published: 1 Okt 2026
doi: 10.21070/midwiferia.v12i2.1915

Screening-Defined Polyendocrine Metabolic Ovarian Syndrome Risk Across Hirsutism Thresholds Among Indonesian Midwifery Students: A Cross-Sectional Study

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OPEN ACCESS
ISSN 2548-2246 (online)
ISSN 2442-9139 (print)
Edited by: Nurul Azizah
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Received: 3 Sept 2026
Accepted: 29 Sept 2026
Published: 1 Okt 2026

Citation: Irma Afifa (2026) Screening-Defined Polyendocrine Metabolic Ovarian Syndrome Risk Across Hirsutism Thresholds Among Indonesian Midwifery Students: A Cross-Sectional Study Midwiferia Jurnal Kebidanan. 12:2 doi: 10.21070/midwiferia.v12i2.1915

ABSTRACT

Introduction *Polyendocrine metabolic ovarian syndrome (PMOS), the 2026 name for polycystic ovary syndrome, is difficult to recognise in late adolescence, and the hirsutism threshold appropriate for Indonesian women is uncertain. This study estimated the proportion of midwifery students meeting screening-defined PMOS risk, examined its variation across modified Ferriman–Gallwey (mFG) thresholds, and explored crude associations with four health factors.* ***Methods*** *This cross-sectional study used total sampling of eligible female Diploma III midwifery students at one Indonesian health polytechnic (n = 96). Screening-defined risk required menstrual irregularity, classified from self-reported cycle items using 2023 adolescent guideline thresholds, and self-assessed hirsutism (mFG ≥ 3). Psychological distress (Self Reporting Questionnaire-20), dietary diversity (nine-group FAO-based questionnaire), self-reported body mass index (BMI), and weekly physical activity frequency were examined using Wilson 95% confidence intervals (CIs) for proportions and separate univariable logistic regression models.* ***Results*** *Twelve students (12.5%; 95% CI 7.3–20.6%) met the screening definition; 32.3% met the menstrual criterion and 50.0% self-assessed hirsutism. The proportion ranged from 17.7% at mFG ≥ 2 to 3.1% at mFG ≥ 8. No statistically significant associations were found for psychological distress, dietary diversity, or BMI, nor for physical activity (odds ratio 0.65; 95% CI 0.24–1.70).* ***Discussion*** *Overall, screening-defined PMOS risk depended on both the hirsutism threshold and the definition of menstrual irregularity, and no factor was consistently associated with it.* ***Conclusion*** *These findings suggest that menstrual health education is more appropriate than diagnostic screening for PMOS.*

Keywords: *polyendocrine metabolic ovarian syndrome, hirsutism threshold, menstrual irregularity, physical activity, midwifery students*

INTRODUCTION

Polyendocrine metabolic ovarian syndrome (PMOS), formerly polycystic ovary syndrome, affects approximately 10–13% of women of reproductive age and is the most common cause of anovulatory infertility [1], [2]. Pooled prevalence varies by diagnostic criteria and region, and estimates under the Rotterdam criteria are among the highest in the World Health Organization South-East Asia region [3]. The condition combines reproductive, endocrine, and metabolic features that extend beyond fertility [4], which gives early recognition a preventive purpose. Recognition in adolescence is nevertheless difficult because irregular cycles, acne, and excess hair growth overlap with normal pubertal changes [5]. In a survey of 86 adolescents with a medical diagnosis, 13% were diagnosed more than two years after first consulting a doctor and only 57% were satisfied with the diagnostic process [6]. Identifying young women whose features warrant follow-up is therefore an important task for adolescent reproductive health services.

In May 2026, a multistep global consensus involving 56 academic, clinical, and patient organisations renamed the condition PMOS to reflect its endocrine and metabolic features rather than ovarian cysts [7], [8]. The change is relevant to adolescent reproductive health because adolescent diagnosis does not rely on ovarian morphology [1], and adolescent perspectives were incorporated in setting clinical and research priorities under the new name [9]. This article uses the new term, including when referring to studies that used the former name.

The original 2003 Rotterdam criteria require two of three features: clinical or biochemical hyperandrogenism, oligo-anovulation, and polycystic ovarian morphology on ultrasound [10]. The 2023 international guideline modified this approach for adolescents: both hyperandrogenism and ovulatory dysfunction are required, ultrasound is not used within eight years of menarche, and cycle irregularity is judged against years since menarche, because irregular cycles are physiological in the first post-menarcheal year and the cycle-length thresholds differ before and after three years [1], [5]. Adolescents with features who do not meet these criteria are considered at increased risk and reassessed later [1], [11]. Applying adolescent rather than original Rotterdam criteria lowers pooled adolescent prevalence from 9.8% to 6.3% [11], and a substantial

proportion of East Asian adolescents diagnosed under the original criteria do not meet the updated definition [12].

Clinical hyperandrogenism is usually assessed as hirsutism with the modified Ferriman–Gallwey (mFG) score, which is subjective and can be lowered by cosmetic hair removal; the guideline recommends a cut-off between 4 and 6 depending on ethnicity [1], whereas the conventional cut-off of 8 was derived largely from White populations [13]. Proposed Asian cut-offs range from 2 to 7 but were derived differently: the Thai, Chinese, Korean, and Filipino values represent the 95th percentile of unselected or unaffected women, whereas the Indonesian value of 2 reflects the lowest score observed among 30 hospital patients with the condition [14], [15]. A recent analysis of 9,829 unselected women likewise found normative cut-offs of 4 to 8 across ethnic groups [16]. These thresholds therefore do not carry equivalent diagnostic validity, and examining how a screening estimate changes across them is a sensitivity analysis rather than a validation exercise.

