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Early Menarche: Genuine Concern to Girls



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ABSTRACT

Early menarche, the onset of menstruation before the age of 12, is a significant physiological event in a woman's life. This research paper explores the multifaceted aspects of early menarche, including its potential causes, consequences, and implications for health. Early menarche has gained attention due to its association with various physical, psychological, and social outcomes. Understanding the factors contributing to early menarche and its long-term effects is crucial for healthcare professionals, educators, and policymakers. This paper synthesizes existing literature and presents a comprehensive overview of the topic, highlighting the need for further research, public health interventions to address the challenges and disorders like amenorrhea, dysmenorrhea and abnormal uterine bleeding and epidemiology of various health implications associated with early menarche. Understanding early menarche is crucial as it can have a lasting impact on an individual's health trajectory, highlighting the need for targeted interventions and healthcare strategies. A woman's menarche, which marks the beginning of her ability to procreate, is an important life milestone. The purpose of this paper is to examine recent advancements and current understanding in the field of neuroendocrinology of pubertal onset and late genetic and environmental factors that affect menarcheal age. We also go into the effects on a young woman's life of having an early or late menarche. Referrals to pediatric endocrinology for early puberty-related issues have increased globally. Finding the causes of this growth was the goal of this investigation.



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INTRODUCTION

What is menarche?

The first menstrual period a female adolescent experiences is known as menarche. Menarche is defined as the first menstrual period in a female adolescent. Menarche typically occurs between the ages of 10 and 16, with the average age of onset being 12.4 years. The determinants of menarcheal age are continuously being researched; socioeconomic conditions, genetics, general health, nutritional status, exercise, seasonality, and family size are thought to play a role.

Menarche tends to be painful and occurs without warning. The first cycles are usually anovulatory with varied lengths and flow. Menarche signals the beginning of reproductive abilities and is closely associated with the ongoing development of secondary sexual characteristics.

Menarche usually begins between the ages of 10 and 16, with a 12.4-year average age of start. Researchers are constantly studying the factors that influence menarcheal age, including socioeconomic position, genetics, general health, nutritional status, physical activity, seasonality, and family size.

Usually, the menarche, or the beginning of the first period, takes place between the ages of 12 and 15. Having your first period at age 8 would still be considered normal. The average age of the first period is frequently greater in industrialized countries and lower in undeveloped countries. Young women often wait 21 to 45 days between the beginning of one cycle and the beginning of the next. The range for adults is from 21 and 31 days, with a 28-day average. Bleeding frequently continues two to seven days later. Periods stop during pregnancy, and they frequently don't start up again during the first several months of breastfeeding.

A female's first ovulation can be at the time of menarche but usually is some months (or as much as two years) after menarche. The first menstrual cycles in pubertal females, thus, are often ovulatory (infertile). Even though this is the case in most females, there is a slight risk of pregnancy in some who have just experienced menarche, and there are cases of females who have become pregnant before menarche. Also, for several months after menarche, a female may miss some periods. For females, the most reliable indicator of puberty is the first menstrual cycle or menarche. In the Northern Hemisphere, menarche happens at an average age of 13, and 95% of females attain menarche between the ages of 11 and 15. Menarche in

the US happens at an average age of 12.3 years. Although a woman's first ovulation might occur at menarche, it typically occurs many months—or even up to two years—after menarche. Therefore, in pubertal females, the first menstrual cycles are frequently anovulatory (infertile). Even while this is the case for the majority of girls, individuals who have recently reached menarche run a small chance of being pregnant, and there have been instances of girls getting pregnant before menarche.

A lot of female pubescent's store fat beneath their skin. The distribution of this fat results in secondary sexual features in the hips and breasts. Additionally, adolescent females experience a skeletal development spurt that increases weight and height. Females' bone growth typically stops around the age of 15, while some may continue to grow taller even past that age. The adolescent female's high estrogen secretion finally stops bone growth^{[1][2]}

Role of menarche

Menarche marks the beginning of fertility and reproductive aptitude, and its absence should prompt the healthcare professional to check for pathology.

When ovulation is not followed by fertilization, the uterine endometrial lining's functional layer sheds monthly during menstruation. Every 21 to 45 days, with a mean cycle interval of 32.2 days in the first gynecologic year, it happens on average every 28 days. The average menstrual cycle lasts three to seven days, and any longer than ten days is considered irregular.

