Association Between Dysmenorrhea and Body Mass Index among Adolescent Girls in Dorayi Karama Secondary School, Kano, Kano State, Nigeria

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ABSTRACT

Background: Dysmenorrhea has long been tolerated by females of reproductive age as a necessary catastrophe to tolerate and live with. Majority of the females either stem the tide of the pains by coping with it or using remedies suggested by family and friends as well as physicians**. Aim of the Study:** This study aimed to find the relationship between dysmenorrhea and body mass index among adolescent girls in Dorayi Karama Secondary School of Kano state, Nigeria. **Methodology:** The study was cross-sectional type conducted among 405 adolescent girls. Statistical analysis was carried out using IBM SPSS version 25. Logistic regression was used to find the association between dysmenorrhea and body mass index. The height was measured in centimeter (cm) using standard protocol. The body weight of the participants were measured using a weight balance in kilograms by asking the participants to stand with their feet together on the flat panel provided on the weight scale without heavy garments and shoes. The heights, weights and menstrual history details of the participants were recorded on a proforma. **Results:** The results showed a high prevalence of dysmenorrhea among the study participants and a menarchial age of 13.24 ± 1.16 years were some of the key findings of the current study. In addition, the role of menarchial age, family history of dysmenorrhea, waist circumference and/or waist-hip ratio were identified as central predictors for the development of dysmenorrhea. There was no significant association between body mass index and dysmenorrhea. **Conclusion:** In conclusion, the study established no relationship between dysmenorrhea with body mass index among the adolescent girls of Dorayi Karama Secondary school of Kano state.

Keywords: Dysmenorrhea**,** BMI, Adolescent, Girls in Dorayi-Karama, Secondary

INTRODUCTION

Dysmenorrhea is one of the commonest menstrual problems reported (Priya *et al.*2017). The word dysmenorrhea is derived from the Greek words, dys- meaning difficult, meno- meaning month and rrhea -meaning flow respectively. Thus referring to the cyclical lower abdominal or pelvic pain which may radiate to the back or thighs that may occur during menstruation (Chauhan & Kala, 2012). The pain usually begins a few hours before or immediately after the commencement of menstruation and may continue for 12 to 72 hours; it may be associated with absenteeism from social functions including schooling, nausea, vomiting, and diarrhea (Jafarnejad *et al*., 2016). It usually commences about 6-12 months after the first menstruation and subsides after the first delivery (Jonathan & Novak, 2007; Chauhan & Kala, 2012). Early onset of menarche, young age at menarche, family history of dysmenorrhea, smoking, stress, heavy exercise, shift-duty work, numerous natural births and early-age marriage have been associated with dysmenorrhea (Nag & Kodali 2013; Ahmad, 2005). The actual cause and pathophysiology of dysmenorrhea are not completely known. Nevertheless, the theory of uterine contractions is the most elaborate theory that explained the biology behind dysmenorrhea in relation to increased production as well as unbalanced production of prostaglandin from the endometrium during menstruation (Dawood, 2006). The reduction in the amount of progesterone at the end of the luteal phase increases prostaglandins secretions and this prostaglandin increases uterine contractions in a dysrhythmic pattern. The pattern is characterized by an increase in the basal tone of the uterus, and an increase in the active pressure in the uterus with associated reduction in uterine blood supply and exquisite pain (Behmanesh *et al*., 2016).

Primary dysmenorrhea is one of the most common gynecological disorders, manifested by painful cramps in the lower abdomen during menstruation without any pelvic lesions (Zhang *et al*., 2019). It is the most prevalent menstrual problem that affect young women's daily activities and quality of life including school absenteeism among young women (Harel., 2006; Ju *et al*., 2014). Primary dysmenorrhea is majorly the result of the activity of prostaglandin F2 alpha, a potent myometrial stimulant, and vasoconstrictor released by endometrial cells. There seems to be an association between dysmenorrhea and prolong uterine contractions and reduced blood flow to the myometrium (Durain, 2004). High serum vasopressin, nitric oxide, and interleukin-6 levels have been associated with dysmenorrhea (Shilpa., 2011). Additionally various studies have shown that age, pregnancy history, family history, oral contraceptive use, smoking, stress, exercise, family history, diet and body mass index (BMI) can affect primary dysmenorrhea (Eittah., 2014; Salmanian *et al*., 2014). Consequently, the aetiology of dysmenorrhea can be divided into external and internal factors. External factors such as caffeine and alcohol consumption, smoking, stress, socioeconomic status, and ethnicity. While the internal factors are disorders of hormonal imbalance such as thyroid problems and polycystic ovarian syndrome (Ganesh *et al* 2015).

