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Comparative Analysis of Depression, Anxiety and Stress across Menstrual Cycle Phases among Young Adult Females

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Abstract

The present study investigated differences in depression, anxiety, and stress across the premenstrual, menstrual, and postmenstrual phases of the menstrual cycle among young adult females in Pakistan. A purposive sample of 25 young adult females (N = 25) aged 18 to 30 years was recruited from a university setting. The Depression Anxiety Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995) was administered at three time points corresponding to the premenstrual (days 21–28), menstrual (days 1–5), and postmenstrual (days 6–13) phases. Three one-way repeated measures analyses of variance (ANOVAs) were conducted. Results revealed that psychological symptom severity was consistently highest during the menstrual phase and lowest during the postmenstrual phase across all three constructs. Statistically significant phase differences were confirmed for depression, $F(2, 48) = 12.91$, $p < .001$; anxiety, $F(2, 48) = 9.61$, $p = .0003$; and stress, $F(2, 48) = 15.26$, $p < .001$. Findings are interpreted within a neurobiological framework emphasizing estrogen and progesterone modulation of serotonergic, GABAergic, and hypothalamic-pituitary-adrenal axis functioning. The study contributes original empirical evidence to Pakistani women's mental health research with implications for clinical assessment, university counselling, and public health policy.

Keywords: Menstrual Cycle Phases, Depression, Anxiety, Stress, Young Adult Females

Introduction

The present investigation is concerned with one of the most clinically significant yet frequently underexplored intersections in the field of health psychology and women's mental health: the relationship between the menstrual cycle and psychological functioning among young adult females. Specifically, this study undertakes a comparative analysis of depression, anxiety, and stress across three distinct phases of the menstrual cycle the premenstrual, menstrual, and postmenstrual phases among young adult females between the ages of 18 and 30 years. The menstrual cycle, far from being a purely reproductive phenomenon, constitutes a dynamic and recurring biological context that profoundly shapes the neurochemical, emotional, and psychological experiences of menstruating individuals across their reproductive years. Despite the growing recognition of this relationship within the international scientific community, systematic empirical investigation of menstrual cycle-related psychological distress remains comparatively limited within Pakistani and broader

South Asian contexts, rendering the present study both timely and necessary. The menstrual cycle is a complex, recurring physiological process central to the reproductive health of females, defined as a series of coordinated hormonal and anatomical changes occurring approximately every 21 to 35 days (Mihm et al., 2011). At the biological core of this process lies the hypothalamic-pituitary-ovarian (HPO) axis, a hierarchical endocrine system through which the hypothalamus, anterior pituitary, and ovaries communicate via precisely regulated hormonal feedback loops. The hypothalamus releases gonadotropin-releasing hormone (GnRH) in pulsatile bursts, stimulating the anterior pituitary to secrete follicle-stimulating hormone (FSH) and luteinizing hormone (LH), which in turn govern the production of estrogen and progesterone the two principal sex hormones orchestrating cyclical changes in the reproductive system and, critically, in the brain (Skorupskaite et al., 2014). Estrogen and progesterone receptors are abundantly expressed throughout limbic and cortical brain regions including the prefrontal cortex, hippocampus, and amygdala that are directly implicated in mood regulation, emotional processing, stress reactivity, and cognitive functioning, thereby establishing the neurobiological substrate through which menstrual cycle phases exert their psychological effects (Brinton et al., 2008). For the purposes of the present investigation, the menstrual cycle is examined across three clinically and psychologically meaningful phases. The premenstrual phase (late luteal phase, approximately days 21 to 28 of a standard 28-day cycle) is characterized by the precipitous withdrawal of both estrogen and progesterone following the demise of the corpus luteum in the absence of fertilization. This hormonal withdrawal particularly the sharp decline of estrogen and the collapse of allopregnanolone, a neuroactive progesterone metabolite with potent anxiolytic properties disrupts serotonergic and GABAergic neurotransmission, precipitating the mood disturbances, anxiety, irritability, and psychological distress that are characteristic of this phase (Rapkin & Akopians, 2012; Bäckström et al., 2014). The menstrual phase (approximately days 1 to 5) is defined by the shedding of the uterine endometrium and is characterized by the lowest circulating concentrations of both estrogen and progesterone across the entire cycle. During this phase, the neurochemical consequences of the hormonal nadir are compounded by the physiological stress of prostaglandin-mediated uterine cramping and systemic inflammation, creating a biological environment conducive to dysphoric mood, fatigue, and heightened psychological distress (Iacovides et al., 2015). The postmenstrual phase (early to mid-follicular phase, approximately days 6 to 13) follows the cessation of menstrual bleeding and is characterized by the progressive rise of oestradiol, which enhances serotonergic neurotransmission and restores neurochemical balance, reproducing a period of relative mood stability, reduced anxiety, and psychological well-being (Bethea et al., 2002).

Depression, anxiety, and stress the three dependent variables of the present study are among the most prevalent and debilitating psychological conditions affecting young adult females globally, and each is independently sensitive to the hormonal fluctuations described above. Depression is defined as a mood disorder characterized by persistent low mood, anhedonia, hopelessness, cognitive impairment, and functional deterioration (American Psychiatric Association, 2013). The monoamine deficiency hypothesis identifies serotonergic dysregulation as a central neurobiological mechanism in depression (Krishnan & Nestler, 2008), and given estrogen's well-documented role in enhancing serotonin synthesis and receptor sensitivity, the withdrawal of estrogen during the premenstrual and menstrual phases creates neurochemical conditions directly conducive to depressive symptomatology (Bethea et al., 2002). Anxiety, broadly defined as a future oriented state of excessive apprehension and physiological arousal disproportionate to actual threat (Barlow, 2002), is neurobiologically linked to GABAergic disinhibition precisely the condition produced by allopregnanolone withdrawal during the late luteal phase (Bäckström et al., 2014). Stress, conceptualized within the transactional framework of Lazarus and Folkman (1984) as the subjective experience of demands exceeding available coping resources, is physiologically

