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Pre-Disposing Factors of Menstrual Irregularities – An Overview

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ABSTRACT
A regular menstrual cycle is an important indicator of a healthy reproductive system. Many factors can disrupt the menstrual cycle and identifying a single cause has been very difficult. Previous studies have reported various factors that are associated with irregular menstruation and early menopause. Disturbances in menstrual function have been associated with many factors, including age, smoking, body weight, exercise, life event, perceived stress, physiological conditions and work environment. Therefore, the combining effects of these modifiable risk factors have not been fully recognized. The menstrual cycle is definitely associated with modifiable risk factors as well as immutable host factors that may be related to the following disease conditions. This study was focused on the modifiable risk factors of individual and combined effects of their modifiable risk factors of menstrual cycle irregularity.

Keywords: Menstrual irregularity, amenorrhea, menarche, hormone irregularity

I. INTRODUCTION

Menarche is one of the signals of attaining puberty. It mostly occurs between the age of 12 to 16 which is a momentous episode in a female's life because it is the period of transition between two stages of life(i.e.) childhood to adulthood.[1] Menstruation is the time when a uterus sheds its mucosal lining (endometrium), causing menstrual fluid to flow from the body through the vagina.[2] Normal menstrual cycles are characterized by a cycle length of 28 days (±7 days), duration of flow of 4 days (±2 days).[3] 75% of girls around the world are experiencing problems related to menstruation.[4]

Normally between the age of 11 to 14 years, the first menstruation takes place in adolescents, with the normal cycle length of 21 to 45 days and a period length of 7 days or less with average blood loss of 20-80ml.[5] The menstrual cycle consists of two phases, follicular phase and luteal phase. The follicular phase (preovulatory& proliferative phases) starts on the first day of menstruation and terminates with ovulation. After completion of the follicular phase, the luteal phase starts at ovulation and ends with menstruation. In women, luteal phase length is very consonant which lasts 10 - 16 days while the follicular phase is much more variable.[6]In women, menses may be different every month and it may not be similar to other women. Menstrual blood flow can be light, moderate or heavy and it can also varies in thelength.[7]

Many factors (body composition, poor nutrition, exercise, pregnancy, reproductive immaturity, psychological stress, acute and chronic endocrine alteration) can affect the menstrual cycle and determining a single factor is complicated.[8] Based upon the women's age, weight, diet, amount of physical activity, level of stress and genetics, menstrual cycles vary in their length and amount of bleeding.[9] A stable release of hormones by the hypothalamic–pituitary–gonadal (HPG) axis is necessary for menstrual cyclicity. Hypothalamic/ pituitary or ovary/uterine failure can cause irregular menstrual cycles, which are mostly non-ovulatory and therefore accompanied by reduced production and secretion of ovarian steroids.[10,11,12,13] A variety of physical and mental conditions as well as health related lifestyles has been reported to have an influence on menstrual cycle irregularity.[14]

Menstrual cycle irregularity may be linked with luteinizing hormone pulsality and amplitude, resulting from the disturbance of circardian rhythmicity. [15,16] Hormonal imbalances, exposure to environmental stress, e.g. changes in energy balance (excessive physical activity, low energy intake),exposure to pollutants (present in polluted air and tobacco smoke) and psychosocial stress can cause menstrual cycle disturbances.[17,18] Some other risk factors of menstrual cycle irregularity includes age at menarche, excessive exercise or rapid gain or loss of body weight.[19]

Regular menstrual cycles play an important role in women's health. Menstrual cycle irregularity has been discussed to be linked with serious health outcomes such as breast cancer, type 2 diabetes, cardiovascular disease, osteoporosis and infertility.[20,21] In adolescents, irregular menstrual

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cycle is common which can trigger reproductive abnormalities and become pathological.[22]

Obesity, stress and smoking are some of the factors associated with irregular menstruation and early menopause that are reported in earlier studies. But, the combining effects of these modifiable risk factors have not been fully recognized. The menstrual cycle is definitely associated with modifiable risk factors as well as immutable host factors that may be related to the following disease condition. This review is focused on the individual and combined effects of the modifiable risk factors of menstrual cycle irregularity.

