

DOI: <https://dx.doi.org/10.18203/2320-1770.ijrcog20233326>

Review Article

Exploring the salient factors influencing menstrual health and hygiene: a review

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Received: 17 September 2023

Revised: 08 October 2023

Accepted: 09 October 2023

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ABSTRACT

Menstruation is a process that induces a series of hormonal and structural changes in the female reproductive system to foster pregnancy. Pre-menstrual syndromes usually occur 5-7 days before a menstrual period with altered levels of estrogen, progesterone, and serotonin at the beginning of the cycle as well as ovarian steroids that modulate cognitive activity. Around 150 known symptoms of PMS may be experienced in women during menstruation varying from cramps, mood swings, breast soreness, bloating, acne, food cravings, excessive thirst and fatigue, influencing the quotidian routine of women. About 3–8% of women experience more drastic problems like premenstrual dysphoric disorder. Even though half of the global female population is of reproductive age, menstruation is still one of the most stigmatized topics from a societal perspective. Lack of proper awareness about menstruation and the factors affecting it may precipitate misconceptions or discrimination, leading to physical health risks, hence preventing the development of public health habits. This article aims to explore the probable complementary or contrary factors influencing the cycle of a woman that may help to safeguard her health without any stress, menstrual shame or barriers to information during menstruation which is a fundamental issue of human rights, dignity and public health.

Keywords: Menstruation, Menstrual hygiene, Menstrual health, Women, Taboo, Dysmenorrhoea

INTRODUCTION

Menstruation is elucidated as a hormonal process of discharging blood, secretions, and tissue debris from the uterus, that a woman's body undergoes monthly to prepare for a possible pregnancy.¹ It is a major stage in which a woman experiences certain reproductive changes from menarche to menopause. The uterus develops a thicker lining of endometrium tissue to harbor the development of a zygote. An egg released from ovary, can be fertilized by a sperm but if it remains unfertilized, pregnancy does not eventuate and the inutile uterine lining is shed as shown in Figure 1.²

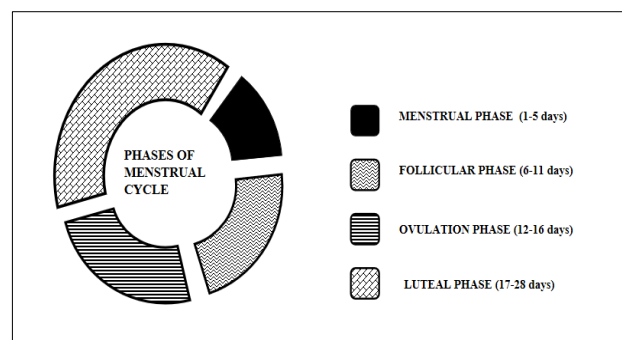


Figure 1: Different phases of menstrual cycle.

The menstrual fluid comprises blood containing phosphate, iron, chloride, mucus, vaginal secretions, unfertilized egg, and endometrial tissue. The onset of menstruation commences with a significant variation range during the age of 10-16 years when a female undergoes many emotional and physiological changes due to a surge in hormone level.³ An average woman has approximately 450 period cycles in her lifetime from menarche to menopause, that is about 3500 days or 10 years of her life are spent menstruating. Some research suggests that an average of 40-60 ml of blood is lost during each cycle. The normal period of ovulatory cycles is between 21 and 35 days. Duration of menstrual flow ranges from 2 to 7 days, though most periods last from 3 to 5 days.

During menstruation, the uterus contracts to expel its lining, triggered by prostaglandins instigating pain and inflammation. When the egg is released, hormones like estrogen and progesterone drop, as depicted in Figure 2. This also influences serotonin levels, which is the main reason for nausea, mood swings, and premenstrual syndrome (PMS).⁴

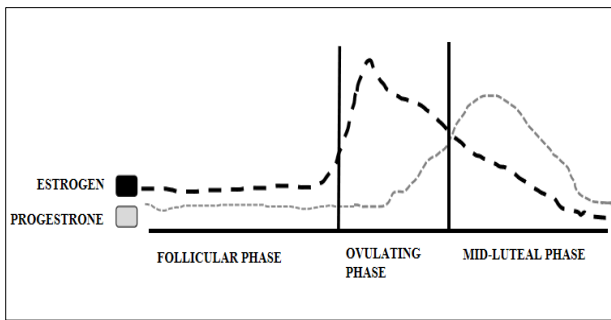


Figure 2: Fluctuations in hormone levels during different phases of menstrual cycle.