mediated through the hypothalamic-pituitary-adrenal (HPA) axis, whose reactivity demonstrates significant cycle-dependent variability, with cortisol stress responses substantially amplified during the premenstrual phase compared to the postmenstrual phase (Roca et al., 2003). The epidemiological burden of these three conditions among young adult females is substantial and well-documented. The World Health Organization (2021) estimates that depression affects approximately 280 million individuals globally, with females nearly twice as likely as males to receive a diagnosis a sex difference most pronounced during the reproductive years. Anxiety disorders affect an estimated 284 million individuals worldwide, with females consistently demonstrating approximately twice the prevalence rate of males, a disparity that emerges during adolescence and intensifies through young adulthood (Bandelow & Michaelis, 2015). Among university-attending young adult females, stress has been identified as a pervasive psychological concern, with academic demands, role transitions, interpersonal pressures, and sociocultural expectations converging to produce a stress burden of considerable clinical significance (Beiter et al., 2015). When these already elevated psychological vulnerabilities are superimposed upon the cyclical hormonal fluctuations of the menstrual cycle, the result is a pattern of recurrent, phase-dependent psychological distress that significantly impairs academic performance, interpersonal functioning, and overall quality of life among young adult females. The international empirical literature has generated substantial evidence supporting the relationship between menstrual cycle phases and psychological symptom variation. Romans et al. (2012), in a systematic review of 47 prospective studies, confirmed that negative mood and psychological distress were significantly elevated during the premenstrual and menstrual phases and lowest during the postmenstrual phase at the group level, though notable inter-individual variability was observed. Direkvand-Moghadam et al. (2014), in a meta-analysis encompassing over 10,000 participants across multiple countries, estimated the global prevalence of premenstrual syndrome at approximately 47.8%, with psychological symptoms including depression, anxiety, and irritability constituting the most distressing features. More recently, Schmalenberger et al. (2021) utilized ecological momentary assessment to document daily fluctuations in negative affect and anxiety across the menstrual cycle, confirming the premenstrual and menstrual phases as periods of heightened psychological vulnerability and the postmenstrual phase as a period of relative psychological restoration. Within the Pakistani context, Nisar et al. (2008) documented that 74% of female university students reported premenstrual psychological symptoms with significant functional consequences, while Qadir et al. (2015) confirmed clinically significant premenstrual psychological disturbance among Pakistani women, with depression and irritability among the most severely rated symptoms.

Despite this growing body of evidence, critical gaps persist in the existing literature that the present study is designed to address. The majority of prior investigations have focused predominantly on the premenstrual phase, neglecting systematic psychological comparisons across all three menstrual phases within the same sample (Romans et al., 2012). Studies simultaneously examining depression, anxiety, and stress as distinct but interrelated constructs across all three phases remain scarce (Carlini et al., 2021). Empirical research conducted specifically among young adult Pakistani females using validated psychometric instruments in a phase-comparative design is virtually absent from the literature. Furthermore, many prior studies have relied upon retrospective self-report or non-standardized assessment instruments, limiting the methodological rigor and comparability of existing findings (Direkvand-Moghadam et al., 2014). The present study addresses each of these gaps through a contemporaneous, phase-comparative design employing the Depression Anxiety Stress Scale-21 (DASS-21) a validated, standardized psychometric instrument capable of measuring depression, anxiety, and stress as theoretically distinct subscales (Lovibond & Lovibond, 1995) administered to a sample of young adult Pakistani females at each of the three menstrual cycle phases.

Rationale of the Study

The rationale of the present investigation is grounded in four converging lines of justification empirical, contextual, clinical, and methodological each of which independently and collectively establishes a compelling case for the necessity of this research.

First, the existing body of psychological and neuroendocrinological research has firmly established that hormonal fluctuations across the menstrual cycle exert measurable influences on mood, emotional regulation, and psychological vulnerability. Estrogen and progesterone modulate serotonergic, dopaminergic, and GABAergic neurotransmitter systems directly implicated in the regulation of depression, anxiety, and stress (Bethea et al., 2002; Bäckström et al., 2014). Despite this well-established neurobiological foundation, the majority of prior studies have examined psychological symptoms in relation to only one phase of the menstrual cycle most commonly the premenstrual phase while neglecting systematic, phase-comparative assessments spanning the full cycle (Romans et al., 2012). Furthermore, studies that have attempted multi-phase comparisons have frequently examined depression, anxiety, or stress in isolation, rather than as simultaneously occurring and interrelated psychological constructs (Direkvand-Moghadam et al., 2014). This fragmented empirical landscape renders the existing evidence base incomplete and limits the degree to which meaningful, integrated conclusions can be drawn about the cyclical psychological experience of young adult females. The present study is therefore empirically justified by the need to conduct a comprehensive, phase-comparative investigation that simultaneously assesses all three psychological constructs across all three menstrual cycle phases within a single, methodologically unified research design.

Second, beyond the empirical gaps present in the international literature, the present study is justified by the acute scarcity of menstrual cycle-related psychological research conducted within Pakistani and broader South Asian contexts. The overwhelming majority of studies examining the relationship between menstrual cycle phases and psychological outcomes have been conducted among Western populations, raising substantive concerns about the cross-cultural generalizability of their findings (Henrich et al., 2010). Cultural attitudes toward menstruation, levels of menstrual health literacy, patterns of psychological help-seeking, and the sociocultural stressors experienced by young adult females differ considerably between Western and South Asian settings, and these contextual factors are known to modulate both the experience and expression of menstrual cycle-related psychological distress (Sommer et al., 2016). Within Pakistan specifically, menstruation remains surrounded by social stigma, cultural taboo, and limited open discourse, resulting in inadequate psychological support structures for young females experiencing cycle-related mental health difficulties (Nisar et al., 2008). The absence of locally grounded, empirically rigorous data on this subject represents a critical gap that not only limits the scientific knowledge base but also impedes the development of contextually appropriate mental health interventions, educational programs, and healthcare policies tailored to the needs of Pakistani young adult females.

Third, the clinical justification for the present study rests upon the significant yet frequently unrecognized burden that menstrual cycle-related psychological distress imposes upon the daily functioning, academic performance, and overall quality of life of young adult females. Epidemiological evidence indicates that between 75% and 80% of menstruating individuals experience psychologically distressing symptoms across their menstrual cycle, with a substantial proportion reporting levels of depression, anxiety, and stress severe enough to interfere with routine functioning (Yonkers et al., 2008). Despite this prevalence, menstrual cycle-related psychological symptoms are routinely normalized, dismissed, or misattributed in both clinical and social contexts, resulting in delayed help-seeking, inadequate diagnosis, and suboptimal treatment (Rapkin & Akopians, 2012). Mental health professionals working with young adult female populations require an empirically grounded, phase-sensitive understanding of psychological symptom variability in order to conduct accurate assessments, formulate appropriate diagnoses, and design targeted interventions. By

generating precise, quantitative data on the differential severity of depression, anxiety, and stress across menstrual cycle phases, the present study provides clinically actionable evidence that can directly inform assessment practices, therapeutic planning, and psychoeducational initiatives within mental health and healthcare settings serving young adult females in Pakistan.

