UNIVERSITY OF EDUCATION, WINNEBA

MENSTRUATION EXPERIENCES AND SUBJECTIVE SPORTS PERFORMANC OF FEMALE SENIOR HIGH SCHOOL ATHLETES IN AJUMAKO DISTRICT

EVELYN AGBORDZOR

MASTER OF PHILOSOPHY

2023

UNIVERSITY OF EDUCATION, WINNEBA

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EVELYN AGBORDZOR
(220023317)

Thesis submitted to the Department of Health, Physical Education, Recreation and Sports. Faculty of Health, Allied Sciences and Home Economics Education, submitted to the School of Graduate Studies in partial fulfilment of the requirements for the award of Master of Philosophy Degree in Physical Education (Sports Science) in the University of Education, Winneba

OCTOBER, 2023

DECLARATION

CANDIDATE'S DECLARATION

I, Evelyn Agbordzor hereby declare that this thesis is the result of my original research and that no part of it has been presented for another degree in this university or elsewhere.

Signature: ……

Date: ……..……

SUPERVISORS' DECLARATION

I/We hereby declare that the preparation and presentation of this project work were supervised by the guidelines on supervision of thesis laid down by the University of Education, Winneba.

Principal Supervisor's Signature: ……

Date: ….……..…..…

Name: Dr. Yayra Kluboito

Co-Supervisor's Signature: ……..……

Date: ……...……..……

Name: Dr. Medina Srem-Sai

DEDICATION

To my Family

ACKNOWLEDGEMENTS

I would like to thank the one hundred and eighty-one female athletes from the four Senior High schools in Ajumako District who participated in my study.

Next, I would like to thank my supervisors, Dr. Yayra Kluboito and Dr. Medina Srem-Sai for their useful suggestions that guided me throughout the writing of this work. Also, all the faculty members of the department of HPERS, UEW, especially Prof. J.O.A. Ammah, Prof. E.O. Sarpong, Mrs. Rahmat Mensah and Mr. Alexandrah Amankwa. My special thanks go to them for their encouragement, direction, and productive suggestions in conducting this study. To my family, I say thanks for everything.

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ABBREVIATIONS

MC:	Menstrual cycle
PCOS:	Polycystic ovaries syndrome
PMS:	Pre-menstrual syndrome
RED-S:	Relative Energy Deficiency in Sports
S. H. S:	Senior High School
E1:	Estrone
E2:	Estradiol
E3:	Estriol
L H:	luteinizing hormone
F.H.S:	follicle-stimulating hormone
GnRH:	gonadotropin-releasing hormone
ACL:	anterior cruciate ligament
HPA:	hypothalamic-pituitary-adrenal axis

ABSTRACT

Variations in sports performance caused by menstruation have piqued curiosity and sparked debate in recent years. This study sought to consider the relationship between menstruation and subjective sports performance among senior high school female athletes in the Ajumako district. A cross-sectional survey design and questionnaire was used to gather data for this study. A total of 200 student female athletes were sampled using the census technique. Data was analyzed through descriptive, Pearson r, and multiple linear regression. Findings from the study revealed that the majority of the respondents have low knowledge levels regarding menstruation (N=80, 44.2%) with satisfactory practice in terms of hygiene and sports. There exists a positive relationship between athletes' knowledge and practice regarding menstruation (r=.268) and only 17% of the variability in female athlete's sports performance can be attributed to the Physical and Psychological effects of menstruation R^2 = .17, F (2,178) =1.56, p=.013. However, the Physical and Psychological effects of menstruation were significant in predicting sports performance (β = -.044; p = .021) and (β = -.107; p = 0.036) respectively. It was concluded that menstruation has a significant effect on sports performance. It was therefore recommended that stakeholders such as physical education teachers, sports coaches, sports professionals, chaperones among others should receive training on how to tailor training regimens and competition schedules to accommodate the physical and psychological fluctuations that can occur during menstruation.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter serves as an introduction to this thesis and it outlines the background to the study, statement of the problem, purpose of the study, objectives, significance of the study, delimitations, and limitations.

1.1 Background to the Study

Changes in sports performance caused by menstruation have piqued curiosity and sparked debate for over half a century (Bruinvels et al., 2017; Oleka, 2020). Research has shown that at least 26% of women worldwide are of reproductive age and menstruating which affect their psyche and influence their mood and causing feelings of dejection (Liang et al., 2019). Menstruation is the monthly discharge of blood and endometrium from the uterus, which begins at puberty and continues until menopause (Jarrah & Kamel, 2012; Siabani et al., 2018). Girls begin to menstruate when they attain menarche which is the age at which menstruation begins while menopause marks the end of menstruation in most women. It starts at the ages of 12-15 years and ends between the ages of 45-55 (Varnell et al., 2021). Women menstruate an average of 457 times before menopause (Pitchers & Elliot-Sale, 2019). Because most women menstruate between menarche and menopause, menstrual health is a crucial component of general health in sports however, for tens of millions of women worldwide, menstruating frequently severely impairs their social, psychological, and physical health (Hutchins, 2020). The study by Bruinvels et al. (2016) not only recorded basic observations of sports performance but also precisely documented the specific physical, psychological, and physiological changes linked to different hormone levels during menstrual cycle.

Over the last decade, the professionalism and interest in female participation in all kinds of sports around the globe have exploded (Woods & Butler, 2020). Sports necessitate that, participants possess an expected high level of physical, physiological, psychological, and neurological fitness (Treneva, 2014). For female athletes, accomplishing an optimal level of sports performance requires extra effort exertion **owed** to constant shifts in physiological and hormonal traits in their developmental stages, particularly during the menstrual cycle (Plowman & Smith, 2013). Participating officially, female athletes aspire to match the level of excellence of their male counterparts (Fernandez-Fernandez et al., 2013). The struggle of most female athletes is often constrained due to their unescapable and uncontrollable biological makeup (Brownmiller, 2013). Throughout the decades, female athletes have been considered small versions of male athletes (Godoy, 2014). Even with that, female athletes have been working with a training plan that could also be used for men, without the consideration of their cycle however working with the body rather than against it is the key to improving performance as an athlete, especially in endurance events (Kepner, 2014).

The hormonal changes that occur throughout each month are a consideration that should not be neglected by female athletes (Carmichael et al., 2021). Normal menstrual cycles or eumenorrhea last between 25 and 35 days, measuring from the first day of menstrual bleeding (menses) to the first day of the next cycle which varies from individual woman, but the average is to have menses every 28 days (Reed & Carr, 2018). The menstrual cycle consists of three hormonally different phases; the follicular phase starts on the first day of menstrual bleeding. During this phase, estrogen levels will steadily increase due to the maturation of a selected follicle in the endometrium. The ovulatory phase is the second phase in the menstrual cycle and

occurs around cycle days 14-15 and may last for 12- 24 hours (Beshay & Carr, 2017). The luteal phase is the final phase in the menstrual cycle during which the endometrium keeps getting thicker and its supply of blood and nutrients is enhanced. During this phase, which for most women lasts 14 days, the uterus is prepared for pregnancy (Adkisson et al., 2010). The corpus luteum will deteriorate, hormone levels will drop, and the next menstrual cycle will begin if fertilization is unsuccessful (Thiyagarajan et al., 2021).

The menstrual cycle has an impact on the unconscious regulation of deep body temperature (autonomic regulation); for instance, it is assumed that mid-luteal phase sweat onset is impaired compared to early follicular phase sweat onset, limiting evaporative cooling (Giersch et al., 2022). Potential changes in sleep throughout the cycle revealed that menstruation had the most unfavorable effects on sleep, increasing the amount of time it takes to fall asleep and decreasing the amount of time spent in deep sleep (Takano et al., 2020). Lack of sleep negatively affects a variety of physiological systems, including the neurological, endocrine, and cardiorespiratory systems causing athletes to be prone to injuries during their menstruation (Fullagar et al., 2015; Koikawa et al., 2020). Physiological changes that influence the likelihood of injury on a given day can result in altered training to reduce the risk. Unfortunately, research has shown that women have a 2–8 times higher risk of anterior cruciate ligament (ACL) rupture than men (Chidi-Ogbolu, 2019).

Female hormones, which are essential for preparing a woman's body for childbirth, function in a beautiful, cyclical way, and these hormones, which are responsible for preparing a woman's body to conceive and deliver a child safely are predicted to have a significant impact on the health of female athletes as well as their sports

performance (Armour et al., 2020). Chrisler (2013) has argued that while every woman globally will experience menstruation in the same way but it will be different depending on the individual's beliefs, attitudes, and actions that have risen from the socio-cultural and psychological milieu in which they are positioned. Female physiological characteristics such as varying female sex hormone concentration throughout the day, may be a significant factor in improving sports performance in both training and competitive sessions as well as maintaining the health of all female athlete (Ackerman & Misra, 2018; Gibbs et al., 2013). One of the major concerns recognized by athletes regarding training during menstruation is "leaking" or "flooding" and flooding during menstruation refers to a heavy surge of blood loss that can result in soaking through your period product and onto your clothes or bedding (Schmitt et al., 2021). Due to the stigma surrounding menstruation, many athletes are fearful of leaking during training or competition (Gray,2013). Sporting outfits and uniforms may work some against female athletes during menstruation, contributing to increased anxiety, low self-esteem, and paranoia (Steinfeldt et al., 2013). leotards, skintight shorts, and spandex, or heavily feature the color white, causing athletes to worry about staining their clothes due to "leaking" (Brown et al., 2021). General stigmatization of menstruation and "leaking" has caused many women to express "leaking" as a traumatic experience associated with their periods (Findlay et al., 2020; Schmitt et al., 2021). Although tampons are more comfortable than menstrual pads during participation in sporting activities many athletes use sanitary pads due to the cost involved in affording tampons hence the fear of "flooding" their dresses (Rzymski et al., 2021; Stewart et al., 2013).

Exercise, menstrual disorders, energy sources, and training are all factors to consider when it comes to athletes' sports performance (Cardoso et al., 2018). Exercise is a planned, structured, and repetitive physical activity done to maintain physical fitness (Jedynak et al., 2021). Menstrual disorders are problems that affect a woman's normal menstrual cycle and they include painful cramps during menstruation, abnormally heavy bleeding, absence of menstruation, and infrequent menstruation (Gray, 2013). Energy sources are foods that athletes may eat to fuel their workouts and muscular contractions. Depending on the athlete, their energy intake might vary during the cycle in terms of proteins, carbohydrates, fats, and vitamins, among other nutrients (Gorczyca et al., 2016; Utami et al., 2021).

As sports performance affects menstruation, menstruation may also affect sports performance which explains why there is a bi-directional connection between exercise and menstruation. Menstruation and its physical and psychological correlates have been proven to hurt everyday activities and physical activity in the general population and female athletes as well (Pallavi et al., 2017). Similarly, menstrual symptoms in the sports setting such as fatigue, tiredness, abdominal pain, and others can reduce athletes' ability to train (Henry et al., 2020).

Davidsen et al. (2007) opines that to determine if menses affect weight reduction in women, researchers should examine hormonal changes throughout the menstrual cycle and aspects of energy balance. Some women appear to consume more energy and expend more energy during the luteal phase of the menstrual cycle, and they also crave for food more frequently than they do during the follicular phase, especially those high in carbohydrates and fat, and this is not so for many female athletes (Ålgars et al., 2014). The "female athlete triad" refers to the interrelationship among

energy availability, irregular menstrual function, and bone mineral density which may be with or without eating disorders and may, unfortunately, cause symptoms in some percentage of female athletes (Barrack et al., 2013). These problems may show clinical signs such as stress fractures, irregular menstruation, and disturbed eating habits (Mountjoy et al., 2014). The female athlete triad is a subgroup of relative energy deficiency syndrome (RED-S) which is a condition of low energy availability affecting athletes of all levels and ages (Dave & Fisher, 2022). Deficiencies in vitamin D, zinc, calcium, magnesium, and B vitamins can result from exercise-related stress and insufficient nutritional consumption ((Reynolds et al., 2018). According to recent data, up to 42% of female athletes have insufficient vitamin D levels and up to 90% fall short of the appropriate calcium intake (Gastrich et al., 2020). The most typical nutrient deficiency is iron, especially in female athletes. Iron is essential for delivering oxygen to the muscles and an absence causes weariness and substandard performance due to monthly blood losses and poor iron intake, female athletes are at risk (Badenhorst et al., 2021).The prime hormones that regulate the menstrual cycle are gonadotropin-releasing hormone (GnRH), follicle-stimulating hormone (FSH), Luteinizing hormone (LH), Progesterone, and Estrogen (Ghodrat et al., 2014).

Progesterone is a hormone secreted by the corpus luteum in the ovary during the second half of the menstrual cycle. It plays an important role in the menstrual cycle and in maintaining the early stages of pregnancy. During the menstrual cycle, when an egg is released from the ovary at ovulation (approximately day 14), the leftovers of the ovarian follicle that surrounded the developing egg start to rise after ovulation through the end of the menstrual cycle (Taraborrelli, 2015). Indicators of high progesterone are similar to premenstrual syndrome and can include anxiety and agitation, bloating, breast swelling and tenderness, depression, fatigue, and weight

gain and low progesterone may cause abnormal uterine bleeding in women who are not pregnant as well as short cycles (Bernal & Paolieri, 2022). Unbalanced or absent periods may indicate unwell functioning ovaries (Maybin & Critchley, 2011; Sundström-Poromaa et al., 2020). Compared to women with lower progesterone cycles, those with medium progesterone levels throughout their cycles reported higher feelings of anxiety and besides increasing the internal temperature (Reynolds et al., 2018). Progesterone speeds up respiration and heart rate. When exercising in particular, all of these symptoms might be seen as an added strangeness on the body, making a female feel as though she is working harder than usual which is likely to cause injury hence affecting sports performance (Cabelka et al., 2016).

Estrogen is one of the sex hormones that are frequently linked to people who were assigned female at birth. Estrogen makes it possible for secondary sex characteristics such as breasts, hips, menstruation, pregnancy, and menopause in women (Patricio & Sergio, 2019). Estrogen has three types; Estrone (E1) is the primary form of estrogen that the female body makes after menopause. Estradiol (E2) is the principal form of estrogen in the female body during the reproductive years and it's the most potent form of estrogen (Reed & Carr, 2015). Estriol (E3) is the prime form of estrogen during pregnancy (Lee et al., 2012). In women, high estrogen levels can result in symptoms like heavy or irregular periods, weight gain, exhaustion, and fibroids. The growth and functioning of the sexual organs might be hampered by low estrogen levels (Marsh et al., 2011). Therefore, there is an increased risk of obesity, osteoporosis, and cardiovascular disease. However, estrogen also reduces the stiffness of tendons and ligaments, which directly affects sports performance and injury risk. Estrogen also promotes the function of bone and muscle. In addition, high estrogen

levels can impair performance and power and increase the risk of a calamitous ligament injury in female athletes (Lebrun et al., 2013).

When discussing performance in an athletic environment, which is often understood to reflect the quest for excellence, an athlete measures his or her performance as a development toward excellence or achievement (Pitsiladis et al., 2013). Sports performance is determined by skill, strength, endurance, coordination and the ability of muscles to recover (Maughan & Gleeson, 2010). It can also be measured either considering the health-related component of fitness or skill related component of fitness. Coordination is the ability to select the right muscle at the right time with proper intensity to achieve proper action (Diedrichsen et al., 2010). The capacity of your muscles to function continually without becoming fatigued is known as muscular endurance (Bogdanis, 2012). For athletes to be successful, athletes need to be well-trained considering their endurance, coordination, strength, jumping, throwing, and other sports-specific skills as well as physical, mental, and physiological prepared for their sports performance (Manilal, 2021).

The intuition of this study was derived from the fact that, research on menstruation and sports performance fosters inclusivity and empathy within the sports community and understanding the physiological changes associated with menstruation during sports performance can help debunk myths and misconceptions surrounding female athletes' capabilities (Fisher, 2016).

Brown and Forest 2021 investigated elite female athletes' experiences and perceptions of the menstrual cycle on training and sports performance and found that athletes experiencing a natural menstrual cycle reported physical symptoms alongside mood disturbances and reduced motivation to train. Contrary to these findings, Ozbar et al.

(2016) concluded that menstruation does not affect the performance of the elite athletes who took part in the study.

Laura et al. (2016) considered female athletes and menstrual disorders, and the findings reviewed that despite menstrual disorders being represented among female athletes, the eventual relationship with the sport practiced is not so evident. Contrary to these findings, Kelly et al. (2020) investigated the effects of the Menstrual Cycle Phase on Exercise Performance in Eumenorrheic women and concluded that exercise performance might be trivially reduced during the early follicular phase of the menstrual cycle , compared to all other phases. Solli et al.(2020) concluded that the majority of athletes participating in the study reported that their fitness and performance were the worst during their periods, yet only 8% felt well educated on the topic and only 27% communicated with their coaches about their cycle.

Pinel et al. (2022) proposed that women amateur footballers in the UK experience barriers to participation in football related to their menstruation and on a contrary Agblo et al. (2022) investigated menstrual cycle syndrome in the athletic Performance of selected female athletes in GUSA and concluded that the menstrual cycle has no significant effects on the athletic performance of the female athletes. The researchers cited above such as Bruinvels et al. and Agblo et al. came up with different outcomes and therefore drew different conclusions about the perceived influence of the menstruation on sports performance. This means that there is inconclusiveness in the available information on the influence of menstruation on sports performance.

1.3 Statement of the Problem

In the twenty-first century, women actively participate professionally in a wide range of sports such as Olympic games, women premier league and many others (Bowes et al., 2021). With more women participating in sports, an alarming number of contraceptives and painkillers are being used to either delay menstruation or lessen discomfort (Schaumberg et al., 2016; Wikström-Frisén, 2016). Although ,the female athletes will have to suffer the side effects of the contraceptives such as amenorrhea, and polycystic ovaries syndrome (PCOS) later in life (Crewther et al., 2015; Martin et al., 2018). Menstruation is rarely discussed in training programs for many coaches, despite the rise in female participation in sports (Hasson, 2016). Most coaches do not account for the individual cycle when developing training plans, and some coaches adopt methods used with male athletes without taking into account the fundamental anatomical, physiological, and endocrinological differences between the sexes, which may also hurt performance (Day, 2018). Empirically, studies on the behavior of female athletes specifically the issue of menstruation have been scanty especially in Ghana. Female athletes are typically underrepresented in exercise science literature and this is challenging individuals working with female cohorts (Emmonds et al., 2019; McNulty et al., 2020). Heather Watson, a British tennis player, made international news when she claimed in an interview that her poor athletic performance in an Australian Open tennis match was due to a "female thing or girls thing" (BBC, 2015). She again stated that the menstrual experiences of female athletes as part of their competitive careers and training routines should be discussed openly, according to sports personalities.

