temiar) in Kuala Kangsar, Perak (n=404)

Health Literacy Levels	Frequency	Percentage
Excellent	9	2.2%
Sufficient	54	13.4%
Problematic	127	31.4%
Inadequate	214	53.0%

Note: Health literacy levels are based on the general health literacy 'Index Score'

3.2. Confirmatory Factor Analysis (CFA): Model Fit, Convergent Validity, and Reliability

The confirmatory factor analysis (CFA) of the HLS-SF12 demonstrated an acceptable model fit. The analysis showed a good absolute fit with an RMSEA value of 0.08 and a GFI measure of 0.94. Incremental fit indices, such as CFI and IFI, were both 0.94, and the NFI was 0.92, exceeding the recommended threshold of 0.90. However, the AGFI was 0.89, slightly below the preferred threshold of 0.90. The χ^2/df ratio was 3.33, indicating a reasonable parsimonious fit. Corrected item-total correlations supported convergent validity with values between 0.51 and 0.57 in the domains of general health literacy, healthcare, disease prevention, and health promotion. Internal consistency, measured by Cronbach's alpha, was robust, with values between 0.75 and 0.88 across all domains. Table 3 summarizes these results, emphasizing the validity and reliability of the HLS-SF12 in assessing general health literacy as well as the three domains: healthcare, disease prevention, and health promotion.

Table 3: Goodness-of-Fit Indices, Convergent Validity, and Reliability of the HLS-SF12

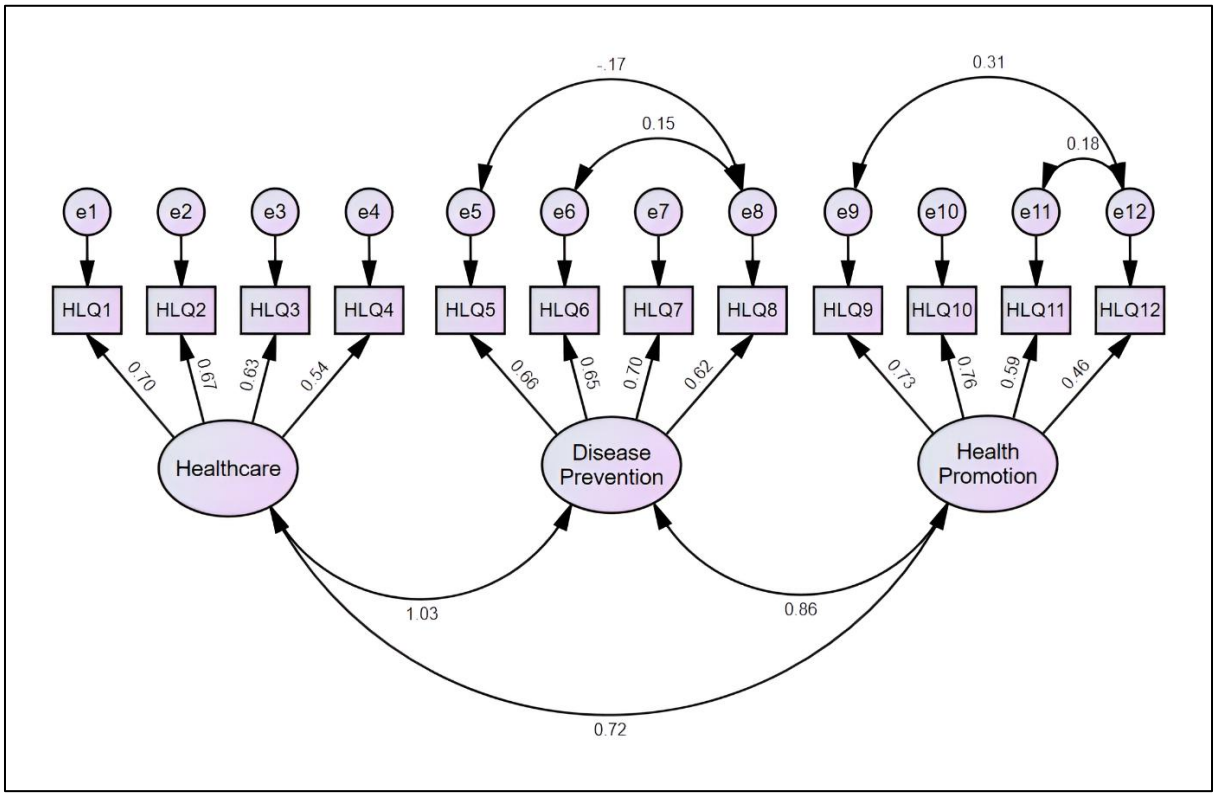
Measure	Indicator	Value
Absolute Model Fit	RMSEA	0.08
	GFI	0.94
Incremental Fit	AGFI	0.89
	CFI	0.94
	IFI	0.94
	NFI	0.92
Parsimonious Fit	χ^2/df	3.33
Convergent Validity	General health literacy	0.57 (0.41-0.67)
Corrected Item-Total Correlations mear	Healthcare domain	0.51 (0.44-0.58)
range)	Disease prevention domain	0.55 (0.45-0.61)
	Health promotion domain	0.56 (0.49-0.66)
Reliability	General health literacy	0.88
(Cronbach's alpha)	Healthcare domain	0.79