Despite being a salient issue concerning women, its management is often considered a taboo which can catalyse further ailments and mental stress. This article focuses on factors like nutritional habits, hydration, physical activity, medications, blood groups, menstrual hygiene practices, and social norms which can reinforce the cycle and daily activities during menstruation.

BACKGROUND

While menstruation is an integral part of the female body, the concept of menstruation is still regarded as taboo and confined to a 'feminine' topic in society. Stress-associated menstruation and reproductive tract infections can be a consequence of inadequate practices of menstrual hygiene. This article correlates the effect of modifiable risk factors of menstrual irregularity and health. It also aims to raise awareness of social norms about menstrual hygiene practices to create a physical, social, and psychologically healthy attitude.

METHODOLOGY

The databases used were Pubmed, ScienceDirect, ResearchGate, Scopus and UpToDate. The search terms used were 'menstruation, menstrual health, menstrual hygiene practices, menstrual hygiene management practices, and dysmenorrhea. A time frame of 10 years was set from 2013 to 2023 for literature to highlight the evolution of influential factors of the menstrual cycle. Non-English articles and papers without open access were excluded.

What is menstrual shame?

Menstrual health is referred to as a state of physical, mental, and social well-being and not just the absence of menstrual problems. This can improve global public health by the achievement of sustained developmental objectives.

Menstrual shame is an attitude of embarrassment or stigma regarding menstruation and associated practices. According to a cross-sectional study in Chennai by Sundari et al, it was observed that a predominant proportion of the participants in the urban area were counselled about menstrual health by their mother whereas the teacher fulfilled this role in the rural areas. Most of them believed that menstrual shame was not imposed by the educational system or family/peers, but by the media and society, and it was unnecessary to consult a physician regarding menstrual problems.⁵ Qualitative studies report girls' fear of leaking blood and staining of clothes during the cycle and excessive body odor subsequently led to their absence from work and social gatherings.⁶ Some restrictions are cultural, such as inhibitions to handle particular food, entering religious spaces, or the requirement of isolation during their period. The misconception that women and girls have diminished physical and emotional capacities, due to menstrual cycle creating barriers to opportunities, reinforcing gender inequality in the mindset of opposite genders and in females themselves.⁷

Menstrual products

There are various menstrual health that help to manage menstrual hygiene but the most used ones in the commercial market are sanitary napkins, tampons, and recently menstrual cups. The pros and cons of these menstrual products are depicted in Table 1.

The disposal of sanitary products

Women may face a crisis in the disposal of menstrual products and hindrance to performing hygiene practices while using public toilets. According to a cross-sectional study by Mathiyalagen et al, a total of 13.8% of women reported absenteeism at work during menstruation and 80.7% reported presenteeism with decreased productivity. The mean absenteeism related to a woman's period was 1.3 days per year, proving that the menstrual cycle decreased

their flexibility in tasks and adversely affected the productivity of work.⁹

Similarly, an Ethiopian meta-analysis by van Eijk et al reported that approximately 69.3% of girls skipped school days due to inadequate latrine facilities to change their absorbents, while 39.2% reported a lack of sufficient water for washing and around 19.1%, due to a lack in disposal facilities.¹⁰ The changing of sanitary pads depends on the flow of menstrual blood, hot weather that accumulates more sweat and moisture in the genitals, and the extent of physical activity, but it is best to change pads at least every 3-4 hours. Sanitary pads used for a prolonged time or cheaper alternatives can lead to urinary tract infections, fungal infections, and bad odor. Using bigger cloth pads than required can cause rashes due to friction between the thighs. Improper menstrual hygiene practices after handling sanitary napkins also lead to infections like Hepatitis B, yeast, and even cervical cancer. India is one of the top-ranking countries with 70,000 victims per year of reported menstrual hygiene-related cancers in women.¹¹

