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Various Causes of Early Menses

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Abstract -The phenomenon of early menses, or premature menarche, defined as the onset of menstruation beforetheageof 8, has shown arisingtrend globally, attributed to multiplefactors. This condition is shaped by a complex interplay of genetic, environmental, and socio-cultural influences.Keycontributorsincludeimprovednutrition,whichacceleratesphysicaldevelopment; increased prevalence of childhood obesity, which alters hormonal pathways; and exposure to endocrine-disruptingchemicals,suchasthosefoundinplasticsand pesticides,whichinterferewith hormonal regulation. Additionally, familial predisposition and genetic factors play a significant role, as a maternal history of early menarche often correlates with earlier onset in daughters.

Socio-economic conditions and lifestyle changes, including urbanization and reduced physical activity, further influence the timing of puberty. Psychological stress and early exposure to sexualizedmediahavealsobeenimplicatedintriggering earlypubertalmilestones.Understanding these multifaceted causes is crucial for addressing the rising incidence of early menses and its associatedhealthrisks.Thisgrowingtrendcallsfortargetedinterventions,awarenesscampaigns, and further research into modifiable factors to mitigate its long-term physical and psychological impacts.

Keywords-
Earlymenses,prematureMenarche,ganeticfactor,socio-economicfactor, Endocrine-disrupting chemicals (EDCs),Familial history,

1- INTRODUCTION

Early menses, also known as premature menarche, refers to the onset of menstruation before the ageof8.Inrecentyears,ithasgainedattentionduetoitsincreasingprevalence.Researchindicates adownwardshiftintheaverageageofmenarcheoverthepastfewdecades,influencedbyfactors such as better nutrition, higher rates of childhood obesity, and exposure to endocrine-disrupting chemicals. Early menarche is a significant milestone in pubertal development and is associated with various physical, psychological, and reproductive health implications.

It has been linked to an elevated risk of chronic conditions later in life, including type 2 diabetes, cardiovasculardiseases,andbreastcancer.Psychologically,earlymenarchecanbechallenging,as it marks a critical biological transition in a girl's life. Girls who mature early may experience emotional distress, body image issues, and social difficulties due to developing physically ahead of their peers.

Understandingearlymensesrequiresexamingenvironmental,genetic,andsocio-culturalfactors that contribute to this trend. Researchers emphasize the need for early interventions, educational efforts, and psychological support to reduce the potential negative outcomes. Raising awareness amonghealthcareproviders,parents,andeducatorsisessentialInaddressingthisphenomenonand supporting affected individuals effectively(.1)

1.1 CAUSESOFEARLYMENSES

1.1.1 Genetics

Early onset of menstruation, also known as precocious puberty, can be influenced by various factors, including genetic causes. Below is a detailed explanation of the genetic factors that may contribute to early menses:

1.1 .1.1FamilialTrendsandInheritancePatterns

1.1.1.1.1 Hereditary Patterns: Early menstruation often runs in families. If a mother or sister experienced menarche (the first menstrual period) at an earlier age, it is more likely for a girl in the same family to also experience early menarche.

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1.1.1.1.2 Genetic Predisposition: S regulating specific genetic variations or mutations can influence the timing of puberty. Variations in genes the production of sex hormones and their receptors can affect the age of menarche.

1.1..1.2KeyGenesInvolvedinPubertalTiming

1.1.1.2.2KISS1 and KISS1R Genes: These genes play a role in the production and regulation of inspecting,aproteincrucialforinitiatingpuberty. Variantsinthesegenescanleadtoearly activation of the hypothalamic-pituitary-gonadal axis, the system that regulates reproductive hormones.

1.1.1.2.1 LIN28BGene:This genehas been linked tothe timingofpuberty.Variants inthis gene canleadtoearlierpuberty.Itregulatestheproductionof microRNAs,whichinturncontrolcellular processes involved in growth and develoment.

1.1.1.2.3MKRN3 Gene (Makorin Ring Finger Protein 3): Mutations in the MKRN3 gene are strongly associated with central precocious puberty (CPP). MKRN3 inhibits the activation of puberty,somutationsinthisgenecancauseearlyactivat ionofthesystemresponsibleforpuberty.

1.1.1.2.4GnRH (Gonadotropin-Releasing Hormone): Genetic mutations affecting GnRH production or its receptor (GnRH) can also trigger early puberty. GnRH is a key hormone responsible for the release of other reproductive hormones from the pituitary gland.(2,3)

1.1.1.2.5

1.1.2 EpigeneticandEnvironmentalInteractio ns

1.1.2.1 Epigenetics: While specific gene mutations or variants are linked to early puberty,environmental factors can influence how these genes are expressed. Factors like nutrition, body weight, and exposure to endocrine-disrupting chemicals can interact with the genetic predisposition and accelerate the onset of puberty.