There are four factors that are routinely measurable that are relevant for this population. The odds of depression are higher in adolescent girls with the condition compared to controls, although not always with regard to anxiety [17] and evidence from genetics indicates that the condition may lead to depression and not the other way around [18]. Observational studies demonstrate that affected women have less physical activity than controls, but not necessarily a different dietary GI or GL [19] and trials show that low-glycaemic-index diets and structured exercise have beneficial effects on some metabolic parameters with variable effects on reproductive hormones [20], [21]. Adiposity is associated with more severe features, yet the condition also occurs in lean women [22]. In a study of the determinants of anaemia among Indonesian adolescent girls, irregular menstruation (68.9%), poor dietary intake (77.9%), and insufficient physical activity (74.7%) were common [23]; irregular cycles and abnormal BMI have been associated with dysmenorrhoea [24], and nutritional status and diet patterns with anaemia [25]. Psychological distress, dietary diversity, body mass index (BMI), and physical activity were therefore selected as exploratory correlates.

Two gaps motivate this study. First, evidence among Indonesian late-adolescent students outside clinical settings is limited and difficult to compare. Available Indonesian estimates come from small studies that used different screening definitions,

such as 17% possible cases among Jakarta university students identified by questionnaire [26] and 42.6% at risk among Surabaya high school students defined by abnormal bleeding with a Ferriman–Gallwey score of 5 or more [27], and international student estimates are similarly heterogeneous [28]. These figures describe screening-defined risk rather than clinically confirmed diagnosis, and their differences largely reflect definitions. Second, the applicability of the proposed hirsutism thresholds to Indonesian women is uncertain, and, to our knowledge, few studies have reported how a screening estimate shifts across the full range of proposed thresholds within a single Indonesian sample. BMI and a food-group diversity score were used because they are feasible in educational settings, although neither captures central adiposity or glycaemic quality [29], [30].

This study therefore aimed (1) to estimate the proportion of female midwifery students meeting a screening definition of PMOS risk based on self-reported menstrual irregularity and self-assessed hirsutism, (2) to examine how this proportion varies across published mFG thresholds and, as a sensitivity analysis, across menstrual definitions, and (3) to explore crude associations of psychological distress, dietary diversity, BMI, and physical activity with screening-defined risk. The study does not establish diagnosis, diagnostic accuracy, or causal risk factors. Its main contribution is a within-sample assessment of threshold-dependent variation in screening-defined PMOS risk in an Indonesian student population, which informs how future screening studies should report and interpret hirsutism thresholds.

METHODS

Study Design

This study used an analytic cross-sectional design in which exposures and the outcome were measured at a single point in time. No intervention was applied. Reporting follows the STROBE checklist for cross-sectional studies.

Setting

The study was conducted among female students of the Diploma III Midwifery Study Programme at Poltekkes Kemenkes Malang, Malang, Indonesia, on 26 September 2026. The programme provides an age-homogeneous group of late-adolescent women, most of whom are more than three years past menarche but still within the eight-year

post-menarcheal period in which adolescent-specific criteria apply [1]. The setting was selected for this age structure and for the feasibility of total sampling; it was not assumed that midwifery students have a higher biological risk than other young women of the same gynaecological age.

Participants

The source population comprised all 100 female students actively enrolled in the first academic year of the programme. Under total sampling, every enrolled student was invited and assessed against the eligibility criteria; no random selection was applied. Inclusion criteria were active enrolment, age ≥ 17 years, post-menarcheal status, and willingness to participate. Exclusion criteria were a self-reported previous physician diagnosis of a condition that can mimic the phenotype, namely thyroid disorder, hyperprolactinaemia, or diabetes mellitus [1]; current routine use of medication; and incomplete responses. No laboratory testing was performed to exclude mimicking conditions, so undiagnosed cases may have remained in the sample. Of the 100 students invited, one declined or did not respond and 99 completed the online questionnaire without missing responses; three were excluded for a self-reported diagnosis of thyroid disorder, hyperprolactinaemia, or diabetes mellitus, and none reported current use of the listed medications, leaving 96 participants for analysis (Figure 1).

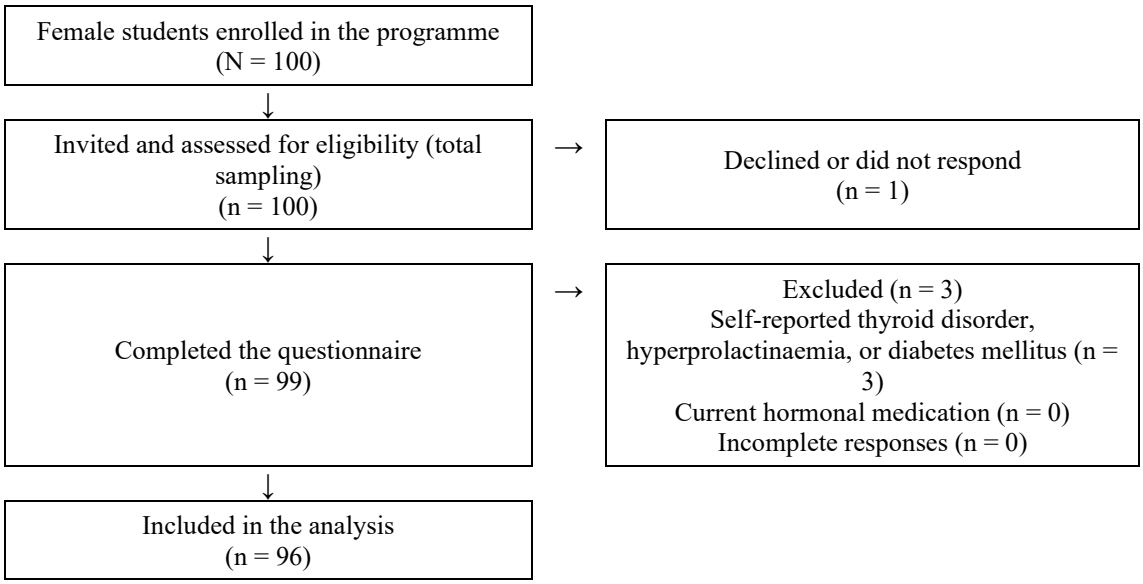


Figure 1. Participant recruitment flow

Variables and Operational Definitions

Outcome. Screening-defined PMOS risk was defined as the presence of both

measurable adolescent guideline features: menstrual irregularity suggestive of ovulatory dysfunction and self-assessed hirsutism [1]. Ovarian ultrasound and serum androgen measurement were not performed, so the outcome denotes risk identified by screening rather than a clinical diagnosis. This term differs from the guideline category of adolescents "at increased risk", which describes those with some features who do not meet diagnostic criteria; here, screening-defined risk denotes participants who self-reported both features but whose status was not clinically confirmed.