	Disease prevention domain	0.75
	Health promotion domain	0.76

Note: Convergent validity was assessed through corrected item-total correlations, with the mean and range of correlations provided. The goodness-of-fit indices indicate acceptable model fit, and Cronbach's alpha values confirm internal consistency reliability across all domains

The Structural Equation Model (SEM), shown in Figure 1, illustrates the relationships between the three latent constructs or health literacy dimensions: Healthcare, Disease Prevention, and Health Promotion, and their corresponding observed items (HLQ1-HLQ12). The path coefficients between the items and the latent constructs represent the strength of these relationships, with higher values indicating stronger associations. The curved double-headed arrows between latent constructs show the correlations among them, while the single-headed arrows indicate the direction of influence from latent constructs to their observed variables. The error terms (e1-e12) represent the variance in each observed variable not explained by the latent constructs. The path coefficients highlight the strength of these relationships, providing additional evidence for the model's convergent validity.

Figure 1: Structural Equation Model (SEM) of the HLS-SF12



3.3. Determinants of Health Literacy: Bivariate and Multivariate Analyses

The analysis explored factors associated with health literacy using simple and multiple linear regression. In the simple linear regression, several socio-demographic factors showed significant associations with health literacy, including age, village type, marital status, education, income, and the presence of underlying diseases. However, after including these significant factors in the multiple linear regression analysis, only higher education remained significantly associated with increased health literacy ($\beta = 4.08$, 95% CI: 2.69 to 5.46, $p < 0.001$). The associations with age, village type, marital status, income, and underlying diseases were not significant after adjustment, indicating that these

factors did not independently influence health literacy. The final model explained 13.7% of the variance in health literacy (R^2 = 0.137, Adjusted R^2 = 0.110). Detailed results for both the simple and multiple linear regression analyses are presented in Table 4. The analysis met the assumptions for linearity, normality of residuals, and multicollinearity.

Table 4: Simple Linear Regression Analysis and Multivariate Linear Regression Analysis of Factors Associated with Health Literacy

Socio-demographic Characteristics	Bivariate model β	95% CI	p-Value	Multivariate model B	95% CI	p-Value
Age						
18-29	Ref.			Ref.		
30-39	-0.02	-1.56, 1.53	0.983	1.39	0.17 – 2.95	0.08
40-49	-2.25	-3.91, -0.59	0.008*	-0.18	-2.03 – 1.67	0.85
50-59	-2.06	-4.02, -0.09	0.040*	0.70	-1.57 – 2.97	0.54
60 and above	-2.62	-5.03, -0.21	0.033*	0.19	-2.44 – 2.82	0.89
Gender						
Female	Ref.					
Male	-0.04	-1.81 – 0.71	0.39			
Village						
Rural	Ref.			Ref.		
Suburban	1.62	0.24, 3.01	0.021*	0.44	-0.95 – 1.84	0.53
Marital Status						
Single	Ref.			Ref.		
Married	-2.09	-4.08, -0,11	0.038*	-0.93	-2.89 – 1.04	0.35
Divorced	-1.08	-7.29, 5.15	0.734	0.85	-5.19 – 6.89	0.78
Widowed	-4.68	-7.93, -1.42	0.005*	-2.28	-5.58 – 1.02	0.18
Educational Level						
Low Education	Ref.			Ref.		
High Education	4.35	3.15, 5.55	<0.001*	4.08	2.69 – 5.46	<0.01*
Income						
Below 500	Ref.			Ref.		
500-1000	1.58	0.32, 2.84	0.014*	0.97	-0.29 – 2.23	0.13
Above 1000	1.87	-0.04, 3,79	0.055	1.18	-0.71 – 3.07	0.22
Employment						
Government	Ref.					
Housewife	-2.26	-6.34, 1.81	0.276			
Private	-1.21	-5.52, 3.12	0.584			
Self-employed	-2.92	-7.05, 1.22	0.167			
Unemployed	-2.84	-7.22, 1.54	0.203			
Underlying Disease						
No	Ref.			Ref.		