FACTORS AFFECTING MENSTRUAL CYCLE

Generally, there are several causes leading to menstrual irregularities, which fall into three main categories: ill-health, effects of medication, stress and lifestyle factors. These may include age, smoking, body weight, exercise, life event, perceived stress, physiological conditions and work environment.

I. AGE OF MENARCHE

Menarche is one of the signals of attaining puberty. It mostly occurs between the age of 12 to 16 which is a momentous episode in female's life because it is the period of transition between two stages of life (i.e.) childhood to adulthood.[1] General health, genetic, socio-economic and nutritional factors determines the age of menarche. The mean age of menarche is typically between 12 and 13 years.[23,24] The age of menarche varies from 9 to 18 years with the average age of about 12 years and 8 months in United States, whereas in India it is slightly lower and has been reported to be around 12 years.

The age at menarche shows the differences in the society's socioeconomic, environmental, nutritional and geographical status. Early age menarche has a direct link with obesity and breast cancer.[25]Early menarche has been associated with a greater risk of several major chronic diseases (e.g., breast and endometrial cancers,[26,27]obesity,[28]type 2 diabetes,[29] cardiovascular diseases,[30] and all-cause mortality[31,32] From the late 19th century, a decrease in age at menarche has been observed in most of the developed countries.[33,34]This decrease has been attributed to changes in socioeconomic conditions and nutritional status during childhood.[35]Menarcheal age has been related to environmental and lifestyle factors. Earlier studies indicated the influence of socioeconomic status, education and place of living on the onset of puberty in girls.[36]

II. BMI

The association between BMI and menstrual blood loss has not been fully investigated, although the risk of ovulatory dysfunction is increased in women with high BMI and may eventually result in heavy menstrual blood loss.[37] Obesity is one among the leading causes of morbidity and mortality in many diseases and is becoming a growing public health issue. It also increases the risk for developing gynecological diseases including infertility and menstrual dysfunction.[38] The risk of co-morbidities associated with PCOS, like impaired glucose tolerance and type 2 diabetes mellitus, hyperlipidemia and arterial hypertension is increased due to obesity. PCOS was found in nearly 30% of morbidly obese women, compared with only 5% of the lean population.[39]

The risk of developing long cycles is fivefold higher in women with BMI of 35 compared with those with a BMI between 22 and 23.[40]There is a correlation between age of menarche and body mass index (BMI), with an earlier menarche associated with a higher BMI. [41]Sex hormone-binding globulin (SHBG), free androgen index (FAI), testosterone, and insulin levels are influenced by high BMI.[42]Studies showed that premature or delayed menarche and menstrual irregularities are associated with deviation from the normal BMI[43] and also revealed that girls with normal BMI had regular menstruation.[44]Menstrual bleeding pattern for a girl with low BMI is different from a girl with high BMI.[45]

A study conducted in Pakistan demonstrated that 89.9% of adolescent girls with normal weight had regular menstruation, while 40% of girls in obese categories showed menstrual irregularity. 75.51% girls in normal BMI category had normal menstruation.[46] Having a healthy and balanced nutrition helps women and girls, particularly adolescent girls, to maintain the normal BMI and experience a more regular menstruation.[47]

III. OBESITY

Obesity has been identified as a major risk factor for a number of medical conditions, including cardiovascular disease, diabetes, osteoarthritis and malignancies of the colon and endometrium. High BMI scores at the age of 3 has

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been recognized as a risk factor for the early onset of puberty.[48]Obesity is associated with an increase and decrease of leptin and adiponectin levels respectively in the circulation.[49]

The risk of miscarriage is higher in overweight and obese women, in case of spontaneously conceived pregnancies, as well as those resulting from fertility treatment.[50]Women with a bodyweight of 70 kg or more has higher risk of developing fibroids when compared to those whom weighing less than 50 kg.[51]

The levels of insulin and testosterone, and a free androgen index are found to be elevated in women with high WC and BMI, whereas the level of sex hormone-binding globulin is decreased, resulting in hormonal changes that cause menstrual irregularity.[52,53]

IV. FAMILY HISTORY

An important predictor for the presence of dysmenorrheal is having a family history of dysmenorrheal. Women having family history of dysmenorrheal are 4 times more likely to have dysmenorrhea compared to those who do not have family history of dysmenorrhea.[54]This suggests that dysmenorrheal has genetic factor and might also have a psychological impact. Daughters may react to menstruation similarly like their mothers and they may share the same attitude and taboos towards menses.