The calibration of toilet facilities according to menstrual hygiene practices must also include the availability of absorbents and their disposal. This necessitates knowledge about the currently used menstrual materials, as the disposal of menstrual blood may be correlated to many cultural considerations. Research proves the statistical correlation of hygienic practices to factors like age, education of parents, residential status, economic background, exposure to mass media exposure, and acquired knowledge. Menstrual products are usually discarded in latrines, burned, or buried. A meta-analysis study in India by Gultie et al implied that careless disposal of absorbents and burning was commonly practiced in the rural community rather than in urban settings. Dustbins with closed lids in female latrines and incineration are a basic need for menstrual waste disposal in workplaces and educational institutions. A more effectual method of disposal may require well-vented incinerators with a direct connection to the toilet cubicle via a chute.¹²

Menstrual hygiene management

Menstrual hygiene management (MHM) practices are assorted based on socio-cultural, educational, and economic background. Vulvar pH is expected to fall approximately at 4.7 and the vagina has a pH of 3.5 with reports varying from 3.8 to 4.2 during menstruation. Several factors influence vulvar pH, including endogenous factors (e.g. sweat, vaginal discharge, menstruation, urine or fecal contamination, anatomical vulvar folding, genetics, and age) and exogenous factors (e.g. soap, detergents, cosmetic products, lubricants, spermicides, occlusion with tight clothing or sanitary pads, and shaving). Although regular vulvar washing abates aggregation of vaginal discharge, sweat, and urine-fecal contamination and prevents offensive body odor, prolonged drying of the vulva from the use of vaginal washes decreases its pH and increases vulnerability to

infections by altering the normal vaginal flora.^{13,14} Particularly, detergent soaps or scented soaps must not be put into the vagina and it is unnecessary to use soaps, specifically labelled for genital use.¹⁵

FACTORS AFFECTING MENSTRUAL HEALTH

The age and height of the subjects were important to determine whether BMI influenced the flow and regularity of periods. A study by Tang et al showed a significant relationship between BMI and menstrual patterns. BMI in the range of 14-24.9 showed a normal pattern of menstruation whereas BMI in the range of 25-29.9 showed infrequent cycles. Adolescent obesity is associated with consequences like hyperandrogenism on menstrual health leading to irregular or absent menses, polycystic ovary syndrome (PCOS), and premenstrual disorders. Although sex hormones play a salient role in regulating menstruation, studies show that a high BMI may result in amenorrhoea, heavy or longer menstruation, irregular menstruation, or dysmenorrhoea.¹⁶

Menarche epitomizes the attainment of reproductive maturity, generally around 14 years. Although it ranges from 10 to 18 years, it varies with race, ethnicity, genetics, diet, physical exercise, medical conditions, like as diabetes, congenital heart diseases, ulcerative colitis, and environmental factors. A study indicated that girls who had late menarche required a longer period to reach ovulation than girls who experienced early menarche. Some studies hypothesized that late menarche was associated with a decreased time for first conception, osteoporosis, depression, and social anxiety issues.¹⁷ Early menarche may be caused by other medical conditions like hypothyroidism, CNS tumors, and head trauma. Girls who had menarche before 12 years were observed to have a greater risk of 23% for the development of breast cancer.^{18,19} The current prevalence of early menarche has been intertwined with increased body mass index, insulin resistance, and unhealthy lipid profile that apexed in risks of cardiovascular diseases like hypertension, coronary heart disease, strokes, and diabetes.²⁰

Anemia in menstruating women may occur as a consequence of heavy bleeding. This may be caused by fibroids, polyps, adenomyosis, ovulation irregularities, menstrual disorders, some drugs, cancer, and other etiologic factors. The ferritin level and physical functions showed a significant decrease as the duration of menstruation increased. Vegetarians are at higher risk for developing iron deficiency anemia. Low blood iron levels result from increased iron loss, inadequate iron intake, or malabsorption.²¹ Meat, shellfish and eggs contain greater levels of promptly absorbable heme-iron compared to vegetarian food which contains iron in non-heme form, which is not absorbed easily. According to an Australian observational study by Moschonis et al, vegetarians were observed to have increased premenstrual and menstrual symptoms, irregular cycles, and heavier periods that could be due to discrepancies in iron levels. Nevertheless,

vegetarians were more likely to have comparatively normal ovulatory cycles than non-vegetarians.^{22,23}