1.1.2.2 Imprinting Disorders: Some imprinting disorders, such as Prader-Willi syndrome andSilver-Russell syndrome, involve genetic regions that can affect pubertal timing through altered gene expression.

1.1.3 EndocrineDisruptors

Endocrine disruptors are chemicals that interfere with the normal functioning of the endocrine system, which is responsible for regulating hormones in the body. These chemicals can mimic, block, or alter the normal hormonal signals that regulate processes such as growth, development, metabolism, reproduction, and mood.

The endocrine system consists of glands (e.g., thyroid, adrenal, pituitary) and hormones (e.g., estrogen,testosterone,insulin,cortisol)thatactaschem icalmessengers.Hormonesregulateawide rangeofbodilyfunctionsbybindingtospecificreceptor soncells.Thissystemisfinelytuned,and even small changes in hormone levels or receptor activity can have significant effects on health.

1.1.3.1 MechanismsofActionofEndocrineDisrupto rs:

1.1.3.1.1Endocrinedisruptorsinterferewiththeendoc rinesysteminseveralways:

1.1.3.1.1.1 Mimicking Hormones: Some disruptors can mimic natural hormones by binding to their receptors. For example, chemicals like bisphenolA (BPA) can mimic estrogen, leading to overstimulation of estrogenic activity in the body.

1.1.3.1.1.2 Blocking Hormones: Some disruptors block hormone receptors, preventing natural hormonesfrombindingandexertingtheirnormaleffect s.Forinstance,certainpesticidescanblock the androgen receptor, inhibiting the action of testosterone.

1.1.3.1.1.3 Altering Hormone Production and Metabolism: Disruptors can interfere with the synthesis, breakdown, or transport of hormones. For example, phthalates are known to interfere with testosterone synthesis, affecting reproductive development.

1.1.3.1.1.4 Disruption of Feedback Loops: Some disruptors interfere with the feedback loops that regulate hormone levels. For example, they may cause the body to produce too much or too little of a hormone, disrupting homeostasis.(4)

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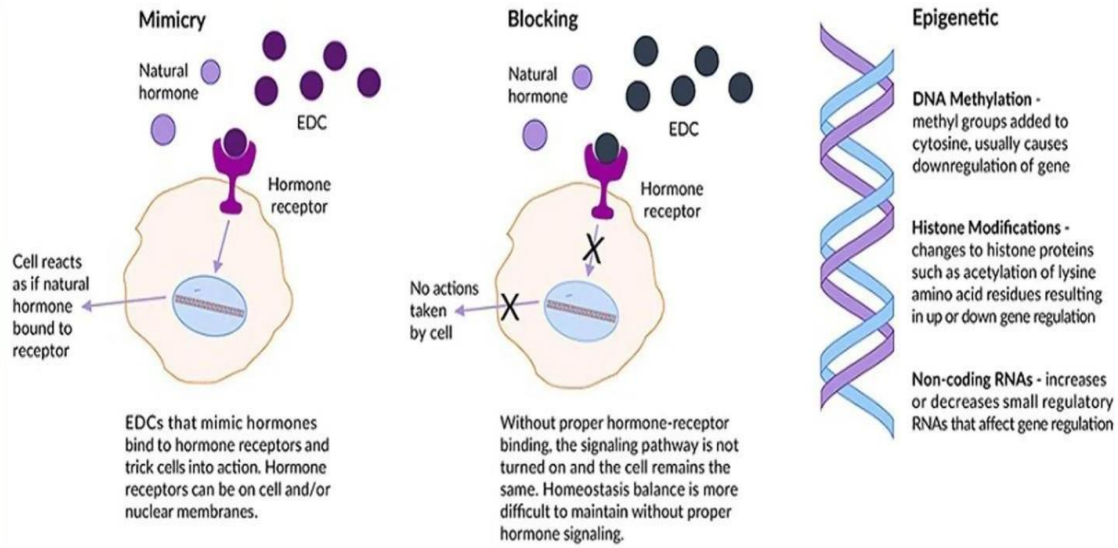

FigNo.1.EndocrineDistruptor

1.1.3.2 CommonEndocrineDisruptors

Therearemanychemicalsidentifiedasendocrinedisruptors.Someofthemostwell-knowninclude Prostaglandins, which are produced in the endometrium, play a significant role in menstruation. They are involved in inducing uterine contractions to facilitate the shedding of the endometrial (lining. High levels of prostaglandinscan also cause menstrual cramps (dysmenorrhea).

