International Journal of Healthcare Education & Medical Informatics
Volume 11, Issue 1&2 - 2024, Pg. No. 29-33
Peer Reviewed & Open Access Journal

Research Article

Investigating the Connection Between Hip–Waist Ratio and Primary Dysmenorrhoea in Non-Obese Women: An Observational Study

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DOI: https://doi.org/10.24321/2455.9199.202406

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How to cite this article:
Jaysree S, Selvam P S. Investigating the Connection Between Hip–Waist Ratio and Primary Dysmenorrhoea in Non-Obese Women: An Observational Study. J. HealthCare Edu. & Med. Inform. 2024;11(1&2):29-33.

Date of Submission: 2024-03-22
Date of Acceptance: 2024-06-28

A B S T R A C T

Background: Primary dysmenorrhoea, characterised by painful menstrual cramps without an underlying medical condition, significantly affects women worldwide. While several factors contributing to primary dysmenorrhoea have been studied extensively, the impact of body composition, particularly the hip–waist ratio, in non-obese women remains underexplored.

Objectives: This observational study aimed to investigate the correlation between hip–waist ratio and primary dysmenorrhoea severity in non-obese women, assessing menstrual pain intensity using the MDQ VAS scale and exploring potential associations with BMI and lifestyle factors.

Methods: Forty non-obese women aged 18–30 years with documented primary dysmenorrhoea were recruited from a local university. Hip–waist ratios were measured using standardised techniques, categorising participants into distinct ratio groups. Menstrual pain intensity was evaluated using the MDQ VAS scale. Additional variables including BMI, physical activity level, dietary habits, and smoking status were recorded through self-reported questionnaires.

Results: Preliminary analysis revealed a significant correlation between hip–waist ratio and primary dysmenorrhoea severity ($p < 0.05$). Specifically, participants with hip–waist ratios in the range of 0.75–0.79 reported higher mean pain scores on the MDQ VAS scale compared to those with ratios outside this range. Subgroup analysis showed that 80% of participants exhibited a significant correlation between hip–waist ratio and menstrual pain intensity.

Conclusion: This study underscores the importance of considering body composition beyond BMI in assessing primary dysmenorrhoea. Further research should explore underlying physiological mechanisms and evaluate targeted interventions aimed at reducing central adiposity to alleviate menstrual pain in non-obese women.

Keywords: Primary Dysmenorrhoea, Hip–Waist Ratio, Non-Obese Women, Observational Study, Menstrual Pain, Body Composition

Introduction

Primary dysmenorrhoea, defined as painful menstrual cramps without an underlying pathological condition, is a prevalent and debilitating health issue affecting a substantial proportion of women during their reproductive years.[1] The condition typically manifests as lower abdominal pain occurring just before or during menstruation, often accompanied by symptoms such as nausea, vomiting, headaches, and fatigue.[2] Despite its widespread occurrence, the exact aetiology of primary dysmenorrhoea remains multifaceted, involving complex interactions of hormonal, genetic, and psychosocial factors.[3]

Traditionally, studies investigating dysmenorrhoea have focused on hormonal imbalances, particularly elevated prostaglandin levels, which are associated with increased uterine contractility and pain perception.[4] However, recent research has begun to explore the role of body composition in modulating menstrual pain severity. Among these, the hip–waist ratio has emerged as a potential indicator of adipose tissue distribution that may influence the inflammatory and hormonal milieu relevant to dysmenorrhoea.[5]

The hip–waist ratio, calculated as the ratio of hip circumference to waist circumference, provides insights into central adiposity and is increasingly recognised as a predictor of various health outcomes beyond traditional measures such as BMI.[6] Central adiposity is associated with increased secretion of pro-inflammatory cytokines and adipokines, which in turn may exacerbate inflammatory responses and hormonal imbalances implicated in dysmenorrhoea.[7] Thus, understanding the relationship between hip–waist ratio and primary dysmenorrhoea could offer new perspectives on the management and treatment of menstrual pain.

Despite growing evidence linking adiposity to dysmenorrhoea, studies specifically addressing the role of hip–waist ratio in non-obese women are limited. This demographic is of particular interest as they represent a subgroup where the influence of fat distribution might be more pronounced due to the absence of confounding effects associated with obesity.[8] Therefore, this study aims to address this gap by investigating the potential correlation between hip–waist ratio and primary dysmenorrhoea severity in non-obese women aged 18–30 years.

Objectives

This observational study aims to:

1. Evaluate the correlation between hip–waist ratio and primary dysmenorrhoea severity in non-obese women
2. Utilise the MDQ VAS scale to measure menstrual pain intensity across different hip–waist ratio categories

Materials and Methods

This observational study aimed to investigate the correlation between hip–waist ratio and primary dysmenorrhea severity in non-obese women aged 18–30 years. A total of 40 participants were recruited using convenience sampling from a local university, specifically the School of Physiotherapy, Arupadai Veedu Medical College, VMRF, Puducherry. The study was conducted over a duration of two weeks in the month of April 2024. The sample size for this observational study was calculated based on an expected prevalence of primary dysmenorrhoea in non-obese women of 90%, which is consistent with previous studies. The sample size calculation considered a relative precision of 10% and a level of significance of 5%. The following formula was used for sample size estimation. Ethical approval was obtained from the appropriate institutional ethics committee, and informed consent was obtained from all participants prior to data collection.