Having family history of PMS has an influence on the presence of PMS. Studies conducted among teacher training university students in Iran and university students in Saudi Arabia shows that the students who had family history of PMS were 4.19 times more likely to have PMS compared to students who had no family history of PMS.[55]Parents being obese significantly increases the probability of their child being obese in adulthood. [56]

V. SLEEP

Sleep plays a significant role in one's growth, development, maturation and health status by controlling the hormones related to energy homeostasis.[57,58]In general, women are well known to have higher prevalence of sleep disturbance than men and thus pose a greater risk of insomnia.[59]Studies indicate changes in hormones such as leptin, cortisol, growth hormone due to lack of sleep. These hormonal changes may lead to stress and obesity.[60]Sleep deprivation leads to hormonal imbalances that result in menstrual irregularity.

Several hormones such as estrogen, progesterone, prolactin and growth hormone not only regulate the reproductive functions but also affect the circadian rhythm and sleep. Therefore any disturbances in these hormones results in both poor sleep and menstrual irregularities.[61]Sleep-wake pattern and menstrual health are both significant rhythmic physiological activities for women, which have important impact on woman's health. Disruption of sleep has a negative impact on hormonal regulation.[62]

In adults, frequency and shift change of work increases menstrual irregularities by disrupting the circadian rhythm. Disrupted sleep poses negative impacts on the secretion of luteinizing hormone. Shorter sleep duration increases the risk of menstrual cycle irregularities and may alter the menstrual cycle.[63]

VI. STRESS

Several studies have found out stress as one of the key factors of menstrual cycle irregularities.[64]Stress is a feeling of emotional or physical tension which has a direct or indirect impact on the menstrual cycle length.[65]If the body is so stressed out, it does not release the hormones needed to reproduce thereby causing menstrual irregularities.[66]Stress activates the HPA axis hormonal pathway which associated with increased cortisol and corticotrophin releasing hormone levels. These hormones suppress the normal levels of reproductive hormones, thereby causing abnormal ovulation, anovulation (absence of ovulation) or amenorrhea (absence of menstruation).[67]

Stress actually changes the menstrual pattern thereby causing irregular or missed periods. These alterations in the menstrual patterns are caused mostly due to academic stress or work-related stress or life event stress.[68]Stress may impact the duration and frequency of the menstrual cycle. Stress occurring after the ovulation can shorten the luteal phase (which is normally between 12 and 16 days) and cause earlier periods.[66]Stress early in the cycle may interrupt the ovulation leading to an anovulatory cycle (no ovulation). Increased stress levels might cause secondary amenorrhea, a condition in which the menstrual period temporarily stops.

Apart from physiological variation, many other factors cause menstrual disorders which includes perceived stress in the college/university setting as a form of academic stress. Multiple pressure such as academic demands, financial,

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time, health related and self-imposed type of stressor are involved in academic stress. Students report academic stress particularly in taking and studying for exams and with respect to grade competition in a minimal amount of time.[69]
In a study conducted in Nigerian students, amenorrhea, PMS and oligomenorrhea were specifically marked during the exam than before the exam.[70]Menstrual problems not only bring the financial stress but also one of the most common causes of absenteeism and poor academic performance among young females.[71]

VII.PHYSICAL ACTIVITIES

When a young female undertakes excessive physical effort like sports training, the menstrual cycle gets severely disrupted and significantly increases the prevalence of menstrual cycle disorders.