Menstrual irregularity was classified from self-reported items on the preceding 12 months: the usual interval between the first days of consecutive periods (response options < 21, 21–35, 36–45, and 46–90 days, or "unpredictable"), the number of periods (6–8, 9–11, or more than 12), and any absence of menstruation for three or more consecutive months. Following the 2023 guideline thresholds [1], a participant three or more years post-menarche was classified as positive if she reported a usual interval of < 21 or > 35 days, 6–8 periods in 12 months, or no menstruation for three or more consecutive months (an interval of more than 90 days); for participants more than one but fewer than three years post-menarche, the criteria were an interval of < 21 or > 45 days or no menstruation for three or more consecutive months, without the period-count criterion. The 6–8 category was classified as positive because six to eight periods a year correspond to a mean interval of about 45 days or more, although its upper value of eight is not itself below the guideline frequency cut-off of fewer than eight. Years since menarche was calculated as age at data collection minus self-reported age at menarche. Because the guideline defines irregularity by cycle length and frequency, an "unpredictable" interval and a between-cycle difference of more than 7 days were not used in the primary classification. Two alternative definitions were examined as sensitivity analyses: the definition applied in the original analysis of these data, which counted an interval > 35 days or "unpredictable", 6–8 periods, or three or more months without menstruation, but not intervals < 21 days; and the guideline definition with "unpredictable" intervals added.

Hirsutism was defined as a total self-assessed mFG score ≥ 3 across nine androgen-sensitive body areas, each scored 0–4 (total 0–36). This primary threshold was selected because it is the lowest population-derived (95th-percentile) cut-off reported for a Southeast Asian population, in Thai women [14], whereas the Indonesian value of

2 was derived from the minimum score in a small hospital sample of affected women rather than from a normative distribution [14], [15]. Because the international guideline recommends 4–6 depending on ethnicity [1] and self-assessed scores tend to exceed clinician scores [31], thresholds of ≥ 2, ≥ 4, ≥ 5, ≥ 6, ≥ 7, and ≥ 8 were applied as sensitivity analyses, with the menstrual criterion held constant. Without an independent clinical reference standard, these comparisons describe the dependence of the estimate on threshold choice and do not establish the diagnostic accuracy of any threshold.

Exposures. Psychological distress was measured with the Self Reporting Questionnaire-20 (SRQ-20) [32], comprising 20 yes/no items each scored 1 for "yes" (total 0–20). The total score was analysed as a continuous variable; for description only, a score ≥ 6 was classified as probable mental-emotional distress, the cut-off used in the Indonesian National Health Survey [33].

Dietary diversity was assessed with a recall of foods consumed during the previous day and night, adapted from the FAO Minimum Dietary Diversity for Women (MDD-W) indicator [30]. The instrument recorded nine of the ten MDD-W food groups; the group meat, poultry, and fish was omitted from the online form, so the score may underestimate diversity, particularly for participants who ate these foods. Each group consumed scored 1, giving a dietary diversity score (DDS) of 0–9, analysed as a continuous variable. Because the standard cut-off of five or more of ten groups was validated only for the ten-group indicator and only at population level [30], [34], the category "fewer than five of nine groups" is reported for description only and is not a validated MDD-W classification.

Nutritional status was assessed as BMI (kg/m²), calculated from the most recent weight and height reported by participants in the online form, and analysed as a continuous variable. For description, BMI was classified using the conventional Asia-Pacific categories of underweight (< 18.5), normal (18.5–22.9), at risk (23.0–24.9), and obese (≥ 25.0); the 23.0 kg/m² boundary corresponds to the public-health action point recommended for Asian populations [35].

Physical activity was assessed with a single self-reported item: "On how many days per week do you do moderate-to-vigorous physical activity for at least 30 minutes?", with the response options none, 1–2, 3–4, and 5–7 days. The item therefore combined weekly frequency with a minimum daily duration of 30 minutes, and intensity

was not measured separately; the World Health Organization defines moderate and vigorous intensity as 3 to < 6 and ≥ 6 metabolic equivalents, respectively [36]. They were entered into logistic regression as a single ordinal variable (0 = none, 1 = 1–2 days, 2 = 3–4 days, 3 = 5–7 days) and the odds ratio (OR) reflects the change in odds for every category increase in activity frequency. Sleep duration and persistent acne were recorded for description only.

Instruments, Validity, and Reliability

Validity evidence for the instruments came from external validation studies, whereas the present data provided only item analysis and internal consistency; these are distinct measurement properties and do not establish construct or diagnostic validity [37]. The Indonesian SRQ-20 has been compared with the Mini International Neuropsychiatric Interview in the Indonesian National Health Survey, where a cut-off of six showed a sensitivity of 75.6% and a specificity of 92.8% for depressive symptoms among women [33], and a single-factor structure has been supported among Indonesian university students [38]. The mFG pictorial scale has not been validated in Indonesian women; in other populations, self-assessed mFG shows high sensitivity (about 95%) but low specificity (37–56%) and exceeds clinician scores by about 4.7 points on average [31]. The MDD-W indicator is validated as a population-level proxy for micronutrient adequacy, not as a measure of individual diet quality [30], [34], and the nine-group adaptation used here has not been validated.