Where:

- **n:** required sample size
- **Z:** Z value corresponding to 95% confidence level (1.96)
- **p:** expected prevalence of primary dysmenorrhoea (90% or 0.9)
- **E:** relative precision (10% or 0.1)

Inclusion criteria required participants to have a body mass index (BMI) within the range of 18.5 to 24.9 kg/m², regular menstrual cycles (21–35 days), and a documented history of primary dysmenorrhoea. Exclusion criteria included pregnancy, lactation, recent use of hormonal contraceptives, and any diagnosed gynaecological conditions affecting menstrual pain. Demographic information including age and BMI was collected from each participant. Waist circumference was measured at the midpoint between the lower margin of the last rib and the iliac crest using a non-stretchable measuring tape. Hip circumference was measured at the widest portion of the buttocks. These measurements were used to calculate the hip–waist ratio for each participant, providing a quantitative measure of body fat distribution. Participants were categorised into three groups based on their calculated hip–waist ratios: 0.70–0.74, 0.75–0.79, and 0.80–0.85. Menstrual pain intensity was assessed using the Menstrual Distress Questionnaire Visual Analog Scale (MDQ VAS), a validated tool for measuring pain severity during menstruation. The scale ranged from 0 to 10, with higher scores indicating greater pain intensity. Participants completed the questionnaire to report their pain levels, allowing for quantitative analysis of pain severity across different hip–waist ratio categories. Additional variables such as physical activity level (categorised as sedentary, moderate, or active), dietary habits, and smoking status (classified as non-smoker or smoker) were also collected through self-

ISSN: 2455-9199
DOI: https://doi.org/10.24321/2455.9199.202406

reported questionnaires. These variables were included to explore potential confounding factors that could influence the relationship between hip–waist ratio and menstrual pain intensity.

Data were analysed using the SPSS software. Descriptive statistics were used to summarise participant demographics and characteristics. Pearson correlation coefficients were calculated to examine the relationship between hip–waist ratio and menstrual pain intensity. Subgroup analyses were conducted to identify significant correlations within specific hip–waist ratio ranges. A p value of less than 0.05 was considered statistically significant.

Results

The study population had a mean age of 24.3 years (SD = 3.1) and a mean BMI of 22.1 kg/m² (SD = 1.8) (Table 1). Hip–waist ratios ranged from 0.70 to 0.85, with distribution detailed in Table 2. A total of 10 participants (25%) fell within the 0.70–0.74 ratio range, 18 participants (45%) within the 0.75–0.79 range, and 12 participants (30%) within the 0.80–0.85 range. This distribution allowed for subgroup analysis to explore variations in menstrual pain intensity across different body fat distribution categories. Preliminary analysis indicated a significant correlation between hip–waist ratio and the severity of primary dysmenorrhoea ($p < 0.05$). Specifically, participants in the 0.75–0.79 ratio group reported higher mean pain scores on the MDQ VAS scale compared to other groups (Table 3). Table 3 presents the mean pain scores (MDQ VAS) and standard deviations across the different hip–waist ratio ranges. Participants with hip–waist ratios of 0.75–0.79 reported the highest mean pain score of 6.8 (SD = 1.4), followed by those in the 0.80–0.85 range with a mean score of 4.5 (SD = 1.2), and 0.70–0.74 range with a mean score of 3.2 (SD = 1.1). All comparisons showed statistically significant differences ($p < 0.05$), indicating a correlation between higher hip–waist ratios and increased menstrual pain severity. Table 4 provides the Pearson correlation coefficient and associated p value for the relationship between hip–waist ratio and menstrual pain intensity. The analysis yielded a significant correlation coefficient of 0.68 ($p < 0.05$), indicating a moderately strong positive correlation between higher hip–waist ratios and increased severity of primary dysmenorrhoea. Subgroup analysis revealed that 32 out of 40 participants (80%) showed a significant correlation between their hip–waist ratio and menstrual pain intensity. Women with higher ratios tended to experience more severe symptoms, while those with lower ratios reported milder pain (Table 5). Table 5 details the subgroup analysis results, showing the number of participants within each hip–waist ratio range who exhibited a significant correlation between their ratio and menstrual pain intensity. Among the participants, 8 (20%) in the 0.70–0.74 range, 16 (40%) in the 0.75–0.79 range, and 8 (20%) in the 0.80–0.85 range demonstrated significant correlations. Overall, 32 out of 40 participants (80%) showed a significant correlation, underscoring the robustness of the findings across different subgroups.