In research conducted on Swedish elite athletes by Dupree (2019), most of the participants reported perceiving negative effects of the menstrual cycle and somewhat experiencing variations in performance throughout the cycle. The study further showed that both coaches' and athletes' perceived knowledge was considerably low, as well as athletes' likelihood to discuss menstrual complications with their coaches. Furthermore, Dietz (2022) reported that 62% of athletes indicated a strong perception that coaches were not making proper training adjustments for menstruating athletes, these participants again perceived that coaches were largely oblivious to the effects of menstruation, and their unwillingness to communicate menstrual considerations with their coaches. The most commonly reported menstrual symptoms were abdominal cramping, lower back pain, headaches, heightened emotional states, and changes in eating habits (Bernal & Paolieri, 2022). Acheampong et al. (2019) reported pain during menstruation negatively influences the daily physical activities of the participants. Furthermore, most scholars have studied elite athletes but this study was on teenagers (Meignié et al., 2021). Lack of awareness and understanding of the issues about menstrual cycle will pose problems such as losing potential student-athletes (Neal et al., 2015).

It has become concerning for female athletes in the district as stress from menstruation may have an adverse effect on their training schedules, competitive results, and general well-being. The researcher has noticed that many SHS female athletes in the Ajumako District who participate in sports report differing degrees of the influence of menstruation on their performance. This is based on anecdotal evidence and self-reported accounts from the female athletes without any empirical research to substantiate and explore these claims and so to address this research gap as

well as satisfy the researcher's curiosity, this study was conducted to investigate this phenomenon.

1.4 Purpose of the Study

The purpose of this study was to investigate the correlation of menstruation experiences and subjective sports performance of female athletes in Senior High Schools in the Ajumako district.

1.5 Research Objective

The main objectives of this study were to;

1. Assess female athletes' knowledge level related to menstruation.
2. Identify female athletes' practices related to menstruation regarding preparation to compete in sports.
3. Identify the link between athletes' knowledge and practices regarding menstruation.
4. Identify the link between menstruation experience and subjective sports performance of female athletes.

1.6 Research Questions

1. What are female athletes' knowledge levels related to menstruation?
2. What are female athletes' practices related to menstruation regarding preparation to compete in sports?
3. What is the correlation between athletes' knowledge and practices regarding menstruation?
4. What is the correlation of menstruation experience on subjective sports performance of female athletes?

1.7 Significance of the Study

The findings offer valuable data on female athletes and their menstruation during sports competition. Again, the findings of this study help female athletes manage their psychological responses, and physiological responses during competitions. The result educates both school matrons and head teachers to provide nutritional needs during menstruation to replenish blood lost in other to prevent iron deficiency among female

In addition, the findings of the study recommend innovative period-tracking systems for athletes and coaches. It would also contribute to the improvement of knowledge in the field of sports and exercise science in particular as well as physical education in general. Finally, the study serves as a source of reference for students and professionals in the field of physical education and sports.

1.8 Delimitations

The study was delimited to the cross-sectional research design. The study was also delimited to female athletes in all four public SHSs in the Ajumako district in the Central Region of Ghana. The questionnaire was used to measure the independent variable (menstruation) and dependent variable (sports performance).

1.9 Definition of terms

Sports Performance: is the measure of excellence in terms of skill, endurance, coordination, strength, and muscle recovery in sports.

Subjective: means without any experiment but self-reported.

Female athlete: is any student girl who participate in sports and represent their school in inter- school competition especially ball games, track and field events.

Coaches: are persons who provides instruction and guidance to athletes on how to improve their performance in a particular sport.

1.10 Limitations

Due to the double-track system of the High Schools in the Ajumako district, some of the participants were not available in their schools on the first visit of the researcher to the schools, and again, at the time of data collection, some of the participants were preparing for their WASSCE examination hence were restrictive towards responding to the questionnaire and this delayed the data collection process. Furthermore, using a questionnaire to measure sports performance relies on athletes' self-reported data which can be influenced the participant ability recall and again the athletes may overestimate or underestimate their abilities. That is to say, there was no intervention or experiment to measure sports performance.

1.11 Organization of the Study

Chapter One deals with the issues that went into the choice of the topic of study and its significance as well as the drawbacks. A review of related literature is in chapter two. Chapter three is systematized under methodology; research design, population, sample and sampling procedures, instrumentation, data collection procedures, and data analysis. Chapter four dealt with results and discussions while Chapter five looked at summary, conclusions, and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Overview

This chapter delves into the existing body of knowledge relevant to the research topic. It provides a summary of the key theories, concepts, and empirical studies that have informed and shaped the research. The literature review is based on relevant research and aimed at providing a base for the need for this study.

2.1 Theoretical Framework

2.1.1 Hormonal Theory

This theory was proposed by Morgan in 1919. The theory keeps revolving as various researchers are making use of it. The hormonal theory of sexuality and gender identity embraces that, just as an introduction to certain hormones plays a role in fetal sex differentiation, such introduction also impacts the sexual orientation and or gender identity that appears later in adulthood (Cunningham, 1922). The hormonal theory proposes that hormones play a significant role in determining behavior, knowledge level, perception, and mood in both humans and animals (Craig et al., 2004). According to this theory, various hormones, such as testosterone, estrogen, progesterone, dopamine, cortisol, and oxytocin, among others, have an important influence on an individual's emotions, motivations, and behavior. For instance, testosterone is linked to aggression and dominance, while estrogen is associated with emotional regulation and nurturing behaviors. The hormone of accomplishment or knowledge level is dopamine. Individual alertness, attention, creativity, long-term memory, and concentration are all improved by having increased dopamine levels in the body. This view is supported by the work of (Denson et al., 2018; Kusev et al., 2017). Additionally, cortisol, the "stress hormone," can impact an individual's

response to stress and anxiety, while oxytocin is involved in social bonding and trust. This is further explained using these examples, during the follicular phase (the first half of the menstrual cycle), estrogen levels rise, which can lead to increased energy levels, improved endurance, and faster muscle recovery. This may result in improved sports performance during this phase. However, during the luteal phase (the second half of the menstrual cycle), progesterone levels rise, which can lead to decreased energy levels, reduced endurance, and slower muscle recovery. Again, some research suggests that during the menstrual phase, when estrogen and progesterone levels are lower, female athletes might experience decreased strength and endurance which may result in a decrease in sports performance during this phase. The hormonal theory suggests that imbalances or fluctuations in these hormones can lead to changes in behavior and mood, including mood disorders such as depression or anxiety and it also implies that manipulating hormone levels through medication or hormone replacement therapy may help regulate or improve certain behaviors or emotional states (Kring, 2013).

2.1.2 Psycho-physiological Theory

This theory was initiated by Fahrenberg in 1988 the psychologist explains the theory as an interdisciplinary field of study that examines the relationships between the mind and body and the impact of psychological factors on physiological processes (Fahrenberg, 1988). This theory suggests that mental states, such as emotions, thoughts and beliefs can affect the functioning of the body and influence physiological responses such as heart rate, blood pressure, and hormone levels (Benson, 2019). The theory is based on the idea that psychological and physiological processes are interconnected and influence each other. For example, stress, anxiety, and other emotional states can cause physiological responses such as increased heart

rate and blood pressure. This was confirmed in this study (Myrtek, 2012). The psycho-physiological theory is used in a variety of fields, including psychology, medicine, and sports science. Research has continued to support the core tenets of psycho-physiological theory, with studies showing that physiological changes can be used to predict emotional responses and that emotional regulation techniques can influence physiological processes (Appelhans & Luecken, 2006). In sports science, psycho-physiological theory helps us better understand the relationship between the mind and body and how they work together to influence human behavior and experience and to optimize performance. The psycho-physiological theory proposes that these physical and psychological factors are interconnected and can affect each other. For instance, the physical discomfort associated with menstruation can lead to negative emotions, which can then impact an athlete's performance. Similarly, a lack of confidence or motivation during the luteal phase can contribute to physical fatigue and decreased performance.

2.1.3 Social- Cultural Theory

Social-cultural theory is a perspective in psychology that emphasizes the importance of social and cultural factors in human development, cognition, and behavior. It was first proposed by the Russian psychologist Lev Vygotsky in the early 20th century (Vygotsky & Cole, 1978), and has since been further developed by other researchers. According to social-cultural theory, individuals learn and develop through their interactions with other people as well as through the cultural and societal norms and values that surround them (Lum, 2013). This theory emphasizes the role of social interaction, language, and culture is shaped by how people think, learn and behave.

One of the key concepts in social-cultural theory is the idea of the "zone of proximal development," which refers to the gap between what a person can do on their own and what they can do with assistance from others who are more knowledgeable or skilled. Social-cultural theorists believe that learning and development occur most effectively when individuals are challenged to work within this zone of proximal development, with guidance and support from more experienced individuals (Hedegaard, 2012). By way of instruction, in some cultures, menstrual products may be expensive or difficult to access, which can impact an individual's ability to participate in physical activities during menstruation. Furthermore, the theory highlights how knowledge is transmitted through social interactions and linking this to menstruation and sports performance, open communication about the topic can lead to a better understanding of its actual effects on athletic performance (Scott & Palincsar, 2013). When accurate information is shared, athletes can make informed decisions and dissipate misconceptions. On the other hand, social-cultural theory also emphasizes the role of social support in shaping individuals' beliefs and behaviors. Athletes who receive positive support and encouragement from coaches, teammates, and peers may have more positive attitudes toward menstruation and feel empowered to perform well regardless of their menstrual cycle (Shabani et al., 2010).

In the framework of female athletes' sports performance, social-cultural theory can help to understand how cultural and social factors, including the menstrual cycle may influence their performance. In confirmation, Fink (2015) explored the perceived influence of menstruation on sports performance among female athletes from different cultural backgrounds. They found that cultural factors including beliefs about menstruation, influenced athletes' perceptions of how menstruation affected their performance.

2.2 The Concept of Menstrual Cycle

The menstrual cycle is a series of natural changes in hormone production and the anatomy of the female reproductive system's uterus and ovaries that allow for pregnancy. Hormonal signals sent from the brain control the menstrual period. Follicle-stimulating hormone encourages the growth and release of mature eggs, and progesterone levels rise to help fertilized eggs attach to the uterine lining (Reed & Carr, 2015). Welling (2013) stated that the menstrual cycle is the time from the first day of a woman's menses to the day before her next menses. The ovarian cycle regulates egg production and release, as well as progesterone and estrogen levels. The uterine cycle is responsible for preparing and maintaining the uterine lining (womb) to accept a fertilized egg. The lining breaks down and blood is discharged if implantation does not take place. The repeating monthly series of physiological changes in women and other female primates in which an egg is generated in the process known as ovulation, and the uterine lining thickens to allow for implantation if fertilization occurs. If the egg is not fertilized, the lining of the uterus breaks down and is discharged during menstruation. Smith & Smith (2018) pointed out that the menstrual cycle refers to the regular, monthly process by which a woman's body prepares for the possibility of pregnancy. It is controlled by the complex interplay of hormones and involves the shedding of the uterine lining (menstruation), the development and release of an egg (ovulation), and changes in the cervical mucus and uterine lining to facilitate the implantation of a fertilized egg. Menstruation after ovulation is often referred to as ovulation menstruation (Mallinson et al., 2013). Women's menstrual cycles are marked by a wide range of cycle lengths (26-35 days), 5-day menses, a fertile period from 5 days before ovulation, and low fertility that is influenced by cycle length and age (Mihm et al., 2011). According to Hurt et al.

(2012), The first day of the previous period marks the beginning, while the first day of the subsequent period marks the end. The length of women's cycles, however, varies, especially in the first year or two following a young woman's first period. Over the first few years, women's periods might range from 21 days to 45 days. Any value outside of this range, though, might call for medical attention. Based on the above definitions, I will therefore explain the menstrual cycle as the sequence of events that occur in the bodies of females as they prepare for the likelihood of pregnancy each month. Every female's cycle is slightly different, but the process is the same. Menstruation, commonly referred to as a period, is a natural physiological process that occurs in the reproductive system of people with female anatomy. It is a monthly occurrence in which the lining of the uterus, known as the endometrium, sheds and is expelled through the vagina (Critchley et al., 2020).

Menarche is well-defined as the first menstrual period in a female adolescent. Menarche naturally occurs between the ages of 10 and 16, with the average age of onset being 12.4 years (Marván & Alcalá-Herrera, 2014). Deferred puberty in girls occurs when breasts don't develop by age 13 or menstrual periods do not begin by age 16 (Dambhare et al., 2012). Puberty changes transpire when the body starts making sex hormones and these changes normally start to appear in girls between the ages of 8 to 14 years (Lin et al., 2018).

Tenforde et al. (2013) reported that late menarche (age >15) was connected with stress fractures among high school runners. Afshariani et al. (2015) conducted a study comparing the menarche of athletes and non-athletes and concluded that the age at menarche for the athletic group was significantly delayed Contrary to these

findings, Calthorpe et al. (2019) concluded that menarche age occurred 1.13 years earlier than non-athletes.

2.3 Phases of the menstrual cycle

The menstrual cycle has four phases which are further compressed into three: menstruation, the follicular phase, ovulation, and the luteal phase. The menstrual phase is the first stage of the menstrual cycle. It is also at this phase that females get their period. This phase starts when an egg from the previous cycle is not fertilized because pregnancy has not taken place, and levels of the hormones estrogen and progesterone drop (Kumar et al., 2013). The thickened lining of the uterus, which would support a pregnancy, is no longer needed, so it sheds through the vagina (Brar et al., 2015). During this period, females release a combination of blood, mucus, and tissue from the uterus. On average, females are in this phase for 3 to 7 days (Barbieri, 2014). The follicular phase begins with menstruation and continues until ovulation and the main event of this phase, as the name describes, is the development of the ovarian follicles in folliculogenesis (El-Sadi et al., 2013). As gonadotropin-releasing hormone (GnRH) from the hypothalamus increases, follicle-stimulating hormone (FSH) from the pituitary gland lifts during the beginning of the cycle, convoyed by a lessening in estrogen and progesterone. During the first 4 days of menses, certain follicles are employed from non-proliferating follicles when FSH enters the ovaries. From day 5 through 7, one of the employed follicles is carefully chosen to ovulate while the others undergo degeneration. The selected follicle then promotes its growth and dominates over the others by day 8 (Holesh et al., 2017). As this follicle grows, the levels of estrogen increase. As the estrogen levels rise, the FSH will drop in response. During the first ten days, luteinizing hormone remains at a steady low level due to inhibition from low estrogen levels. However, as the maturing follicle produces

a surge of estrogen, it stimulates the release of luteinizing hormone (Larasati, 2021). About 34-36 hours after the onset of the surge in luteinizing hormone, ovulation occurs in the mature follicle (Markovic & Markovic, 2008). The oocyte or egg is released from the ovary and luteinizing hormone, GnRH, and estrogen all decrease. The FSH has a small spike around ovulation as well, thought to assist in freeing the oocyte from the beginning after ovulation, normally around day 14 of the menstrual cycle. The coordinated function of the hypothalamus, pituitary, ovary, and endometrium leads to the ovulatory menstrual cycle. The hypothalamus controls the menstrual cycle tempo through the pulsatile release of gonadotropin-releasing hormone. The follicle that is left over is termed a corpus luteum, hence the luteal phase. This follicle stimulates declining estrogen levels to rise and then drop slightly, progesterone levels (which had been low the whole time) to rise, and inhibin levels that were not present to increase. Inhibin suppresses the release of FSH while progesterone suppresses the release of GnRH. Progesterone stimulates the growth of the uterine or endometrial lining to prepare the egg for implantation in the case of fertilization (Rosner et al., 2019). If a pregnancy occurred, human chorionic gonadotropin would sustain the corpus luteum. However, without fertilization, the corpus luteum continues to degenerate, and the release of progesterone, estrogen, and inhibin decreases; this, in turn, allows GnRH to increase, stimulating FSH. The decrease in progesterone leads to shedding of the uterine lining, also called the endometrial lining, and marks the beginning of the next cycle (Jones & Lopez, 2013)

2.4 Premenstrual Syndrome (PMS)

Premenstrual syndrome (PMS) is the heading applied to a far-reaching range of physical and psychological symptoms that occur cyclically, usually seven to 14 days before the commencement of a woman's menstruation, and vanish after menstruation

(Jasuja et al., 2014). Premenstrual Syndrome is a term often used as a pun to describe ridiculous behavior in females however, the group of symptoms that are associated with PMS should not be taken lightly. Statistics have revealed that 80-95% of females experience repeated symptoms of PMS, with 5% experiencing symptoms so severe that their daily lives are disordered (Rapkin et al., 2019). Another study showed a prevalence of 23-31% of reproductive-aged women experiencing symptoms that caused daily life disruption (Heesterbeek et al., 2017). This was contrary to a study conducted by Chung et al. (2014) which concludes that in most female athletes the symptoms are mild without causing impairment in daily activities. Those symptoms are in the literature described as physiological rather than pathological. The Journal of Clinical and Diagnostic Research considers PMS to involve a group of emotional symptoms that may or may not be accompanied by physical symptoms, related to a woman's reproductive cycle and occurring during the luteal phase up to the time of menstruation (Noviyanti et al., 2021). Although 17 different symptoms may be categorized under PMS, Freeman et al. (2011) found that using only 6 core symptoms discriminated, just as effectively, whether a woman was experiencing PMS. These symptoms include anxiety/tension, mood swings, aches, appetite/food cravings, cramps, and a decreased interest in activities. Abnormal functioning of the hypothalamic-pituitary-adrenal axis (HPA) leading to flawed adrenal hormone secretion, nutritional defects, and environmental factors have been identified as the main causes of PMS (Doan, 2021). An additional factor, noted by Bharati (2016) indicates that the rise in ovarian steroid hormones during the menstrual cycle unmasks a calcium deficiency that is otherwise hidden in the rest of the cycle. PMS is one of the clearest impacts of the menstrual cycle on female athletics. This slew of symptoms is something many females will experience for up to 7 days, every single month.

Czajkowska et al. (2015) found that 42.4% of the 75 female athlete subjects aged 16 to 22 years old had symptoms that were diagnosed as PMS. Having anxiety, mood swings, aches, food cravings, cramps, and a decreased interest in activities understandably affects how the female athlete is feeling during training and competition (Twark et al., 2018). The most prevalent symptoms include irritability, mood lability, depression, anxiety, impulsivity, fluid retention, breast swelling, and general aches (Koushkie Jahromi et al., 2008). These symptoms mimic feeling sick and not much like the normal self of females. While there are many painkillers and hormonal supplements on the market to manage these symptoms, a study in the Journal of Caring Sciences showed that yoga proves to be an effective form of alleviation from PMS symptoms due to its stress reduction in increasing parasympathetic activity and a moderate degree of exercise and toning to the body (Bharati, 2016). It also found calcium supplementation to be of benefit, but not quite as impactful as yoga. Although PMS is not desirable when it comes to athletics, females can take action to mitigate their symptoms. Takeda et al. (2015) showed that premenstrual symptoms affect not only the daily activities but also the athletic performance of collegiate athletes. Conversely, Adachi et al. (2008) concluded that (56%) of respondents reported premenstrual symptoms might not affect their athletic performance. Competitive sports, an older median age, an older menarche age, a longer athletic career, and an intense training regimen are all associated with PMS. The length and intensity of competitive exercises enhance the likelihood of PMS (Czajkowska et al., 2015).