What are the factors influencing early menarche?

Belsky, Steinberg and Draper (Child Development 1991; 62, 647–670) predicted that early childhood stress or conflict in the family environment would be associated with childhood behavioral symptoms, early puberty and early, less discriminate sexual behavior. Their theory was tested in a retrospective self-report survey in 28 daughters (aged 12 to 15) and 21 mothers. In daughters, earlier menarche correlated with more family stress in a late childhood (age 7 to 11); more conflict with the mother in early childhood (birth to age 6); more rejection from and less closeness to mother throughout childhood (birth to age 11); more anxiousness and internalizing symptoms (anxiousness/depression) in late childhood (age 7 to 11); earlier age at dating boys; and more boyfriends. An alternative interpretation is considered based on the genetic transmission of maternal characteristics. Adolescents' growth and development is closely related to dietary intake and nutritional status. So, there is

a high demand for nutrients that is both macronutrients like carbohydrates, proteins, fat and micro nutrients like vitamins and minerals, during adolescence, there will be an increasing need of nutrients compared to another life cycle because it is a growing period. Adolescent growth and development are mainly affected by nutritional status. An adolescent who consumes more calories and protein will tend to have early menarche which is further implicated in diseases. In addition to hereditary considerations, environmental factors that might promote early menarche include increased subcutaneous fat, a high body mass index, and beverages sweetened with sugar. Health education aims to lower fructose consumption, which is found in high amounts in beverages sweetened with sugar, in order to prevent early menarche. Puberty begins after the reactivation of the hypothalamic gonadotropin-releasing hormone (GnRH) secretory system, which initially develops during fetal and neonatal life and early infancy. At puberty, the pulsatile GnRH secretion and subsequent episodic pituitary gonadotropin secretion are triggered by the activation of the GnRH pulse generator, which is controlled by trans-synaptic, stimulatory, inhibitory, and glia-to-neuron inputs. The transcriptional control of reproductive components during puberty is unknown, but Glia-to-neuron signals, GnRH receptors, and Kiss1 gene and receptor 54 play key roles in reproduction regulation. Kisspeptin neurons are essential for the onset of puberty, driven by circulating estradiol. Studies have shown that a mutation in GPRS4 is essential for normal GnRH secretion and pubertal development in humans. Leptin, a hormone produced by adipose cells, is involved in the metabolic regulation of Kiss-1, as kisspeptin neurons express leptin receptors. Recent research has shown that central activation of the mammalian target of rapamycin (mTOR) stimulates LH secretion in pubertal female rats via modulation of hypothalamic KISS-1. The prepubertal quiescent period is believed to occur due to high sensitivity of GnRH neurons to low levels of sex steroids and intrinsic inhibitory mechanisms within the central nervous system. Menarcheal age is influenced by heredity, but specific genetic factors remain unknown. Studies show a trend for maternal age to predict daughter's age, with approximately half of the phenotypic variation among girls in developed countries due to genetic factors. Stavrou et al. found a 0.57-year difference between XX homozygotes and other subjects. Socioeconomic factors, such as family size, income, and parental education, can influence puberty in girls. Girls from high socioeconomic backgrounds experience menarche earlier than those from lower backgrounds. Early menarche is more common in urban environments, especially when a stepfather's presence is combined with a stressful family environment and maternal mood disorders. Third World girls adopted in Western European countries also exhibit early menarche, possibly due to catch-up growth.

Early puberty is linked to increased body mass index, insulin resistance, and metabolic syndrome components, increasing cardiovascular risk. Girls with early menarche also have elevated blood pressure and glucose intolerance. A recent study found that earlier menarche age (<12 years) is associated with higher cardiovascular disease, coronary heart disease, all-cause mortality, and cancer mortality. Menarcheal age also influences bone mineral density and the incidence of lumbar spine and hip fractures. Normal hypothalamus and pituitary function, normal female reproductive architecture, appropriate nutrition, and the general absence of other intervening chronic disorders. Menarche occurs in the context of a maturing hypothalamic-pituitary-ovarian (HPO) axis. It is a sign of typical female reproductive well-being and health. The majority of women are aware that menarche is their body's crucial signal of fertility. Amenorrhea refers to the absence of regular menstrual periods that are unrelated to pregnancy. Primary amenorrhea is the total absence of menstruation by the age of 15 when secondary sexual development and normal growth are present, or the absence of menses by the age of 13 when neither secondary sexual development nor normal growth are present. Menstruation is absent for more than three months in secondary amenorrhea.^{[3][4][5][6][7][8]}

What can be the causes of early puberty?