Junk foods lack micro-nutrients and contain a high level of saturated fatty acids which jeopardize the metabolism of progesterone during menstruation and trigger dysmenorrhea, premenstrual symptoms, and menstrual irregularities. Immoderate intake of junk food regularly also has a conspicuous association with the occurrence of early menarche.²⁴ Studies done on the consumption of carbonated drinks showed that it caused a rapid peak in blood sugar levels resulting in consequent elevation of body weight and insulin hormone levels, which influenced menstruation.²⁵

It was also elucidated in another study by ZkiBin et al that the intensity of dysmenorrhoea is higher among those consuming non-vegetarian tea/coffee. Caffeine inhibits hydrolysis of cyclic 3',5'-adenosine mono-phosphate and 3',5'-guanosine mono-phosphate and antagonism of adenosine due to which, it alters hormone profiles and affects menstrual function. Irregular periods were reported by 140 women (40%), amenorrhoea by 26%, oligomenorrhoea by 20.9%, heavy periods by 13.4%, and prolonged periods by 9.7%.^{26,27}

Chocolate is an insatiable craving for menstruating women but some reports have delineated that it can elevate prostaglandins and worsen period cramps by uterine wall contraction. However, a limited quantity of dark chocolate is beneficial whereas milk chocolate must be avoided as it is often diluted with milk, sugar, and cream and consists of less cocoa.²⁸ Dark chocolate comprises caffeine, theobromine, and tryptophan which reduces the levels of stress hormone, cortisol in the body and increases serotonin and endorphin levels to instigate a sense of serenity. It contains vitamins A, B1, C, D, and E, antioxidants like phenol and flavonoids, calcium, and iron, and diminutive quantities of omega 3 and 6 which can remarkably diminish menstrual and premenstrual pain. The prominent level of potassium and traces of magnesium can also relieve muscle cramps, water retention, and bloated feeling. Dark chocolate is a rich iron source that can supplement blood hemoglobin levels. Essential minerals in dark chocolate like copper, iron, and zinc are substantiated to promote cell repair, detoxify skin, and reduce menstrual acne.²⁹

As estrogen and progesterone levels recede during menstruation, the body retains more water and jeopardizes the digestive system causing constipation, acidity, and bloating. During menstruation, the endometrium produces a substantial amount of prostaglandin F2a, a causative factor for dysmenorrhea, due to uterine contraction, cramps, hypoxia, and uterine ischemia. Other salient vasoconstrictor agents in the non-pregnant uterus the endothelin-1 noradrenaline and arginine vasopressin (AVP). Studies have shown the importance of arginine vasopressin in the onset of uterine myometrium hyperactivity and decrease in uterine blood flow, leading

to appearing symptoms of early dysmenorrhea.³⁰ A slight deficit of water immediately activates AVP and in low plasma concentrations, AVP induces nearly maximal renal water conservation well before activation of thirst. Data indicates that although no significant difference between the plasma osmolality in people who have high or low hydration levels exists, elevated vasopressin level is observed in low-drinkers. Drinking at least 9-10 glasses of hot water alleviates bloating and abdominal cramps of menstruation while increasing blood circulation to relax the muscles.³¹

Generally, physical activity doesn't affect menstruation unless very active sessions are practiced, which causes a lighter period. Exercise can however increase the release of endorphins to improve mood, reduce anxiety, and depression. Exercises like walking, light cardio/aerobic exercises, strength training, light stretching and balancing, and yoga can relax the muscles and decrease cramps. Strenuous or prolonged exercise and inversion-type poses must be avoided as they cause exercise-induced inflammation, stretching of ligaments that support the uterus, and compression of veins that carry blood away from the uterus resulting in in vascular congestion and increased bleeding as the arteries perpetuate blood pumping to the area.^{32,33}

The length of a cycle depends on the number of days from the first day of bleeding to the start of the next menstrual cycle. The length of the cycle, while not on birth control practices, can be an important indicator of imbalances in hormone levels and ovulation.³⁴ Short cycles can indicate that the ovaries contain fewer eggs than expected, improper ovulation, or signs of perimenopause. Longer cycles or heavy bleeding termed as menorrhagia are caused by anovulation, a common cause of infertility. During a normal cycle, the fall in progesterone levels causes bleeding but if a follicle does not mature and ovulate, progesterone is not released and the endometrium continues to proliferate in response to estrogen. The lining thickens and becomes inconsistent, eventually collapses and then prolonged, heavy bleeding occurs. It may have diverse etiologies like uterine fibroids or polyps, endometriosis, pelvic inflammatory disease, or hormone imbalances.^{35,36}