2.5 Management Strategies for Menstrual-Related Symptoms

Several studies have investigated management strategies for menstrual cycle-related symptoms that may impact athletic performance. A study by Rechichi (2010) found that female athletes commonly used oral contraceptives to regulate their menstrual cycle, and this was associated with improved athletic performance. The authors suggested that oral contraceptives may provide a stable hormonal environment, reducing the impact of hormonal fluctuations on athletic performance.

Micklewright et al. (2017) investigated the impact of menstrual cycle-related symptoms, such as pain and fatigue, on athletic performance and management strategies. The authors found that female athletes commonly used pain relief medication, such as non-steroidal anti-inflammatory drugs (NSAIDs), to manage menstrual cycle-related pain. Additionally, the authors found that premenstrual syndrome (PMS) management strategies, such as lifestyle modifications and stress reduction techniques, may improve athletic performance during the menstrual cycle.

In cases of iron deficiency anemia, iron supplements may be recommended to restore iron levels (Snook et al., 2021). Mood changes and irritability are common symptoms experienced by female athletes during their menstrual cycle, engaging in regular exercise has been shown to stabilize mood swings and improve overall mood however Stress management techniques, including relaxation exercises and mindfulness practices, have also been effective in reducing irritability and improving emotional well-being (Anderson et al., 2022).

Female athletes often experience bloating and fluid retention during their menstrual cycle, limiting sodium intake has been shown to help reduce fluid retention however increasing water consumption may seem counterintuitive but can help flush out

excess fluids and alleviate bloating (Smith & Johnson, 2017). Fatigue and low energy levels can significantly affect athletic performance, ensuring adequate rest and sleep during the menstrual cycle are crucial to combat fatigue furthermore consuming a balanced diet that includes iron-rich foods can also help combat fatigue associated with anemia (Avery, 2021).

In summary, female athletes can effectively manage menstrual cycle-related symptoms through various strategies. Pain and cramps can be alleviated with NSAIDs and heat therapy. Hormonal birth control methods and iron supplements can help regulate heavy bleeding and prevent anemia. Engaging in regular exercise, stress management techniques, and maintaining a balanced diet are beneficial for managing mood changes, irritability, and fatigue. Sodium restriction and increased water consumption can aid in reducing bloating and fluid retention. Implementing these management strategies can contribute to the overall well-being and athletic performance of female athletes (Anderson et al., 2022).

2.6 Menstrual disorders among female Athletes

Menstrual disorders refer to any abnormal or problematic changes in a woman's menstrual cycle. These distractions could be physical, emotional, and in some cases psychological symptoms that come up before, during, and after menstruation. Pregnancy, hormonal imbalances, infections, diseases, trauma, and certain medications are the likely factors that cause menstrual disorders among the general population. Female athletes may experience menstrual disorders due to a variety of factors such as training intensities, anxiety to win, improper dieting, overtraining, stress, weight loss, and duration of training related to their training and competition. For women involved in sports, menstrual anomalies have been more common than

their sedentary counterparts (Stefani et al., 2016). The most common menstrual disorder among female athletes is called "exercise-induced amenorrhea," which is the absence of menstrual periods due to high levels of physical activity. It is grouped into primary and secondary. Primary amenorrhea is usually defined as a failure to reach the first menstrual period—menarche before 12- 15 years and secondary amenorrhea is explained as the absence of menstruation for 3 or more months in women with previously regular menses or for 6 months in women with previously irregular menses (Gimunová et al., 2022; Nora et al., 2021). This can be caused by a combination of factors, including low body weight, low body fat percentage, and high levels of stress hormones such as cortisol (Klein & Poth, 2013).

Dysmenorrhea is one of the most common menstrual disorders and is defined as painful menses classically relating to abnormal cramps. Painful menstruation is categorized into primary and secondary forms. Primary dysmenorrhea is defined as painful menses with no recognizable pelvic pathology which comes as a result of abnormal contractions of the uterus due to a chemical imbalance in the body. Secondary dysmenorrhea refers to painful menses resulting from a pelvic abnormality that occurs as a result of medical conditions, such as fibroids (Gray, 2013).

Menorrhagia is heavy menstrual bleeding that lasts longer than normal. It may be related to hormonal imbalances or conditions such as endometriosis. It is known as hypermenorrhea. It may be associated with anemia, fatigue, and other health problems. Menorrhagia among athletes may be caused by a variety of factors. Intense training and exercise can disrupt the normal hormonal balance and affect the menstrual cycle. Athletes who have low body weight or body fat may also be at increased risk of developing menorrhagia (Bruinvels et al., 2016).

A study conducted by Wodarska et al. (2013) on menstrual cycle disorders among female volleyball players and the results of the study showed that irregular menstruation occurred in 19% of girls, spotting between menstrual periods in 27%, and heavy menstruation was reported in 33% of girls. Out of all volleyball female players participating in the study, 94 girls (45%) declared an absence of menstrual periods after regular cycles. De Souza et al. (2010) reported that it is known that female athletes underreport menstrual cycle problems, with a prevalence of up to 40% in some studies. Miller et al. (2012) found that 22% of athletes in lean-build sports would not report amenorrhea. Witkoś &Wróbel (2019) found that Menstrual disorders following a period of regular menstruation were reported by 132 (56.7%) of ballroom dancers. In 105 (79.5%), the absence of a menstrual period lasted for less than 3 months, in 18 (13.6%) it persisted for 3 up to 6 months, while in 9 (6.8%) it lasted for over 6 months.

2.7 Female Athletic Triad

The female athletic triad refers to a combination of three interrelated conditions (disordered eating, Amenorrhea and low energy availability) that commonly affect physically active females, particularly those involved in sports or endurance activities (de Oliveira et al., 2017). Disordered eating refers to a range of irregular eating behaviors and attitudes towards food (Barrack et al., 2013). Athletes with the triad may restrict their caloric intake, engage in extreme dieting, or develop an unhealthy obsession with body weight and shape. Disordered eating patterns can lead to inadequate nutrition, which can negatively impact overall health and athletic performance (Loth et al., 2014). The most common eating disorders among female athletes include bulimia nervosa and anorexia nervosa. Bulimia nervosa is characterized by cycles of binge eating followed by compensatory behaviors such as

self-induced vomiting, excessive exercise, or the misuse of laxatives and female athletes participating in sports that emphasize appearance, weight, or performance in weight-class sports (Coelho et al., 2014). Anorexia Nervosa involves extreme restriction of food intake, fear of gaining weight, and distorted body image. Female athletes, especially those in sports that emphasize leanness or weight control, such as gymnastics, figure skating, or endurance sports, may be at higher risk (de Oliveira et al., 2017). Amenorrhea is the absence or cessation of menstrual periods. In the context of the female athletic triad, it is often caused by low energy availability due to inadequate caloric intake. Intense exercise can also contribute to the disruption of hormonal balance, leading to the suppression of the menstrual cycle (Barrack et al., 2013). Prolonged amenorrhea can have long-term health consequences, such as reduced bone density and an increased risk of stress fractures (Matzkin et al., 2015). Osteoporosis is a condition characterized by decreased bone mineral density and increased susceptibility to fractures. In the female athletic triad, the combination of disordered eating and amenorrhea can significantly impact bone health. Insufficient calorie intake and hormonal imbalances can disrupt the normal bone remodeling process, leading to weakened bones and an increased risk of fractures (Weiss Kelly et al., 2016). Many more female athletes experience difficulties along the range of energy balance, menstrual function, and bone mineral density (Thein-Nissenbaum & Carr, 2011). While the triad can affect athletes of all ages, it poses particular risks for adolescent athletes due to the vulnerability of their developing bodies (Ackerman et al., 2019). Mountjoy et al. (2014) engaged on a cross-sectional study that assessed 1,285 adolescent athletes aged 13 to 18 years and found a prevalence rate of 18.5% for the triad. Furthermore, they identified several risk factors such as high levels of sports specialization, early initiation of intense training, and pressure to excel in

sports. These findings were supported by a longitudinal study conducted by Tenforde et al. (2020), which followed 675 female adolescent runners over three years they reported a prevalence rate of 21.6% for the triad and noted that early onset of menstruation and high running mileage were significant risk factors.

The consequences of the female athlete triad among adolescent athletes extend beyond immediate health concerns. In a study by Mehta et al. (2018), which included 200 adolescent female gymnasts, participants with the triad exhibited significantly lower bone mineral density compared to those without the condition. This finding raises concerns about long-term skeletal health and the potential for increased risk of stress fractures and osteoporosis later in life. In addition to the physical implications, the triad also impacts psychological well-being. A study by Nichols et al. (2016) involving 256 female high school athletes demonstrated that those with the triad had higher levels of depression and anxiety compared to their counterparts without the condition.

2.8 Relative Energy Deficiency in Sports (RED-S)

Relative Energy Deficiency in Sports (RED-S) is a condition that affects both male and female athletes but is particularly prevalent among female athletes. RED-S occurs when there is an imbalance between energy intake and energy expenditure in the body, leading to a chronic state of low energy availability (Mountjoy et al., 2014). Female athletes are at a higher risk of developing RED-S due to factors such as societal pressures related to body image and weight, sport-specific demands, and hormonal fluctuations (Ackerman et al., 2019). RED-S can occur in any sport or activity level, ranging from recreational athletes to elite competitors. RED-S can have various negative effects on a female athlete's health and performance. These include

menstrual disturbances, bone health issues, metabolic and endocrine disruptions, impaired athletic performance, and psychological and emotional effects (Ackerman et al., 2019).

RED-S and menstrual dysfunction can have several negative consequences for female athletes. The reduced levels of estrogen associated with menstrual dysfunction can lead to a decrease in bone mineral density, which increases the risk of stress fractures and osteoporosis additionally, RED-S can affect an athlete's immune function, cardiovascular health, and psychological well-being (Fenton, 2022). It is important to note that RED-S is a complex condition influenced by multiple factors, including energy intake, exercise volume, and other individual factors. It is not solely caused by low body weight or body fat levels but can occur in athletes across the weight spectrum. Athletes participating in sports that emphasize leanness or have weight-class categories may be particularly susceptible due to the pressure to maintain low body weight (Mancine et al., 2020).

The treatment for RED-S and menstrual dysfunction involves increasing energy availability through adequate calorie intake and balancing energy expenditure with rest and recovery (Givens et al., 2023; Logue et al., 2020). Athletes may need guidance from healthcare professionals, including sports dietitians, to develop appropriate nutrition and training plans that support their energy needs (Thein-Nissenbaum & Hammer, 2017). Hormones like estrogen and progesterone play vital roles in bone health, muscle function, and recovery. Low estrogen levels resulting from RED-S can affect bone mineral density, leading to an increased risk of stress fractures and other bone-related injuries however hormonal imbalances can also

impact muscle strength, power, and endurance, potentially compromising athletic performance (Lane et al., 2021).

2.9 Menstruation, injuries, and ligament laxity

Sports injuries occur more frequently in women than in men, sometimes by a factor of almost 10 and these statistics are the result of several athletic endeavors, including baseball games, running, and military training (Clarsen, 2021). Anatomical and biomechanical elements, neuromuscular control, and ligament laxity are a few suggested ways that the female hormones may have an impact (Breedt et al., 2019). Interestingly, female athletes suffer greater injuries in sports that don't involve the more popular running, jumping, and landing movements. Women experienced almost twice as many injuries while mountain biking, according to a recent study (Kronisch et al., 2012). Lower body and bone mass may raise the chances of falls and fractures, according to the researchers' hypothesis. However, the majority of research focuses on ACL laxity and knee injury (Renstrom et al., 2018). Injuries can occur due to accidents, overexertion, repetitive motions, or trauma from either emotional, psychological, or physical occurrence and they can affect different parts of the body, including muscles, bones, tendons, and ligaments (Saragiotto et al., 2014). Ligaments are tough bands of tissue that connect bones and provide stability to joints. Injuries to ligaments can range from mild sprains to severe tears depending on the extent of damage (Chan et al., 2011).

Ligament laxity refers to the looseness or excessive flexibility of ligaments (Wolf et al., 2011). Some individuals naturally have more lax ligaments, which can make their joints more mobile. However, excessive ligament laxity can increase the risk of injuries, particularly those related to joints (Belanger et al., 2013). Some women may

experience ligament laxity or joint stability changes during specific phases of their menstrual cycle. This could be due to hormonal fluctuations or fluid retention, which may affect ligament and joint function Such changes might increase the risk of injuries during certain menstrual cycle phases (Eiling et al., 2017). A correlational study was led by Martínez-Fortuny et al. (2023) to analyze the relationship between the menstrual cycle and injuries in female sports practice and it was concluded that the ovulatory phase is associated with an increased risk of injury they again found out that it seems that hormonal fluctuations throughout the menstrual cycle alter values such as laxity, strength, body temperature, and neuromuscular control, among others. This fact causes women to constantly adapt to hormonal variations, which exposes them to a higher risk of injury. On the contrary, results from (Adachi et al., 2018) indicated that a significant increase in non-contact ACL injuries in teenage female athletes during the ovulatory phase of the menstrual cycle and the subjective activity level and the premenstrual and menstrual symptoms might not affect the likelihood of the injuries. Athletes reporting disordered eating were twice as likely to be injured compared to those reporting normal eating behaviors (Thein-Nissenbaum et al., 2011).

Hormonal contraceptives, female athletes, and menstruation

Hormonal contraceptives are used by roughly half of female athletes and might disturb athletic performance as a consequence of their action on the endogenous hormonal scene (Martin & Elliott-Sale, 2016). Hormonal contraceptives are medications or devices that use synthetic hormones to prevent pregnancy by altering the natural hormonal balance in the body as well as delaying the menstrual cycle they can play a significant role in the lives of female athletes by providing them with reproductive health control and allowing them to effectively manage their menstrual

cycles (Colquitt & Martin, 2017). Hormonal contraceptives can help regulate and stabilize the menstrual cycle, this can be particularly beneficial for female athletes who may experience irregular or heavy periods, as it can provide predictability and allow them to plan their training and competition schedule more effectively (Robakis et al., 2015). Some female athletes may experience uncomfortable symptoms during their menstrual cycle, such as cramps, bloating, and mood changes but hormonal contraceptives can help alleviate these symptoms, allowing athletes to perform at their best without being hindered by menstrual-related discomfort (Heyward et al., 2022). Intense physical training and high levels of exercise can sometimes lead to menstrual irregularities, such as amenorrhea and hormonal contraceptives can help regulate the menstrual cycle as well as prevent these irregularities, which can be important for maintaining bone health and hormonal balance (Thompson et al., 2020).

Hormonal contraceptives, such as birth control pills, patches, or vaginal rings, offer convenience and flexibility in managing reproductive health (Mansour, 2014). This helps provide athletes with the ability to plan and control their menstrual cycles, allowing them to schedule their training, competition, and recovery periods more effectively it was again argued that using medication to delay menstruation may reduce anxiety and stress related to concerns about menstrual symptoms and their potential impact on performance. Heavy menstrual bleeding can sometimes lead to iron deficiency anemia, which can negatively impact athletic performance hormonal contraceptives can help reduce the amount of bleeding and lower the risk of anemia in female athletes and it was again highlighted that delaying menstruation through medication can help female athletes maintain consistent training and competition schedules, potentially improving overall performance (Deldicque & Francaux, 2015).

McNulty et al. (2020) on the effects of contraceptive use on exercise performance in athletes found out orals contraceptives pills use might result in slightly inferior exercise performance on average when compared to naturally menstruating women, although any group-level effect is most likely to be trivial. Antero et al. (2023) conducted a study on the Prevalence of hormonal contraceptive use and reported side effects of the menstrual cycle and hormonal contraceptive use in powerlifting and rugby and they found out that HC use was reported by 51.1% of athletes with the most common being unnamed cramping (42.4%), headache/migraine (24.5%), and fatigue (24.5%). Side effects were reported in 40.0% of HC users.

According to a study by O'Connor et al. (2017), contraceptives (COCs) were found to decrease the duration and intensity of menstrual bleeding in female athletes. Similarly, another by study Williams and MacDonald (2021) indicated that POCs led to a higher prevalence of amenorrhea study or oligomenorrhea among athletes. These findings suggest that hormonal contraceptives can disrupt normal menstrual function in female athletes. In a randomized controlled trial conducted by Mitchell et al. (2018), COCs were associated with decreased leg strength and slower 10-km running performance in female athletes. On the other hand, a systematic review by Gomes et al.(2022) reported no significant effects of hormonal contraceptives on aerobic performance or muscle strength in athletes.

2.10 Menstruation and Dietary Intake

Female athletes require optimal nutrition to support their athletic performance, recovery, and overall health. Dietary intake refers to the consumption of food and beverages by an individual or a population. It represents the quantity and quality of nutrients, energy, and other components obtained through eating and drinking.

Dietary intake encompasses all the foods, beverages, and supplements that are consumed over a specific period, such as a day, a week, or a month (Stang & Stotmeister, 2017). Dietary intake includes various macronutrients (carbohydrates, proteins, and fats), micronutrients (vitamins and minerals), fiber, water, and other bioactive compounds in foods. It can also refer to the specific types of diets or eating patterns followed by individuals, such as vegetarian, Mediterranean, or low-carbohydrate diets (Schmidt et al., 2021).

Assessing and monitoring dietary intake is important for understanding nutritional status, identifying deficiencies or excesses, and evaluating the impact of diet on health outcomes. Methods for assessing dietary intake include food diaries, 24-hour dietary recalls, food frequency questionnaires, and more advanced techniques like biomarker analysis (Naska et al., 2017). Rogan & Black (2022) asserts dietary energy intake across the menstrual cycle and it was concluded that energy intake seems to be lower in the follicular phase likened to the luteal phase, with a particular decrease in the days leading up to and including ovulation. Smith et al. (2018) steered a study with 50 women and found that energy intake was significantly higher during the luteal phase compared to the follicular phase. Furthermore, a study by Johnson and Brown (2019) explored the influence of menstrual cycle phases on macronutrient intake. They reported that women tend to consume more carbohydrates and fats during the late luteal phase compared to the early follicular phase. However, there were no significant differences in protein intake between the menstrual cycle phases. Contrarily, a study by Anderson et al. (2022) observed no significant differences in dietary energy intake across the menstrual cycle phases among a sample of 100 women. Women with premenstrual syndrome (PMS), who may be more sensitive to cyclical hormonal or neurotransmitter variations, have been reported to have higher

premenstrual increments in caloric intake and a preference for carbohydrates (Bryant et al., 2016).