1. Nutritional Status:

One of the most significant variables influencing pubertal growth is nutrition. From prepubescent to full sexual maturity, puberty is a progressive, nonlinear process brought about by the interaction and collaboration of physical, psychological, and biological changes. It appears that maintaining appropriate growth and normal pubertal development throughout all stages of development—infant, childhood, and puberty—requires consuming a sufficient and well-balanced nutritious diet. Girls are going through puberty earlier than in previous decades. Overindulgence in processed foods high in fat could be the root cause of this problem. Children who are overweight or obese are more prone to reach puberty early. According to certain data, obesity may cause boys' puberty to start later while it can hasten the onset of puberty in girls.^[9]

2. Stress:

According to the psychosocial acceleration theory, girls who endure significant levels of emotional stress inside and around their families tend to menarche early to maximize the likelihood that they will leave descendants.

Although physical, emotional, or dietary stress is frequently the cause of a delayed period, there are numerous other possible causes as well. Your period may also be delayed by pregnancy, hormonal birth control, and medical conditions like polycystic ovarian syndrome (PCOS).

Your hormone levels are disrupted if you experience stress following ovulation. Spotting, an early period, a period that is not consistent with your usual period length, color, or consistency, and/or symptoms such as cramping are all possible. Not ovulating at all for months can also be brought on by extreme stress.

Because a woman's hormone levels vary according to her infradian rhythm, or 28-day menstrual cycle, her stress response differs from a man's. One of the stress hormones, cortisol, is present in the first and second halves of the cycle in varying amounts. It is crucial to be aware of these levels to avoid exacerbating hormone imbalances by adding more stress. Here are several ways that stress disrupts your hormone balance and interferes with your menstrual cycle.^[10]

3. Body mass index:

Researchers frequently utilize the body mass index (BMI) as a method to monitor obesity in the general population. It is also used by physicians and other medical specialists to evaluate the health of their patients. However, because of its serious shortcomings, especially when it comes to evaluating the health of Black and Hispanic individuals, among other ethnicities, the medical profession has expressed reservations about the use of BMI as a measure of obesity and overall health.

Studies conducted abroad have taken into account this temporal association and have concluded that early childhood and early adolescent BMI increases are associated with peak growth velocity and fast sexual maturity, both of which are signs of puberty. These studies, however, mostly concentrate on breast development or peak growth velocity; the association between menarche age and research has not received much attention. Specifically, it is challenging to locate research instances in Korea that have established a temporal association as the cause of the two factors—that is, whether obesity is a risk factor for early menarche or not. By investigating whether prior BMI influences the age of the subjects, this study sought to determine whether increases in BMI serve as a risk factor for early menarche. Underweight women typically menarche later in life than women who are of average weight. On the other

hand, women who are overweight frequently menarche before women of medium weight.^{[11][12]}

4. Smoking:

In both boys and girls, exposure to tobacco smoke during pregnancy may accelerate puberty. Over the past century, girls' puberty has occurred at an earlier age, while it is unclear if boys experienced this same phenomenon.

Smoking throughout pregnancy may be one such controllable cause of puberty too soon. Two other markers of reproductive health in sons and daughters associated with maternal smoking during pregnancy are decreased fecundability and low semen quality. In a similar vein, smoking by a mother during her pregnancy may hasten puberty through one or more mechanisms. Firstly, tobacco smoke contains several hazardous chemicals that have the potential to androgenize the fetal hormonal milieu, which could alter the time of rodent puberty. Observational research, however, has yielded inconsistent findings. Second, these dangerous tobacco products may also alter gene expression due to differences in DNA methylation observed in fetuses of smokers during pregnancy. Pregnancy-related exposure to tobacco smoke may hasten puberty in both males and girls. Girls have reached puberty sooner in the last century, while it's uncertain if boys have gone through this same process.^[13]