Fourth, the methodological justification for the present investigation arises from the significant limitations characterizing much of the prior research in this area. As identified through critical appraisal of the existing literature, prior studies have been constrained by reliance on retrospective self-report designs vulnerable to recall bias, use of non-standardized or single-construct assessment instruments, failure to assess all three menstrual cycle phases within the same sample, and the use of small, non-representative, and culturally homogeneous samples (Romans et al., 2012; Schmalenberger et al., 2021). The present study addresses each of these limitations through a contemporaneous assessment design, the use of the validated and psychometrically robust DASS-21 capable of simultaneously measuring depression, anxiety, and stress as distinct subscales (Lovibond & Lovibond, 1995), a full three-phase comparative design encompassing the premenstrual, menstrual, and postmenstrual phases, and a sample drawn from a Pakistani young adult female population whose psychological experiences remain underrepresented in the global mental health literature. Together, these methodological features position the present study as a rigorous, comprehensive, and contextually relevant contribution to the empirical literature on menstrual cycle psychology and women's mental health.

Literature Review

The literature review presented in this chapter provides a comprehensive and critically synthesized examination of the theoretical, neurobiological, and empirical foundations underpinning the present investigation. It encompasses a systematic review of scholarly work pertaining to the menstrual cycle and its hormonal mechanisms, the psychological constructs of depression, anxiety, and stress, the established relationships between menstrual cycle phases and psychological symptomatology, and the empirical evidence generated across international and regional research contexts. The chapter concludes with a critical appraisal of the existing literature and a clear delineation of the research gap that the present study is designed to address. The menstrual cycle constitutes one of the most fundamental and recurring biological processes in female reproductive physiology. It is formally defined as a cyclical series of hormonally coordinated changes occurring in the uterus, ovaries, and associated endocrine structures, repeating approximately every 21 to 35 days throughout the reproductive years (Berek, 2012). Initiated at menarche and continuing until menopause, the menstrual cycle spans several decades of a woman's life and exerts far-reaching influences not only on reproductive functioning but also on neurological activity, immunological responses, metabolic processes, and most pertinent to the present investigation psychological and emotional well-being (Skovlund et al., 2016). The biological regulation of the menstrual cycle is governed by the hypothalamic-pituitary ovarian (HPO) axis, a hierarchical endocrine system in which the hypothalamus releases gonadotropin-releasing hormone (GnRH) to stimulate the anterior pituitary's secretion of follicle-stimulating hormone (FSH) and luteinizing hormone (LH), which in turn govern ovarian production of estrogen and progesterone (Skorupskaite et al., 2014). These two principal sex hormones orchestrate the sequential progression of menstrual cycle phases through precisely regulated positive and negative feedback mechanisms, and their receptors are abundantly distributed throughout limbic and cortical brain regions including the prefrontal cortex, hippocampus, and amygdala that are directly implicated in mood regulation, stress reactivity, and cognitive functioning (Brinton et al., 2008). The menstrual cycle is clinically organized into three phases of primary relevance to the present investigation. The postmenstrual phase, corresponding to the early-to-mid follicular period (approximately days 6 to 13), is characterized by the

progressive rise of estradiol under FSH stimulation, producing a neurochemical environment conducive to mood stabilization, reduced anxiety, and psychological well-being through estrogen's enhancement of serotonergic neurotransmission (Bethea et al., 2002). The premenstrual phase (late luteal phase, approximately days 21 to 28) is characterized by the precipitous withdrawal of both estrogen and progesterone following corpus luteum demise, disrupting serotonergic and GABAergic neurotransmitter systems and producing the mood disturbances, anxiety, irritability, and psychological distress characteristic of this hormonally volatile period (Rapkin & Akopians, 2012; Bäckström et al., 2014). The menstrual phase (approximately days 1 to 5) is defined by the lowest circulating concentrations of both estrogen and progesterone across the entire cycle, with the psychological consequences of hormonal nadir further compounded by prostaglandin-mediated neuroinflammation, uterine cramping, and systemic physiological stress (Iacovides et al., 2015). Together, these three phases create a dynamic, cyclically recurring hormonal landscape that profoundly shapes psychological functioning across the reproductive years. Depression, the first dependent variable of the present study, is defined in the DSM-5 as a mood disorder characterized by persistent low mood, anhedonia, hopelessness, cognitive impairment, and significant functional deterioration, requiring the presence of five or more specified symptoms over a two-week period for formal diagnosis (American Psychiatric Association, 2013). As a neurobiological condition, depression is most comprehensively explained by the monoamine deficiency hypothesis, which implicates deficiencies in serotonin, norepinephrine, and dopamine as central pathophysiological mechanisms (Krishnan & Nestler, 2008). The cognitive theory developed by Beck et al. (1979) complements this neurobiological perspective by identifying maladaptive cognitive schemas organized around the cognitive triad of negative views of the self, the world, and the future as the primary psychological mechanisms maintaining depressive states. The biopsychosocial model of Engel (1977) further integrates biological vulnerabilities, maladaptive psychological patterns, and social stressors into a unified explanatory framework that is particularly appropriate for understanding depression among young adult females, whose psychological functioning is simultaneously shaped by hormonal biology, developmental challenges, and sociocultural pressures. Epidemiologically, the World Health Organization (2021) estimates that depression affects approximately 280 million individuals globally, with females nearly twice as likely as males to receive a diagnosis a sex difference most pronounced during the reproductive years and widely attributed to the interaction of hormonal, psychosocial, and cultural factors. Among university-attending young adult females, Beiter et al. (2015) documented depression as one of the most frequently endorsed psychological concerns, with female students demonstrating significantly higher depressive symptom scores than their male counterparts. Research has further demonstrated that depressive symptoms among young adult females are not static but exhibit cyclical fluctuations corresponding to hormonal changes across the menstrual cycle, with Hartlage et al. (2012) documenting significant premenstrual exacerbation of depressive symptoms and Rubinow and Schmidt (2006) demonstrating that the neuroendocrine changes of the late luteal phase create neurochemical conditions directly conducive to depressive mood states even in previously asymptomatic individuals. Anxiety, the second dependent variable, is broadly defined as a future-oriented emotional state characterized by excessive apprehension, uncontrollable worry, and physiological arousal disproportionate to actual environmental threat (Barlow, 2002). The DSM-5 classifies anxiety disorders as the most prevalent category of mental health conditions, encompassing Generalized Anxiety Disorder, Panic Disorder, Social Anxiety Disorder, and related conditions, all characterized by persistent, functionally impairing fear or anxiety (American Psychiatric Association, 2013). A theoretically important distinction relevant to the present study is that between state anxiety a transient, situationally determined emotional response and trait anxiety a stable individual disposition to perceive situations as threatening and respond with heightened anxious arousal (Spielberger, 1972). The neurobiological