Inter-menstrual bleeding or prolonged bleeding may be caused by structural problems like polyps, fibroids, cancer, or cervical or uterine infection that can further cause compromised implantation, lower pregnancy rates, or an increased chance of a miscarriage. Lack of menstruation or oligo-ovulation is commonly caused by polycystic ovarian syndrome (PCOS), as a result of being born with multiple eggs which causes hormonal imbalances. Additionally, thyroid gland disruptions or elevations of the hormone prolactin can cause anovulation.³⁷

The texture and color of menstrual blood vary during each cycle or monthly influenced by a plethora of reasons like

age, diet, physical exertion, hormonal variations, lifestyle, and environment as depicted in Table 2.^{38,39}

Normal vaginal discharge may be a white or clear color with a non-offensive odor that can fluctuate over time. It is thick and sticky for most of the menstrual cycle, which

becomes clearer and wetter around ovulation, noticeable during pregnancy, use of contraceptives, and with sexual stimulation. The volume of discharge at menopause drops due to estrogen levels. The various indications of vaginal discharge are depicted in Table 3.^{40,41}

Table 1: The advantages and disadvantages of available sanitary products.^{8,9}

Menstrual cups	Tampons and pads
Advantages	
Economical as the recurring expenditure is low due to longevity	Easily available
Prevent the risk of rashes and vaginal infections	Available in various sizes and lengths that can be used according to blood flow
Prevent unpleasant odour of menstrual blood as no chemicals and perfumes are added	Easy to remove
Can be worn without discomfort, wetness or itching up to 12 hours	
Not associated with toxic-shock syndrome or cancer.	
Environment friendly as it can be reused up to 3 years and reduces accumulation of waste	
Easy disposal of menstrual blood by pouring out the menstrual blood and washing it with water	
Disadvantages	
Risk of infections if not used hygienically	Costly due to recurring expenditure
Minimal risk of uterine pro-lapse if pulled out roughly during removal	Can cause rashes and vaginal infections
Uncomfortable to insert and remove in public latrines	Pads cause unpleasant odour as the added chemicals and perfumes in the pads react with the menstrual blood
	Wetness causes discomfort and itching
	Cannot be used for a prolonged time and needs to be changed with 4-5 hours.
	Can cause toxic-shock syndrome or cancer
	Requires incineration for disposal

Table 2: The color of menstrual blood and its indications.

Colour	Indications
Pink	Anemia, use of hormonal birth control, blood mixed with cervical fluid
Orange	Infections such as bacterial vaginosis or trichomoniasis
Dark red	Blood that has remained in the uterus for a while but has not oxidized enough to turn brown-usually seen upon waking up from lying position
Brown	Pregnancy, lochia, or post-partum bleeding
Black	Old coagulated blood that has settled in the uterus for a prolonged time and oxidized or vaginal blockage
Grayish	Active infection
Excess white/watery	Cervical erosion
Bright red clots	Rapid and steady flow of blood from the uterus (abdominal cramps are expected)
Heavy persistent bleed	Polyyps or fibroids, rarely cervical cancer

Table 3: The texture of vaginal discharge and its indications.

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Dark red	Blood that has remained in the uterus for a while but has not oxidized enough to turn brown-usually seen upon waking up from lying position

Continued.