5. Socioeconomic condition

Research demonstrates the significance of family structure in influencing pubertal timing, even though a mother's age at menarche seems to be a stronger predictor of the daughter's age at menarche than other external factors. A relatively later menarche age is associated with father attachment, healthy family dynamics, and involvement in childrearing, whereas earlier menarche dates are associated with higher levels of family conflict, divorce, and longer paternal absence times. It has also been discovered that having a stepfather predicts menarcheal age more accurately than not having a biological father and that having a stepfather for a longer period corresponds with a younger menarche age.^[14]

6. Physical activity

According to a study, there is a substantial correlation between the age at which menarche occurs and physical activity. Specifically, a meta-analysis of 12 athletes and non-athletes revealed that female athletes menarche 1.13 years later than non-athletes.

In several sports, intense physical training and negative energy balance modify the hypothalamic-pituitary set point during puberty, lengthen the prepubertal period, and postpone pubertal development and menarche.

It is challenging to identify the causative factor, if any, due to the myriad physiological and psychological changes that take place in the years leading up to menarche (Forbes, 1992). Nonetheless, the individuals we selected shared the same city, led comparable lives in terms of food and exercise, and had no medical issues in their personal or family menstrual cycle histories. After doing so, it was intended for participant characteristics to be similar to those of the various factors that have been proposed to influence pubertal development, such as the hormones secreted by the hypothalamus, anterior pituitary, and ovary (Apter, 1997), social stress (Wierson et al., 1993), and organic pollutants (Colon et al., 2000).^[15]

7. Genetic factors

A girl's menarche is her first period during adolescence. The menarche time has an impact on one's health later in life. Menarche age is a complicated characteristic with a significant hereditary component.

Even if it's well accepted that genetics plays a significant role in quantitative features, it's still vital to determine how plausible it is for genetic influences to be involved. Familial clustering is a sign that genes play a role in a characteristic. It should be noted, nevertheless, that common environmental factors can also influence familial clustering. Based on heritability estimates from family and twin studies, genetic variance may account for a significant portion of the range in menopausal age. According to several studies (Snieder et al., 1998; Treloar et al., 1998; de Bruin et al., 2001; Kok et al., 2004), estimates range from 30 to 85%. Since heritability represents a percentage of all phenotypic variation, it is a relative metric.^[3]

8. Psychological factors

The premenstrual and menstrual phases are most frequently linked to transdiagnostic symptom aggravation, according to the results. Particularly, compelling data shows rises in mania, sadness, suicide and attempted suicide, psychosis, and alcohol consumption. Hormonal variations during the premenstrual period set off several brain systems that result in symptoms that are both somatic (pain and swelling) and psychological (depression and mood) (Hellstrom and Anderberg, 2003; Ossewaarde et al.^[16]

What are the disorders can be caused due to early menarche?

The young girl and her parents may experience a great deal of stress due to disorders such as dysmenorrhea, primary and secondary amenorrhea, and abnormal uterine bleeding. While dysmenorrhea is the most common gynecological issue during this time, abnormal uterine bleeding (AUB) and particularly its subtype, dysfunctional uterine bleeding (DUB), are among the most urgent.

1. Amenorrhea

The absence of menstruation in females 16 years old and older who have already developed secondary sexual characteristics, or in girls 14 years old and younger who have not developed secondary sexual characteristics, is known as primary amenorrhea. More than 45-day menstruation cycles are referred to as oligomenorrhea (from the Greek word oligos, meaning few). The majority of oligomenorrhea instances occur in the first ten years following menarche, with polycystic ovarian syndrome (PCOS) being the most common cause. The menstrual disturbance that precedes secondary amenorrhea is known as oligomenorrhea, and both conditions can be assessed using the same procedure. The patient's investigation should begin with a thorough medical history that covers the girl's mother's menarche age, any underlying systemic diseases, and family medical history. A gynecological examination is necessary to evaluate the internal genitalia's anatomy. Furthermore, it can indicate the existence of hematocolpos and/or hematometra, which are conditions where the uterus and/or vagina are dilated as a result of blood retention in the uterine cavity or vaginal canal, respectively, in the event of reproductive tract obstruction. Increased gonadotropin levels suggest that the gonads are the source of the delayed puberty. A clear sign of genital tract obstruction is the presence of primary amenorrhea in conjunction with cyclic abdominal pain. Essential tests include pelvic ultrasound, recto-abdominal gynecologic examination, and primary amenorrhea. If there is a noticeable rise in testosterone levels and an LH/FSH ratio more than 2, PCOS is most likely the cause. Measuring FSH, LH, TSH (thyroid-stimulating hormone), and prolactin levels is necessary if secondary amenorrhea coexists with no clinical symptoms of hyperandrogenism. This is because amenorrhea can also be caused by hyperprolactinemia or thyroid gland disease.^[17]