perspective on anxiety emphasizes the role of the amygdala in fear processing and the GABAergic system in anxiety regulation, with dysregulation of GABA-A receptor functioning produced by allopregnanolone withdrawal during the premenstrual phase directly implicated in cycle-related anxiety elevation (Bäckström et al., 2014; LeDoux, 2000). The cognitive model of Clark and Beck (2010) further identifies threat overestimation, vulnerability appraisals, and attentional biases toward threatening information as the primary cognitive mechanisms maintaining anxiety, while the learning theory perspective of Mowrer (1960) explains anxiety acquisition and maintenance through classical conditioning and negative reinforcement. Globally, anxiety disorders affect an estimated 284 million individuals, with females consistently demonstrating approximately twice the prevalence rate of males a disparity emerging during adolescence and intensifying through young adulthood (Bandelow & Michaelis, 2015; McLean et al., 2011). Altemus et al. (2014) demonstrated that women exhibit heightened anxiety sensitivity and greater physiological stress reactivity during the late luteal phase, while Nillni et al. (2011) confirmed that anxiety sensitivity was significantly elevated during the premenstrual phase indicating that both neurobiological and cognitive mechanisms interact to amplify anxiety during hormonally vulnerable cycle phases. Sylvén et al. (2013) further confirmed prospectively that anxiety symptoms were significantly more severe during the premenstrual phase and lowest during the postmenstrual phase, a pattern consistent with the neurobiological framework of GABAergic disinhibition following allopregnanolone withdrawal. Stress, the third dependent variable, is most comprehensively conceptualized within the transactional model of Lazarus and Folkman (1984), which defines stress as a dynamic process arising when environmental demands are appraised as exceeding available coping resources through a two-stage cognitive appraisal process involving primary evaluation of threat and secondary evaluation of coping capacity. Selye's (1956) General Adaptation Syndrome provided an earlier foundational biological model, describing the nonspecific physiological stress response unfolding across alarm, resistance, and exhaustion stages, while McEwen's (2007) allostatic load model extended this framework by documenting the cumulative neurobiological costs of chronic or repeated stress activation including hippocampal atrophy, amygdala hyperreactivity, and prefrontal cortical dysfunction. Hobfoll's (1989) conservation of resources theory further contributes to the understanding of stress among young adult females by proposing that stress arises from actual or threatened loss of valued personal resources, a framework particularly relevant to university students navigating academic, social, and psychological resource depletion. Neurobiologically, stress is mediated through the HPA axis and the release of cortisol, whose reactivity demonstrates significant cycle-dependent variability with cortisol stress responses substantially amplified during the premenstrual phase compared to the postmenstrual phase (Roca et al., 2003; Tsigos & Chrousos, 2002). Cohen and Janicki-Deverts (2012) documented the young adults aged 18 to 33 reported the highest stress levels of any age group, with females consistently reporting greater stress severity than males, while Beiter et al. (2015) identified academic demands, role transitions, and interpersonal pressures as major stress contributors among university-attending young adult females. Lustyk et al. (2010) demonstrated that women with premenstrual syndrome reported significantly higher perceived stress during the late luteal phase, associated with HPA axis hyperreactivity and more pronounced psychological symptomatology findings that establish stress as a psycho-biologically meaningful variable whose cyclical variation across menstrual phases warrants systematic empirical investigation.

The relationship between menstrual cycle phases and psychological symptomatology is neurobiologically grounded in the modulatory effects of estrogen and progesterone on the serotonergic, dopaminergic, GABAergic, and HPA axis systems that collectively regulate mood, anxiety, and stress. Estradiol enhances serotonin synthesis, inhibits its reuptake, upregulates postsynaptic receptor sensitivity, and facilitates dopaminergic reward signaling

producing mood-stabilizing and anxiolytic effects during phases of elevated estrogen activity (Bethea et al., 2002; Yoest et al., 2014). Allopregnanolone, the neuroactive metabolite of progesterone, ordinarily provides anxiolytic and mood-stabilizing effects through positive allosteric modulation of GABA-A receptors during the mid-luteal phase; however, its abrupt withdrawal during the late luteal phase creates a state of GABAergic disinhibition that manifests as heightened anxiety, emotional lability, and stress reactivity in susceptible individuals (Bäckström et al., 2014; Rapkin & Akopians, 2012). Estrogen further exerts inhibitory modulation of HPA axis reactivity, with its withdrawal during the premenstrual phase associated with amplified cortisol responses, prolonged stress recovery, and elevated subjective stress perception (Roca et al., 2003; Kajantie & Phillips, 2006). These interconnected neurobiological mechanisms collectively create a phase-specific psychological vulnerability profile in which the premenstrual and menstrual phases are characterized by elevated depression, anxiety, and stress, and the postmenstrual phase by relative neurochemical balance and psychological well-being. The international empirical literature provides robust and broadly convergent support for this neurobiological framework across diverse methodological designs and cultural contexts. Dennerstein et al. (1993), in a landmark cross-national study spanning seven countries, demonstrated that premenstrual psychological symptoms including depressed mood, tension, and anxiety were consistently reported across culturally diverse populations, affirming the biological universality of cycle-related psychological disturbance. Romans et al. (2012), in a systematic review of 47 prospective studies involving over 3,500 participants, confirmed that negative affect and depressive symptoms were significantly elevated during the premenstrual and menstrual phases and lowest during the postmenstrual phase at the group level, while also documenting substantial inter-individual variability in the magnitude of phase-related psychological fluctuation. Steiner et al. (2003) confirmed through a multicentre international study that depressive and anxious symptoms were significantly more severe during the late luteal phase and that serotonergic pharmacological intervention effectively attenuated these symptoms providing indirect pharmacological confirmation of the serotonergic mechanism. Direkvand-Moghadam et al. (2014), in a meta-analysis of 17 epidemiological studies encompassing over 10,000 participants, estimated global PMS prevalence at approximately 47.8%, with psychological symptoms constituting the most distressing features. Pérez-López et al. (2009) confirmed in a prospective study of Spanish university students that depressive and anxiety scores were significantly higher during the premenstrual and menstrual phases than during the postmenstrual phase, with these differences observed across both symptomatic and asymptomatic participants. More recently, Fierobe et al. (2021) utilized ecological momentary assessment to document daily psychological fluctuations across two complete menstrual cycles, confirming that negative affect, anxiety, and perceived stress were significantly elevated during the premenstrual phase and at their lowest during the postmenstrual phase, while also identifying the menstrual phase as characterized by a distinct profile of somatic distress-driven psychological disturbance. Schmalenberger et al. (2021) further refined understanding of cycle-related psychological variation through a large-scale prospective ecological momentary assessment study, confirming phase-dependent elevations in negative affect and anxiety while emphasizing the substantial inter-individual variability that moderates the expression of these group-level patterns. Toffoletto et al. (2014) provided direct neuroimaging evidence for phase-dependent changes in emotional processing, demonstrating significantly greater amygdala reactivity to negative emotional stimuli during the luteal phase compared to the follicular phase a neurobiological finding that directly parallels the psychological symptom elevation documented in behavioural studies. Hartlage et al. (2012) confirmed in a population-based American study that both women with and without prior psychiatric diagnoses demonstrated measurable premenstrual elevations in depressive, anxious, and stress-related symptoms relative to their postmenstrual baseline,

affirming the dimensional nature of cycle-related psychological variation and supporting the use of continuous psychometric measurement in non-clinical samples.