The relationship between body mass index (BMI) and primary dysmenorrhea remains inconclusive (Rafique & Al-Sheikh, 2018). A study examining the influence of BMI and daily activities on primary dysmenorrhea in adolescents reported a significant effect of BMI on dysmenorrhic symptoms. Specifically, both underweight and obese adolescents exhibited higher pain intensity and lower pain thresholds compared to their normal-weight and overweight peers. Similar findings have been documented in other studies, which indicated that extremes of BMI, whether underweight or obese, are associated with greater severity of primary dysmenorrhea among

adolescent girls (Kaur et al., 2017; Rafique & Al-Sheikh, 2018). Additionally, increases in body weight and BMI have been linked to heightened dysmenorrheic severity (Snehalata et al., 2016). A U-shaped relationship between BMI and dysmenorrhea has also been reported, supporting the association between BMI extremes and the prevalence of dysmenorrhea (Hong et al., 2015).

Contrastingly, a recent study did not replicate these associations, revealing that females with normal BMI experienced higher frequency and severity of dysmenorrhea compared to other weight categories, suggesting that previously reported associations between BMI and dysmenorrhea may not be universally applicable (Soheir et al., 2020).

The impact of dysmenorrhea extends beyond physical discomfort, affecting academic performance and daily functioning. Research indicates that approximately 60.4% of females with dysmenorrhea experience disruptions in educational activities, including class absenteeism, decreased concentration, poor focus during examinations, and difficulties completing homework (Gebeyehu et al., 2017). Similarly, more than two-thirds of respondents reported social withdrawal, while over half (51.4%) noted a decline in academic performance during menstruation. Restrictions in routine daily activities were reported by 40.9% of participants, and 31.1% experienced class absenteeism due to dysmenorrhea. Furthermore, 43.4%–54.5% of participants reported reduced concentration on academic tasks during menstruation (Gebeyehu et al., 2017; Rafique & Al-Sheikh, 2018).

Overall, BMI appears to influence the severity of primary dysmenorrhea, with underweight and obese adolescents being more severely affected than their normal-weight and overweight counterparts. While daily activities are generally unaffected, school absenteeism and limitations in social engagement were more pronounced among underweight and obese individuals.

MATERIALS AND METHODS

Materials

The following instruments and materials were used for data collection: a stadiometer (Seca, ZT 769, USA), a weighing scale (Seca, ZT 769, USA), and a structured proforma for recording anthropometric and demographic data.

Ethical Considerations

Ethical approval was obtained prior to the commencement of the study. Informed consent was provided by the principal of the selected school on behalf of the students. Additionally, verbal consent was obtained from each participant after explaining the aims and objectives of the study.

Sample Size Determination

The minimum sample size for the study was calculated using the Cochran (1977) formula:

$$n = Z^2pq/d^2 = \frac{(1.96)^2(0.5)(1-0.5)}{(0.05)} = 384$$

Where:

- (n) = minimum sample size required
- (Z) = standard normal deviate at 95% confidence level (1.96)
- (p) = estimated variance in the population (50%)
- (q) = 1 − (p)
- (d) = margin of error (5%)

To increase precision, the sample size was rounded to 405 participants.

Study Location

The study was conducted in Kano metropolis, located in Northern Nigeria (latitude 12°N, longitude 9.4°E), the most populous state in the country with a population of approximately 9,383,682 (Ibrahim, 2016). The urban area covers 137 km² and comprises six local government areas: Kano Municipal, Fagge, Dala, Gwale, Tarauni, and Nassarawa. The study was carried out in a single government girls' secondary school within Kano metropolis.

Study Design

A cross-sectional study design was employed. Participants were selected using a simple random sampling technique.

Inclusion Criteria

Participants were included if they:

1. Provided consent to participate in the study
2. Were apparently free from memory or recall challenges
3. Resided within the study location
4. Were within the adolescent age range of 10–19 years

Exclusion Criteria

Participants were excluded if they:

1. Resided outside the study location
2. Were outside the reproductive age range
3. Refused consent
4. Experienced difficulty recalling past events

Anthropometric Measurements

Height Measurement

Participants were asked to stand upright in a Frankfort horizontal plane position with feet together. Height was measured to the nearest centimeter using a stadiometer, by lowering the headpiece onto the participant's head and recording the straight-line distance from the floor to the vertex of the head (Ozaltin et al., 2010).