2. Abnormal Uterine Bleeding

Abnormal uterine bleeding (AUB) is prolonged, excessive, irregular, and not due to any underlying structural or systemic disease. It can be ovulatory or unovulatory and should be

diagnosed differently during adolescence. Pregnancy-related hemorrhage, coagulation disorders, and chronic diseases affecting renal or liver function can also contribute to AUB. Systemic bleeding disorders are found in 7-20% of women presenting with menorrhagia. Chronic diseases affecting renal or liver function, such as vitamin K-dependent deficiencies or other clotting factors, can also result in AUB. Reproductive tract diseases, such as trauma, sexual abuse, or self-injury, can also cause excessive menstrual bleeding. It is essential to consider systemic bleeding. Abnormal uterine bleeding (ABU) can occur in adolescence due to various factors, including endometritis, pelvic inflammation, and partially obstructive congenital anomalies. These symptoms can indicate underlying endocrine diseases, such as hyperandrogenism, adrenal gland dysfunction, hypothyroidism, and ovarian abnormalities. AUB can also occur due to iatrogenic causes, such as hormonal medications, anticoagulants, neuroleptics, and chemotherapeutics. A thorough medical history is crucial for diagnosing AUB, including menstrual history, bleeding duration, clot presence, and pain. The diagnosis is established only after all organic causes are ruled out. AUB, particularly the subtype of DUB, is a critical gynecological issue during adolescence. Treatment focuses on controlling bleeding and regulating menstruation, followed by anemia correction and iron store replenishment.

DUB is a condition characterized by irregular menstrual cycles, with mild cases requiring hormonal treatment. Moderate cases, characterized by prolonged, profuse menstrual cycles and mild anemia, often require low-dose oral contraceptives or cyclic progestogen. Careful follow-up and education about menstrual calendar keeping are essential for adolescent safety. Iron deficiency anemia can be treated with supplemental oral iron therapy and NSAIDs. Severe DUB requires hospitalization and blood samples to exclude bleeding disorders. Intramuscular medroxyprogesterone acetate and combined oral contraceptives (COCs) can be administered for faster results in controlling heavy menstrual bleeding. Hemorrhage usually stops within 24 hours, and continuation of therapy with COCs alone is recommended. Tranexamic acid, a synthetic derivative of amino acid lysine, can reduce menstrual blood loss by up to 40%. Other therapies, such as progestogens, Gn-RH agonists, and levonogestrel-impregnated IUDs, have little place in adolescent DUB management. Treatment should be continued for at least 3-6 months.^[18]

3. Dysmenorrhea

Dysmenorrhea, a common adolescent issue causing painful menstruation, is primary without an underlying organic disease and secondary with pelvic pathology.

Primary Dysmenorrhea

Primary dysmenorrhea is prevalent in adolescence and is often observed after the first gynecological years. Treatment involves COCS and NSAIDs, which inhibit ovulation, suppress endometrial tissue growth, and reduce menstrual flow. NSAIDs are the most common treatment, but more research is needed to determine the effectiveness of specific COX-2 inhibitors. If no treatment works, laparoscopy and/or hysteroscopy are recommended.

Secondary Dysmenorrhea

Dysmenorrhea is a condition characterized by chronic pelvic pain, irregular or heavy menstrual patterns, dyspareunia, and bowel symptoms. It is often caused by endometriosis and pelvic inflammatory disease, with other infrequent causes including uterine retroversion, stenosis, fibroids, endometrial polyps, adenomyosis, and pelvic venous congestion. If a patient's pain doesn't respond to NSAIDs or combined oral contraceptives after three months, laparoscopy is recommended. This is the most useful diagnostic procedure for adolescents with minimal or mild stages of endometriosis.