Yes	-1.34	-2.63, -0.05	0.042*	0.19	-1.27 – 1.64	0.80

Note: P-values indicate statistical significance, with $p < 0.05$ marked by an asterisk (*). The model explained 13.7% of the variance in health literacy ($R^2 = 0.14$, Adjusted $R^2 = 0.11$). The analysis met assumptions for linearity, normality of residuals, and homoscedasticity. Variance Inflation Factor (VIF) values ranged from 1.14 to 1.85, indicating no significant multicollinearity concerns. F-Change: 5.165, P-Value: <0.001.

4. Discussion

This study represents the inaugural validation of the short-form health literacy questionnaire (HLS-SF12) among the Temiar Orang Asli, emphasizing particular health literacy challenges obstacles encountered by this indigenous population. Results showed that 53.0% of participants were categorized as having inadequate health literacy, with only a small fraction achieving sufficient (3.22%) or excellent (1.24%) health literacy levels, and only 15.6% demonstrating sufficient or excellent literacy levels. The research highlights an urgent public health issue because inadequate health literacy leads to worse health outcomes and challenges in healthcare system navigation and preventive health practice engagement (Ithnin et al., 2020). Other indigenous groups around the world show similar patterns where systemic exclusion and insufficient healthcare infrastructure result in diminished health literacy rates (Crengle et al., 2018; Rheault et al., 2019).

The confirmatory factor analysis (CFA) indicated a satisfactory model fit, validating the HLS-SF12 as a dependable instrument for evaluating health literacy among the Temiar. Considering the distinctive cultural and language backgorund of the Temiar, further modifications may enhance its efficacy in addressing culturally specific health literacy difficulties. Considering external validity, broader studies across different Orang Asli sub-tribes are needed to determine if the HLS-SF12 accurately reflects health literacy across diverse indigenous groups within Malaysia, who may each exhibit distinct health literacy barriers due to their unique cultural contexts.

Interestingly, while bivariate analyses identified factors such as age, village type, marital status, education, and income as significant correlates of health literacy, multivariate analysis revealed that only educational attainment remained an independent predictor. This mirrors findings from rural populations in Vietnam, where education was similarly shown to be positively associated with improved health literacy (Duong et al., 2019b). These insights underscore the value of targeted educational programs to enhance health literacy levels among indigenous communities like the Temiar.

5. Limitations

This study has several limitations. Through convenience and snowball sampling method selection bias could occur because participants familiar with healthcare system or those possessing stronger community ties were probably more inclined to join the study. This may restrict the generalizability of findings to all Temiar populations. Additionally, reliance on self-administered questionnaires may introduce social desirability and recall biases. Future research may integrate qualitative methods, such as focus group discussions or interviews, to gain deeper insights into the specific challenges Temiar individuals face in accessing and understanding health information. Further validation of the HLS-SF12 across other Orang Asli sub-groups and indigenous populations in

Malaysia would also enhance its broader applicability and help identify potential cultural adaptations for diverse indigenous contexts.

6. Conclusions

Validating the HLS-SF12 among the Temiar Orang Asli has paved the way for meaningful health literacy assessments within indigenous Malaysian communities. The results demonstrate the immediate necessity to develop health literacy initiatives that address the distinct socio-economic and geographical barriers confronted by the Temiar. These initiatives improve both access to and comprehension of health information which enables the Temiar to make knowledgeable healthcare decisions resulting in fewer health disparities and better health outcomes.

Ethics Approval and Consent to Participate

Ethical clearance and permission for this study were obtained from the National Medical Research and Ethics Committee (MREC) (NMRR ID-23-01634-U35 (IIR)), the UiTM Research and Ethics Committee (REC/02/2024 (PG/FB/4)), and the Department of Orang Asli Development (JAKOA).

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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