2.11 Iron Status and Female Athletes

Iron is a nutritionally important mineral needed to promote mental and physical health. Female athletes' performance may be impacted by low iron levels, which are typical in premenstrual women and may worsen after physical activity (Thachil, 2015). Inadequate dietary iron intake, iron losses through menstruation, gastrointestinal bleeding, and decreased iron absorption as a result of pro-inflammatory cytokine production are all factors that could influence the iron status of female athletes (McClung, 2012). Women who are menstruating, especially those who have severe monthly blood flow, are more likely to be anemic and according to Sandström et al. (2012) in their study on iron deficiency in female adolescent athletes, their findings reviewed iron deficiency and iron deficiency anemia are common among female adolescents but not more common among athletes than nonathletes. The presence of a menstrual cycle in the premenopausal years is frequently mentioned as the cause of the higher prevalence of iron insufficiency in female athletes than in their male counterparts (Badenhorst et al., 2021). Thachil (2015) found that iron deficiency anemia can lead to reduced oxygen-carrying capacity, resulting in early fatigue, decreased endurance, and impaired recovery. Furthermore, De Souza et al. (2010) highlighted that iron deficiency may hinder muscle function and compromise immune responses, increasing the susceptibility to infections and injury among female athletes.

2.12 Body Temperature and menstruation of female athletes

Body temperature can be influenced by various factors, including menstrual cycles. During the menstrual cycle, hormone levels, particularly estrogen, and progesterone, fluctuate, which can have an impact on thermoregulation and body temperature in some female athletes (Tatsumi et al., 2020). Around the time of ovulation (usually mid-cycle), when estrogen levels are higher, some women may experience a slight increase in basal body temperature. This is known as the luteal phase temperature rise and is often used by women who are trying to conceive to track their fertility (Baker et al., 2020). During menstruation, women's body temperatures may be slightly lower on average due to hormonal changes, but this change is also subtle and not usually noticeable in normal day-to-day functioning. However, during intense physical activity, female athletes, regardless of their menstrual cycle phase, can experience an elevation in body temperature due to the thermogenic effects of exercise (Charkoudian et al., 2017). This increase is primarily influenced by the intensity and duration of the activity rather than the menstrual cycle itself. It is essential for all athletes, including menstruating female athletes, to stay adequately hydrated and take appropriate measures to prevent overheating during intense workouts or competitions (Tambalis, 2022). Ensuring access to fluids, taking regular breaks, and practicing proper heat acclimatization strategies are crucial in maintaining optimal performance and preventing heat-related illnesses (Nichols, 2014). Speaking with a healthcare expert, such as a sports medicine physician or gynecologist, can offer tailored guidance and strategies to maximize the athletic performance of female athletes who are having disruptive menstrual cycle symptoms or who are worried about their performance and body temperature regulation (Forbes-Robertson et al., 2012).

2.13 Sleep status and menstruation

Women report poorer sleep quality and are more likely to experience insomnia than males, and these gender variations in sleep start at a very young age (Meers et al., 2019). Variations in reproductive hormones, stress, sadness, age, changes in one's life or role, and other things might have an impact on one's ability to sleep. Changes in sleep architecture and circadian rhythms are related to the menstrual cycle (Shechter & Boivin, 2010). In comparison to other periods of the menstrual cycle, premenstrual week sleep quality and disruption are frequently reported to be worse in menstruating women (even without severe menstrual-related problems) (Baker & Lee, 2022). Women with severe premenstrual syndrome frequently experience more troubling dreams, increased tiredness, weariness, and lower alertness and focus during the premenstrual phase in addition to these sleep disruptions (Nowakowski et al., 2013).

During the follicular phase, characterized by low estrogen and progesterone levels, women generally experience better sleep quality (Baker et al., 2020). However, in the luteal phase, with elevated levels of these hormones, sleep disturbances such as increased wakefulness and decreased sleep efficiency have been reported (Baker et al., 2020). Female athletes may face sleep disorders, such as insomnia and sleep apnea, which can be exacerbated by menstrual irregularities. Hormonal imbalances and disruptions in the menstrual cycle commonly seen in female athletes have been associated with sleep disturbances (Kwan et al., 2013).

Results suggested by Xing et al. (2020) show that sleep disturbance is associated with menstrual problems among female university students. More attention should be paid to improving sleep quality and insomnia symptoms in individuals with menstrual problems. Similarly, Liu et al. (2017) reviewed that irregular periods and period pain

appear to be associated with sleep disturbance and that early menarche may have a short-term impact on sleep in adolescent girls. Conversely, to the findings above Most athletes reported some sleep complaints, with men reporting more sleep complaints than women in the clinical evaluation. Polysomnography (PSG) showed that 36% of all athletes had a sleep disorder with a greater reduction in sleep quality in men than in women (Silva et al., 2019). In a study conducted by Riederer (2020), the author found that approximately 66% of athletes fell below the recommended 8 hours of sleep per night. Those teams that finished higher in the competition had greater durations of sleep than those that finished lower in the competition. The author concluded that athletes who had more time in bed and longer sleep duration finished higher in the competition.

2.14 Menstrual cycle education and female Athletes

Menstrual cycle education signifies the provision of information about the menstrual cycle, including its phases, hormonal changes, and potential impacts on physical and psychological health. It aims to empower individuals, particularly females, to understand and manage their menstrual cycles positively (Joshi et al., 2015). To effectively incorporate menstrual cycle education, several best practices can be adopted, to begin with, the use of evidence-based educational materials, such as online resources and interactive workshops, can provide accurate information on menstrual cycle physiology and its implications for athletic performance (Oosthuyse & Bosch, 2010). Additionally, integrating menstrual cycle tracking apps and technologies such as FLO Health, and Spot On can help athletes monitor their cycle and identify patterns or irregularities (Baltzell et al., 2019). Furthermore, creating a supportive and inclusive environment through open dialogue, non-judgmental communication, and DE stigmatization efforts can encourage athletes to seek

guidance and share their experiences (Hills et al., 2022). Menstrual cycle education promotes body literacy, empowering athletes to recognize and address any menstrual-related issues promptly (Heikura et al., 2020).

2.15 Athletes' Knowledge level related to the menstrual cycle

Menstrual knowledge refers to the understanding and awareness an individual has about the menstrual cycle, including the biological processes, physiological changes, and the impact it may have on their health, emotions, and performance (Kressbach, 2021). This knowledge includes understanding the menstrual cycle's phases, duration, frequency, and common symptoms such as cramps, bloating, and mood swings. It also includes knowledge of menstrual hygiene, such as proper menstrual product usage, disposal, and cleaning practices (Chandra-Mouli & Patel, 2020).

It was postulated by Larsen et al. (2020) that student athletes' knowledge surrounding the menstrual cycle and oral contraceptives were low in most elite athletes. It was suggested that further education is warranted to enable athletes to make informed decisions regarding hormonal contraception, and any educational interventions should be implemented across all athlete groups. In line with the literature above, female student athletes' knowledge of the menstrual cycle is not sufficient, and for that matter coaches and physical education teachers should educate student-athletes on the symptoms of menses and their implications on athletes' sports performance.

Martin et al. (2018) discovered that the perceived knowledge of elite athletes on the menstrual cycle was inadequate and they also oblivious about side effects of contraceptives on their sports performance. It was therefore indicated that athletes and coaches should maintain an open dialogue to pursue the best interests of the athletes about their menstrual cycle. Based on the review above, it is clear that female athletes

do not have adequate knowledge of the menstrual cycle as well as its side effects on their sports performance. This, therefore, suggests that coaches and physical education teachers should ensure open and free dialogue among female athletes on the menstrual cycle to appreciate the importance of menses and how it may influence sports performance.

Engseth et al. (2022) conducted a study on the Prevalence and Self-Perceived Experiences with the Use of Hormonal Contraceptives Among Competitive Female Cross-Country Skiers and Biathletes in Norway: The fendura Project, which revealed that student-athletes resort to the use of hormonal contraceptives to manipulate their menstrual cycle due to perceived negative menstrual-related symptoms that interfered with their training sessions and/or competitions. The above-reviewed literature suggests that student-athletes have some perceived knowledge of the menstrual cycle and how the menstrual symptoms affect their training sessions as well as competitions.

A study by Brown et al. (2021) on Elite female athletes' experiences and perceptions of the menstrual cycle on training and sports performance revealed that athletes experiencing a natural menstrual cycle reported physical symptoms alongside mood disturbances and reduced motivation to train. They added that the decision to actively control the menstrual cycle was often triggered by a desire to reduce the effect on competition, to lessen anxieties about making the required weight, or to reduce distractions to manage during competition. Athletes indicated an openness to talk about the menstrual cycle to other females, however, there was variation in the comfort athletes experienced regarding talking to male coaches. Overall, the findings highlighted the need to educate elite athletes and coaches on the menstrual cycle,

considering it in the same light as other physiological functions in sports to improve health, well-being, and performance. Furthermore, they suggested that providing education on how to construct positive conversations, and equipping individuals with the correct terminology, and confidence to talk about the menstrual cycle will reduce some reservations identified through improved knowledge and understanding. About the above review, female student-athletes have some perceived knowledge of the menstrual cycle, which manifests through the numerous symptoms exhibited by them. In line with that, this, therefore, suggests that coaches, as well as physical education teachers, should educate female student-athletes on the health protocols during menses and their implications on their sports performance.

Based on previous studies on women athletes from various sports (Bruinvels et al. 2021; Heather et al., 2021) the most commonly reported symptoms in this cohort were abdominal cramps, headache, mood swings, irritability, and breast tenderness. Also, like other studies, they were most frequently reported during menses and the week before menses (Brown et al., 2020). Given the above literature, it is obvious that student-athletes have some perceived knowledge of the menstrual cycle as well as its implications on sports performance, which therefore suggests that the menstrual cycle has a lot of influence on the sports performance of female student-athletes.

Further studies have indicated that understanding the menstrual cycle in women football players is all the more pertinent as it and the hormonal fluctuations thereof may cause physical symptomatology such as breast tenderness, abdominal pain, and cramping and a variety of menstrual disorders which may negatively impact football participation and performance (Bruinvels et al., 2016). Additionally, since psychological parameters such as mood changes, anxiety, and caution (or lack

thereof) can be influenced by menstrual cycle hormones, psychological symptoms may also be a risk factor for injury in women football players (Niyonsenga & Phillips, 2013). Therefore, the occurrence of menstrual cycle symptoms ought to be explored further in women football players to better inform training schedules and injury prevention models.

A study conducted by Chauhan et al. (2019) to assess knowledge, attitude, and practices related to the menstrual cycle and management of menstrual hygiene among school-going adolescent girls in a rural area of South India indicated that the knowledge about the menstrual cycle found to be very poor with schools playing no role in its improvement. Schools need to be encouraged in imparting the right information and encouraging girls to speak and this implies that individual student-athletes as well have low knowledge regarding the menstrual cycle. In addition to somatic symptoms, physically active females report affective symptoms related to their menstrual cycles, such as mood swings and irritability (Bruinvels et al. 2020). Psychological symptoms such as irritability may be a risk factor for injury in female football players and may explain differences in injury incidences observed in female football players (Martin et al., 2021). Therefore, the coaching and player support personnel should be aware of the effects of negative symptomatology related to the menstrual cycle and, as much as possible, consider it in the design of training programs especially in those whose symptoms are severe however, this presents an opportunity for team support personnel to educate, counsel, and train football players on management protocols to alleviate menstrual symptoms, preferably using non-pharmacological interventions (Olmedilla-Zafra et al., 2017). From the above review, female student-athletes have some perceived knowledge of the menstrual cycle most

especially the symptoms. So, it is expected that coaches and physical education teachers should consider their athletes in planning training sessions and competitions.

Asha et al. (2019) espoused that a Poor level of knowledge and practices was observed among the survey respondents, though the level of attitude was satisfactory but on a contrary, Desai & Dave (2020) settled that the level of knowledge related to menstrual health and hygiene; more than 50% of the athletes have good knowledge, about 3% participants have poor knowledge. Regarding the practice related to menstrual health and hygiene, the majority of the participants use sanitary napkins as primary management material for menses, and disposal is done mainly in dustbins.

In a study by Stavrou et al. (2020), female adolescent athletes in Cyprus were found to have limited knowledge about the menstrual cycle and its impact on sports performance. Similarly, in a study by Martinez et al. (2019), female collegiate athletes in the United States reported limited knowledge about menstrual cycle-related issues and had poor communication with their coaches and medical staff about these issues. In contrast, a study by Julian et al. (2017) found that female athletes in Spain had good knowledge about the menstrual cycle and its impact on sports performance. However, the study also found that athletes had limited access to menstrual cycle-related resources and support.

In a research conducted with the title Offered Support and Knowledge about the Menstrual Cycle in the Athletic Community showed that most athletes perceived their coach's knowledge about female athlete health as being poor or very poor, while almost a quarter perceived their knowledge of this area to be good or very good (von Rosen et al., 2022). Bergström et al.(2023) opine that while the coaches felt their knowledge of MC was inadequate and primarily managed by outsourcing MC

communication to female staff and apps, the players appeared unaware of their lack of MC knowledge and failed to see a connection between the MC and their health and performance level). Generally, it might be argued that both the players and the coaches interfered with the MC communication. The findings of this study infer that both coaches' and athletes' knowledge regarding the menstrual cycle was low.

Majumder et al. (2022) stipulated that Indian endurance athletes claimed that the MC greatly affected their 22-sleep quality, readiness to train, training quality, fitness, and performance but had limited knowledge of and communication about the MC. The majority of female athletes knew little to nothing about MC, its impact on the body, and musculoskeletal issues. Furthermore, there was a general lack of knowledge regarding how hormonal contraceptives affect the body. This emphasizes the significance of enhancing female athletes' and sports community stakeholders' knowledge of the MC's effects on injury occurrence (Sefotha et al., 2023).

Somewhere in South Africa in a survey on perceived knowledge of the menstrual cycle and adjustment of training during training sets, the results indicated that Coaches clarified that training is adjusted based on their observations, but whether this is being done correctly during the menstrual cycle requires more research. Swimmers and coaches alike seem to have slight knowledge of menstruation, its effects on training, and how to adapt to, or overcome, those effects during training or competition (Marais et al., 2022). The findings indicate that both coach's and athletes' knowledge regarding the menstrual cycle was low which deters the longevity of female swimmers in the sports. Adolescent girls' overall knowledge and menstrual hygiene practices were 11.735.08 on a scale of 1 to 16 and 2.673.18 on a Likert scale with 4 points, respectively. Among adolescent girls, there was a statistically favorable

connection between knowledge and practice of menstruation (p = 0.001). The study showed how many adolescent females were knowledgeable about menstruation and menstrual hygiene practices (Akter et al., 2019).

Despite these mixed findings, it is clear that female athletes need to have adequate knowledge and practices related to their menstrual cycle to optimize their athletic performance and well-being. Athletes, coaches, and medical staff should work together to promote open communication, provide education and resources, and create a supportive environment for athletes to manage their menstrual cycle.

2.16 Practices related to the menstrual cycle

According to Holmes et al. (2021), practices related to the menstrual cycle may include tracking the menstrual cycle, managing menstrual symptoms, adjusting physical activity, maintaining hygiene, and nourishing the body. Proper hygiene practices are important during the menstrual cycle to prevent infection and reduce the risk of scent (Khanna et al., 2015). This includes changing menstrual products regularly (such as pads, tampons, or menstrual cups) and washing the genital area regularly. Depending on the severity of their menstrual symptoms, individuals may need to adjust their physical activity during their cycle (Thakre et al., 2012). While some individual athletes may be able to maintain their normal exercise routine, others may need to take a break or engage in lower-intensity activities (Orendurff et al., 2010). Many individuals experience uncomfortable symptoms during their menstrual cycle, such as cramps, bloating, and mood changes Practices such as taking over-the-counter pain relievers, applying heat to the affected area, and practicing relaxation techniques like yoga or meditation may help manage these symptoms (Caudill, 2016).

Maintaining proper hygiene during menstruation is crucial for female athletes to prevent infections and discomfort. Bruinvels et al. (2017) emphasize the importance of using suitable sanitary products, such as tampons or menstrual cups, to ensure comfort and minimize the risk of leakage during training sessions or competitions. It is also essential to practice good genital hygiene and change sanitary products frequently to prevent odor and infection.

The menstrual cycle is characterized by hormonal fluctuations that can affect various physiological parameters and performance in female athletes. Research by Oosthuyse and Bosch (2010) suggests that during the follicular phase when estrogen levels are high, female athletes may experience increased endurance capacity and reduced perception of effort. This phase may be ideal for high-intensity training and competition.

Conversely, during the luteal phase, when progesterone levels rise, female athletes may experience increased fatigue, decreased muscle strength, and impaired thermoregulation (Elliot-Sale et al., 2020). Therefore, adjusting training intensity and volume during this phase may be necessary to prevent overtraining and enhance recovery however pointed out the substantial individual variability in how menstruation affects performance, and therefore, making generalized recommendations to reduce training may not be suitable for all female athletes. A study conducted by Chauhan et al. (2019) assessed knowledge, attitude, and practices related to the menstrual cycle and management of menstrual hygiene among school-going adolescent girls in a rural area of South India and concluded that Menstrual hygienic practices are found to be satisfactory but need improvement in disposal of menstrual waste. In a research conducted by Ali & Rizvi (2010) on Menstrual

knowledge and practices of female adolescents in urban Karachi, Pakistan and they concluded there are several unhygienic and unsatisfactory practices among female adolescents in Pakistan. Minimal knowledge of the menstrual cycle has consequences on the progress of menstrual cycle considerate training environments and enlightening resources in African women's football (Mkumbuzi et al., 2023).

Schaumberg et al. (2017) asserts a systematic review examining the effects of hormonal contraceptives on exercise performance. They found that certain types of hormonal contraceptives, such as combined oral contraceptives, may offer benefits for athletic performance, including reduced menstrual symptoms and more predictable menstrual cycles and they again analyze the current practices of female athletes regarding menstrual cycle tracking. They found that a significant number of athletes use various methods, such as menstrual cycle calendars, smartphone apps, or wearable devices, to monitor their menstrual cycle and plan their training accordingly.

2.17 Training adjustment for menstruating female Athletes

Menstruating female athletes experience hormonal fluctuations that can impact their training and athletic performance. Effective training adjustments during the menstrual cycle are crucial to optimize performance and support athlete well-being. During the follicular phase, estrogen levels rise, leading to potential improvements in strength, power, and endurance (Lebrun et al., 2013). Coaches can capitalize on this phase to implement high-intensity training and skill-focused sessions for optimal gains. The luteal phase (days 15 to 28) is characterized by increased progesterone levels, which may lead to decreased exercise tolerance and increased perceived exertion. Coaches can adjust training during this phase by focusing on recovery, lower-intensity workouts, and incorporating more flexibility and mobility exercises.

Adequate intake of essential nutrients such as iron, calcium, and B vitamins can support performance and reduce the risk of deficiencies associated with menstruation and coaches as well as athletes should work together to develop a well-balanced diet plan that meets the athlete's individual needs (Deldicque & Francaux, 2015). Female athletes may face a higher risk of certain injuries during specific phases of the menstrual cycle (Bennell et al., 2018). Coaches should be vigilant and adjust training plans accordingly to mitigate injury risks especially during the luteal phase providing access to comfortable and appropriate menstrual products during training sessions is essential for female athletes' comfort and confidence. Coaches should be proactive in ensuring that athletes have access to clean and discreet facilities for changing menstrual products during workouts and competition (Alenabi & Smith, 2012).

