

BIOLOGICAL PREDICTOR OF EATING DIFFICULTIES: ROLE OF BODY WEIGHT AND MENARCHE AGE IN WOMEN WITH IRREGULAR MENSTRUAL CYCLES

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Abstract

The objective of this study was to investigate whether or not the potential predictors of body weight (kg) and age at the onset of menarche (years) may help identify women who experience difficulties eating in women with irregular cycles. The researcher conducted cross-sectional research using a snowball sampling method to recruit 200 adult females (aged 19) who had irregular menstrual cycles (i.e., fewer than 12 or greater than 12 cycles per year; less than 21 days apart or greater than 35 days apart) residing in Gujrat, Lala Musa, and Kharian. Women who had any type of mental illness, any other health problems, or hormonal imbalances due to causes other than the irregularity of their menstrual cycles were excluded. To measure the degree of difficulty eating, respondents completed the Eating Disorder Examination-Questionnaire (EDE-Q). A Demographics Form was utilized to

collect data such as body weight and age at the onset of menarche. Data were analyzed using SPSS (Version 21.0) by way of descriptive statistics and through multiple regression analyses. Based on the findings from the multiple regression analysis, $F(2, 197) = 23.49$ $p < .001$, body weight and age at onset of menarche were the only two significant predictors of problems experienced while eating, explaining 19.3% of variance in problems experienced while eating. Based on the beta, body weight was found to be the most powerful predictor of problems caused by excessive weight, with a $B = 1.18$ and $\beta = .386$ ($p < .001$). That is, body weight was strongly correlated with a person's chance of developing problems related to eating as body weight increases. Conversely, age at the onset of

menarche was negatively correlated with a woman's likelihood of experiencing eating problems. A women with early age at menarche was more likely to have a higher number of problems related to eating behavior than an late onset. Age at menarche has a B of -4.80 and a beta of -.209, $p = .001$. Results showed that Body Weight and Age at Menarche were both predictors of eating difficulties among women who had irregular menstrual cycles. Therefore, these two variables should be included in the evaluation and treatment of eating issues related to this demographic group.

INTRODUCTION

Overview of Biological Predictors of Eating Difficulties in Women

Eating Disorders (EDs) behaviors represents one of the world's largest public health crises with high prevalence rates for being chronic, co-morbid, and deadly (Arcelus et al. 2011). Furthermore, females have a higher lifetime prevalence of AN, BN, BED than males indicating a large male-to-female disparity in the likelihood of developing these disorders (Smink et al., 2012). This difference in the lifetime prevalence of Eating Disorders suggests that understanding the biological vulnerabilities in the female population is essential to our understanding of this phenomenon and the biological unique to females (Culbert & Klump, 2021).

Biological Vulnerabilities related to the female Population

The cyclical patterns of female reproductive hormones, the fluctuation of energy expenditure with time as well as many years of developmental changes (i.e., puberty and onset of menses) create a unique metabolic and psychological environment where females are at increased risk of developing Edis and Disordered Eating's (Hackney, 2021).

Menstrual Irregularities and Eating Behavior

Variations in Hormones affect the tools to Manage Appetites.

A woman's menstrual cycle is a product of the hormone production of the ovaries. The hormone Estrogen (which is produced mainly in the follicular phase of the cycle) decreases appetite and helps maintain fullness after eating. This has been found in women and animal studies (Asarian & Geary, 2013). Progesterone is a hormone released from the ovaries in the luteal phase of the menstrual cycle. Women experience a greater appetite and less fullness following meals during this time than they do during the follicular phase of their menstrual cycles (Alonso-Alonso et al., 2011). When women experience Irregular Menstrual Cycles (IMC), they are unable to properly regulate the hormone fluctuations that occur during their menstrual cycle. As a result, IMC can lead to an imbalance in how women use energy and how much they eat (Attia et al., 2023).

The Psychological and Physiological Impacts of Irregular Menstrual Cycles

Irregular menstrual cycles indicate significant hormonal imbalances, which may be caused by conditions such as Functional Hypothalamic Amenorrhea (FHA) and Polycystic Ovary Syndrome (PCOS). Both conditions result in underlying issues with metabolism, including insulin sensitivity in PCOS, and inadequate caloric intake in FHA. Additionally, IMC is often associated with

psychological problems, including the potential for developing a negative body image (Lee, 2006). The metabolic and psychological problems associated with IMC can each increase the risk of developing and/or maintaining disordered eating patterns (Yu & Muehleman, 2023).