In the present sample, the corrected item–total correlation of every SRQ-20 and mFG item exceeded the critical value of 0.2006 (df = 94; two-tailed $\alpha = 0.05$). Internal consistency was 0.814 (Kuder–Richardson 20) for the SRQ-20 and 0.730 (Cronbach's alpha) for the mFG score. These statistics indicate item homogeneity in this sample only; they do not validate the SRQ-20 cut-off, the mFG threshold, or the screening-based PMOS classification. Internal consistency was not computed for the DDS because it is a count of food groups (a formative index) rather than a reflective scale.

Procedures

After institutional permission was obtained, eligible students received oral and written information on the study purpose, procedures, benefits, risks, and participant rights; declining had no academic consequence. Data were collected on 26 September

2026 with a self-administered online questionnaire (Google Forms), completed in a single session between 10:08 and 12:16. The first item was a consent statement, which every respondent accepted before continuing. Completion took approximately 20–30 minutes.

Weight and height were not measured by the researchers. Participants entered the most recent weight and height they recalled from a previous weighing, and BMI was calculated from these values, so no equipment calibration or measurement standardisation applied.

Hirsutism was self-assessed rather than clinically examined, in order to preserve privacy. The online form presented the standard nine-area mFG pictorial chart [13], showing the reference drawings for scores 0–4 in each area. Participants scored each area privately and were instructed to rate their natural hair growth. They could ask the researcher for clarification without the researcher viewing the body area. Understanding was checked against the reference pictures provided in the questionnaire. Because self-assessed scores tend to exceed clinician scores and hair removal can lower apparent severity, both over- and under-classification were possible [1], [31].

Responses were exported directly from Google Forms, so no manual data entry was required, and no item was left unanswered. Several single-answer items were formatted as checkboxes, so 20 participants selected more than one option for at least one analysed item. These answers were resolved as follows: for SRQ-20 and food-group items, an answer that included "yes" was scored as yes (12 and 3 participants, respectively); for mFG areas, the mean of the two adjacent scores was used (2 participants); for physical activity, the lower category was used (1 participant); for the usual cycle interval, an answer that included an abnormal option was classified as abnormal (5 participants); and for the number of periods, both options selected were in the normal range (2 participants). One age at menarche reported as a calendar year was converted to age. Five participants answered that they had not menstruated in the preceding 12 months but reported six or more periods; this item was treated as misread, and their classification was based on the remaining menstrual items. Each record was assigned a study code, and the e-mail addresses and names collected by the form were removed before analysis.

Data Analysis

Continuous variables were summarised as mean ± standard deviation (SD) and, by screening status, as median (interquartile range [IQR]); categorical variables were summarised as n (%). Proportions were reported with 95% confidence intervals (CIs) calculated by the Wilson score method, which maintains coverage better than the Wald method in small samples. Between-group distributions of continuous and ordinal variables were compared descriptively with the Mann–Whitney U test because the Shapiro–Wilk test indicated non-normal distributions; these comparisons were not the primary analysis.

The primary association analysis used four separate univariable binary logistic regression models. Each model had screening-defined PMOS risk (1 = present, 0 = absent) as the outcome and one predictor: SRQ-20 score (per 1 point), DDS (per food group), BMI (per 1 kg/m²), or physical activity (per one ordinal category, 0–3). Because all predictors were entered as single continuous or ordinal terms, no reference category applied. Results are reported as crude ORs with 95% Wald CIs and Wald p-values. Normality is not an assumption of logistic regression; linearity of the logit was assessed by adding a quadratic term for each continuous predictor and, for physical activity, by comparing the ordinal model with a model treating activity as categorical. No multivariable model was fitted, because 12 screening-positive participants do not support stable adjustment [39]; all estimates are therefore unadjusted and may be confounded. Because the physical activity categories were sparsely populated, with no screening-positive participant in the 3–4-day category and two participants in the 5–7-day category, the stability of its estimate was examined by cross-tabulating activity categories by screening status and by refitting the model with Firth's penalised-likelihood correction, which reduces small-sample bias when events are few [40]. The same models were refitted for the two alternative menstrual definitions. The significance level was 0.05. Analyses were performed in IBM SPSS Statistics version 26; Firth models were fitted in R with the logistf package.

Ethical Considerations

The study was approved by the Health Research Ethics Committee of NHM University (approval number 3741/KEPK/UNIV-NHM/EC/IX/2026, dated 15 September 2026) before participant recruitment and data collection began. All

participants gave informed consent electronically at the start of the online form. Participants whose SRQ-20 responses indicated a possible mental health difficulty, including any endorsement of the item concerning thoughts of ending one's life, were contacted individually on the same day and offered voluntary referral to the institutional counselling service; this offer did not affect study participation. Confidentiality was maintained by identity coding, with the code key accessible only to the principal investigator.

RESULTS

Ninety-six students were analysed (Figure 1). Participants were late adolescents with a mean age of 18.36 years and a mean of 6.03 years since menarche (range 2–9); two (2.1%) were fewer than three years post-menarche. Most participants (79; 82.3%) had a self-reported BMI below 23.0 kg/m², and 71 (74.0%) reported moderate-to-vigorous physical activity on fewer than three days per week (Table 1).