Weight Measurement

Participants removed heavy outer garments and shoes. Weight was measured in kilograms using a calibrated weighing scale, with participants standing with feet together on the flat panel of the scale (Ganesh et al., 2015), as shown in plate 1.



Plate I. Technique for height and weight measurements

Body Mass Index Determination

BMI was calculated using the standard formula:

BMI =Weight (kg)/Height (m^2)

Statistical Analysis

Data were expressed as mean ± standard deviation (SD). Statistical analyses were performed using SPSS software version 25 (IBM Corp., Armonk, NY, USA). Logistic regression was employed to determine associations between primary dysmenorrhea and BMI. A p-value of <0.05 was considered statistically significant.

Results

Anthropometric and Menstrual Characteristics

The quantitative anthropometric and menstrual characteristics of the participants are presented in Table 1. The mean age at menarche among the study population was 13.24 ± 1.16 years. The mean body weight was 40.94 ± 6.48 kilograms, while the mean height was 1.54 ± 0.06 meters. Correspondingly, the mean body mass index (BMI) was 17.37 ± 2.52 kg/m². These results indicate that the majority of participants fell within the underweight to normal BMI range based on standard adolescent BMI classifications.

Table 1: Descriptive statistics of the menarchial age and anthropometric parameters (n=405)

Variables	Mean±SD
Age (years)	15.68±1.14
Weight (kilogram)	40.94±6.48
Height (metres)	1.54±0.06
Body Mass Body (kg/m^2)	17.37±2.52
Menarchial age	13.24±1.16

n=Sample size,SD=Standard deviation

The mean menarchial age of 13.24±1.16 was one of the key findings of the current study which support and also contradicts the findings of other scholars.

Menstrual Pain Characteristics and Management

Table 2 summarizes the menstrual pain characteristics and the remedies employed by participants for dysmenorrhea. The most commonly reported pain symptom was pelvic pain, experienced by 226 participants. Pain at the onset of menses was reported by 271 participants, while 217

participants described the pain as severe and intolerable. Regarding management strategies, a substantial proportion of participants (228) reported using non-steroidal anti-inflammatory drugs (NSAIDs), massage therapy, and herbal remedies to alleviate dysmenorrhea pain. These findings highlight that dysmenorrhea is prevalent and often severe among adolescents, prompting the use of multiple self-management approaches.

Table 2: Menstrual history details and Remedies used for dysmenorrhea of the participants (N=405)

History	Measures	Freq.
Remedies used	NSAIDS, Massage, Herbal treatment	228
	Nothing, Lifestyle changes, Others	177
Site of Pain	Abdomen, Lumbar, Thigh	179
	Pelvic	226
Onset of Pain	At onset of menses, After wards	271
	Before menses	134
Pain During Menses	Mild, Tolerable, No pain	188
	Moderate tolerable, Severe intolerable	217

N; sample size, STD; standard deviation, Freq.; frequency

Association Between Anthropometric Parameters and Dysmenorrhea

The association between anthropometric variables and the occurrence of dysmenorrhea was evaluated using logistic regression analysis (Table3). The results indicated that BMI was not significantly associated with dysmenorrhea ($p = 0.09$). Similarly, neither body weight nor height showed a statistically significant association with dysmenorrhea symptoms ($p = 0.08$). These findings suggest that, within this cohort, variations in anthropometric measures do not appear to influence the prevalence or severity of primary dysmenorrhea.

Table 3: Association between anthropometric measures (height, weight, body mass index) with dysmenorrhea

Variables	B	S.E	Wald	Sig.	Exp (B)	95%C.I. for EXP (B)	
						Lower	Upper
Body Mass Index	0.845	0.49	2.96	0.09	2.33	0.89	6.09sssss
Weight (Kg)	-0.359	0.20	3.07	0.08	0.69	0.47	1.04
Height (m)	19.711	11.11	3.14	0.08	3.6E8	0.13	1.04E18
Constant	-32.97	17.2	3.66	0.06	0.00	1.01	