Smith et al. (2018) found that only 25% of coaches surveyed considered the menstrual cycle when planning training sessions. This lack of awareness or acknowledgment of the menstrual cycle's impact on athletic performance suggests that many athletes are not receiving tailored training programs that align with their physiological needs (Appelbaum & Erickson, 2018). Williams et al. (2019) asserts that female athletes reported feeling uncomfortable discussing their menstrual health with coaches, leading to a lack of personalized training adjustments. Coaches' discomfort or lack of knowledge about menstruation may hinder effective communication and prevent them from making appropriate training modifications. Rechichi et al. (2020) reported that athletes who received training tailored to their menstrual cycle demonstrated improved performance compared to those who followed standard training plans. Additionally, failure to adjust training during the luteal phase when injury risks may be higher could lead to increased injury incidence and potential long-term consequences (Bennell et al., 2018).

A study by Brown et al. (2021) demonstrated that coaches who underwent menstrual health education were more likely to consider the menstrual cycle when planning training sessions and such interventions can improve coaches' understanding of the menstrual cycle's implications, leading to better-informed training adjustments. Bruinvels et al. (2021) reported that tailored training can optimize performance during the follicular phase and support recovery and injury prevention during the luteal phase. Moreover, menstruating athletes who receive personalized training may experience reduced stress and improved well-being, leading to a more positive training environment.

2.18 Communication about the menstrual cycle at training

Research advocates that athletes and coaches infrequently communicate about the menstrual cycle (Sanderson et al., 2017). The dearth of communication might also give interpretation for the fact that females do not adjust their training to their menstrual cycle (Williams et al., 2019). Female athletes and their coaches similarly give the impression to perceive barriers to communication about the menstrual cycle which brings uncertainty on both flanks about who should take the inventiveness and initiate conversations about the female cycle (Taim et al., 2024). Social customs and concerns about athletes' concealment makes coaches hesitant to address the menstrual cycle and this enable both coaches and athletes regularly quote unsatisfactory knowledge as a reason to clarify a lack of communication (Solli et al., 2020). Some scholars found that male coaches do know not as much about the menstrual cycle and menstrual anomalies as their female counterparts and some other studies found that female coaches were also in want of edification because their perception of a 'normal' menstrual cycle is grounded on their own experiences an example is (Read et al., 2022). Studies reveal that communication about the menstrual cycle between coaches

and female athletes is often hindered by multiple factors including Stigma, cultural taboos, and societal norms surrounding menstruation can create discomfort and reluctance for athletes to discuss their menstrual health openly (Heather et al., 2021). Additionally, coaches may lack knowledge about the menstrual cycle's intricacies, leading to apprehension in addressing the topic with their athletes (Bergström et al., 2023). Communication about the menstrual cycle between coaches and female athletes plays a pivotal role in optimizing training programs and safeguarding athlete welfare (Drew et al., 2023). Breaking down communication barriers and promoting open dialogue is crucial for addressing the impact of menstrual health on athletic performance, reducing injury risks, and supporting overall well-being (Laske et al., 2024). Coaches must actively engage in educational initiatives to enhance their understanding and approach to discussing menstrual health with their athletes, ultimately fostering an environment conducive to peak performance and athlete success (Dupree, 2019).

2.19 Perceived influences of menstruation on sports performance

Carmichael et al. (2021) revealed that overall sports performance can be influenced by the menstrual cycle of student-athletes. They further indicated that the effect of the menstrual cycle on physical performance is being increasingly recognized as a key consideration for women's sports and a critical field for further research. According to them, sports performance can be influenced by both perceived psychological and physical factors.

Oleka (2020) indicated that high school sports performance can be enhanced by the female menstrual cycle. They further added that the impact of the menstrual cycle on female sports performance is a growing interest area in sports and athletics. He added

that strength training is more advantageous in the first half of the menstrual cycle because the body adapts and recovers better to optimize training and sports performance.

Read et al. (2022) conducted a study on the menstrual cycle and football; the experiences of African women football players revealed that Menstrual symptoms can affect training and competition; therefore, team support personnel should be aware of the menstrual cycle's implications for African women football players and their effect on athletic performance and well-being. Further studies by Bruinvels et al. (2016) on the prevalence and impact of heavy menstrual bleeding (menorrhagia) in elite and non-elite athletes indicated that heavy menstrual bleeding among high school female student-athletes affects their active participation in sporting activities which subsequently leads to poor sports performance.

It was opined by Kishali (2006) during a study on the Effects of the menstrual cycle on sports performance, which found that physical performance is not affected by the menstrual period however, the pain usually decreases during training and competition. Other symptoms such as breast tenderness could make running or contact in tackling uncomfortable, while backache and abdominal cramps would make training equally uncomfortable (Brown et al., 2020). However, unlike previous studies, where most female athletes are negatively affected by menstrual cycle symptoms, most symptoms were primarily reported as mild (Armour et al., 2020; Findlay et al., 2020). According to the above literature review, female student-athletes experience some symptoms of the menstrual cycle.

It was opined by Dasa et al. (2021) that no performance differences were seen among top-level female team athletes according to hormonal contraception use. This shows that in top-level team athletes, the MC does not affect acute strength and power performance on a collective basis. This implies that the menstrual cycle does not affect sports performance both physically and psychologically. This could be because these top athletes could have a certain level of Knowledge and can develop strategies to cope with menstrual syndromes that are experienced during the menstrual cycle.

The menstrual cycle can also have psychological effects that may impact sports performance in female athletes and these effects come as a result of the symptoms associated with the menstrual cycle. Hormonal variations during the menstrual cycle can contribute to mood changes such as irritability, mood swings, anxiety, and depressive symptoms (O'Brien et al., 2011). These mood fluctuations can affect an athlete's mental well-being, motivation, and overall focus during training and competition. Some female athletes report changes in cognitive function during different phases of the menstrual cycle (Dam et al., 2022). This can include difficulties with concentration, memory, and decision-making. These cognitive changes may impact an athlete's ability to strategize, react quickly, and make accurate judgments during sports performance (Brown et al., 2021).

Some female athletes may experience a decline in self-confidence during certain phases of the menstrual cycle, which can affect their belief in their abilities and performance expectations (Janse de Jonge, 2003). The hormonal changes associated with the menstrual cycle can influence an athlete's ability to manage stress and regulate emotions effectively. This can impact an athlete's resilience, coping strategies, and performance under pressure (Romans et al., 2012). Changes in body

weight, fluid retention, and bloating during the menstrual cycle can influence an athlete's body image perception. Negative body image can contribute to decreased self-esteem and potentially affect sports performance (Lebrun, 2017).

Conversely, several studies have found no significant psychological effects of the menstrual cycle on sports performance. For instance, in a study by Oosthuyse and Bosch (2010), female athletes' performance in cycling time trials was not affected by the different menstrual cycle phases. Similarly, a study by Bruinvels et al. (2017) on middle-distance runners found no significant differences in performance across menstrual cycle phases. Psychologically, confidence, focus, and reaction to criticism were commonly affected by about 66.7% (Read et al., 2022).

Furthermore, research conducted by Lebrun (2017) found that female athletes' self-confidence, motivation, and focus were not influenced by the menstrual cycle. The study observed that athletes' perceived exertion, motivation, and mood remained consistent throughout the menstrual cycle, indicating a lack of significant psychological effects. In a systematic review by Agblo et al. (2022) the authors concluded that the evidence supporting the influence of the menstrual cycle on athletic performance, including psychological factors, is inconclusive. The menstrual cycle can impact recovery and fatigue levels in female athletes. Tiredness and increased fatigue have been reported during the premenstrual and menstrual phases (Eisenlohr-Moul et al., 2016). These factors may influence an athlete's ability to perform optimally and recover adequately between training sessions or competitions.

The physical symptoms of the menstrual cycle can potentially impact sports performance in female athletes. Pain, fatigue, fluid retention, joint and muscle changes, and variations in physical performance are some of the factors that may

influence an athlete's ability to train and compete optimally (Dupree, 2019). And again, the findings showed that athletes with a natural menstrual cycle also experienced emotional changes and decreased motivation to work out in addition to physical symptoms. A study was conducted on 130 Turkish sultans' volleyball league players on their menstrual cycle and sporting performance perceptions and the results indicated that the participants itemized the problems they have during their menstrual periods as irritability (36.2 %) and anger (47.7%.); and 45.4% think that menstruation sometimes affects their sporting performance whereas 35.4% consider it does not. In conclusion, it can be said that female volleyball players do not experience menstrual problems such as delayed menarche, amenorrhea, and oligomenorrhea and sports do not change their menstrual period and that menstruation affects sporting activity rather psychologically (Ergin & Kartal, 2020).

2.20 Conceptual framework

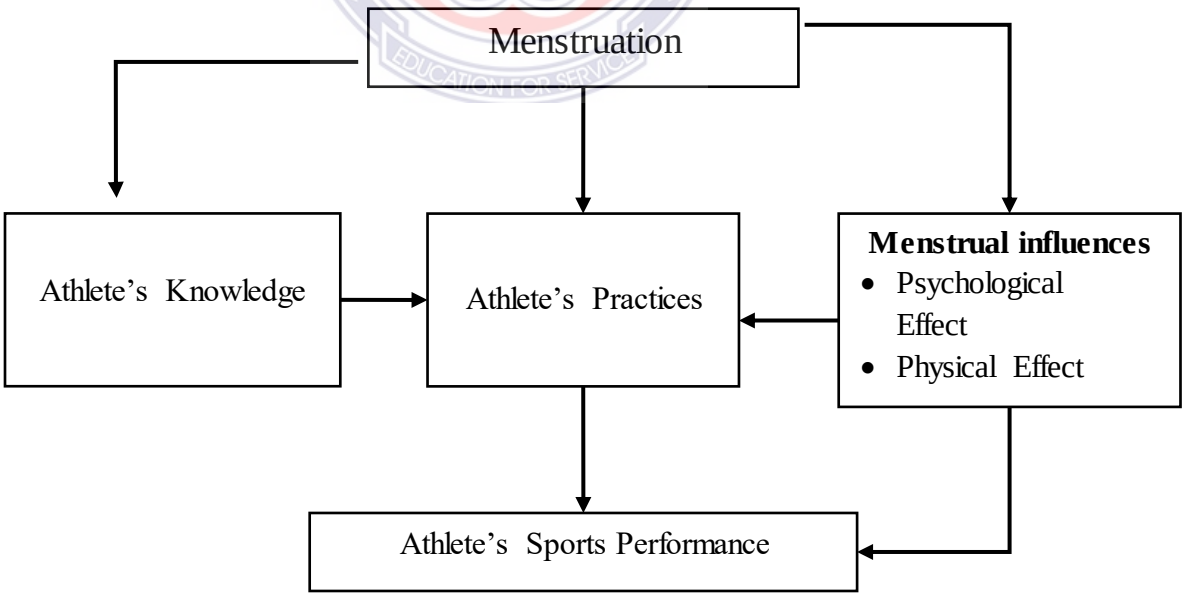

Figure 1*:* Conceptual framework on perceived influences of menstruation on Sports performance among female athletes, 2023.

A female athlete is likely to be conversant about menstruation once it occurs. Knowledge of the menstrual bleeding phase, awareness of common menstrual symptoms, knowledge of the various menstrual products available at the market, their usage and how to choose the one that suits individual preferences and needs. Their practices in terms of hygiene (Use of Sanitary Products, Hand Washing, Disposal of Menstrual Waste, Personal Hygiene, Management of Menstrual Pain, Communication about Menstruation with Co-Players and Coaches, maintaining a Balanced Diet) and practices in terms of training adjustment (Reduction of Training Intensity, Frequency and Duration) are informed by this knowledge. Women who compete in sports may experience physical syndrome (headache, abdominal pains, back pain, weight gain) and psychological effects (lack of concentration, isolation, anxiety, mood swings, etc.) from menstruation, which causes them to use painkillers to treat their symptoms and, in some cases, skip workouts and competitions, all of which have an impact on their ability to perform well.

Investigations have been conducted to test the proposed relationships between female athletes' knowledge, practices, and menstrual influences on their sports performance. It was concluded that athletes with better knowledge of menstrual effects may proactively adjust their training and competition strategies during different phases of the menstrual cycle (Rechichi et al., 2016). They may recognize the potential influence of hormonal fluctuations on energy levels, strength, and endurance, and adapt their training accordingly which will improve sports performance however athletes with limited knowledge of menstrual effects will not adopt better strategies to adjust training hence reducing sports performance (Wasserfurth, 2020). Similarly,

improved knowledge and practices may empower female athletes, reducing anxiety and boosting confidence during menstruation, leading to improved sports performance (Tenan et al., 2017).

Again, athletes who track their menstrual cycles and understand their patterns may be better equipped to anticipate fluctuations in performance (Elliott-Sale et al., 2018). Tracking allows athletes to optimize training, recovery, and nutrition to align with their hormonal variations (Seshadri et al., 2019). Some female athletes use hormonal contraceptives to regulate their menstrual cycles or reduce menstruation frequency (Oosthuyse & Bosch, 2010). The choice of contraceptive methods may affect hormonal profiles and influence performance outcomes.

Finally, Athletes who feel comfortable discussing menstruation-related concerns with coaches, teammates, or sports medicine professionals may experience reduced psychological stress and enhanced concentration during training and competitions (Rechichi et al., 2016).

Psychologically, Rico-Lara et al. (2023) investigated how menstrual isolation practices may affect female athletes' access to sports facilities and opportunities during their menstrual periods. The authors found that these restrictions could hinder training and competitive participation, potentially leading to performance disparities. Menstruation-related discomfort or concerns about leakage might impact an athlete's self-confidence and body image, potentially affecting performance and participation (Kissinger et al., 2019). In another study, Gomez-Merino et al. (2017) declares that emotional changes, such as increased anxiety and irritability during menstruation were associated with reduced sports performance and higher levels of perceived exertion. Similarly, Chen and Lee (2020) examined the influence of menstrual

perception on performance motivation in female athletes. They institute that negative beliefs or stigma associated with menstruation could impact athletes' self-efficacy and motivation, potentially affecting their overall sports performance. Physically, Menstrual headache also known as menstrual migraine was indicated to have been prevalence ranging from 10% to 60% among menstruating women (MacGregor, 2015). Menstrual headaches can have detrimental effects on sports performance in female athletes. The pain and associated symptoms can lead to reduced focus, concentration, and coordination during training and competition (Hameed et al., 2018). Athletes may also experience decreased motivation to engage in physical activity, leading to suboptimal training sessions or missed workouts. It was further stated that in the case of severe menstrual headaches experienced by females, non-steroidal anti-inflammatory drugs (NSAIDs) and triptans can be effective in alleviating pain and associated symptoms (MacGregor, 2015). For athletes with severe and debilitating menstrual headaches, hormonal interventions, such as oral contraceptives may be considered to stabilize hormone fluctuations (Kristoffersen et al., 2019).

Menstrual abdominal pain can have a considerable impact on sports performance in female athletes. The pain and discomfort can disrupt an athlete's focus, concentration, and mental resilience during training and competition (Armstrong et al.,2014). Athletes may struggle to maintain optimal form and technique, leading to suboptimal performance and increased risk of injury. Additionally, the distraction caused by menstrual abdominal pain can negatively affect decision-making and overall sports proficiency.

The discomfort and pain associated with menstrual back pain can lead to reduced performance and endurance levels during training and competitions (Smith et al., 2016). Athletes may experience limitations in their range of motion, loss of balance, and decreased overall physical capacity.

In conclusion, the above studies propose that the relationship between athletes' knowledge, practices regarding menstruation, and sports performance is significant (Johnson, 2008). Female athletes who possess accurate information and manage menstruation effectively may experience improved physical and psychological well-being, leading to enhanced sports performance. Coaches, sports medicine professionals, and educators should prioritize providing comprehensive menstrual education to female athletes to support their athletic endeavors throughout their menstrual cycles (Dijkstra et al., 2014).

2.21 Summary

The review of literature related to the study critically looked at the athlete's knowledge and practices regarding menstruation and its perceived effects on their sports performance. The literature was based on the fact that for sports performance to be enhanced among female athletes, consideration should be given to their nutritional needs, training, and biological makeup (Hausswirth & Le Meur, 2011). On the need to strategically manage menstruation and sports performance literature has been consistent on the use of sanitary materials to do away with "flooding" of dressings during training and competition. Again, with pain management, many female athletes use pain reliever medication, and heat therapy as well as athletes who experience psychological problems such as irritability, mood swings, anger, and the like stick to the use of YOGA. The perceived influences of menstruation on sports performance

among female athletes are multifaceted and vary widely among individuals according to the literature. While some athletes may report experiencing physical and psychological changes during their cycle, others may not notice any significant effects on their athletic performance. Coping strategies, proper planning, and education about menstruation and its potential impacts can help female athletes better manage their athletic endeavors throughout the cycle. Studies have highlighted that female athlete often possess limited knowledge about how menstruation can influence their sports performance. Many athletes report that they were not adequately educated about the subject during their training and development. A lack of awareness about menstrual physiology and its potential effects on athletic performance can lead to misconceptions and uncertainties among female athletes. Female athletes adopt various practices and coping strategies to manage their menstruation while participating in sports activities. These practices can include adjusting training intensity and type during different phases of the menstrual cycle, modifying dietary choices, and using menstrual products like tampons or menstrual cups to ensure comfort and hygiene during physical activity. Some athletes also seek advice from coaches, sports medicine professionals, or peers to optimize their performance and well-being throughout their menstrual cycle. Psychological factors such as body image concerns, self-confidence, and stigma around menstruation can influence female athletes' practices and decisions regarding sports participation during menstruation.

CHAPTER THREE

RESEARCH METHODS

3.0 Overview

This chapter focuses on research design, population, sample, and sampling technique, Instrument for data collection, validity and reliability of the instrument, data collection procedure, data processing and analysis.

3.1 Research Design

The study adopted a cross-sectional survey design. This design was used to acquire information to signify a picture or snapshot of the occurrence (Ogah, 2013). The purpose is to generalize to the population so that inferences can be made about some characteristics, attitudes, or behaviors of this population and the data was collected at one point in time or once from the respondents (Creswell, 2014). This design again allows the researcher to describe and provide an understanding of the phenomenon using simple descriptive statistics (Alam et al., 2017).

3.2 Population

The total population for this study included 200 female athletes from four public Senior High Schools in the Ajumako district (Enyan Maim Secondary, Enyan Denkyira Secondary Technical School, Mando Secondary School, and Bisease Secondary School). 35 female athletes from Enyan Maim Secondary School, 55 female athletes from Enyan Denkyira Secondary Technical School, 60 female athletes from Mando Secondary Technical School, and 50 female athletes from Bisease Secondary Technical School. The information was provided by the various Physical Education unit heads of the respective institutions which was later verify by researcher during her visit to the schools. These athletes are registered students of

various institutions who are members of their school sports teams. They represent their school in the inter-school games competition. They participate in various disciplines including football, volleyball, handball, netball, table tennis, and track and field events. These athletes train for inter-house competitions and when selected to play for the school team, continue to train for inter-school games. The inter-house competitions are organized in the first semester of each academic year and the inter-school competition is usually organized early second semester of every academic year. This infers that these athletes train for at least two and half months each semester of every academic year.