Table 1. Characteristics of Participants (n = 96)

Characteristic	Value
Continuous variables, mean ± SD	
Age (years)	18.36 ± 0.65
Age at menarche (years)	12.33 ± 1.30
Years since menarche	6.03 ± 1.44
Body mass index (kg/m²)	20.69 ± 3.12
SRQ-20 score (range 0–20)	4.45 ± 3.72
Dietary diversity score (range 0–9)	6.21 ± 1.90
Self-assessed mFG score (range 0–36)	3.06 ± 3.03
Categorical variables, n (%)	
Fewer than three years since menarche	2 (2.1)
Body mass index category	
Underweight (< 18.5 kg/m²)	25 (26.0)
Normal (18.5–22.9 kg/m²)	54 (56.3)
At risk (23.0–24.9 kg/m²)	9 (9.4)
Obese (≥ 25.0 kg/m²)	8 (8.3)
Moderate-to-vigorous physical activity	
None	12 (12.5)
1–2 days/week	59 (61.5)
3–4 days/week	23 (24.0)
5–7 days/week	2 (2.1)
Sleep duration < 7 hours/night	61 (63.5)
Persistent acne (any severity)	33 (34.4)

Table 1. Means ± SD are shown for comparability with previous studies; medians (IQR) by screening status are given in Table 4. Percentages use n = 96 as the denominator and are rounded to one decimal place. Years since menarche = age at data collection − self-reported age at menarche. BMI was calculated from self-reported weight and height. BMI categories are the conventional Asia-Pacific categories; 23.0 kg/m² is the public-health action point for Asian populations [35]. SD = standard deviation; SRQ-20 = Self Reporting Questionnaire-20; mFG = modified Ferriman–Gallwey.

Twelve participants (12.5%; 95% CI 7.3–20.6%) met the study-defined screening criteria for PMOS risk. This figure represents screening-defined risk, not the prevalence of clinically confirmed PMOS. Thirty-one participants (32.3%) met the menstrual criterion, most often through a reported usual interval shorter than 21 days, and 48 (50.0%) self-assessed hirsutism at mFG ≥ 3 (Table 2). All 12 screening-positive participants were three or more years post-menarche; the two participants fewer than three years post-menarche did not meet the screening definition. Seven of the 12 met the menstrual criterion only through a reported interval shorter than 21 days, and four of these seven reported 6–11 periods a year, which is inconsistent with such short cycles.

Table 2. Screening-Defined PMOS Risk, Its Components, and Descriptive Exposure Categories (n = 96)

Indicator	n	%	95% CI (%)
Menstrual criterion (2023 guideline thresholds) and its components			
Usual interval < 21 days	20	20.8	13.9–30.0
Usual interval > 35 days	2	2.1	0.6–7.3
6–8 periods in the past 12 months	9	9.4	5.0–16.9
No menstruation for ≥ 3 consecutive months	8	8.3	4.3–15.6
Menstrual criterion met (any of the above)	31	32.3	23.8–42.2
Hirsutism and screening-defined outcome			
Self-assessed hirsutism (mFG ≥ 3)	48	50.0	40.2–59.8
Screening-defined PMOS risk (menstrual criterion and hirsutism)	12	12.5	7.3–20.6
Descriptive exposure categories			
Probable mental-emotional distress (SRQ-20 ≥ 6)	32	33.3	24.7–43.2
Fewer than five of nine food groups	22	22.9	15.6–32.3
Body mass index ≥ 23.0 kg/m² (self-reported)	17	17.7	11.4–26.5

Table 2. Menstrual components are not mutually exclusive; for participants fewer than three years post-menarche, an interval > 45 days replaced > 35 days and the period-count criterion was not applied. 95% CIs were calculated by the Wilson score method.

Hirsutism was self-assessed with the pictorial mFG scale, not clinically examined. The food-group category is descriptive and is not a validated MDD-W classification. CI = confidence interval; mFG = modified Ferriman–Gallwey; SRQ-20 = Self Reporting Questionnaire-20.

The screening-defined proportion depended strongly on the mFG threshold (Table 3). Self-assessed hirsutism ranged from 57.3% at a threshold of 2 to 12.5% at a threshold of 8, and screening-defined risk from 17.7% (95% CI 11.4–26.5%) to 3.1% (95% CI 1.1–8.8%), a more than fivefold difference across thresholds applied to the same participants.

Table 3. Screening-Defined PMOS Risk by mFG Threshold (n = 96)

mFG threshold	Source of threshold (derivation)	Hirsutism n (%)	Screening-defined risk n (%) [95% CI]
≥ 2	Indonesia (minimum score among 30 hospital patients with the condition)	55 (57.3)	17 (17.7) [11.4–26.5]
≥ 3 (primary)	Thailand (95th percentile, unselected women)	48 (50.0)	12 (12.5) [7.3–20.6]
≥ 4	Lower bound of guideline range (4–6); cut-off from population cluster analysis in several ethnic groups	37 (38.5)	9 (9.4) [5.0–16.9]
≥ 5	China (95th percentile, unselected women)	27 (28.1)	7 (7.3) [3.6–14.3]
≥ 6	Korea (95th percentile, unselected women)	21 (21.9)	4 (4.2) [1.6–10.2]
≥ 7	Philippines (95th percentile, unaffected women)	15 (15.6)	3 (3.1) [1.1–8.8]
≥ 8	Conventional (predominantly White populations)	12 (12.5)	3 (3.1) [1.1–8.8]

Table 3. Thresholds were derived in different reference populations using different methods (Indonesia [14], [15]; Thailand, China, Korea, and the Philippines as compiled by Ilagan et al. [14]; guideline range and population cluster cut-offs [1], [16]; conventional [13]) and were applied retrospectively to the same self-assessed scores as a threshold sensitivity analysis, with the guideline-based menstrual criterion held constant. Values for the same population can differ by method; for Korean women, the 95th-percentile method gave 6 and cluster analysis gave 4. The differences between rows show how the estimate depends on threshold choice; they do not validate any population-specific cut-off, because no clinical reference standard was available. CIs by the Wilson score method. mFG = modified Ferriman–Gallwey.