Within South Asian and Pakistani contexts, the empirical literature, while comparatively limited, has generated findings of considerable relevance to the present investigation. Nisar et al. (2008) conducted a pioneering study among Pakistani university students documenting that 74% of participants reported premenstrual psychological symptoms - including mood swings, anxiety, and depressive feelings with significant disruptions to academic performance and daily functioning. Tabassum et al. (2011) documented significant psychological distress among Pakistani nursing students during both the premenstrual and menstrual phases, highlighting the compounding effect of physical menstrual symptoms on psychological well-being and the mutual reinforcement of somatic and psychological dimensions of menstrual distress. Qadir et al. (2015) confirmed clinically significant premenstrual psychological disturbance among Pakistani women, with depression and irritability among the most severely rated symptoms and marked functional impairment across domestic, interpersonal, and academic domains. Seedhom et al. (2013), in a study of Egyptian university students sharing sociocultural characteristics with Pakistani young adult females, documented elevated premenstrual depressive and anxiety symptoms and identified academic stress, limited social support, and negative menstrual attitudes as significant predictors of psychological symptom severity underscoring the role of sociocultural factors in amplifying biologically driven cycle-related distress. Carlini et al. (2021), in a recent systematic review of 26 studies, confirmed that anxiety and depressive symptoms were significantly higher during the premenstrual phase in non-clinical young adult samples and identified the simultaneous assessment of depression, anxiety, and stress across all three menstrual phases as a notable gap in the existing literature a gap that the present investigation directly addresses. Gudipally and Sharma (2023) further affirmed in a contemporary clinical review that psychological symptoms remain the most clinically significant and functionally impairing features of cycle-related distress and emphasized the continued need for empirical research examining psychological symptom profiles across all menstrual cycle phases in diverse cultural populations.

A critical appraisal of the literature reviewed above reveals several areas of substantial convergence alongside important divergences, methodological limitations, and research gaps that collectively establish the rationale for the present investigation. In terms of convergence, the preponderance of evidence consistently supports significantly elevated psychological distress particularly depression, anxiety, and negative affect during the premenstrual phase relative to the postmenstrual phase, a finding replicated across diverse methodological designs, measurement instruments, and cultural contexts (Romans et al., 2012; Direkvand-Moghadam et al., 2014; Carlini et al., 2021). The neurobiological mechanisms underlying this pattern serotonergic consequences of estrogen withdrawal, GABAergic disinhibition from allopregnanolone decline, and HPA axis hyperreactivity have been consistently identified across independent biological and pharmacological research programs (Bethea et al., 2002; Bäckström et al., 2014; Roca et al., 2003), lending the theoretical framework of the present study considerable empirical robustness. However, meaningful divergences and inconsistencies also characterize the literature. The psychological profile of the menstrual phase remains inconsistently characterized, with some studies reporting persistent distress (Iacovides et al., 2015; Fierobe et al., 2021) and others documenting relatively rapid psychological improvement following menstrual onset (Romans et al., 2012). The relative severity of anxiety compared to depression across phases is similarly inconsistent across studies, with some reporting more robust anxiety elevation (Altemus et al., 2014; Nillni et al., 2011) and others finding comparable or greater depression elevation (Hartlage et al., 2012). Substantial inter-individual variability in the magnitude of phase-related psychological

fluctuation has been documented by multiple investigators (Romans et al., 2012; Schmalenberger et al., 2021), suggesting that biological sensitivity, psychological vulnerability, and sociocultural moderators interact to produce highly individualized patterns of cycle-related psychological experience. From a methodological standpoint, the existing literature is characterized by several significant limitations. Retrospective self-report designs, vulnerable to recall bias and documented to systematically overestimate premenstrual distress relative to prospective methods, have been employed in a substantial proportion of prior studies (Direkvand-Moghadam et al., 2014). Single-construct measurement approaches examining depression or anxiety in isolation rather than simultaneously assessing all three constructs fail to capture the co-occurring and potentially interactive nature of these psychological variables across menstrual phases (Carlini et al., 2021). The predominant focus on the premenstrual phase alone, with comparative neglect of the menstrual and postmenstrual phases as distinct psychological contexts, has produced a fragmented and incomplete picture of the full-cycle psychological experience of young adult females (Romans et al., 2012). Cultural homogeneity, with the overwhelming majority of studies conducted with Western samples, raises substantive concerns about cross-cultural generalizability, particularly to South Asian populations where sociocultural attitudes toward menstruation, help-seeking patterns, and stressor profiles differ substantially from Western contexts (Henrich et al., 2010; Sommer et al., 2016). Small, non-representative samples and the absence of phase-verified biological hormone confirmation further constrain the interpretability and generalizability of existing findings (Schmalenberger et al., 2021). These convergent methodological and contextual limitations delineate a clearly defined and empirically significant research gap: no study identified in the present review has simultaneously examined depression, anxiety, and stress as distinct psychometric constructs across all three menstrual cycle phases premenstrual, menstrual, and postmenstrual within a sample of young adult females in Pakistan, utilizing a validated standardized instrument administered contemporaneously at each phase. The present study directly addresses this gap through a contemporaneous, full cycle, multi-construct comparative design employing the DASS-21 (Lovibond & Lovibond, 1995) with a sample of young adult Pakistani females aged 18 to 30 years. In doing so, it contributes original, contextually situated, and methodologically rigorous empirical knowledge to both the international literature on menstrual cycle psychology and the nascent but growing body of Pakistani women's mental health research, thereby fulfilling the scientific and social imperatives the motivated its design and positioning it as a meaningful and necessary contribution to the field.

Hypothesis

It was hypothesized that there would be significant differences in depression, anxiety, and stress across the menstrual cycle phases premenstrual, menstrual, and postmenstrual among young adult females.

Methodology

Research Design

The present study employed a quantitative repeated-measures (within-subject) research design to investigate differences in depression, anxiety, and stress across different phases of the menstrual cycle among young adult females. A repeated-measures design was considered appropriate because the same participants were assessed repeatedly across three menstrual cycle phases: premenstrual, menstrual, and postmenstrual. This design allowed the researcher to examine within-participant variations in psychological symptoms across different phases of the menstrual cycle while minimizing individual differences between participants.

Sample Techniques

The sample consisted of 25 young adult females selected through convenience sampling technique. Participants were recruited from academic settings and personal contacts based on accessibility and willingness to participate. The selected sample size was considered appropriate for an undergraduate-level repeated-measures research design because the same participants were assessed multiple times across different menstrual phases.