3.3 Sampling Procedure

The sample for this study consisted of 200 female athletes of the four public SHS in the Ajumako district. Census sampling is preferred and more attractive for small populations (Creswell, 2014; Hibberts et al., 2012). Census sampling ensures that every member of the population has an equal chance of being selected. This means that the sample is more likely to be representative of the population, which in turn increases the accuracy of the results (Buchstaller & Khattab, 2013). This technique sampled a population of fewer respondents and it again eliminates sampling error and provides data on all the individuals in the population (Martínez-Mesa et al., 2016; Singh & Masuku, 2014). They are all senior high school students and could therefore read, write, and understand.

3.4 Data Collection Instrument

A modified questionnaire from Kishali et al. (2006) and (Desai & Dave, 2020) was adapted as the data gathering instrument for the study (See appendix A). The questionnaire was adapted because is shown to be time efficient, suitable for

obtaining relevant information, anonymous, transparent, most reliable for sensitive topics, self-paced, and easy to administer than other instrument such as the interview technique (Krosnick, 2018). The questionnaire had five sections; A, B, C, D, and E. Section A requested information on the background characteristics of respondents such as age, menarche age, menstrual regularity, type of sports played, how long the participants have played the sports, etc. Eight alternate choice items were composed in this section. Section B comprises items on athletes' knowledge related to menstruation. There were 15 items and participants were asked to tick "Yes" or "No" to determine their extent of knowledge. Section C consists of 18 items of athletes' practices regarding their menstruation which were measured on a three-point Likert scale of Always(A), Sometimes(s), and Never(N). Section D consisted of information on perceived influences of menstruation a four-point Likert scale items of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD) and section E consisted of questions measuring subjective sports performance in terms of endurance, running, strength, jumping ability, coordination, and throwing abilities which were on five scale Excellent = (5) Very Good =4, Good = 3; Poor =2, Very Poor =1. The questionnaire demanded respondents to tick responses that best applied to them. The researcher anticipated that the caliber of respondents that were involved would supply true, genuine, and reliable responses devoid of extraneous influences (Baburajan et al., 2020). The closed-ended items aimed at ensuring uniformity in the responses and thereby preventing subjectivity of any kind. Adams (2015) recalls that irrespective of close-ended items limiting the responses of respondents, its adoption guarantees editing and proper analysis of data using statistical package for social sciences.

3.5 Validity of the Instrument

The instrument was validated by the supervisors after critiquing the content and making the necessary alterations. This was after two other lecturers from the Department of Health, Physical Education, Recreation and Sports (HPERS) of the University of Education, Winneba (UEW) had scrutinized and effected the necessary corrections to restructure and make sure that it was void of ambiguities checking for all aspects of validity (content and face validity). The instrument was again validated through pre-testing. The pre-testing was achieved through a structured group discussion about the content, vagueness, outline, number of questions, and wording of the questionnaire (Moser & Kalton, 2017). items discussed were written down and changes were made to specific questions to increase the comprehension and quality of the questionnaire. Additionally, the pre-testing of the instrument helps to determine if the items are reliable, sensitive and meaningful. The group that performed the pre-testing were five female athletes and they were conveniently sampled. After the pre-testing, additional changes were made to the questionnaire then it was considered ready for distribution. For instance, have you missed your misses in the last three months?

3.6 Reliability of the Instrument

To ensure the repeatability, stability, and consistency of the instrument of this study, the researcher employed the test-retest method (Aboagye et al., 2016). The purpose of this test-retest method required the measurement tool to produce twice the same values and again help to ensure that measurement disparity is due to replicable differences between people regardless of time, target behavior, or user profile (Aldridge et al., 2017; Berchtold, 2016). The test-retest was done within intervals of two weeks (Verma & Abdel-Salam, 2019) with 30 Apam SHS female athletes. The 30

respondents represented 15% of the total respondents that were used for the main study. These respondents were selected because they have homogenous characteristics with the main sample and it was convenient getting access to them. The piloting of an instrument helps to determine if the items are reliable, subtle, and instructional. Such an exercise helps to improve validated instruments and provides additional knowledge that adds to the eminence of research. This was in line with the statement by Thabane et al. (2010) that as soon as a researcher has formed an instrument it should be administered to a pilot group of respondents similar to the main sample to certify that the items are reliable and valid. They further suggested that after establishing reliability and validity in the small sample, the researcher can then administer the instrument to the main sample. The Cronbach alpha coefficient, a measure of internal consistency, was used to determine the reliability. A reliability coefficient of .79 was realized based on standardized items (see Appendix B). This was found to be consistent with the .70 to be the minimum acceptable value for the determination of the reliability of an instrument (Post, 2016). The study instrument was eventually used as a result of this reliability coefficient.

3.7 Data Collection Procedures

Before the data was collected, an introductory letter was obtained from the Head of the Department of Health, Physical Education, Recreation and Sports (HPERS) to allow the collection of the needed responses or information from the respondents. This was after the supervisors had given the go-ahead for the collection of the data. All the sampled schools were visited. Permission was taken from the head masters and mistresses of the sampled schools. Contact numbers of the heads and Physical education teachers were taken and meeting between respondents and the researcher for the data collection was purely based on the convenience of the respondents. The

researcher met the athletes during their recess period after talking to the various heads, physical education teachers, and in some cases, coaches.

The purpose of the study was explained to the athletes before data collection began. The athletes were assured of anonymity and confidentiality of their responses and in doing that, the respondents were not allowed to add their names. All the sampled athletes were asked to sign consent forms before responding to the questions. Some of the physical Education teachers helped in explaining some of the words in the questionnaire to the respondents. Before completing the questionnaire, athletes were informed that there were no right or wrong answers and that they should choose the answers that described how they feel about the perceived impacts of menstruation on their sports performance. The administration of the questionnaire was solely done by the researcher. Copies of the questionnaire were given to the sampled group to respond to. The respondents were allowed 45 minutes to respond to the items after which the questionnaires were retrieved. The researcher used four weeks for data gathering. 181 questionnaires were retrieved given a return rate of 90.5 percent. A 70 percent return rate is considered an acceptable return rate for face-to-face surveys according to (Robertson et al., 2015).

3.8 Data Processing and Analysis

After receiving the questionnaires from the respondents, the researcher checked for completeness of the questionnaire. The reason for checking was to recognize whether respondents had followed directions correctly and whether all items had been responded to. The questionnaires were coded for easy identification of errors during data entry. Data were screened for missing values and outliers. Data was processed with the aid of SPSS version 22.0. Descriptive statistics were used to summarize

demographic variables. Data on research question one was analyzed using frequency and percentages this was after the knowledge level on menstruation was characterized into "Low", "Moderate "and "High". To establish a benchmark for this scale, a criterion mean value of 1.5 was determined. The criterion mean value (CMV =1.5) was ascertained by adding together all the scores divided by the number in the scale (2+1 =3/2 =1.5). In practical terms, any statement with a mean score lower than this criterion mean value (CMV < 1.5) was categorized as "low knowledge level." Conversely, statements with a mean score value of 1.5 were classified as 'Moderate knowledge level' and 'statement with mean score value greater than the mean value (CMV > 1.5) was categorized as "High knowledge level" respectively. Data from research question two was analyzed using frequency counts and percentages. The descriptive measures were used because the researcher was mainly interested in the manifestation and evidence of the variables among the athletes. Research question three was analyzed using Pearson product-moment correlation (Pearson's r). The choice of Pearson's r was influenced by the proposition of Cohen et al. (2013) which explains that, when measuring the strength and direction of the relationship between two quantitative variables the appropriate statistical tool to use is Pearson Product Moment Correlation Co-efficient (PPMCC).The constructs measuring athletes' knowledge of menstruation were transformed and computed to form a single variable; 'knowledge of menstruation. Subsequently, in the analysis, correlation (r) was used to determine the degree and the direction of the relationship between the variables. The correlation was tested at a 5% confidence level. Finally, after data had met the assumptions of linear regression, data from research question four was analyzed using multi-linear regression. The choice of this was predisposed by Uyanık & Güler (2013) who explain that, when examining the association between two or more nontrivial

predictors or independent variable and one outcome or dependent variable multiple linear regression is the best statistical tool.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This chapter presents the results and discussion on the correlation of menstruation on sports performance among female athletes of SHS. This chapter is in three sections. The first section shows the results on the demographic characteristics of the respondents followed by its discussion. The chapter's second section focuses on presenting the main findings to address the research questions. The findings are presented on tables for easy understanding and readability. The third part also focused on the discussion of the main results in light of the research questions.

4.1 Background Information of the Respondents

This section provides background information about the demographic characteristics of the respondents. The data were solicited from female athletes from public Senior High Schools in the Ajumako district. The background information encompasses an array of variables, including age, the duration since the onset of menarche (which signifies the commencement of menstruation), the degree of menstrual bleeding severity, the presence of menstrual pain, the various levels of menstrual pain intensity, menstrual regularity, the diversity of sports played, and the number of years these respondents have been actively engaged in sports. The background information is presented in Table 1.

Table 1:

Background Information of the Respondents

Variable	Sub-scale	N	Percent (%)
Age (Years)	12-14 years	1	.6
	15-17 years	90	49.7
	18-20 years	78	43.1
	above 20 years	12	6.6
Years since the onset of menarche	9-11 years	10	5.5
	12-14 years	107	59.1
	15-17 years	61	33.7
	18-20 years	3	1.7
The severity of menstrual bleeding	Yes	77	42.5
	No	104	57.5
Menstrual pain	Yes	142	78.45
	No	39	21.55
Menstrual pain level	No pain	35	19.3
	Mild	17	9.4
	Moderate	45	24.9
	Severe	55	30.4
	Very severe	29	16.0
Menstrual regularity	Yes	29	16.0
	No	152	84.0
Number of years participants play sports	Less than 1 year	37	20.4
	2-4 years	59	32.6
	3-7 years	45	24.9
	Above 7 years	40	22.1

Source: Field Survey, 2023

Table 1 shows age distribution among the respondents displays considerable diversity. The majority of the respondents used for the study fall within the 15-17 years age bracket (N=90; 49.7%), closely followed by the 18-20 years category (N= 78, 43.1%). Again, 12 female students representing 6.6% were aged above 20 years while only one student was below 15 years (N=1, N=0.6%). Furthermore, the data presents a comprehensive insight into the length of time since the onset of menarche among the respondents. Notably, the majority experienced menarche between the ages of 12-14

years (N=107, 59.1%), while 61 representing 33.7% experienced menarche between the ages of 15-17 years. A smaller yet significant portion had their menarche between 9-11 years (N= 10, 5.5%) and 18-20 years (N=3, 1.7%).

The exploration of the severity of menstrual bleeding is another salient aspect explored in the study. Most of the respondents reported experiencing no severity in their menstrual bleeding (N=104, 57.5%), while the remaining 77 (42.5%) acknowledged some level of severity. Additionally, the dataset delves into the prevalence of menstrual pain among the respondents. A substantial 142 (78.45%) reported experiencing menstrual pain. This was however opposed by 39 female athletes representing 21.55% who indicated no incidence of menstrual pains. Additional insights into this area reveal a diverse spectrum of pain levels, with 35(19.3%) indicating the absence of pain, 17 (9.4%) experiencing mild pain, 45(24.9%) grappling with moderate pain, 55 (30.4%) enduring severe pain, and 29 (16.0%) coping with very severe pain. In the area of menstrual regularity, only 29 (16.0%) of the respondents reported having regular menstrual cycles, while the vast majority (N=152, 84.0%) indicated irregularity in their menstrual patterns.

Table 2:

Information on Sports played.

	Responses	
Sports played	**N**	**Percent**
Volleyball	134	18.9%
Football	117	16.5%
Handball	119	16.8%
Table tennis	58	8.2%
Netball	125	17.6%
Other sports	26	3.7%
Athletics	130	18.3%
Total	**709**	**100.0%**

Sources: Field Survey, 2023.

The dataset provides insights into the types of sports engaged in by the respondents. The table shows that, notable portion of the athletes were involved in volleyball with (134 responses representing 18.9 % of the total population). 16.5% of the participant played football. 16.8 % of the participant were engaged in handball, 8.2% of the participants played table tennis, 17.6% of the participant were actively engaged in netball, 18.3% of the participant were involved in athletics and 3.8% were engaged in other sports such as…….

Presentation of Main Results

This section presents the main findings of research questions that were formulated to guide the study. The data for research question one was collected through a binary response scale, which consisted of two options: "Yes" and "No." Simple frequencies and percentages were used to analyze the data on female athletes' knowledge level related to menstruation. The data on research question two was collected on a 3-point Likert scale, where respondents could choose from three options: "Always," "Sometimes," and "Never." It was analyzed using simple frequencies and percentages

to determine recurring practices. Research question three was analyzed using Pearson's r Correlation and research question four was analyzed using a regression model.

***Research Question One**: What are athletes' knowledge levels related to menstruation?*

Research question one aimed to assess the knowledge levels about menstruation with evidence drawn from female athletes in public SHS in the Ajumako district. To investigate this specific research question, the research participants were presented with a series of statements designed to gauge their understanding of menstruation. The results obtained are finally presented in Table 3.

Table 3:

Knowledge Level of Menstruation

Knowledge Level of Menstruation	**Frequency**	**Percent**
Low	80	44.2
Moderate	53	29.3
High	48	26.5
Total	**181**	**100.0**

Source*:* Field survey, 2023.

Table 3 shows that the majority of female athletes in the four public senior high schools in the Ajumako district have low knowledge regarding menstruation (N=80, 44.2%). This discovery is disconcerting because menstruation constitutes a fundamental facet of female reproductive health, and a deficiency in knowledge can potentially exert adverse repercussions on the physical and emotional well-being of

these athletes. Also, among the 181 respondents in the study, 53 of them, representing 29.3% demonstrated a moderate knowledge level regarding menstruation. While this is an improvement over the low-knowledge group, it still indicates that a momentous portion of these female athletes may not possess a comprehensive understanding of menstruation. Furthermore, the data in Table 3 indicated that 48 out of the 181 respondents, accounting for 26.5% have a high knowledge regarding menstruation. This group represents a minority among the female athletes surveyed but is nonetheless encouraging. These individuals are likely to possess a complete and accurate understanding of menstruation, which can contribute to their overall well-being and empowerment.

Research Question Two: **What are athletes' practices related to menstruation?**

The second research question in this study aimed to investigate the practices of female athletes about menstruation. To gather insights into this aspect, the researchers designed a questionnaire in which respondents were requested to provide their feedback on a set of statements. The results obtained from the participants' responses were meticulously analyzed through frequency and percentages and are presented in Table 4.

Table 4:

Female Athlete's Practices Related to Menstruation

Statement	Always n (%)	Sometimes n (%)	Never n (%)
I use disposable sanitary pads to manage menses	130 (71.8)	39 (21.5)	12 (6.6)
I use old clothes to manage menses	8 (4.4)	43 (23.8)	130 (71.8)
I use new clothes to manage menses	13 (7.2)	61 (33.7)	107 (59.1)
I use tampons to manage menses	7 (3.9)	25 (13.8)	149 (82.3)
I take medication to delay menses	16 (8.8)	37 (20.4)	128 (70.7)
I wash my hands after changing menstrual materials	122 (67.4)	52 (28.7)	7 (3.9)
I use only water to wash to clean the external genitalia	114 (63.0)	49 (27.1)	18 (9.9)
I use soap and water to clean the external genitalia	51 (28.2)	55 (30.4)	75 (41.4)
I dispose of menstrual materials in the dustbin	79 (43.6)	53 (29.3)	49 (27.1)
I dispose of menstrual materials by burning them	73 (40.3)	68 (37.6)	40 (22.1)
I dispose of menstrual materials by burying them	33 (18.2)	59 (32.6)	89 (49.2)
I dispose of menstrual materials by throwing them by the roadside	7 (3.9)	6 (3.3)	168 (92.8)
I take painkillers to reduce pain during menses	36 (19.9)	82 (45.3)	63 (34.8)
I reduce the intensity of my training during menstruation	39 (21.5)	123 (68.0)	19 (10.5)
I do not train as frequently as before during menstruation	33 (18.2)	100 (55.2)	48 (26.5)
I skip training sessions during menstruation	32 (17.7)	93 (51.4)	56 (30.9)
I avoid training/ competition during menstruation	35 (19.3)	68 (37.6)	78 (43.1)
I inform my coach when am menstruating	28 (15.5)	75 (41.4)	78 (43.1)

Source: Field survey, 2023

Table 4 reveals that the majority of respondents, 130 (71.8%), reported using disposable sanitary pads to manage their menses, indicating a prevalent reliance on this method. A notable portion, 39 (21.5%), reported using them sometimes, while only 12 (6.6%) claimed never to use them. This data suggests that disposable sanitary pads are the preferred choice for menstrual management among the surveyed individuals. A mere 8 (4.4%) of respondents claimed to always use old clothes for menstrual management, while a significantly higher percentage, 43 (23.8%), reported using them sometimes and the majority, 130 (71.8%), stated that they never use old clothes for this purpose. It was again demonstrated that 13 (7.2%) of respondents always use new clothes for menstrual management, while 61 (33.7%) do so sometimes, and the majority, 107 (59.1%), never use new clothes. This data indicates a moderate preference for new clothes compared to old clothes, but disposable sanitary pads remain the dominant choice. The use of tampons for menstrual management is relatively uncommon, with only 7 (3.9%) reporting always using them, 25 (13.8%) using them sometimes, and a vast majority of 149 (82.3%) never used them. it was revealed that the majority of respondents, constituting 122 (67.4%), reported that they always wash their hands after changing menstrual materials, indicating a commendable adherence to hygiene practices in this aspect. However, it is concerning that 52 (28.7%) of participants admitted to only sometimes doing so, and a further 7 (3.9%) never did.

The table reveals that 16 (8.8%) of respondents always take medication to delay their menses, 37 (20.4%) do so sometimes, and the majority, 128 (70.7%), never take such medications. This data suggests that taking medication to delay menstruation is not a common practice among the surveyed population, however, to examine the usage of painkillers to alleviate menstrual pain. A significant proportion, 36 (19.9%), reported

always using painkillers, while 82 (45.3%) indicated doing so sometimes. Meanwhile, 63 (34.8%) claimed to never resort to painkillers during menstruation. The data shows that 114 (63%) of respondents claimed to always use only water to clean their external genitalia, additionally, 49 (27.1%) reported sometimes using only water, while 18 (9.9%) never do. The table demonstrates that a substantial portion of respondents, 75 (41.4%), reported never using soap and water to clean their external genitalia. Only 51 (28.2%) reported always using soap and water, and 55 (30.4%) sometimes do.