In the univariable logistic regression models (Table 4), no statistically significant association was detected between screening-defined PMOS risk and SRQ-20 score (crude OR 1.05; 95% CI 0.90–1.23; p = 0.526), DDS (crude OR 1.10; 95% CI 0.79–1.54; p = 0.569), BMI (crude OR 1.04; 95% CI 0.86–1.25; p = 0.710), or physical activity frequency (crude OR 0.65; 95% CI 0.24–1.70; p = 0.376); these CIs are compatible with small to moderate associations in either direction. Firth's correction gave a similar estimate for physical activity (OR 0.67; 95% profile-likelihood CI 0.25–1.67). One of the 25 participants active on three or more days per week met the screening definition, compared with 11 of the 71 (15.5%) active on fewer days (Fisher's exact p = 0.175; Table 5). Because the 3–4-day category contained no screening-positive participants, a model treating activity as categorical could not be estimated reliably, so linearity across activity categories could not be assessed; quadratic terms for SRQ-20 score, DDS, and BMI were not statistically significant (p = 0.494, 0.666, and 0.900, respectively).

Table 4. Crude Associations of Psychological Distress, Dietary Diversity, Body Mass Index, and Physical Activity With Screening-Defined PMOS Risk (n = 96)

Predictor (unit of OR)	At risk (n = 12) median (IQR)	Not at risk (n = 84) median (IQR)	Mann–Whitney p	Crude OR (95% CI)	p
SRQ-20 score (per 1 point)	5.0 (2.3–7.0)	3.5 (1.0–6.0)	0.432	1.05 (0.90–1.23)	0.526
Dietary diversity score (per food group)	7.0 (5.3–8.0)	7.0 (5.0–8.0)	0.539	1.10 (0.79–1.54)	0.569
Body mass index, self-reported (per 1 kg/m²)	20.1 (18.9–22.2)	20.3 (18.2–22.5)	0.894	1.04 (0.86–1.25)	0.710
Physical activity (per one category, 0–3)	1.0 (1.0–1.0)	1.0 (1.0–2.0)	0.223	0.65 (0.24–1.70)	0.376

Table 4. Crude (unadjusted) ORs from four separate univariable binary logistic regression models; outcome coded 1 = screening-defined PMOS risk (guideline-based menstrual criterion and mFG ≥ 3), 0 = not at risk. Predictors were entered as continuous terms (SRQ-20 score 0–20; dietary diversity score 0–9; BMI in kg/m²) or as an ordinal term (physical activity: 0 = none, 1 = 1–2, 2 = 3–4, 3 = 5–7 days/week); each OR is the change in odds per one-unit or one-category increase, so no reference category applies. CIs are Wald

intervals. Mann–Whitney p-values are descriptive comparisons of distributions. CI = confidence interval; IQR = interquartile range; OR = odds ratio; SRQ-20 = Self Reporting Questionnaire-20.

Table 5. Physical Activity Frequency by Screening Status (n = 96)

Moderate-to-vigorous activity	At risk (n = 12) n (%)	Not at risk (n = 84) n (%)	Total n (%)
None	2 (16.7)	10 (11.9)	12 (12.5)
1–2 days/week	9 (75.0)	50 (59.5)	59 (61.5)
3–4 days/week	0 (0.0)	23 (27.4)	23 (24.0)
5–7 days/week	1 (8.3)	1 (1.2)	2 (2.1)

Table 5. Column percentages; they may not sum to 100 because of rounding. Screening status by the guideline-based definition. The 3–4-day category contained no screening-positive participant, which limits the precision of the ordinal estimate in Table 4.

The menstrual definition changed which participants were classified (Table 6). Of the 31 participants who met the guideline criterion, 14 also met the original study definition, which counted "unpredictable" intervals but not intervals shorter than 21 days, and only 5 of the 15 participants who were screening-positive under the original definition remained screening-positive under the guideline definition. Under the original and broad definitions, 15.6% (95% CI 9.7–24.2%) and 22.9% (95% CI 15.6–32.3%) were screening-positive, and higher physical activity frequency was associated with lower crude odds of screening-defined risk (OR 0.25, 95% CI 0.09–0.70, and OR 0.30, 95% CI 0.12–0.73; Firth-corrected OR 0.27 and 0.32, respectively). No other factor was associated with screening-defined risk under any definition.

Table 6. Screening-Defined PMOS Risk and Crude Associations Under Alternative Menstrual Definitions (n = 96)

Menstrual definition	Menstrual criterion n (%)	Screening-defined risk n (%) [95% CI]	SRQ-20 OR (95% CI)	DDS OR (95% CI)	BMI OR (95% CI)	Physical activity OR (95% CI)
2023 guideline thresholds (primary)	31 (32.3)	12 (12.5) [7.3–20.6]	1.05 (0.90–1.23)	1.10 (0.79–1.54)	1.04 (0.86–1.25)	0.65 (0.24–1.70)
Original study definition	31 (32.3)	15 (15.6) [9.7–24.2]	0.97 (0.83–1.13)	0.98 (0.73–1.30)	0.98 (0.81–1.17)	0.25 (0.09–0.70)*

Menstrual definition	Menstrual criterion n (%)	Screening-defined risk n (%) [95% CI]	SRQ-20 OR (95% CI)	DDS OR (95% CI)	BMI OR (95% CI)	Physical activity OR (95% CI)
Guideline thresholds plus "unpredictable" interval	48 (50.0)	22 (22.9) [15.6–32.3]	0.97 (0.85–1.11)	1.01 (0.78–1.30)	1.01 (0.86–1.17)	0.30 (0.12–0.73)*

Table 6. Hirsutism was defined as mFG ≥ 3 in all rows. Original study definition: usual interval > 35 days or "unpredictable", 6–8 periods in 12 months, or no menstruation for ≥ 3 consecutive months; intervals < 21 days were not counted. Fourteen participants met both the guideline and the original menstrual criterion, and five were screening-positive under both. Crude ORs from univariable logistic regression, with units as in Table 4; CIs for proportions by the Wilson score method. * p = 0.008. CI = confidence interval; DDS = dietary diversity score; OR = odds ratio; SRQ-20 = Self Reporting Questionnaire-20.