Inclusion Criteria

- Were between 18–30 years of age
- Had a regular menstrual cycle
- Were able to understand the questionnaire
- Were willing to participate voluntarily in the study

Exclusion Criteria

- Had irregular menstrual cycles
- Were using hormonal medications or contraceptives
- Had any diagnosed psychological disorder
- Had any diagnosed gynaecological or chronic medical condition that could affect menstrual functioning.

Instruments

Psychological symptoms in the present study were assessed using the Depression Anxiety Stress Scale-21 (DASS-21), developed by Lovibond and Lovibond (1995). The DASS-21 is a standardized self-report instrument designed to measure three negative emotional states: depression, anxiety, and stress. It consists of 21 items, with seven items allocated to each subscale (depression, anxiety, and stress). Responses are recorded on a 4-point Likert scale ranging from 0 (Did not apply to me at all) to 3 (Applied to me very much or most of the time). Scores were calculated using standardized scoring procedures, where higher scores indicate greater levels of depression, anxiety, and stress. The scale has demonstrated satisfactory reliability and validity across diverse populations and is widely used in psychological research.

Procedure

Prior to data collection, ethical approval was obtained from the relevant department/instructor. Participants were recruited through academic institutions and personal contacts, and informed consent was taken after explaining the study's purpose and objectives. Demographic information was collected to assess eligibility based on inclusion and exclusion criteria. The same participants were assessed across three menstrual cycle phases (premenstrual, menstrual, and postmenstrual) using the DASS-21 questionnaire. Data were collected individually in a comfortable setting, with confidentiality ensured through the use of identification codes instead of personal details. All data were securely stored and used only for research purposes.

Statistical Analysis

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS). Descriptive statistics including means and standard deviations were calculated for depression, anxiety, and stress scores across menstrual cycle phases.To examine differences in psychological symptoms across premenstrual, menstrual, and postmenstrual phases, Repeated Measures Analysis of Variance (Repeated Measures ANOVA) was applied. This statistical test was considered appropriate because the same participants were measured repeatedly across three conditions/phases. Statistical significance was determined at the .05 level.

Ethical Considerations

The study adhered to ethical principles of psychological research. Participation in the study was completely voluntary, and informed consent was obtained prior to participation. Participants were assured that their responses would remain confidential and anonymous. Participants were informed about their right to withdraw from the study at any point without any penalty. No harmful or invasive procedures were involved in the research process. All collected information was used strictly for academic and research purposes only.

Operational Definitions of Variables

Menstrual Cycle

According to the World Health Organization (2022), the menstrual cycle is a biological process regulated by hormonal fluctuations that influence physical and psychological functioning. In the present study, menstrual cycle phases were identified through participant self-report and categorized as premenstrual (3–7 days before menstruation), menstrual (during menstrual bleeding), and postmenstrual (the first 7 days after menstruation).

Depression

Depression is a mental health condition that can cause a chronic feeling of sadness, emptiness, or an inability to feel pleasure. It can affect people of all ages, and can make it difficult to work, maintain relationships, and stay healthy. In severe cases, depression can lead to suicide (Conway et al., 2017).

Anxiety

Anxiety is an uncontrollable, diffuse, unpleasant, and persistent state of negative affect, characterized by apprehensive anticipation regarding unpredictable and unavoidable future danger, and accompanied by physiological symptoms of tension and a constant state of heightened vigilance (Barlow, 2002).

Stress

Stress defines as the physiological or psychological response to internal or external stressors. It involves systemic changes affecting nearly every bodily system, influencing emotions, behaviours, and health. This response is often described as the body's reaction to environmental change, potentially disrupting homeostasis and causing a range of physical and emotional symptoms (The American Psychological Association 2023).

Result

This chapter reports the findings of the statistical analyses conducted to examine differences in depression, anxiety, and stress across the three menstrual cycle phases. Results are organized as demographic characteristics, descriptive statistics, and inferential statistical findings.

Table 1 Demographic Characteristics of the Sample (N = 25)

Variables		**n**	**%**
Age	18–20 years	7	28.0
	21–23 years	9	36.0
	24–26 years	6	24.0
	27+ years	3	12.0
Gender	Female	25	100.0
Marital Status	Unmarried	24	96.0
	Married	1	4.0
Education Level	Undergraduate	19	76.0

	Postgraduate	4	16.0
	Other	2	8.0
Occupation	Student	20	80.0
	Employed	4	16.0
	Other	1	4.0
Residential Area	Urban	24	96.0
	Rural	1	4.0

Note. *n = frequency.*

Table 2 Descriptive Statistics for Depression, Anxiety, and Stress Across Menstrual Phases

Variable	**M**	**SD**	**N**
Depression (Pre)	5.96	5.49	25
Depression (During)	8.24	5.62	25
Depression (Post)	3.76	3.46	25
Anxiety (Pre)	5.44	4.75	25
Anxiety (During)	7.68	4.98	25
Anxiety (Post)	4.20	4.61	25
Stress (Pre)	6.84	5.41	25
Stress (During)	9.28	5.28	25
Stress (Post)	4.84	4.50	25

Note. *M = mean; SD = standard deviation. Pre = premenstrual phase; During = menstrual phase; Post = postmenstrual phase. Scores based on DASS-21.*

Table 3 Repeated Measures ANOVA Results for Depression

Source	**F**	**Df**	**P**
Phase	12.91	2, 48	< .001

Note. *df = degrees of freedom. Phase = within-subjects factor (Pre, During, Post).*

Table 4 Repeated Measures ANOVA Results for Anxiety

Source	**F**	**Df**	**P**
Phase	9.61	2, 48	.0003

Note*. df = degrees of freedom. Phase = within-subjects factor (Pre, During, Post).*

Table 5 Repeated Measures ANOVA Results for Stress

Source	**F**	**df**	**P**
Phase	15.26	2, 48	< .001

Note. *df = degrees of freedom. Phase = within-subjects factor (Pre, During, Post).*