Body Weight as a Biological Predictor

How do hormones influence metabolism?

Metabolic hormones, such as insulin, ghrelin and leptin, are related to a person's body weight and the way they maintain their body weight. The relationship between these hormones, their actions and the way humans gain weight, and lose weight is very clear. Leptin is produced from fat cells and indicates how much fat is stored in the body. Leptin is often very low in people who are in an active anorexia nervosa (Klok et al., 2007).

Leptin resistance is the reason why obese people experience this metabolic dysfunction (Friedman). Body weight and metabolic health are linked through insulin. Insulin has an important role to play in sugar metabolism. In a majority of the population, insulin resistance is associated with the pathology of binge-eating disorder (BED) and obesity (Obradovic et al., 2021). The hormone ghrelin is referred to as the "hunger hormone". Elevated ghrelin levels are typically seen in calorie-deficient states. The pattern of ghrelin suppression and secretion found in individuals who have eating disorders is variable; however, it is not restricted to recurrent (disordered) eating. The link between body weight and disordered eating, as measured by BMI, has a strong relationship with biological mechanisms for regulating body fat (very low BMI = anorexia nervosa; very high BMI = binge-eating disorder and subclinical disordered eating behaviors) (Fairburn & Harrison, 2003). The stress on the body's metabolism due to a person's significant deviation from a physiological weight set-point is one of the many factors leading to the maintenance of eating disorder behaviors.

Interaction between body weight and irregular menstrual cycle

There is a very tight relationship between BMI of <19 and FHA (a form of IMC) (Golden et al., 2002) as well as BMI of >29 and obesity will often be characteristics or contributing factors to IMC in women with PCOS (Lim et al., 2019). The Age at first menstrual period (also known as Menarche) can also predict biological outcome for post menarcheal process because it is often linked to metabolic and hormonal activity that occurred during childhood and developmental periods. In addition, it is believed that menarche (used as an indicator to predict early or late onset of menstruation) provides the needed reflection of the history of metabolic (nutritional and hormonal) status of females prior to menarcheal development. An early menarche typically occurs around 11 years and is frequently linked to (higher childhood obesity rates and) an increased lifetime estrogen exposure, both of which have demonstrated an increased metabolic risk trajectory in females after early menarche (Biro et al., 2012). Alternatively, a late menarche (generally occurring at around 15 years) can often indicate delayed growth and/or chronic under-nutrition during growth and development (Soliman et al., 2022). Research studies have shown a positive association between menarcheal timing at early menarche and later eating difficulties. A study found that there was a strong positive correlation between early menarche and the increased risk of being dissatisfied with

your body, experiencing increased psychological distress, and developing BN and/or BED after early menarche. Early menarche and the increased body image issues, high levels of psychological stress, etc as a result of being “early” on the growth/metabolic maturity spectrum is a likely mediating factor through which the association exists (Graber, 2004). .

Similarly, the association between early menarche and risk for developing a subsequent atypical cycle of irregular menstruation (IMC) is also present through the use of early menarche as a predictor of future reproductive dysfunctions. Early menarche increases the likelihood of developing atypical menstruation patterns associated with future reproductive dysfunctions higher metabolic baseline (Graber, 2004).

Menarche Age (Atypical Menarche) Is Related To Irregular Menstrual Cycles

A typical Menarche has been found to be predictive of subsequent Reproductive Dysfunction. Approximately 20% of PCOS women will experience an Irregular Menstrual Cycle due to having an early Menarche (Guarnotta et al., 2021), and Late Menarche is a common characteristic of those women who will develop Irregular Menstrual Cycles due to FHA (Guarnotta et al., 2021).

Weight and Menarche Timing Combined Influence an Irregular Cycle

Body weight, age at menarche, and current menstrual cycle status all share biological pathways through the Hypothalamic-Pituitary-Gonadal (HPG) and Hypothalamic-Pituitary-Adrenal (HPA) axes. Stresses on and dysregulation of the HPG and HPA axes lead to a state of profound biological instability (Mbiydenyuy & Qulu, 2024).

Increased Susceptibility to Eating Disturbance

With the synergistic risk hypothesis in mind, it is theorized that a subset of women with IMCs who also have atypical menarche history and abnormal body mass index (BMI) are the most biologically vulnerable to DE. One example is a woman with an IMC who has high BMI and early menarche. These women are subjected to additional metabolic stress due to insulin resistance and chronic reproductive dysfunction, making them very prone to binge-eating pathology (Krug & Paganini, 2019).