DISCUSSION

In this single-institution sample of late-adolescent midwifery students, 12.5% met the study's guideline-based screening definition of PMOS risk. This proportion varied more than fivefold across published hirsutism thresholds and changed with the menstrual definition, and no factor was associated with screening-defined risk under the primary definition. Each finding is interpreted below in light of the screening-based outcome, the self-reported measures, and the small number of screening-positive participants.

Screening-Defined Risk in a Single-Institution Student Sample

It is important to note that this 12.5% figure should not be compared directly with the prevalence of clinically diagnosed PMOS, as it is based on self-reported menstrual history and self-assessed hirsutism, without any clinical examination or biochemical testing, or laboratory exclusion of mimicking conditions. The findings could be compared to those of other studies of young women that have applied screening or self-report definitions; differences in population and definition are noted. A meta-analysis of medical and dental students, primarily from South Asian countries and Iran, found a pooled prevalence of 24.7% (with very high heterogeneity) with a combination of abnormal uterine bleeding and a Ferriman–Gallwey score ≥ 5 [28]; 17% of female non-medical university students in Jakarta were classified as possible cases [26] and

42.6% of high school students in Surabaya were at risk with a combination of abnormal uterine bleeding and a Ferriman–Gallwey score ≥ 5 [27]. These screening-based estimates are higher than the present estimate, with differences primarily due to differing definitions; for this reason, it is advisable to include a definition with any estimate. For the same reason a diagnosis based estimate of 17.4% of college women aged 18-25 years in the city of Delhi, based on Rotterdam criteria and ultrasound for new cases [41] cannot be compared. Also, female university students have demonstrated their lack of understanding of the connection between lifestyle and the condition [42] that would benefit from pairing the screening activity with education.

Because cycle irregularity can be physiological soon after menarche, the menstrual criterion was applied according to years since menarche [1], [5]. Only two participants were fewer than three years post-menarche and neither met the screening definition, so the age-dependent thresholds had little influence on the estimate.

Dependence of the Estimate on the Hirsutism Threshold

The screening-defined proportion fell from 17.7% to 3.1% as the mFG threshold rose from 2 to 8. Estimates that rely on clinical or self-assessed hirsutism are therefore not comparable across studies unless the threshold and assessment method are stated. This dependence is consistent with evidence that the criteria applied change adolescent prevalence [11] and the classification of East Asian adolescents [12], and with ethnic variation in normative mFG cut-offs, which range from 4 to 8 in unselected populations [16]. The present study cannot determine which threshold is correct for Indonesian women, because no clinical reference standard was available. Two features of the data nevertheless call for caution at the lower thresholds. First, the primary threshold of 3 lies below the guideline range of 4–6 [1]. Second, self-assessed scores tend to exceed clinician scores and have low specificity [31], so at low thresholds some participants classified as hirsute may not meet clinical criteria. The threshold-specific estimates are therefore best read as a range of plausible screening outcomes, and a population-based normative study with clinician assessment is needed to define an Indonesian cut-off.

Dependence of the Estimate on the Menstrual Definition

Changing the menstrual definition altered which participants were classified more than how many. The guideline and original definitions each classified 31

participants as having menstrual irregularity, but only 14 were common to both, and only 5 of the 15 participants who were screening-positive under the original definition remained so under the guideline definition. The difference arose from two response categories. Intervals shorter than 21 days count as irregular under the guideline [1] but had not been counted originally, whereas an "unpredictable" interval, which had been counted, cannot be mapped to the guideline cycle-length thresholds. Self-reports of short cycles also require caution: 8 of the 20 participants who reported an interval shorter than 21 days reported 6–11 periods a year, which is inconsistent with such cycles and suggests misreading of the interval question or recall error. Screening studies should therefore record cycle length in days, ideally from a menstrual calendar, rather than in categories, so that guideline thresholds can be applied directly [1], [5].

Physical Activity

There was no significant association between frequency of physical activity and screening-defined risk (crude OR 0.65; 95% CI 0.24–1.70); the Firth-corrected OR was close to this. An inverse association was only seen when the two definitions that classified an "unpredictable" interval as irregular were used (OR 0.25 and 0.30). The association reported in the original analysis was therefore dependent on the definition of menstrual irregularity – in particular on the "unpredictable" response, rather than on the definition of the guideline-defined outcome, and was not interpreted as a protective effect. The estimates are unadjusted and may be confounded by other factors, such as adiposity, sleep or academic workload, or by the reverse causal association of affected women reporting less physical activity than control women [19]; they are only potentially affected by small-sample bias because there are few events and empty categories [40]. The results of this study are consistent with previous research that has indicated a biological relationship between activity and the condition that this study did not test.

Exercise trials in women with the disease report beneficial improvements in insulin and anthropometric parameters with inconsistent hormonal effects [21], physical activity interventions are linked with menstrual regularity and ovulation [44] and composition of the daily movement behaviours is associated with the cardiometabolic markers [45]. Insulin resistance, androgen levels and mediation were not measured and the model was not adjusted for BMI so the present data can not show that such a pathway

exists or not. Limited interpretation through measurement, as brief self-report measures only moderately correlate with accelerometer measured activity among college students [46] and the one item used here was based on self judged intensity.

Psychological Distress

No statistically significant association was detected between SRQ-20 score and screening-defined risk (OR 1.05; 95% CI 0.90–1.23). This result does not show that psychological distress is unrelated to PMOS risk: with 12 events, the study had limited power to detect small or moderate associations, and the CI is compatible with modest associations in either direction. Hypotheses from previous research may also be relevant. Meta-analytic evidence in adolescent girls shows higher odds of depression but no consistent difference in anxiety [17], genetic evidence suggests that the condition may contribute to depression rather than the reverse [18], and body-image concerns [43] and the severity of hyperandrogenism [47] have been proposed as pathways. If distress develops mainly after symptoms are recognised or diagnosed, an association may be weaker in a sample in which no participant reported a diagnosis. Measurement may also contribute, because the SRQ-20 captures general mental-emotional distress and its cut-off was validated against depressive symptoms in a general-population survey rather than among students [33].