The table indicates that 79 (43.6%) of respondents claimed to always dispose of menstrual materials in the dustbin. While this is a reasonably good practice, it still leaves room for improvement. Approximately 53 (29.3%) reported sometimes disposing of menstrual materials in the dustbin, and 49 (27.1%) never did. Proper disposal of menstrual materials is vital not only for personal hygiene but also for environmental concerns. The result shows that 73 (40.3%) of the respondents reported always disposing of menstrual materials by burning them, and an additional 68 (37.6%) reported sometimes using this method, which still represents a significant proportion. Only 40 (22.1%) of respondents never used this disposal method. These findings underscore the importance of raising awareness about safe and eco-friendly menstrual material disposal methods. It reveals that 33 (18.2%) of the participants claimed to always bury their menstrual materials, while 59 (32.6%) reported doing so sometimes and 89 (49.2%), indicated that they never bury their menstrual materials. On the other hand, sheds light on the practice of disposing of menstrual materials by throwing them by the roadside. The data is quite contrasting, with only 7 (3.9%) admitting to always adopting this method and a mere 6 (3.3%) occasionally doing so. A substantial majority of 168 (92.8%) stated that they never dispose of menstrual materials in this manner.

The results reveal that 39 (21.5%) of the respondents always reduce their training intensity during their cycle, while a substantial 123 (68.0%) do so occasionally. In contrast, a relatively small portion, 19 (10.5%), never adjusts their training intensity during menstruation. Data regarding the frequency with which individuals adjust their training routines during menstruation. Notably, 33 (18.2%) of respondents indicated they always alter their training regimen during this time, 100 (55.2%) sometimes do, and 48 (26.5%) never make such adjustments. The data reveals that 32 (17.7%) of respondents always skip sessions, 93 (51.4%) do so occasionally, and 56 (30.9%) never skip training sessions during this period. With the behavior of avoiding training or competition entirely during menstruation. The data illustrates that 35 (19.3%) always avoid it, 68 (37.6%) sometimes avoid it, and 73 (43.1%) never do so. Finally, the data explores whether individuals inform their coaches about their menstrual cycles. The findings reveal that 28 (15.5%) always inform their coaches, 75 (41.4%) sometimes do, and 78 (43.1%) never disclose this information.

Research Question Three: **What is the correlation between athletes' knowledge level and practices regarding menstruation?**

This research question sought to analyze the correlation between athletes' knowledge and practices regarding menstruation with evidence drawn from female athletes in public SHS in the Ajumako district. The results obtained are summarised and presented below.

Table 5:

Results on the relationship between athletes' knowledge and practices regarding menstruation

Correlations			
Variables		Knowledge of menstruation	Practices regarding menstruation
Knowledge of Menstruation	Pearson Correlation	1	.268**
	P value		.000
Practices regarding menstruation	Pearson Correlation	.268**	1
	P value	.000	

Correlation is significant at the 0.01 level (2-tailed)

Source: Field Survey, 2023.

This correlation is quantified as a Pearson correlation coefficient r (181) =.268, p < .001. The result reveals that there exists a weak positive relationship between these variables. Essentially, this implies that as female athlete's knowledge about menstruation increases, so does their propensity to engage in certain practices associated with menstruation. This positive association implies that, when female athletes possess a higher degree of knowledge about menstruation, they are more inclined to adopt and implement healthier and more informed practices in managing their menstrual health. In practical terms, this could translate to improved hygiene, better coping mechanisms, and potentially enhanced overall menstrual well-being among those who are well-informed about menstruation. This exceedingly low p-value ($p < 0.05$) underscores the statistical strength of the relationship between Knowledge of Menstruation and Practices regarding menstruation. In simpler terms, it

asserts that this observed connection is not merely a chance occurrence but holds substantial statistical weight.

Research Question Four: What are the perceived influences of menstruation on sports performance among female athletes?

Research question four sought the perceived influence of menstruation on sports performance among female athletes. The results obtained are presented in Table 6 below.

Table 6:

Perceived Influences of menstruation on sports performance among female athletes

Variables	**Unstandardized Coefficients**		**Standardized Coefficients**			
	B	**Std. Error**	**Beta**	**R**	**R^2**	**P value**
(Constant)	48.594	1.638		.131	.17	.000
Physical effects	-.044	.113	-.040			.021
Psychological effects	-.107	.110	-.100			.036
F (2,178) = 1.56						
Adj R- square 0.06						

N = 181; p = .013

Source: Field Survey, 2023

The result of the overall model shows that there exists a statistically significant association between the independent variables and the dependent variable R^2 = .17, F (2,178) =1.56, p=.013. Consequently, in terms of the model's predictive capacity, it is observed that only 17% of the variability in female athlete's sports performance can be attributed to the Physical and Psychological effects of menstruation (**R^2**= .17). This

discovery also implies that a substantial 83% (100% - 17%) of the variability is influenced by factors other than those included as predictors in this model.

The general form of the equation to predict the sports performance of athletes from the physical and psychological effects of menstruation is given by

SP = 48.59 - .044 (PHY_EFF) -.107 (PSY_EFF) …….. (1)

Where;

SP= Sports Performance

PHY_EFF = Physical effects

PSY_EFF = Psychological effects

From the regression equation, the 'C' (constant) is 48.59. This constant serves as the forecasted value for the dependent variable, specifically the Sports Performance, under the condition that all independent variables are set to zero (PHY_EFF = 0, and PSY_EFF = 0). This setting represents a situation where female students' sports performance is projected to be 48.59% in the absence of menstruation. Furthermore, the regression coefficients in the equation offer invaluable insights into the expected alterations in the dependent variable, which is the Sports Performance, with each one-unit increase in the respective independent variable. As elucidated in equation 1, the coefficient for 'physical effects of menstruation' stands at -.044. This outcome suggests that, with every unit increment in the physical effects of menstruation, there is a statistically significant decrease in the performance of female athlete students by 4.4% (β = -.044; p = .021). Likewise, a discernible pattern emerges within the regression model when it comes to the psychological effects of menstruation. Here, a per-unit increase in the psychological effects of menstruation corresponds to a

substantial, statistically significant decrease in Sports Performance in athletics by 10.7% (β = -.107; p = 0.036). These findings underscore the significance of considering both physical and psychological aspects when analysing the performance of female athletes in the context of menstruation.

4.4 Discussion

The first research objective aimed to assess the knowledge levels about menstruation with evidence drawn from female athletes from public SHS in the Ajumako district. The result shows that a significant number of female athletes lacked sufficient knowledge about menstruation. Out of a total of 181 participants, 44.2% demonstrated a low level of understanding, while 29.3% showed a moderate level, and 26.5% exhibited a high level of knowledge when it comes to menstruation. The study's discovery of low knowledge levels among female athletes about menstruation is consistent with Martin et al.'s (2018) research, which also reported limited perceived knowledge among even elite athletes. This consistency suggests that the low level of knowledge coupled with a lack of awareness regarding menstrual health among athletes is a prevalent issue that might outdoes different geographical regions and athletic levels.

Furthermore, the study's findings are in agreement with the studies conducted by Stavrou et al. (2020) and Martinez et al. (2019) which found limited knowledge among adolescent athletes in Cyprus and collegiate athletes in the United States, respectively. These studies and the current study all point to the fact that female athletes often lack sufficient information about their menstruation and its implications for sports performance. The similarity in findings suggests that there may be common underlying factors contributing to this lack of knowledge, which could emanate from

several possible reasons. Firstly, there may be a lack of comprehensive and age-appropriate menstrual education programs in these schools (Heikura et al., 2020). This has been attributed to the fact that many educational systems often overlook or provide limited information about menstrual health, leaving students to rely on informal sources or their own experiences to gain knowledge (Stoilova et al., 2022). Without proper guidance and education, it is not surprising that a substantial portion of female athletes demonstrated a low level of understanding. More so, stigmatization surrounding menstruation may contribute to the low level of participant knowledge. Indeed, in some communities, menstruation is considered a sensitive or embarrassing topic, leading to limited discussions at home or in school (Findlay et al., 2020). This lack of open conversation could be a contributing factor hindering female athletes from gaining accurate information about menstruation, resulting in a significant portion of them having low or moderate levels of knowledge.

On the other hand, the study by Rodriguez et al. (2022) in Spain reported commendable knowledge about the menstrual cycle among female athletes. The contrast in findings could be that female athletes in Spain have access to better resources or educational programs on this topic compared to those of the students in public SHS in the Ajumako district. The study by Rodriguez et al. (2022) also highlighted the importance of access to resources and support, which may be a crucial factor influencing athletes' knowledge, aligning with the findings that female athletes in the Ajumako district lack sufficient knowledge. The findings are again in contrast to Desai & Dave, (2020) who settled that the level of knowledge related to menstrual health and hygiene; more than 50% of the athletes have good knowledge, and about 3% of participants have poor knowledge. The variation in findings could be a result of

differences in sample size, geographical location, the measurement tool, cultural factors, and maybe researchers' biases.

The findings of this research support existing theoretical frameworks including Hormonal theory, Psychophysiological theory, and Social-cultural theory. First, from a hormonal theory perspective, it's possible that hormonal fluctuations during menstruation could contribute to the lower knowledge levels observed in some female athletes, as they may experience hormonal changes that temporarily impact their comprehension of menstruation (Kusev et al., 2017). Also, findings support the psychophysiological theory which suggests that psychological factors, such as stress or anxiety, can influence cognitive processes. Female athletes, due to their rigorous training schedules and competitive pressures may experience higher levels of stress and anxiety, which could in turn affect their ability to retain knowledge about menstruation (Myrtek, 2012).

This theory may support the variability in knowledge levels observed in the study, with some athletes having moderate or high knowledge levels while others have low levels. More so, the social-cultural theory posits that cultural norms and societal attitudes can shape an individual's knowledge and understanding of menstruation. In certain cultures, menstruation may be a topic that is considered taboo or not openly discussed, leading to lower knowledge levels among female athletes from such backgrounds. On the other hand, those with higher knowledge levels may come from more open and informed cultural contexts. Therefore, these theories shed light on the varied knowledge levels observed among female athletes in public SHS in the Ajumako district and provide potential avenues for further research and intervention (Scott & Palincsar, 2013). Drawing from the above, the study provides fresh evidence

that supports and extends existing knowledge on the limited awareness and knowledge of menstruation among female athletes, particularly in public SHS in the Ajumako district. It adds depth to the understanding of this issue by categorizing knowledge levels and relating them to theoretical frameworks. This data not only contributes to the academic literature but also highlights the urgency of addressing this knowledge gap to promote the overall well-being and athletic performance of female athletes in the Ajumako district.

The second research question in this study aimed to investigate the practices of female athletes about menstruation. The results that emerged indicated that female athletes predominantly use disposable sanitary pads for menstruation, maintain proper hygiene through consistent handwashing and cleansing, dispose of menstrual items responsibly in designated dustbins or by burning them, occasionally choosing to bury them, and prioritize eco-friendly practices by avoiding improper roadside disposal. Also, the use of medication to delay menstruation is infrequent while painkillers are occasionally used for pain relief. The findings are in alignment with Desai and Dave (2020) disposable sanitary materials mostly used for management. The above-mentioned findings unequivocally indicate that female athletes attending public Senior High Schools in the Ajumako district have embraced a contemporary and sanitary method, with disposable sanitary pads being their preferred option for managing menstruation. Their dedication to personal hygiene is commendable, as they consistently engage in handwashing and cleansing, ensuring that they maintain a high level of cleanliness during this sensitive time. Moreover, their responsible disposal of menstrual materials, whether through designated bins or burning, exemplifies their commitment to environmental responsibility, and the occasional preference for burying materials underscores their carefulness. The findings from this

study align with existing literature on menstrual practices among female athletes. They underscore the importance of proper hygiene during menstruation, in line with recommendations from Khanna et al. (2015) highlighting the need for regular changing of sanitary products and genital area cleansing and this contributes to physical comfort during sports activities, allowing athletes to focus better on their performance rather than discomfort or distractions. Proper hygiene helps prevent infections and irritation which could potentially sideline an athlete due to discomfort or illness. Infections or irritation can also affect concentration and energy levels indirectly impacting performance (Keaney et al., 2018).

In terms of sports, female athletes typically reduce training intensity during menstruation, occasionally adjust training frequency, and skip competitions when necessary and this finding is in agreement with Orendurff et al. (2010) explaining that, while some individual athletes may be able to maintain their normal exercise routine, others may need to take a break or engage in lower-intensity activities as well as the frequency. The results are consistent with the literature's emphasis on adjusting physical activity and training intensity based on menstrual symptoms and hormonal fluctuations, one study found that 60 minutes of moderate to intense exercise during menstruation caused exercise-induced inflammation as discussed by (Thakre et al., 2012; Oosthuyse & Bosch, 2010). Inversely, Elliot-Sale et al. (2020) pointed out the substantial individual variability in how menstruation affects performance. Therefore, making generalized recommendations to reduce training may not be suitable for all female athletes.

Furthermore, the relatively rare use of medication to delay menstruation is in alignment with McNulty et al. (2020) expressed concerns about the long-term health implications of using medication to suppress menstruation and also in sports. It may be considered an unfair advantage and raise questions about the level playing field for all athletes. On the contrary, Deldicque and Francaux (2015) highlighted that delaying menstruation through medication can help female athletes maintain consistent training and competition schedules, potentially improving overall performance. The findings suggest that these athletes prioritize natural menstrual cycles, while the occasional use of painkillers indicates a pragmatic approach to pain management. The selective communication of menstrual status with coaches reflects a delicate balance between transparency and discretion, emphasizing the multifaceted nature of their approach to menstruation. Within the context of sports and these findings align with a study by Williams et al. (2019), female athletes reported feeling uncomfortable discussing their menstrual health with coaches, leading to lack of personalized training adjustments indicating deficiency of open communication between the athletes and their coaches.

The findings as presented above support existing theoretical models such as; Social-cultural theory (Vygotsky & Cole, 1978); Psychophysiological theory (Fahrenberg, 1988); and Hormonal theory by Morgan (1919). From a social-cultural perspective, the predominance of disposable sanitary pads among female athletes aligns with Vygotsky and Cole's (1978) theory, which emphasizes the influence of cultural and social contexts on behavior and cognition. In this context, the widespread use of sanitary pads may be linked to cultural norms and the availability of modern menstrual hygiene products, reflecting the impact of societal practices on the athletes' choices. Furthermore, the responsible disposal practices and environmental consciousness exhibited by these athletes can also be understood as influenced by

their cultural context, as these behaviors align with contemporary concerns about sustainability and eco-friendliness.

From a psychophysiological standpoint, Fahrenberg's (1988) theory comes into play when considering the athletes' management of pain and adjustments in training intensity during menstruation. The occasional use of painkillers aligns with the physiological aspect of pain management reflecting an understanding of the psychophysiological processes involved in menstrual discomfort (Finnerup et al., 2020). Similarly, the athletes' decision to reduce training intensity and occasionally skip training sessions during menstruation demonstrates an awareness of the psychophysiological changes that occur in their bodies during this time, indicating a pragmatic approach to maintaining their physical well-being and performance. Hormonal theory (1919) can be related to the infrequent use of medication to delay menstruation among these athletes. This theory highlights the hormonal fluctuations that occur during the menstrual cycle and suggests that altering this natural process with medication may have implications for hormonal balance. The athletes' limited use of such medication may be attributed to their understanding of the potential hormonal effects and a desire to maintain their overall hormonal health. This choice reflects a consideration of the physiological aspects of their menstrual cycle and hormonal balance, aligning with the principles of hormonal theory.

The findings about practices regarding menstruation could emanate from a lot of reasons. Firstly, the preference for disposable sanitary pads may be attributed to their convenience and ease of use, which aligns with an active lifestyle. Disposable pads are readily available, easy to carry, and can be discreetly used during athletic activities, making them a practical choice for female athletes these will boost

confidence hence maximizing sports performance. Again, their use may be influenced by the perception of better absorbency and reduced leakage compared to other methods like cloth which is crucial for athletes who need to stay comfortable and focused during their activities. More so, the emphasis on proper hygiene practices such as consistent handwashing and external genitalia cleansing could be attributed to the athletes' awareness of the importance of maintaining personal hygiene during menstruation to prevent infections and discomfort. This heightened awareness might stem from the rigorous training and competition schedules of female athletes, as they strive to minimize any disruptions caused by menstrual issues (Hamlin et al., 2019). Similarly, responsible disposal methods and avoidance of improper roadside disposal can be linked to the female athletes' understanding of their environmental responsibilities, as many athletes are role models and may be more inclined to uphold eco-friendly practices. Lastly, the infrequent use of medication to delay menstruation and the occasional use of painkillers may reflect a preference for a more natural approach to managing menstrual cycles and discomfort that without focusing on the use of medication, as well as a concern for the potential side effects of medication, which could affect sports performance.

Research question three aimed to examine how female athletes' comprehension and actions related to menstruation are connected, using information obtained from female athletes in public SHS in the Ajumako District. The resulting indicates a statistically significant and positive correlation between knowledge of menstruation and practices associated with menstruation (correlation coefficient $r = 0.268$; $p < 0.001$).

This finding is consistent with previous research findings which state females who are more knowledgeable about the menstrual cycle and its potential impacts on training and performance are more likely to integrate this awareness into their athletic routine (Brown & Brutsaert, 2019). The observed statistically significant and positive correlation between knowledge of menstruation and corresponding practices could be that when individuals have a better understanding of menstruation, they are more likely to make informed decisions and adopt appropriate practices related to menstrual hygiene and management. The findings are again in connection with Akter et al.'s (2019) studies which concludes that among adolescent girls, there was a statistically favourable connection between knowledge and practice of menstruation ($p = 0.001$). The study showed how many females athletes were knowledgeable about menstruation and menstrual hygiene practices. In this context, female athletes with higher knowledge levels may be more inclined to follow recommended menstrual hygiene guidelines such as using proper sanitary products and maintaining good personal hygiene during their menstrual cycles. This may lead to better menstrual health practices, contributing to the positive correlation observed. This finding conclusively supports the research question's intent, demonstrating that a higher level of knowledge is associated with more favourable practices regarding menstruation among female athletes in this specific context. This new finding reaffirms the importance of education and awareness regarding menstruation and emphasizes its practical implications for female athletes in optimizing their performance and well-being during menstruation, adding valuable insights to the existing body of knowledge in this field.

The final research question examined how menstruation affects the sports performance of female athletes. The findings revealed that approximately 17% of the variations in female athletes' sports performance can be attributed to the physical and psychological effects of menstruation. Furthermore, the regression analysis demonstrated that for each unit increase in the physical effects of menstruation, there was a statistically significant 4.4% decrease in the performance of female athlete (β = -.044; p = .021). Likewise, the psychological effects of menstruation were found to significantly reduce female students' performance in sports by 10.7% (β = -.107; p = 0.036). The study's findings align with previous research by Carmichael et al. (2021) and Bruinvels et al. (2016), which both suggested that the menstrual cycle can indeed impact female athletes' sports performance. Carmichael et al. (2021) emphasized that the menstrual cycle's influence on physical and psychological factors is increasingly recognized as a crucial consideration in women's sports. This supports the current study's assertion that both physical and psychological aspects of menstruation significantly affect sports performance of the female athletes. Also, Bruinvels et al.'s (2016) on the prevalence and impact of heavy menstrual bleeding in elite and non-elite athletes indicated that heavy menstrual bleeding among high school female athletes affects their active participation in sporting activities which subsequently leads to poor sports performance.