Colour	Indications
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Excess white/watery	Cervical erosion
Bright red clots	Rapid and steady flow of blood from the uterus (abdominal cramps are expected)
Heavy persistent bleed	Polyps or fibroids, rarely cervical cancer

Several prescription and non-prescription medicines can influence the menstrual cycle. Aspirin and other anticoagulants interfere with ovulation by inhibiting prostaglandin production by cyclooxygenase. Nonsteroidal anti-inflammatory drugs (NSAIDs) like Ibuprofen and Naproxen reduce the production of prostaglandins that trigger uterine contraction and shedding the endometrium monthly.⁴² Some anti-psychotics frequently cause a hike in plasma prolactin levels. Along the several adverse effects correlated with hyperprolactinemia, are menstrual disorders such as amenorrhea or oligomenorrhea which have not been adequately evaluated.^{43,44} Similarly prolonged use of asthmatic medications containing steroids such as prednisolone can cause menstrual irregularities and prolonged and heavier blood flow.⁴⁵ Allergic progesterone hypersensitivity can progress to anaphylaxis and catamenial anaphylaxis and cause irregular menstrual periods, according to a recent study.⁴⁶ Menstruation is superintended by a network of gonadotropins encompassing luteinizing hormone (LH), follicle-stimulating hormone (FSH) and sex steroid hormones which are the chief constituents of the hypothalamic-pituitary-gonadal axis. This system is close-knit to the hypothalamic-pituitary-thyroid axis, which regulates thyroid function and hence any thyroid diseases may also cause menstrual discrepancies.⁴⁷ Seizures can cause hormonal alterations that control estrogen and progesterone levels and some anti-epileptic medications like lamotrigine may also affect the breakdown of estrogen and progesterone in your body.⁴⁸ During chemotherapy, women may have menstrual irregularities or amenorrhoea due to some chemotherapeutic medications like alkylating agents (e.g. Tamoxifen) that inflict ovary damage, consequently resulting in menopausal symptoms or menopause.⁴⁹

Menstrual suppression alleviates menstrual-related symptoms or medical conditions associated with morbidity or exacerbation, the choices ranging from the extended or perpetual use of combined hormonal oral contraceptives to hormonal patches and rings, progestins administered as various formulations like intramuscular injections, oral drugs and intrauterine devices, and other agents such as gonadotropin-releasing hormone (GnRH) antagonists. Menstrual suppression manages gynecologic conditions like dysmenorrhea, abnormal bleeding, premenstrual

dysphoric disorder, pelvic pain uterine fibroids, sickle cell disease, von Willebrand disease, and immune thrombocytopenia. During chemotherapy, when menstruation may cause anemia or excessive bleeding during therapy, menstrual suppression is recommended. It is also used by individuals with numerous personal reasons to have less frequent or no menses, including physical or mental disabilities, gender dysphoria, and travel.⁵⁰ Menstrual suppressants have diverse rates of efficacy in inducing amenorrhoea but have side effects like increasing rates of amenorrhoea over prolonged use, dysmenorrhea, and unscheduled bleeding. The term “therapeutic amenorrhoea” describes the menstrual suppression in women with hematologic disorders and coagulation defects that result in heavy menstrual bleeding.⁵¹ It is also associated with risks for individuals with specific medical problems, like migraine headaches with aura, breast cancer, or a history of deep vein thrombosis where progestin-only options (depot medroxyprogesterone acetate, oral progestins) are appropriate.⁵²

Cortisol can hinder ovulation interfere with progesterone production and sometimes cause spotting of blood. Although there appears to be a relationship between the type and severity of the stress and the proportion of women who develop menstrual problems, in practice it is difficult to set a threshold at which stress will interfere with the normal cycle. High-stress levels (PSS >20) were associated with only menstrual irregularities and not with duration, amount of flow, or dysmenorrhoea.⁵³

PAIN MANAGEMENT DURING MENSTRUATION

Following endometrial sloughing, endometrial cells release prostaglandins that are liberated by the cells of the endometrium to initiate menstruation. These prostaglandins are responsible for the stimulation of ischemia and consequently, myometrial contractions. Women who experience severe dysmenorrhoea, are observed to have increased levels of prostaglandins in the menstrual fluid and these levels peak during the initial two days of the menstrual cycle. The types of dysmenorrhoea are depicted in Figure 3.⁵⁴

The criteria for classification as secondary dysmenorrhoea can be illustrated as shown in Figure 4.