Dietary Diversity

No statistically significant association was detected for dietary diversity (OR 1.10; 95% CI 0.79–1.54), and both groups had a median of seven of nine food groups. Dietary diversity and diet quality are different constructs. Diversity scores count the food groups consumed and were developed as population-level proxies for micronutrient adequacy [30], [34]; they do not capture glycaemic index or load, energy intake, or the share of processed foods. The dietary evidence relevant to PMOS concerns these quality dimensions: low-glycaemic-index diets improve insulin resistance and sex hormone-binding globulin in trials [20], higher dietary phytochemical index scores have been associated with lower odds of the condition [48], and diet-quality indices such as the MIND diet score have been examined in relation to its phenotypes [49], whereas observational studies have not consistently found differences in glycaemic index or load [19]. The nine-group adaptation used here, which omitted meat, poultry, and fish and

was based on a single recall day, may therefore not capture the dietary exposures most relevant to PMOS; the null result may reflect this measurement limitation, the small number of events, or a genuinely weak association.

Nutritional Status

No statistically significant association was detected for BMI (OR 1.04; 95% CI 0.86–1.25), in contrast to an Indonesian high school study in which overweight was strongly associated with a broader risk definition [27]. Possible explanations include the narrow BMI distribution, with only 17 participants at ≥ 23.0 kg/m² and eight at ≥ 25.0 kg/m², error in self-reported weight and height, and the limited ability of BMI to represent central adiposity: central adiposity measures such as waist-to-height ratio are associated with insulin resistance in affected women [29], and the condition also occurs in lean women [22]. These explanations were not tested in this study, and the result may equally reflect limited power or a weak association in this population. Future studies should measure weight, height, and waist circumference rather than rely on self-report.

Implications for Adolescent Midwifery Care

The findings are in support of awareness, not validation of screening. We did not assess the diagnostic accuracy, feasibility or effectiveness of screening, and the proportion defined by screening was based on a self-assessed measure, on the threshold used, and on the menstrual definition. In schools, midwives can provide menstrual health education to support students to recognise when their menstrual cycle is abnormal, including a cycle that is too short or too long, a period lasting more than 3 months or the absence of periods, and any unwanted growth of terminal hair and refer them for clinical assessment including examination and laboratory tests that exclude other causes [1]. Incorporating such education into adolescent reproductive health services that are youth-friendly, may help reach more young people, since awareness of such services among youth is still low [50]. The renaming as PMOS enables counselling of metabolic and long term health and fertility [7]. Physical activity promotion is reasonable as general health guidance consistent with international recommendations [36], but these data provide no consistent evidence that activity frequency is associated with screening-defined risk and none that it prevents PMOS.

Limitations

This study has several limitations. First, all association estimates were unadjusted and may be confounded. With 12 screening-positive participants, multivariable adjustment was not feasible and precision was limited, with a 95% CI of 7.3–20.6% for the main proportion [39], and the absence of significant associations indicates insufficient evidence rather than demonstrated absence of association. Second, the outcome may be misclassified. Hirsutism was self-assessed, which tends to exceed clinician scores [31], and the threshold chosen strongly affected classification. Menstrual history was self-reported in categories, so the guideline thresholds could be applied only approximately: the 6–8-period category straddles the guideline frequency cut-off, an "unpredictable" interval could not be classified, and some reports of intervals shorter than 21 days were inconsistent with the reported number of periods. Which participants were screening-positive changed substantially with the menstrual definition. Mimicking conditions were excluded only by self-reported diagnosis, without laboratory confirmation. Third, serum androgens were not measured and ovarian ultrasound was not performed, the latter in line with adolescent guidance [1], so the outcome indicates screening-defined risk rather than diagnosis. Fourth, BMI was calculated from self-reported weight and height and was the only adiposity measure; the dietary instrument was a non-validated nine-group adaptation that omitted meat, poultry, and fish and covered one recall day; physical activity was assessed with a single item; and several single-answer items were formatted as checkboxes, so some participants selected more than one option. Fifth, the cross-sectional design does not permit inference about temporal order. Finally, the sample came from one midwifery programme at one institution, which limits generalisability to other student groups and to Indonesian young women more broadly.

CONCLUSIONS

In this single-institution sample, 12.5% of female midwifery students met a screening definition of PMOS risk based on menstrual irregularity, classified from self-reported cycle items using adolescent guideline thresholds, and self-assessed hirsutism. The estimate varied more than fivefold across published mFG thresholds and changed with the menstrual definition, so reports of screening-defined risk should state the

hirsutism threshold, the assessment method, and the menstrual items and thresholds used; an Indonesian hirsutism threshold requires a normative study with clinician assessment. No statistically significant associations were detected for psychological distress, dietary diversity, BMI, or physical activity under the guideline-based definition; the inverse association with physical activity observed under alternative definitions was unadjusted and definition-dependent and does not demonstrate a protective effect. For midwifery practice, the findings support menstrual health education, recognition of concerning symptoms, and referral for clinical assessment rather than diagnostic screening. Larger studies with menstrual calendars that record cycle length in days, clinician-assessed hirsutism, measured anthropometry including central adiposity, validated dietary and activity instruments, and prospective follow-up are needed.

ACKNOWLEDGMENT

The authors thank Poltekkes Kemenkes Malang for granting research permission and all students who agreed to participate. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization, Methodology, Data Curation, Formal Analysis, Writing – Original Draft, and Writing – Review & Editing. Author 2: Methodology, Investigation, Data Collection, and Writing – Review & Editing. Author 3: Supervision, Validation, and Writing – Review & Editing. All authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY

The de-identified dataset supporting the findings of this study is available from the corresponding author upon reasonable request.

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