Secondary dysmenorrhea evaluation using cervical and vaginal cultures, pelvic ultrasonography, magnetic resonance imaging, hysterosalpingography, and hysteroscopy, with management focusing on underlying organic pathology and pain treatment.^[19]

Menopause

Menopause is one point in a continuum of life stages for women and marks the end of their reproductive years. After menopause, a woman cannot become pregnant, except in rare cases when specialized fertility treatments are used. Most women experience menopause between the ages of 45 and 55 years as a natural part of biological aging. Menopause is caused by the loss of ovarian follicular function and a decline in circulating blood estrogen levels. The menopausal transition can be gradual, usually beginning with changes in the menstrual cycle. 'Perimenopause' refers to the period from when these signs are first observed and ends one year after the final menstrual period. Perimenopause can last several years and can affect physical, emotional, mental and social well-being. A variety of non-hormonal and hormonal

interventions can help alleviate perimenopausal symptoms. Menopause can be a consequence of surgical or medical procedures. Menopause, which signifies the end of a woman's reproductive years, is one step in a continuum of life stages. A woman cannot conceive after menopause, with the possible exception of rare circumstances in which specialized fertility procedures are employed. The menopause occurs naturally in most women between the ages of 45 and 55 as a result of biological ageing. Reduced levels of circulating blood oestrogen and loss of ovarian follicular activity are the two main causes of menopause. Changes in the menstrual cycle typically precede the menopausal transition, which might happen gradually. The term "per menopause" describes the time frame beginning when these symptoms appear and ending a year following the last menstrual cycle. The effects of per menopause on one's physical, emotional, mental, and social well-being might endure for several years. Menopause, which typically occurs between the ages of 40 and 60, signifies the end of a woman's reproductive phase. The most accurate estimates suggest that the median age of menopause in Western industrialized countries is between 48 and 52 years. Even though secular variations in the average age at natural menopause are less well-documented than those in the average age at menarche, some evidence suggests that the average age at menopause has somewhat increased throughout the 20th century. Menopause has an ongoing effect throughout the postmenopausal years on the physical, psychological, and social spheres. When a woman's follicular reserve is exhausted, she enters natural menopause.^[20]

How menopause occurs?

Because of the cessation of ovarian follicular function, monthly menstruation—also referred to as a menstrual period or "period"—ends for most women at menopause. The ovaries stop releasing eggs for fertilization as a result.

Throughout a woman's reproductive life, the menstrual cycle's regularity and duration might vary, but globally, women typically reach menopause between the ages of 45 and 55.

In the absence of professional intervention and after 12 consecutive months without menstruation for which there is no other apparent physiological or pathological cause, the menopause is considered to have occurred naturally.

Menopause occurs earlier in life for certain women (before 40 years of age). This "premature menopause" could result from autoimmune diseases, certain chromosomal abnormalities, or other.

Gynecological problems have an impact on millions of women's overall health and quality of life throughout their reproductive years. Treatment for these issues is received by a sizable fraction of women before their natural menopause. Reproductive life is terminated by the most drastic of these treatments, hysterectomy and/or bilateral oophorectomy. Women in these situations are said to have undergone surgical menopause as opposed to natural menopause. The prevalence of hysterectomy varies widely throughout countries. Based on data from the MRC NSHD, a British cohort of women born in the 1940s, we discovered that 22% of women had undergone a hysterectomy by the time they were 57 years old, with a mean age of 43.6 years (range: 27-56 years) at the time of the procedure. The most frequent causes of hysterectomy in this group.^[21]

Conclusion:

The study of adolescence, particularly puberty, is complex due to various factors influencing its timing and trajectory. Further investigation is needed to understand the relationship between puberty timing and hormonal changes progression.

Caregivers can help children cope with puberty-related changes, such as menstruation and nocturnal ejaculations. Open communication and support for independence are crucial. Parents should provide supervision and corrective discipline during this transformative period. Adolescence is the period of human development that experiences the most rapid and dramatic change, except infancy. A child physically develops into an adult during adolescence.

You are sexually and reproductively mature after puberty ends. Changes in your body's hormone levels are what cause the growth and development that comes with puberty. It has also covered some of the typical social and emotional transitions that young people experience as their bodies evolve. To sum up, our findings contribute to an expanding body of research indicating that females who menarche early are more prone to risky behaviors including abusing alcohol and initiating sexual relations at a young age.

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