Discussion

The present study investigated differences in depression, anxiety, and stress across the premenstrual, menstrual, and postmenstrual phases of the menstrual cycle among young adult Pakistani females (N = 25). The findings provide robust empirical support for the research

hypothesis, with statistically significant phase differences confirmed across all three psychological constructs. The following discussion interprets the demographic characteristics of the sample, the descriptive patterns observed across menstrual cycle phases, and the inferential statistical findings, situating each within the existing theoretical and empirical literature. The sample was predominantly composed of 21-year-old (28.0%), unmarried (96.0%), undergraduate-level (76.0%), student-status (80.0%), and urban-resident (96.0%) young adult females. This demographic profile is consistent with the target population of the study and reflective of the university recruitment context. The homogeneity of the sample in terms of marital status, educational level, and occupational status suggests that the psychological findings are most directly applicable to university-attending young adult females a population recognized as particularly vulnerable to both academic stress and hormonal cycle-related psychological distress (Beiter et al., 2015). The predominantly urban and undergraduate composition further reflects the sociocultural context of Pakistani higher education, where young adult females navigate the dual burden of academic pressure and cultural expectations surrounding menstruation (Nisar et al., 2008). Examination of the descriptive statistics revealed a consistent and theoretically coherent pattern across all three psychological constructs. Depression scores were highest during the menstrual phase ($M = 8.24$, $SD = 5.62$), intermediate during the premenstrual phase ($M = 5.96$, $SD = 5.49$), and lowest during the postmenstrual phase ($M = 3.76$, $SD = 3.46$). Anxiety scores followed the same directional pattern, with the menstrual phase yielding the highest scores ($M = 7.68$, $SD = 4.98$), followed by the premenstrual phase ($M = 5.44$, $SD = 4.75$), and lowest during the postmenstrual phase ($M = 4.20$, $SD = 4.61$). Stress scores similarly peaked during the menstrual phase ($M = 9.28$, $SD = 5.28$), followed by the premenstrual phase ($M = 6.84$, $SD = 5.41$), with the lowest scores observed during the postmenstrual phase ($M = 4.84$, $SD = 4.50$). The consistent ordering of menstrual > premenstrual > postmenstrual symptom severity across all three constructs is theoretically coherent with the neurobiological consequences of the hormonal milieu characterizing each phase, including the serotonergic and GABAergic disruptions of premenstrual hormonal withdrawal, the compounded neurochemical and physiological stress of active menstruation, and the mood-stabilizing effects of rising oestradiol during the postmenstrual period (Bethea et al., 2002; Bäckström et al., 2014; Roca et al., 2003).

The statistically significant main effect of menstrual cycle phase on depression, $F(2, 48) = 12.91$, $p < .001$, with the highest scores during the menstrual phase ($M = 8.24$) and lowest during the postmenstrual phase ($M = 3.76$), is consistent with the established neurobiological framework linking estrogen withdrawal to serotonergic dysregulation and depressive mood states (Bethea et al., 2002; Rubinow & Schmidt, 2006). Estrogen's well-documented role in enhancing serotonin synthesis, inhibiting reuptake, and upregulating postsynaptic receptor sensitivity means that its withdrawal during the late luteal and early menstrual phases creates a neurochemical environment analogous to that observed in clinical depression (Krishnan & Nestler, 2008). The observed depression peak during the menstrual phase rather than the premenstrual phase as more commonly reported in Western literature (Romans et al., 2012; Hartlage et al., 2012) may reflect the compounding of sustained hormonal nadir with prostaglandin-mediated neuroinflammation, somatic menstrual distress, and the additional sociocultural burden of menstruation within the Pakistani context (Iacovides et al., 2015; Fierobe et al., 2021). The significantly lower depression scores during the postmenstrual phase ($M = 3.76$) confirm the mood-stabilizing neurobiological effects of rising oestradiol during the early follicular period, consistent with prior research (Pérez-López et al., 2009; Romans et al., 2012). These findings extend prior Pakistani research by Nisar et al. (2008) and Qadir et al. (2015), providing the first quantitative, phase-comparative psychometric evidence of depressive symptom variation across all three menstrual phases in this population.

The statistically significant main effect of menstrual cycle phase on anxiety, f (2, 48) = 9.61, p = .0003, with the highest scores during the menstrual phase (M = 7.68) and lowest during the postmenstrual phase (M = 4.20), is consistent with the allopregnanolone withdrawal hypothesis advanced by Bäckström et al. (2014). Allopregnanolone the neuroactive progesterone metabolite that ordinarily provides anxiolytic effects through positive allosteric modulation of GABA-A receptors declines precipitously during the late luteal phase, creating a state of GABAergic disinhibition that elevates anxiety reactivity (Rapkin & Akopians, 2012). The persistence of elevated anxiety into the menstrual phase, exceeding even the premenstrual phase scores (M = 7.68 vs. M = 5.44), suggests that somatic arousal from menstrual discomfort and prostaglandin-mediated physiological activation further amplify anxiety during active menstruation beyond the hormonal withdrawal-driven anxiety of the premenstrual phase (Iacovides et al., 2015). These findings are consistent with Altemus et al. (2014), who documented heightened anxiety sensitivity during hormonally vulnerable cycle phases, and with Nillni et al. (2011), who demonstrated significantly elevated anxiety sensitivity during the premenstrual phase, indicating that both neurobiological and cognitive mechanisms interact to amplify anxiety. The lowest anxiety scores during the postmenstrual phase (M = 4.20) reflect the anxiolytic neurobiological effects of rising estrogen on serotonergic and GABAergic functioning, consistent with findings from Sylvén et al. (2013).

The strongest and most statistically robust finding of the present study was the significant main effect of menstrual cycle phase on stress, F (2, 48) = 15.26, p < .001, with the highest scores during the menstrual phase (M = 9.28) and lowest during the postmenstrual phase (M = 4.84). The prominence of stress as the most phase-sensitive construct is theoretically coherent with the well-documented cycle-dependent variability in HPA axis reactivity, which governs the physiological stress response through cortisol release and is significantly amplified during hormonally depleted cycle phases (Roca et al., 2003; Kajantie & Phillips, 2006). Consistent with Lustyk et al. (2010), who documented significantly higher perceived stress during the late luteal phase in association with HPA axis hyperreactivity, the present findings confirm that stress is not only statistically but also practically the most phase-sensitive psychological construct among young adult Pakistani females. From the transactional stress framework of Lazarus and Folkman (1984), hormonal withdrawal during the premenstrual and menstrual phases may simultaneously impair cognitive appraisal processes and deplete perceived coping resources, amplifying the subjective experience of stress. From Hobfolls (1989) conservation of resources perspective, the physiological and psychological demands of menstruation may deplete the personal resources available for stress management, further elevating perceived stress burden. The lowest stress scores during the postmenstrual phase (M = 4.84) reflect the restorative neurobiological effects of rising estrogen on HPA axis regulation and psychological coping capacity (Roca et al., 2003; McEwen, 2007). Collectively, the findings of the present study confirm that menstrual cycle phase is a statistically significant and clinically meaningful determinant of depression, anxiety, and stress among young adult Pakistani females. The consistent menstrual > premenstrual > postmenstrual ordering of symptom severity across all three constructs, combined with the robust F-values obtained particularly for stress (F = 15.26) indicates that the psychological burden of the menstrual phase in this sample is both statistically demonstrable and practically significant. The finding that all three psychological constructs peaked during the menstrual phase rather than the premenstrual phase represents a contextually important observation that distinguishes the present Pakistani sample from the predominantly Western literature and warrants further cross-cultural investigation. The present findings extend and quantitatively substantiate the qualitative observations of Nisar et al. (2008) and Qadir et al. (2015), contributing original empirical knowledge to Pakistani women's mental health research.