1.1.3.2.1 BisphenolA(BPA): Used in the production of plastics, BPAcan mimic estrogen and has been linked to reproductive disorders, early puberty, and metabolic disorders.

1.1.3.2.2 Phthalates: These are chemicals found in plastics, personal care products, and cosmetics. Phthalates interfere with testosterone production and are associated with reproductive abnormalities, particularly in males.

1.1.3.2.3 Polychlorinated Biphenyls (PCBs): These industrial chemicals have been banned in many countries but persist in the environment. They can disrupt thyroid hormone regulation and have been linked to cognitive deficits and developmental delays.

1.1.3.2.4 Dioxins: Produced as by-products of industrial processes, dioxins interfere with estrogen and androgen receptors and are linked to reproductive and immune system p(5,6)

1.1.3.3 SourcesofExposure

Humanscanbeexposed toendocrinedisruptorsthroughvarious routes:

1.1.3.3.1 Food and Water: Many endocrine disruptors, such as BPA and phthalates, leach from plastic containersandfoodpackaging.Pesticideresiduesonfruitsandvegetables,andcontaminants in water (like atrazine and PFAS), also contribute to exposure.

1.1.3.3.2 Air and Dust: Flame retardants and other chemicals found in household products can accumulate in household dust, leading to inhalation or ingestion.

1.1.3.3.3 PersonalCareProducts:Cosmetics,shampoos,lotions,andperfumescancontain phthalates, parabens, and other endocrine disruptors, which are absorbed through the skin.

OccupationalExposure:Peopleworkinginindustrieslikeagriculture,manufacturing,orchemical plants may be at higher risk of exposure to endocrine disruptors .

1.1.3.3 HealthEffectsofEndocrineDisruptors

Endocrine disruptors can have a wide range of adverse health effects, depending on the timing, level, and duration of exposure. Key health impacts include:

1.1.3.3.1 Reproductive Health: Disruptors like

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BPA, phthalates, and dioxins are linked to infertility, reduced sperm quality, and birth defects. In females, they are associated with early puberty, menstrual irregularities, and polycystic ovary syndrome (PCOS).

1.1.4 premature ThelarcheandAdrenarche

Puberty marks a series of biological changes leading to sexual maturity. The key events include Thelarche(breastdevelopment),Adrenarche(onsetof adrenalglandmaturation),puberties(pubic hair development), and menarche (onset of menstruation). Premature thelarche and adrenarche refer to the early activation of these processes, often occurring before the typical age of puberty. Understanding these premature conditions is essential, as they can lead to early menarche (onset of menses), which can have long-term physical, psychological, and metabolic consequences.

1.1.4.1 PrematureThelarche

referstotheisolatedbreastdevelopmentingirlsbeforet heageof8withoutothersignsofpuberty. It usually occurs between infancy and early childhood.The exact cause of premature thelarche is unclear but may involve transient hormonal activation or increased sensitivity to circulating estrogen. This condition is generally benign and self-limiting, but in some cases, it can be a precursor to central precocious puberty (CPP), leading to early menarche.

1.1.4.1.1 CausesofPrematureThelarche

1.1.4.1.1.1 TransientGonadotropinActivation:Atemporaryriseingonadotropin-releasing hormone (GnRH) could stimulate breast tissue growth without initiating full puberty.

1.1.4.1.1.2 Peripheral Estrogen: Somegirls mayhave increased sensitivity tolow levels ofcirculating estrogen, causing early breast tissue development without systemic puberty.

1.1.4.1.1.3 ExogenousEstrogenExposure:E nvironmentalfactorslikeexposuretoendocrine disruptors or medications could mimic the effects of estrogen on breast tissue.(7,8)

1.1.4.2 PrematureAdrenarche

Premature adrenarche is characterized by the early maturation of the adrenal glands, resulting in the production of androgens (e.g., dehydroepiandrosterone [DHEA] and DHEAsulfate [DHEA-S])earlierthanusual.Thisleadstotheearlyappearanceo fpubichair,bodyodour,andsometimes acne.Prematureadrenarchetypicallyoccursinchildren betweentheagesof5and8.While prematureadrenarcheitselfdoesnotdirectlycauseearl ymenarche,itcanbeasignofearly activationofthehypothalamic-pituitary-adrenal(HPA)axis,whichmayoverlapwithearly pubertal changes.

1.1.4.2.1.1 CausesofPrematureAdrenarche

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1.1.4.2.1.2 Early Adrenal Maturation: The adrenal glands begin producing androgens earlier than the typical timeline, possibly due to genetic or environmental influences.