Hosmer lemeshow statistic P = 0.174, Omnibustest P = 0.046; Kg = Kilogram; m = meters; cm = centimeter, S. E; standard error, B =Regression coefficient

From the logistic regression results in table 3, body mass index (p=0.09), height (0.08) and weight (0.08) were not significantly associated with severity of dysmenorrhea

DISCUSSION

A high prevalence of dysmenorrhea among the study participants and a menarchial age of 13.24± 1.16 years were some of the key findings of the current study. In addition, the role of menarchial age, family history of dysmenorrhea, waist circumference and/or waist-hip ratio were identified as central predictors for the development of dysmenorrhea. Dysmennorhea is one of the commonest menstrual problems reported (Priya *et al*.,2017). Its prevalence in various studies in Iran had been reported to be between 74% - 90% (Aksoy *et al*.,2014).This was in keeping with the finding from the current study which revealed that 217 (53.6%) participants had severe dysmenorrhea while the remaining 46.4 % had mild dysmennorhea. Thus, the results from the current study suggested that the entire study population had some form of dysmennorhea which can be ranked based on severity. The mean menarchial age of the adolescent girls in the current study at Dorayi Karama Secondary School was 13.24 ± 1.16 years. This was similar to reports of menarchial age of 13.1 ± 0.08 years in an earlier retrospective study among 600 adolescent girls from three different Nigerian tribes of Igbo, Yoruba and Hausa (Otobo *et al*.,2018). A mean menarchial age of 13.14 ± 1.173 years was also reported in another literature study for the relationship between body mass index and menstrual irregularities (Thapa & Shrestha, 2015).Younger menarchial age had been reported in other literature reports such as; 12.52 ± 1.20 years (which is similar to the result from a Rajasthan province study) in a study among adolescent girls of the urban slum dwellers of West Bengal (Kanna *et al*., 2005; Samanta *et al.*, 2019). The current study revealed that there was no association between body mass index with dysmenorrhea, this is in line with many studies done by different researchers.

There are studies that suggested that there was no association between age at menarche or BMI with primary dysmenorrhea in female students (Khodakarami *et al*., 2015; Akbarzadeh *et al*., 2017). In contrast, a different literature report had identified a significant relationship between BMI and dysmenorrhea (Chauhan *et al*., 2012).The biological basis for the relationship between BMI and dysmenorrhea may be linked to the inverse association between BMI and the total level of oestrogen alone or in equilibrium with the progesterone (Zahradnik & Breckwoldt,1984; Montero *et al*., 1996). In addition, the role of fat tissue adipokines may also directly impact on ovarian function via disturbing the hypothalamus-pituitary ovarian axis (HPA axis) with associated menstrual dysfunction. Thus, the aforementioned effects of BMI on menstruation may provide an explanation for menstrual disturbances among persons with extremes of BMI which can manifest as dysmenorrhea (Latthe *et al*., 2006).

A number of literature assessment revealed a significant correlation between body mass index (BMI) and menarchial age, which was an inverse relationship; thus, the higher the BMI, the lower the menarchial age (Zhu *et al*., 2010; Pejhan *et al*., 2011). Other reports suggested a relationship between height and menarchial age; taller girls have their menarche earlier than shorter ones (Wellence *et al*., 1992; Kaplowitz,2006; Khakbazan *et al*., 2005; Kim *et al*., 2005; Goon *et al*., 2010).Thus, these literature reports regarding the association of BMI or height with menarchial age were in keeping with the earlier scientific hypothesis that female menarche can only be achieved if a certain threshold of size was attained by the female (Frisch,1990; Pour Aram *et al*., 2023).

Conclusion: The mean menarchial age of the adolescent girls in Dorayi Karama Secondary School was 13.24 ± 1.16 years. The current study showed that dysmenorrhea pain was not associated with BMI.

Recommendations

i. Detailed whole genome sequencing should be embarked upon to identify the genetic factors associated with dysmenorrhea.

ii. Future studies on dysmenorrhea should ask patients regarding the severity of the pain and thus incorporate same information in analysis.

iii. Additional studies should be carried out in other geographical areas to ascertain the role of environment in dysmenorrhea.

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Author's Contributions

1. U.M.M[1] (Research conception, design, data collection, analysis, and interpretation of results)
2. I.M.D[2] (Data collection and revising manuscript)
3. I.M.B[3] (Revising manuscript and data analysis)
4. I.R.F[3] (Revising manuscript and corrections)