Conclusion

The present study set out to examine whether significant differences exist in depression, anxiety, and stress across the premenstrual, menstrual, and postmenstrual phases of the menstrual cycle among young adult females, utilizing the Depression Anxiety Stress Scale-21 (DASS-21) as the measurement instrument and repeated measures ANOVA as the primary inferential statistical approach. The findings unequivocally support the research hypothesis: statistically significant differences were observed across all three menstrual cycle phases for each of the three dependent variables depression, $F(2, 48) = 12.91$, $p < .001$; anxiety, $F(2, 48) = 9.61$, $p = .0003$; and stress, $F(2, 48) = 15.26$, $p < .001$. Across all three psychological constructs, a consistent pattern emerged: psychological symptom severity was highest during the menstrual phase, intermediate during the premenstrual phase, and lowest during the postmenstrual phase. This pattern is theoretically coherent with the neurobiological consequences of the hormonal milieu characterizing each phase, including the serotonergic and GABAergic disruptions of premenstrual hormonal withdrawal, the compounded neurochemical and physiological stress of active menstruation, and the mood-stabilizing and anxiolytic effects of rising estrogen during the postmenstrual period. The finding that the menstrual phase rather than the premenstrual phase was associated with the highest psychological distress across all three constructs represents a noteworthy contribution to the literature, suggesting that the psychological burden of active menstruation among young adult Pakistani females may exceed that of the anticipatory hormonal withdrawal phase, potentially reflecting the additional contribution of somatic menstrual distress, cultural stigma, and limited psychological coping resources within this sociocultural context. The present study makes several important contributions to the psychological literature. It provides the first phase comparative, multi-construct psychometric assessment of depression, anxiety, and stress across all three menstrual cycle phases among young adult Pakistani females, employing a validated and standardized instrument in a contemporaneous assessment design. It extends the international empirical literature to a South Asian cultural context that has been significantly underrepresented in menstrual cycle psychology research. It affirms the clinical and public health significance of menstrual cycle related psychological distress as a legitimate and measurable phenomenon among non-clinical young adult female populations. And it establishes an empirical baseline upon which future longitudinal, experimental, and intervention-based research in this domain can be systematically constructed. In conclusion, the menstrual cycle represents a clinically significant, recurring biological context that meaningfully and measurably shapes the psychological experiences of young adult females. Depression, anxiety, and stress are not static psychological traits but dynamically varying states whose severity is substantially influenced by the hormonal fluctuations of the menstrual cycle. Recognizing, measuring, and responding to this cyclical psychological variability is an imperative for psychological science, clinical practice, educational institutions, and healthcare systems serving young adult female populations.

Limitation and Future Directions of the Study

The study contributes valuable data but has several limitations affecting interpretation and guiding future work. First, the small sample (N=25) limits statistical power, precision of effect-size estimates, and generalizability to the broader population of young adult Pakistani females. Larger samples are needed to improve representativeness and reduce sampling error. Second, phase assignment relied on self-reported cycle day without biological hormone verification. Without salivary or serum assays for oestradiol, progesterone, and cortisol, phase misclassification is possible and may attenuate observed effects; future studies should include hormonal biomarkers. Third, assessments occurred at a single time point within each phase rather than via continuous or daily monitoring. Single-point measures may miss within-phase variability and the timing of symptom peaks; ecological momentary assessment across full cycles would yield more temporally precise, ecologically valid data.

Fourth, potential confounders were not comprehensively controlled. Variables such as academic stress, sleep quality, physical activity, nutrition, hormonal contraceptive use, prior psychiatric history, and social support can influence both menstrual symptoms and psychological functioning; their omission means phase differences cannot be attributed solely to hormonal mechanisms. Future research should measure and statistically adjust for these factors. Fifth, the sample was homogeneous predominantly undergraduate, unmarried, urban students limiting applicability to rural populations, different educational or occupational groups, and varied marital statuses; more heterogeneous and probability-based sampling is recommended.

Sixth, reliance on self-report (DASS-21) introduces response biases (social desirability, mood-congruent reporting) despite the instrument's validity. Multi-method approaches clinical interviews, behavioural measures, physiological markers would strengthen inference.

Future directions: recruit larger, more representative samples across multiple sites; incorporate biological hormone assays to confirm phase membership and examine hormone symptom associations; adopt longitudinal, prospective designs with ecological momentary assessment over multiple cycles to capture intra-individual stability and temporal dynamics; and assess moderating roles of traits (neuroticism, anxiety sensitivity), coping, cultural attitudes, and contextual stressors. Intervention research should test cycle-informed approaches (psychoeducation, timing of CBT, mindfulness, lifestyle changes) using randomized controlled trials. Finally, cross-cultural comparative studies across South Asian and Western samples would clarify biological versus sociocultural contributions to menstrual-cycle psychological variation, advancing a more inclusive science of women's mental health.

Implications of the Study

The study's findings have clear implications for research, clinical practice, education, healthcare, and public policy in Pakistan and similar contexts. For psychological science, this study fills a gap by documenting phase-specific profiles of depression, anxiety, and stress among young adult Pakistani females. The menstrual phase showed the highest symptom severity, providing cross-cultural replication of prior Western findings and demonstrating that DASS-21 can be used effectively for phase-comparative research in resource-limited South Asian settings.

Clinically, results indicate that menstrual phase substantially affects symptom counts: single-point assessments especially during the menstrual phase may overestimate baseline psychological burden, while postmenstrual assessments may underestimate it. Mental health practitioners should routinely ask about menstrual phase, consider multi-point assessments across cycles, and adopt cycle-informed interventions (psychoeducation, timing of skills training, and tailored coping strategies) to improve diagnostic accuracy and treatment timing.

For educational institutions and university counselling services, findings are particularly relevant given the predominantly undergraduate sample. Universities should provide menstrual-health literacy and psychoeducational resources, train counselling staff in cycle-aware assessment, offer referral pathways for severe cases, and consider academic accommodations (flexible exam scheduling, deadlines, attendance policies) during symptomatic phases.

Within healthcare, gynaecologists and primary-care providers should screen for menstrual-related psychological distress during routine consultations and coordinate referrals to mental health services. System-level integration of reproductive and mental health services is supported by these findings.

At the public health level, robust phase differences across depression, anxiety, and stress identify menstrual cycle related psychological distress as a significant public-health concern. Policies should address menstrual stigma, expand menstrual and mental health literacy, and increase access to integrated services to mitigate educational, occupational, relational, and quality of life impacts.

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