Summary of Empirical Evidence

Empirical evidence backs the independent role of each variable extensively (Arcelus et al., 2011; Culbert et al., 2015), however, the research specifically examining the three-way interaction of current BMI x Menarche timing x IMC on the full range of subclinical DE behaviours is very limited, with much of the current research concentrating primarily on either one or two of these variables or only looking at Clinically Diagnosed EDs (Wang et al., 2016).

Rationale for Current Study

The research currently available shows that studying the combined biological risk profile (Menarche Timing and BMI) will potentially provide evidence that the combined biological profile provides

more synergistic effects for DE than either Menarche Timing or BMI individually, particularly in a population that is biologically vulnerable.

● Importance for Women with Irregular Menstrual Cycle (IMC)

The narrowing of the population of female study participants with IMC will provide a unique group that is experiencing extreme endocrine/metabolic dysregulation and therefore a population of high biological relevance for studying biological risk. IMC will also serve as a distinct, measurable, and objective indicator of biological stress.

● Contributing to an Understanding of Eating Difficulties

This study will provide important data for a more refined description of the aetiology of ED. Specifically, the study will allow for a more systemic perspective on the approach to the Aetiology of ED by integrating Developmental History (menarche age), Current Metabolic Status (BMI), and Endocrine Function (IMC) into a model. In addition, the findings will allow for the development of biologically based and separately defined screening tools for identifying individuals early on, and thus inform treatment.

Objective of the Study

To explore the role of body weight and menarche age in predicting eating difficulties in women with irregular menstrual cycles

RESEARCH METHODOLOGY

Research Design

A cross-sectional research design was used in the study for data collection.

Participants

Adult women that were experiencing irregular menstruation was studied in the current research.

Inclusion criteria

- Only adult women that have age 19 or above were included
- Women with irregular menstruation were enrolled for the study
- Irregular menstruation was measured by counting at least below or above 12 cycles/year.

Exclusion criteria

- Adult women that accompany any mental disorder or health condition were excluded.
- Adolescent were also excluded.
- Further, women with any hormonal issues other than irregular menstrual cycle were excluded.

Sampling technique

Participants were selected by employing a snowball non-probability sampling method. Adult women from Gujrat, Lala Musa, and Kharian were asked to fill out a Google Form. The target members who had experience 12 or fewer menstrual cycles/year and were over the age of 19. Further, women experience menstrual cycle less than 21 or more than 35 day.

Measures**Demographics Form**

The demographic form collected information about the women's age, education, marital status, family structure, job status, children have, weight (kg), residence type, menstrual cycles in one year, menarche age, time since married, and social-economic status.

Eating Disorder Examination- Questionnaire (EDE-Q)

The Eating Disorder Examination-Questionnaire (Fairburn & Beglin, 2008) was used to weigh-out the eating difficulties. The EDE-Q is a 28-statement self-reported scale available for public use and has been translated into Urdu. It establishes concurrent validity with (Mond, et al., 2004) with 4 sub-scales of restriction, weight, shape and eating concern. The response options consist of 4 point Likert scale. Test-retest reliability for the EDE-Q score globally is between 0.66 and 0.83 for its sub scales (Calugi, et al, 2015).

Procedure

The research sample was found through a non-probability snowball sampling technique which included adult women participants from various cities. 200 women were selected based on irregular menstrual cycles (having less than 12 cycles/year or more than 12 cycles/year and cycle length less than 21 or more than 35 days) statistics. All respondents were provided with information related to aims, methodology, and research importance before getting consent. Instructions were given to respondents to answer statements carefully and attentively prior to submission.

Data Analysis

The Statistical Package for the Social Sciences (SPSS, V 21.0) was used to compute the descriptive frequency and regression.

RESULT

The statistical analysis on the predictive relationship between body weight and menarche age on eating difficulties in women with irregular menstrual cycles is presented in this section.

Demographic results of women indicated that majority were single, aged 20 - 24 years, completed high school and Master degree, unemployed, lived in urban areas, belong to Joint family systems, have weight in range of 41 - 50, report having 10 - 14 menstrual cycles each year and belong to middle socio-economic background. Further, majority have menstruated between the ages of 13 to 15.