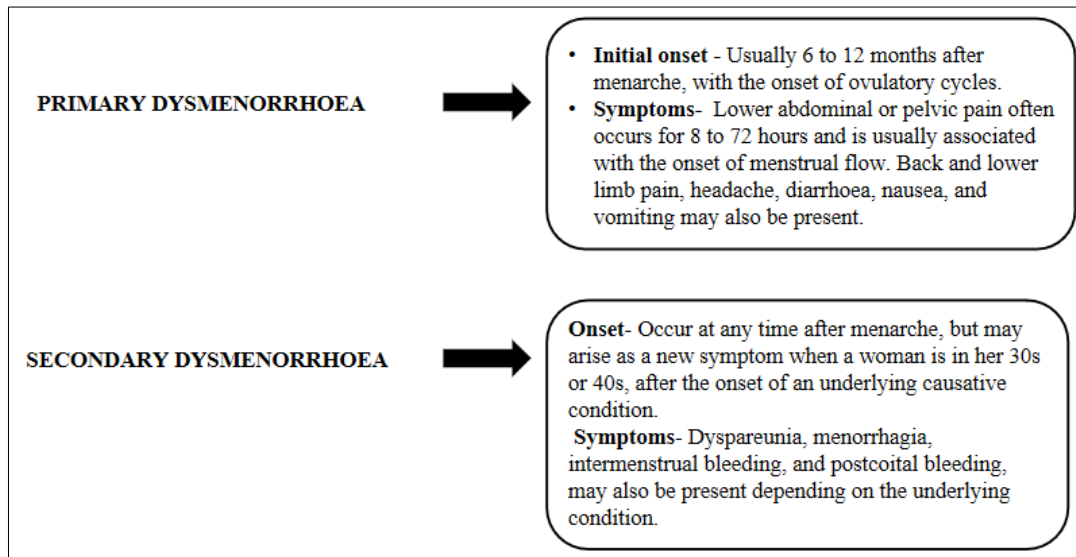


Figure 3: Types of dysmenorrhoea.

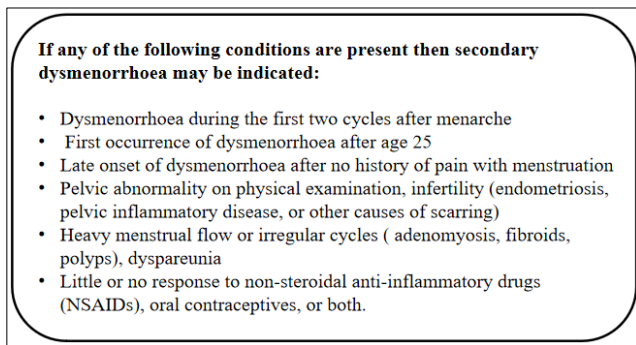


Figure 4: Criteria for classification as secondary dysmenorrhoea.

Pain management during menstruation includes physical exercise, pharmacological (e.g. analgesic medication, NSAIDs), non-pharmacological (e.g. herbal medicine, heat), or psychological strategies (e.g. meditation).⁵⁵ Progestogen compounds like medroxyprogesterone acetate and gestrinone are inducers of anovulation which subsequently lead to amenorrhoea and hence are effective to treat the symptoms of dysmenorrhoea in endometriosis. Studies show that dietary supplements like 100 mg of thiamine (vitamin B-1), fish oil (omega 3 fatty acids), and magnesium are substances that can reduce the level of prostaglandins in the blood during dysmenorrhoea.⁵⁶

CONCLUSION

Despite increased social attention to menstruation-related topics, substantial apertures about it exist in public knowledge. The present menstrual education does not consider the additional information on menstruation relating to the transgender, intersex, or non-binary population. The still-sensitive nature of menstrual topics hinders observational data collection for the estimation of menstrual hygiene and factors influencing menstruation.

Further investigation is required to analyze and minimize a myriad of biases in self-reported menstrual practices. Several misconceptions and taboos about menstruation can be eradicated by comprehensive health education for both parents and adolescent girls at school. Awareness campaigns and posters can spread essential knowledge about menstrual health and hygiene.

ACKNOWLEDGMENTS

Authors would like to thank the faculty of department of Amrita School of Pharmacy and Department of Obstetrics and Gynaecology, Amrita Institute of Medical Sciences and Research.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Lakshmi VU, Menon JCM, Johnson A, Sabu J, Narmadha MP. Exploring the salient factors influencing menstrual health and hygiene: a review. *Int J Reprod Contracept Obstet Gynecol* 2023;12:3427-35.