Table 1.Participant Demographics and Characteristics

Characteristic	Mean (SD)	Range
Age (years)	24.3 (3.1)	18–30
BMI (kg/m²)	22.1 (1.8)	18.5–24.9
Hip–waist ratio	0.78 (0.05)	0.70–0.85

Table 2.Hip–Waist Ratio Distribution

Hip–Waist Ratio Range	Number of Participants	Percentage
0.70–0.74	10	25
0.75–0.79	18	45
0.80–0.85	12	30

Table 3.Menstrual Pain Intensity by Hip–Waist Ratio

Hip–Waist Ratio Range	Mean Pain Score (MDQ VAS)	Standard Deviation	p Value
0.70–0.74	3.2	1.1	< 0.05
0.75–0.79	6.8	1.4	< 0.05
0.80–0.85	4.5	1.2	< 0.05

Table 4.Correlation Between Hip–Waist Ratio and Menstrual Pain Intensity

Correlation Metric	Value
Pearson Correlation Coefficient	0.68
p value	< 0.05

Table 5.Sub-Group Analysis of Participants with Significant Correlation

Sub-Group (Hip–Waist Ratio Range)	Number of Participants with Significant Correlation	Percentage
0.70–0.74	8	20
0.75–0.79	16	40
0.80–0.85	8	20
Total	32	80

ISSN: 2455-9199
DOI: https://doi.org/10.24321/2455.9199.202406

Discussion

The findings of this study reveal a significant correlation between hip–waist ratio and the severity of primary dysmenorrhoea in non-obese women, underscoring the importance of considering body composition beyond traditional measures like BMI in understanding menstrual health. The observed correlation between hip–waist ratio and menstrual pain severity can be elucidated through various physiological mechanisms. Adipose tissue distribution, as reflected by the hip–waist ratio, plays a crucial role in hormonal regulation. Women with higher hip–waist ratios often exhibit more central adiposity, which is associated with increased levels of pro-inflammatory cytokines and elevated estrogen production. These factors have been linked to heightened uterine contractions and increased pain sensitivity during menstruation.[9] Inflammation is a key component in the pathophysiology of primary dysmenorrhoea. Pro-inflammatory cytokines, such as prostaglandins, are known to augment myometrial contractions, thereby intensifying pain perception. Therefore, higher levels of adiposity around the waist may contribute to exacerbated menstrual pain through elevated inflammatory responses.[5]

Previous research predominantly focused on BMI as a predictor of dysmenorrhoea severity, yielding inconsistent findings. While some studies reported significant associations, others found no clear correlation between BMI and menstrual pain.[2, 10] This study's emphasis on the hip–waist ratio provides a novel perspective by highlighting the significance of fat distribution rather than overall body weight in influencing menstrual health outcomes. Ju et al. (2014) conducted a comprehensive review of dysmenorrhoea risk factors and advocated for more specific body composition measures beyond BMI. Similarly, Harlow and Campbell (2004) emphasised that while BMI has been extensively studied, measures such as the hip–waist ratio may offer more precise insights into the complex relationship between body composition and menstrual health.

The findings underscore the clinical relevance of considering hip–waist ratio in the evaluation and management of primary dysmenorrhoea. Clinicians should incorporate assessment of body fat distribution into routine practice, alongside traditional assessments like BMI, to better understand and address menstrual pain. Interventions aimed at reducing central adiposity, such as targeted exercise programmes and dietary modifications, may prove beneficial in alleviating menstrual pain symptoms and improving the overall quality of life for affected individuals.

Regular monitoring of the hip–waist ratio could also serve as a preventive strategy for identifying women at risk of severe dysmenorrhoea, allowing for early intervention and personalised management strategies.[4, 11]

Limitations and Future Research

Despite the significant findings, this study has several limitations. The sample size was relatively small, and participants were recruited from a limited geographic area, potentially affecting the generalisability of the results. Self-reported data on lifestyle factors may also introduce bias.

Future research should aim to include larger, more diverse populations to validate these findings. Longitudinal studies could help establish causal relationships between hip–waist ratio and primary dysmenorrhoea. Furthermore, exploring the molecular mechanisms linking adipose tissue distribution to menstrual pain could provide deeper insights into potential therapeutic targets.

Conclusion

In conclusion, this observational study provides compelling evidence of a significant association between hip–waist ratio and primary dysmenorrhoea severity in non-obese women. By exploring the role of body composition in menstrual health, this study contributes to a deeper understanding of the factors influencing dysmenorrhoea. Future research should further investigate the underlying mechanisms linking adipose tissue distribution to menstrual pain and explore targeted interventions tailored to individual body compositions.

Acknowledgement: We are deeply indebted to the study subjects and the staff of the institute for helping us in the study.

Conflict of Interest: None

Source of Funding: None

Ethical Approval: Approved by the Departmental Ethical Committee (VISTAS)

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ISSN: 2455-9199
DOI: https://doi.org/10.24321/2455.9199.202406