Table 1 Multiple Regression Analysis Predicting Eating Problems from Body Weight and Age at Menarche (N = 200)

Predictor	B	SE B	β	t	P
Constant	56.45	24.24	—	2.33	.021
Weight (kg)	1.18	0.19	.386	6.04	.000
Age at Menarche	-4.80	1.47	-.209	-3.27	.001

Note: $R = .439$, $R^2 = .193$, Adjusted $R^2 = .184$, $F(2, 197) = 23.49$, $p < .001$

The current study check the role of predictive power of body weight and age at menarche in the development of eating difficulties in women with irregular menstrual cycles. The results revealed through a multiple regression analysis. The analysis ($F(2, 197) = 23.49$, $p < .001$) supports that the body weight and age at menarche significantly predicted the eating difficulties. It was confirmed from the results that the model counted for 19.3% of the variance that is $R^2 = .193$, it means that change eating problems due to body weight and age at menarche. If observe individually, body weight was considered as a positive strong predictor ($B = 1.18$, $\beta = .386$, $p < .001$). The higher the body weight, the more likely that individual would have an increased risk of developing eating problems. Conversely, age at menarche was identified as a significant negative predictor; that is, women who had an earlier onset of menarche (lower age of onset) had more eating problems ($B = -4.80$, $\beta = -.209$, $p = .001$) than women with later ages at menarche.

DISCUSSION

The study examines the relationship between health literacy, eating disorders and adaptations in adult women who do not have regular menstrual cycles. Using snowball sampling, a total of 200 adult women participated in this study. Results were derived using regression analysis. The analysis of regression indicated that both body weight and age at the onset of menstruation were valuable predictors of difficulties in eating behaviours among this population of adult women with irregular menstrual cycles. In addition to these results, the demographic characteristics of the sample should provide additional context with which to interpret the findings. The majority of participants in this sample were young, single women between the ages of 20 and 24, indicating that the findings may reflect risk factors associated with this developmental stage, which is associated with the emergence or continuation of disordered eating behaviour (Smink et al., 2012). Most of the participants reported an average of 10 to 14 menstruation cycles per year, which supports the use of participants who have been identified as having irregular menstrual cycles (IMC) as a central component of the inclusion criteria, indicating that they are likely experiencing some level of underlying endocrine/metabolic stress (Lee, 2006). The typical range for age at onset of menarche within the sample (13-15 years) falls within the normative range, making deviations from this range of particular relevance to the other primary outcomes of the study. Body weight and age at menarche were examined using multiple regression analysis to determine their combined ability to predict eating difficulties. The results were statistically significant ($F(2, 197) = 23.49$, $p < .001$) and show that body weight and age at menarche account for a large part of the variance in eating difficulties together

(see Table 1), in that they only accounted for 19.3% of the variance in eating problems. Thus, more than 80% of the variance remains unexplained by body weight and age at menarche alone (highly suggestive of the significant roles of other biological factors, psychological factors, social influences, and genetics) while their contributions are substantial and important from a clinical perspective (Fairburn & Harrison, 2003). Body weight (kg) was a significant positive predictor of eating difficulties ($\beta = .386$, $p < .001$). As noted above, the positive β ($B = 1.18$) suggests that as an individual's body weight increases, the odds of having nearly any severity of eating problem increases, providing support for the research linking increased weight and adiposity (increased body fat), with increased rates of certain disordered eating, including Binge Eating Disorder (BED) or repeated subclinical binge-eating episodes, conditions frequently observed with other conditions related to IMC or Polycystic Ovary Syndrome (PCOS) (Lim et al., 2019). In this analysis, weight has the highest individual predictive ability within the model's structure (largest β value) and demonstrates that current metabolic status is the most essential factor determining an individual's risk of developing eating disorders. The sample used in this investigation may contain a disproportionate number of participants with BMIs on the low end of the normal range (Krug & Paganini, 2019). Menarche age is a significant ($p = .001$) negative predictor of eating disorder symptoms ($\beta = -.209$) with a negative β coefficient ($B = -4.80$), therefore indicating that earlier menarche ages correspond to higher eating disorder symptom scores. The negative relationship between eating disorder symptoms and age at menarche corresponds with several epidemiological studies (Combs et al., 2011), suggesting that earlier menarche represents an 'important' developmental risk factor. Furthermore, researchers have suggested that early menarche is associated with greater body dissatisfaction, increased psychological distress and more lifetime exposure to hormonal influences that may disrupt body image and emotional regulation, increasing the susceptibility of individuals to develop eating disorders (Graber, 2004; Melisse et al., 2025).

Conclusion

The relationship between a woman's weight and her age at the onset of menstruation influences her potential for eating-related disorders. Studies show that heavier women and those who begin menstruating early develop greater difficulties with food intake/consumption. This indicates the impact of biological variables on the development of eating-related problems in females who suffer from menstrual irregularities.

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