The menstrual disorders in females participating in competitive sports is up to 44%, while in sport fields which requiring a thin silhouette, like dancers, the menstrual disorders might be up to 75–79%.[72] Young girls undertake vigorous exercise, along with a negative energy balance, is related to significant physiological changes in participant's body ,usually resulting in hormonal imbalance demonstrated by: delayed puberty, delayed menses, menstrual disorders, and even long-term secondary amenorrhea which is the ceasing of regular menses for three months or irregular menses for six months.[73]

Competitive sport and rigorous exercise might lead to the development of a number of symptoms which are known as "Female Athlete Triad syndrome"or the"Triad". These terms represent a correlation between eating disorders (low energy supply), and amenorrhea or menstrual disorders, as well as decreased bone density or osteoporosis density or diagnosed osteoporosis.[74]

Menstrual disturbances which are related to exercise occur along with continuum of severity ranging from mild disturbances like luteal phase defects (LPD) and anovulation in regular cycles length asymptomatically, to severe menstrual disturbances like oligomenorrhea, and amenorrhea[75]. Further aspects such as physique, energy balance (especially negative) and genetic factors can have a major influence on menarche age and menstrual cycle irregularity.[76]

One of the common concern for men and women are losing weight and weight maintenance, people mostly use some common strategy to lose weight like consuming less fat but fewer calories, which shows they are not using the recommended combination of hypo caloric diet associating physical activity.

VIII. FOOD HABIT

Nowadays, fast foods have become more popular and trend among the younger generation. Fast foods became trend because of their better taste, wide availability, attractive packaging and public advertisement which influence the new generation to consume fast foods and additionally busy schedule makes them to skip their meals.[78] One of the important issue in the world and specially in women's population is the correlation between food habit and menstrual dysfunction.[79]Girls who consume fast food regularly are facing menarche in earlier age. Recently, skipping breakfast has become habitual among adolescent girls, which also cause obesity.[80]These factors are predicted to not only influence the female's present lifestyle, but also they lead to gynecological disorders such as dysmenorrhea and irregular menstruation.[81]

IX. SMOKING

A systematic review reported the relationship between smoking and pre-menopause, however a clear association between the smoking period or quantities of cigarettes smoked was not observed.[82] Another study reported that smokers who had been smoking for a period > 26 years or > 10 cigarettes/day had higher risk of getting early natural menopause than the other smokers.[83] Smoking can cause hypoestrogenism which in turn cause irregular menstruation and early menopause.[84]

X. EMPLOYMENT STATUS

Employed women having psychosocial stress and stress due to job's physical setting may have changes in menstrual cycle, spontaneous abortion and other gynecological problems due to fluctuation in female hormones. Moreover, the individual characteristics such as age, body mass index, smoking, child birth, job stress, employment category and work burden have been linked with irregular menstruation. Night-Shift, over time working and physically challenging work including heavy lifting are associated with irregular menstruation with a high prevalence rate of 34%. The prevalence is also high in temporary workers as well as shift workers due to unstable working patterns or night time work that can leads to sleep disorders and stress which results in menstrual

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irregularities. Greatest impact on quality of life of women significantly due to severe menstrual symptoms that interrupt them in their school, employment, mutual relationships, family, social life,[85] and can also leads to increased healthcare utilization, decreased occupational productivity and absence from their work. [86]

XI. MARITAL STATUS

Primary dysmenorrhea occurs in 61% of unmarried women and 51% of married women.[87]Dysmenorrhea have a high prevalence in unmarried young women; however they do not pursue medical advice or treatment. It was reported in one study that majority (98%) of unmarried young women preferred non-pharmacological methods e.g.; heat, rest, or distraction to treat dysmenorrhea, with the effectiveness of 40% or less and it was found out that around 30-70% of unmarried young women used self-medicating with over-the-counter (OTC) pain medications occasionally.

Around 56% of unmarried and 44.44% of married women had normal bleeding pattern on the first day of menstruation.[88]Married women have less pain and also less premenstrual symptoms compared to unmarried women because of their physiological changes.[89]

II. CONCLUSION

Our review showed the importance of healthier behavioral practices to maintain menstrual cycle regularity and the occurrence of early menopause. Given the association between irregular menstruation and women's health, improvements in health behaviors should be emphasized among the adolescent and young women in view of public health. Therefore, identifying the prevalence of irregular menstruation and factors associated with its occurrence by occupational status is important for women's health, national economy and the health care industry.

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