From the above, it is glaring that the findings presented in the study have addressed research question four, which aimed to examine how menstruation affects the sports performance of female athletes in public SHS in the Ajumako district. The results provided valuable insights into the relationship between menstruation and sports performance among female student-athletes in this specific context. The regression analysis has provided evidence to support how the physical and psychological effects

of menstruation affect female athlete's sports performance. These specific numerical findings lend statistical credibility to the idea that menstruation affects the sports performance of female athletes in public SHS in the Ajumako district.

The observed decline in sports performance among female athletes with increasing physical effects of menstruation could be attributed to various factors. First, menstrual symptoms such as abdominal cramps, fatigue, and bloating could be physically discomforting and distracting, potentially diverting an athlete's focus and energy away from their sport (Bruinvels et al., 2016). These physical discomforts might lead to reduced agility, endurance, and overall physical performance. Again, hormonal fluctuations during menstruation could impact muscle strength and coordination, further affecting athletic abilities. Female athletes may also be less inclined to push themselves to their limits when experiencing these physical symptoms, which can result in decreased sports performance. The dire implication is that female athletes who experience heightened physical discomfort during menstruation may face a greater challenge in maintaining their peak performance, leading to disparities in their athletic records and potential missed opportunities in competitions.

On the other hand, the reduction in sports performance associated with the heightened psychological effects of menstruation might be explained by the emotional and cognitive challenges that menstruation can bring. Mood swings, irritability, and anxiety, which are common psychological symptoms during this time can disrupt an athlete's mental state, leading to decreased concentration and focus. Confidence levels may also decrease affecting female athlete's self-belief and performance expectations. Such psychological hurdles could hinder an athlete's overall athletic journey,

preventing them from reaching their full potential and affecting their long-term athletic development (Niyonsenga & Phillips, 2013).

The findings of this study offer valuable insights that can be linked to existing theoretical frameworks in the field of sports psychology and performance. One theoretical framework that can be related to these findings is the Psychophysiological theory, as proposed by Fahrenberg, (1988). This theory suggests that physiological factors play a crucial role in determining an individual's performance in various activities, including sports. In the context of the study's results, the physical and psychological effects of menstruation align with the psychophysiological perspective, where hormonal changes during menstruation can affect an athlete's physical condition as well as mental preparedness which impact their sports performance.

The statistically significant 4.4% decrease in performance with each unit increase in physical effects supports the idea that physiological changes are influential in this context. Furthermore, these findings can be connected to the Hormonal theory. This theory posits that hormonal fluctuations can have significant effects on various aspects of human behavior and physiology. In the context of female athletes and menstruation, the study's results confirm the relevance of hormonal factors. The significant decrease in sports performance by 10.7 due to psychological effects of menstruation underscores the role of hormonal fluctuations in affecting an athlete's mental state, as postulated by Morgan in the hormonal theory. The emotional and psychological aspects of sports performance could be strongly tied to hormonal changes and this finding aligns with that perspective these can be explained that changes in hormone levels may influence factors like strength, endurance, and susceptibility to injury (Lebrun et al., 2013). Conversely, the findings contradict

several studies that have found no significant psychological effects of the menstrual cycle on sports performance. For instance, in a study by Oosthuyse and Bosch (2010), female athletes' performance in cycling time trials was not affected by the different menstrual cycle phases. Correspondingly, a study by Bruinvels et al. (2017) on middle-distance runners found no significant differences in performance across menstrual cycle phases. Similarly, a study conducted by Dasa et al. (2021) concluded that no performance differences were seen among top-level female team athletes. This shows that in top-level team athletes, the MC does not affect acute strength and power performance on a collective basis (Agblo et al., 2022). This implies that the menstrual cycle does not affect sports performance both physically and psychologically. This may be because these elite athletes have a certain amount of knowledge and experience that helps them create techniques to manage with menstruation syndromes that are experienced during their cycle, resulting in an enhancement in their performance. These contradictions in findings could be associated with the fact the variability in sports performance can be influenced by other unknown 83% factors such as improper nutrition, lack of proper training, weather, and others (Nolte, 2013).

The findings provide new evidence related to the impact of menstruation on the sports performance of female athletes within the context of SHS in Ajumako who engaged in sports such as athletics, volleyball, soccer, table tennis, netball and handball. The study has provided quantitative evidence, demonstrating that both physical and psychological aspects of menstruation have statistically significant negative effects on sports performance among female athletes in SHS in Ajumako. These findings contribute to the understanding of how menstrual symptoms can physically and psychologically affect female athletes, potentially leading to a decline in their sports

performance in the elements below (endurance, strength, skills, coordination and muscle's ability to recover) in ball games and athletics.

4.5 Chapter Summary

The results from data collected on the research questions formulated to guide the study were logically presented in this chapter of the study. The results indicated that a significant number of female athletes attending public high schools in the Ajumako district have a low level of knowledge about menstruation. The study's findings revealed that female athletes primarily use disposable sanitary pads and maintain good hygiene practices during menstruation, including the responsible disposal of menstrual items and a preference for eco-friendly practices. Medication to delay menstruation is rarely used, while painkillers are occasionally employed for pain relief. In terms of athletics, female athletes typically lower training intensity, occasionally adjust training frequency, skip competitions when needed, and selectively communicate their menstrual status to coaches. Furthermore, the results revealed a statistically significant and positive correlation between knowledge of menstruation and practices associated with menstruation. Lastly, the results of the study demonstrated that the physical effects of menstruation, as well as the psychological effects of menstruation, were found to impact female athlete's sports performance negatively.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.0 Overview

This chapter presents a summary of the research process and highlights the significant findings regarding the perceived influences of menstruation on sports performance among female athletes. Based on the important findings, conclusions have been drawn, providing guidelines and ideas for further research.

5.1 summary of Findings

The following are the study's main findings

1. The study revealed that a significant number of female athletes attending public Senior High Schools in the Ajumako district have a low to moderate level of knowledge about menstruation.
2. The study also revealed that female athletes primarily use disposable sanitary pads and maintain good hygiene practices during menstruation, including the responsible disposal of menstrual items and a preference for eco-friendly practices. Medication to delay menstruation is rarely used, while painkillers are occasionally employed for pain relief. In terms of sports, female athletes sometimes lower training intensity, occasionally adjust training frequency, skip competitions when needed, and selectively communicate their menstrual status to coaches.
3. The results revealed a statistically significant and positive correlation between knowledge of menstruation and practices associated with menstruation.
4. Physical as well as psychological effects of menstruation negatively impact female athlete's subjective sports performance.

5.3 Conclusions

The findings have significant implications for female athletes' performance in sports and as a result, several inferences can be drawn:

1. The research findings indicated that a considerable proportion of female athletes enrolled in public Senior High Schools within the Ajumako district lack sufficient understanding of menstruation. This discovery is pertinent to the well-being and health of female athletes as menstruation is a biological process and understanding it is essential for maintaining proper hygiene and overall health. The study concludes that insufficient knowledge about menstruation when not addressed could further lead to misconceptions, poor menstrual hygiene practices, embarrassment, discomfort, potential health risks, and a further decrement in sports performance.
2. More so, the findings of this study hold significant relevance and importance for both female athletes in senior high schools and society at large. The fact that female athletes predominantly use disposable sanitary pads and maintain good menstrual hygiene practices highlights their responsible and eco-conscious behavior. Additionally, the infrequent use of medication to delay menstruation and the occasional use of painkillers underscore the athletes' commitment to their sports and well-being. Moreover, their adaptive strategies in adjusting training intensity and frequency, as well as their selective communication with coaches regarding menstrual status, demonstrate their resilience and determination in pursuing their athletic goals. In conclusion, these findings also serve as a positive societal model, highlighting the significance of sustainable menstrual practices and the capacity to excel in sports while effectively managing menstruation.

3. The observed statistical significance and positive correlation between knowledge of menstruation and associated menstrual practices highlight the importance of education in promoting healthy and informed behaviors. This again explains the direct relationship between awareness and the adoption of appropriate menstrual practices, suggesting that improved knowledge can positively impact how female athletes manage menstruation.
4. The research discovered that both the physical and psychological consequences of menstruation negatively affect the sports performance of female athletes by about 17%. This finding highlights the pressing need for educational initiatives and support systems aimed at addressing these challenges within the context of high school sports. The study concludes that, by addressing both the physical and psychological effects of menstruation, female athletes would be empowered to navigate these challenges effectively, ultimately leading to improved sports performance.

5.4 Contributions to knowledge

The study highlights a critical knowledge gap concerning menstruation among female athletes attending public senior high schools in the Ajumako district. This sheds light on an important issue that has been relatively overlooked in their sporting activities. Understanding the extent of this knowledge deficit is crucial for developing targeted educational interventions aimed at equipping female athletes with essential information about menstrual health and sports performance. This contribution emphasizes the need for comprehensive menstrual education programs specifically tailored to the athletic community, to promote better health and well-being among female athletes.

The research provides valuable insights into how menstruation affects the sports performance of female athletes and how they manage it. This contribution not only confirms the widely acknowledged impact of menstruation on physical and psychological aspects of athletic performance but also delves into the practical strategies female athletes employ to navigate these challenges. This knowledge is crucial for coaches, sports administrators, and athletes themselves, as it informs the development of menstrual-aware training and competition policies and guidelines. It also highlights the importance of destigmatizing menstruation in sports and encourages the adoption of supportive measures to ensure that female athletes can perform at their best while managing their menstrual health effectively.

5.5 Recommendations

To address the low level of knowledge about menstruation among female athletes in public senior high schools in the Ajumako district, it is recommended that comprehensive menstrual education programs be implemented within the school curriculum. These programs should focus on providing accurate information about menstruation, menstrual hygiene, and the physical and emotional aspects of menstruation. Additionally, workshops and seminars could be organized to facilitate open discussions about menstruation, helping to reduce stigma and increase awareness among female athletes.

Given the positive findings regarding responsible menstrual practices among female athletes, it is advisable to further promote eco-friendly and sustainable menstrual hygiene products. Schools and other organizations can collaborate with local sanitary pad manufacturers to provide affordable and environmentally friendly options. Moreover, coaches should be encouraged to maintain open channels of

communication with their athletes regarding menstrual health and training adjustments, fostering a supportive and understanding environment that allows female athletes to manage their menstruation effectively while continuing their athletic pursuits.

Building on the positive correlation between knowledge and menstrual practices, it is crucial to continually evaluate and enhance menstrual education programs. This includes regularly updating the curriculum to ensure it remains relevant and informative. Furthermore, collaboration between schools, healthcare providers, and community organizations can be encouraged to provide ongoing support and resources for female athletes to maintain healthy menstrual practices. Periodic assessments of knowledge and practices can help track progress and ensure that education efforts are effectively addressing the needs of female athletes in the Ajumako district.

To mitigate the adverse effects of menstruation on female athletes' sports performance, it is essential to develop personalized training and competition strategies that account for menstrual cycles. Coaches and sports professionals should receive training on how to tailor training regimens and competition schedules to accommodate the physical and psychological fluctuations that can occur during menstruation. This can help female athletes optimize their performance and reduce the impact of menstrual symptoms on their athletic endeavors. Coaches should also employ various methods, such as menstrual cycle calendars, smartphone apps such as Spot On, or wearable devices to monitor the menstrual cycle of athletes and plan their training accordingly.

5.6 Suggestions for Further Studies

1. Future studies could employ experimental design to examine the sports performance of female athlete's vis a viz before and after menstruation.
2. Future studies can assess coaches' level of knowledge regarding menstruation at various SHS.
3. Future studies can extend it to other districts/metropolis for comparative purposes.

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APPENDICES

APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

QUESTIONNAIRE FOR FEMALE ATHLETES

I am Evelyn Agbordzor a student of the Department of Health, Physical Education Recreation and Sports at the University of Education, Winneba. I am carrying out research on "Perceived influences of menstruation on sports performance among female athletes". It is also in partial fulfillment of the requirement for the award of Master of Philosophy Degree in Physical Education.

The questionnaire is strictly for an academic exercise, and you are please requested to provide accurate and sincere information that will assist me in obtaining correct data for the study. Confidentiality in respect of whatever information you may give is fully assured. All information and data collected will be used strictly for research and publication of results.

Thank you.

Consent

I have read the forgoing information about the study and fully understood what it entails. I therefore consent to voluntarily participate in this study.

Signature…….

Date……...

SECTION A: DEMOGRAPHIC INFORMATION

Instruction: You are kindly requested to tick (√) in the space that best describes your view about each item.

Age

12-14 years ☐ 15-17 years ☐
18- 20years ☐ Above 20 years ☐

1. **At which age did you start menstruating?**

   Below 9 years ☐ 9-11 years ☐ 12-14 years ☐
   15-17 years ☐ 18-20 years ☐ Above 20 years ☐

2. **Do you have severe menstrual bleeding?**

   Yes ☐ No ☐

3. **Do you experience menstrual pains?**

   Yes ☐ No ☐

4. **If yes, how would you rate your menstrual pain?**

   Mild ☐ Moderate ☐ Severe ☐ Very Severe ☐

5. **Have you missed your menses in the last three months?**

   Yes ☐ No ☐

6. **What sport do you play? (Select all the sports you play)**

   Football ☐ Netball ☐ Volleyball ☐ Handball ☐
   Table tennis ☐ Athletics ☐ Others ☐

7. **How long have you played sports?**

   Less than 1 year ☐ 2-4 years ☐ 5-7 years ☐ above 7 years ☐

SECTION B

Instruction: For each item select from the options by ticking (√) in the appropriate column (**YES**) or **(NO**) to indicate your agreement to the item.

ATHLETES' KNOWLEDGE OF MENSTRUATION

S/N	Items	YES	NO
1	Menstrual bleeding comes from the uterus		
2	Menstrual bleeding usually lasts between 1-7 days		
3	Menstruation is controlled by hormones		
4	Menstruation comes with common menstrual symptoms such as headache, breast pain, anxiety		
5	Menstruation is affected by physical activity and exercise		
6	Menstruation is lifelong		
7	Menstruation is affected by diet		
8	On average, menstruation occurs every 28 days		
9	Missed periods make your bones weak		
10	Severe menstrual bleeding can cause anemia		
11	Body temperature can extremely change during menstruation		
12	Sleep patterns can change during menstruation		
13	Stress fractures occur more commonly in female athletes who miss periods.		
14	Wearing sanitary materials for too long can lead to an infection.		
15	Some women may experience changes in strength, endurance, and energy levels during menstruation		

SECTION C

Instruction: For each item select from the options by ticking (√) in the appropriate column: (A) = Always, (S) = Sometimes and (N) = Never.

ATHLETES' PRACTICES REGARDING MENSTRUATION

	Items	Please TICK (√) your option to rate EACH item		
		A	S	N
1.	I use disposable sanitary pads to manage menses			
2.	I use old cloth to manage menses			
3.	I use a new cloth to manage menses			
4.	I use tampons to manage menses			
5.	I wash my hands after changing menstrual materials			
6.	I use only water to clean the external genitalia			
7.	I use soap and water to clean the external genitalia			
8.	I dispose menstrual materials in the dustbin			
9.	I dispose menstrual materials by burning them			
10.	I dispose menstrual materials by burying them			
11.	I dispose menstrual materials by throwing them by the roadside			
12.	I take medication to delay menses			
13.	I take painkillers to reduce pain during menses			
14.	I reduce the intensity of my training during menstruation			
15.	I do not train as frequently as before during menstruation			
16.	I skip training sessions during menstruation			

17.	I avoid training/ competition during menstruation			
18.	I inform my coach when am menstruating			

SECTION D

ATHLETES PERCEPTION OF EFFECTS OF MENSTRUATION

Instruction: Indicate your level of agreement on each of the following statements by ticking (√) in the column provided.
Strongly Agree = (SA), Agree = (A), Disagree = (D) and Strongly Disagree = (SD)

I. PHYSICAL EFFECTS

S/N	Items	Please TICK (√) your option to rate EACH item			
		SA	A	D	SD
1	During menstruation, I experience headache which makes me less- active and lose focus whiles performing				
2	During menstruation, I experience abdominal pains, which make me lose concentration while performing				
3	During menstruation, I experience back pain which prevents my ability to gain balance whiles performing				
4	During menstruation, I experience breast pain which makes me less confident whiles performing				
5	During menstruation, I gain weight which makes me heavier whiles performing				
6	During menstruation, I experience acne which makes me isolate from coaches and teammates				
7	During menstruation, I experience nausea which prevent me from performing/ training or competing				

II. PSYCHOLOGICAL EFFECTS

SN	Items	Please TICK (√) your option to rate EACH item			
		SA	A	D	SD
1	I isolate myself during menstruation which prevents me from bonding with my team during training and competition.				
2	I experience anxiety which makes me not to concentrate during menstruation.				
3	I experience depression which drains my energy level during menstruation.				
4	I experience mood swings during menstruation which give me mix feelings				
5	I experience anger during menstruation which makes me not to do extra				
6	Low spirit during menstruation makes me not to train hard for competition.				
7	I lack concentration during menstruation which makes me prone to injuries				
8	Dress stain stigmatization makes me abandoned training/ competition during menstruation				

SPORTS PERFORMANCE DURING MENSTRUATION

Instruction: Please tick (√) when applicable in the column provided.
Excellent = (5) Very Good =4, Good = 3; Poor =2, Very Poor =1.

	Items	1	2	3	4	5
1.	How would you rate your running speed in sports?					
2.	How would you rate your endurance in sports?					
3.	How would you rate your jump ability in sports?					
4.	How would you rate your throwing ability in sports?					
5.	How would you rate your coordination in sports					
6.	How would you rate your general performance in sports?					

APPENDIX B

RELIABILITY STATISTICS OF THE SCALE

Cronbach's alpha	Cronbach's alpha based on standardized items	Number of items
.606	.795	57

APPENDIX C

Introductory Letter

UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF HEALTH, ALLIED SCIENCES AND HOME ECONOMICS EDUCATION
DEPARTMENT OF HEALTH, PHYSICAL EDUCATION, RECREATION AND SPORTS
P. O. Box 25, Winneba, Ghana
hpers@uew.edu.gh
+233 (03323) 22494

Our ref: FHASHEE/ DHPERS /I.3/VOL.3.3 ***Date:*** 16th October, 2023

TO WHOM IT MAY CONCERN

Dear Sir/ Madam,

LETTER OF INTRODUCTION

We humbly write to introduce to you **Ms. Evelyn Agbordzor,** a student from the above-named Department pursuing an MPhil in Physical Education at the University of Education, Winneba with index number **220023317.**

She is writing her research thesis on the topic "Perceived Influence of Menstruation on Sports Performance among Female Senior High School Athletics in Ajumako District".

This introductory letter is for you to grant her the necessary assistance to collect data to help her complete her academic work.

Thank you.

Yours faithfully,

Dr. Regina Akuffo Darko
Ag. Head of Department