1.1.4.2.1.3 Obesity and Insulin Resistance: Children with premature adrenarche often have a higher body mass index (BMI), which may contribute to insulin resistance. Insulin can stimulate androgen production, further accelerating pubertal changes.

1.1.5. Increasecaloricintakeandimprovenutrition

1.1.5.1 IncreasedCaloricIntake

1.1.5.1.1 Energy Balance and Puberty: Review studies have consistently highlighted the role of increased caloric intake in promoting early pubertal onset. Increased energy availability leads to the accumulation of body fat, which is essential for the activation of the hypothalamic-pituitary gonadal (HPG) axis, the system responsible for regulating puberty.

1.1.5. 1.2 Leptin and Adipose Tissue: Fat tissue produces the hormone leptin, which plays a critical role in regulating energy balance and signaling the brain to initiate puberty, suggest that higher leptin levels due to increased body fat lead to earlier activation of the HPG axis, thereby advancing the onset of menstruation.

1.1.5.1.3 Obesity Link: There is a well-documented relationship between obesity and early menarche. Higher body mass index (BMI) in childhood is correlated with earlier puberty onset. Confirmthatobesegirls,duetohighercaloricintake,oft enexperiencemenarcheearlierthan their normal-weight peers.

1.1.5.2 ImprovedNutrition

1.1.5.2.1 Nutrient Availability and Growth: Improved access to better-quality nutrition, including proteins, vitamins, and minerals, accelerates overall physicalgrowth and development.

This,inturn,influencespubertaltiming,thatimprovedn utritioncontributestomorerapidgrowth during childhood, which correlates with earlier menarche.

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1.1.5.2.2 Micronutrients and ReproductiveHealth:Specific micronutrients,suchas iron, zinc, andvitaminD,areessentialforhealthyreproductivedevelopment.Richinthesenutrientssupport early maturation, indirectly contributing to the earlier onset of menstruation..

1.1.6 Thyroiddysfunction:

Chemicals like PFAS and flame retardants interfere with thyroid hormones, leading to hypothyroidismor hypethyroids function, particularly hypothyroidismand hyperthyroidism, has beenimplicatedintheabnormaltimingofpuberty,including earlymenarche. Thyroidhormones are crucial regulator of growth, metabolism and overall development of which influence pubertal timing.(9,10,11)

1.1.6.1 ThyroidFunctionandPubertalDevelopment

The thyroid gland produces hormones, primarily thyroxine (T4) and triiodothyronine (T3), that regulate metabolism, growth, and development. These hormones interact with the hypothalamic pituitary-gonadal(HPG)axis,whichcontrolstheonsetandprogressionofpuberty.Disruptionsin thyroid function can lead to alterations in the timing of menarche.

1.1.6.2 HypothyroidismandEarlyMenarcheRoleofHypothyroidism:

Hypothyroidism, characterized by low thyroid hormone levels, can paradoxically cause early menarcheinsomecases.Theexactmechanismiscomplex,butitisbelievedthatthedeficiencyin thyroid hormones leads to increased secretion of thyrotropin-releasing hormone (TRH) from the hypothalamus. TRH stimulates the release of both thyroid-stimulating hormone (TSH) and prolactin from the pituitary gland. Elevated prolactin levels, a condition known as hyperprolactinemia,caninterferewiththenormalregulationofreproductivehormones,leadingto early or irregular menarche.

1.1.6.2.1 Evidence from Review Studies:hypothyroid girls often experience premature sexual development, including early menarche. This is linked to the high levels of prolactin seen in hypothyroid patients, which disrupts the normal feedback mechanism in the HPG axis. Additionally, prolonged hypothyroidism can cause ovarian cyst formation, contributing to premature menstrual cycles.(12)

1.1.6.2.2 SubclinicalHypothyroidism:

Even mild or subclinical hypothyroidism can lead to early menarche that even in cases where thyroidhormonelevelsarenotseverelydeficient,subtle disruptionsintheendocrinebalancemay influence the timing of menarche. 7.5.3 Hyperthyroidism and Early Menarche Hyperthyroidism and Accelerated Puberty: While hyperthyroidism (excess thyroid hormone production) is more commonly associated with delayed puberty, some studies suggest that it can lead to accelerated growth and earlier pubertal onset in rare cases. Hyperthyroid conditions can increase metabolism and growth rates, indirectly influencing the early onset of puberty, including menarche.

1.1.6.3 ThyroidHormone'sRoleinGrowth:

Since thyroid hormones regulate metabolic and growth processes, excess thyroid hormone can stimulaterapidskeletalgrowth,potentiallyadvancingpubertalmilestones.However,moststudies focus on hypothyroidism as the more common cause of early

1.1.7 SocioeconomicandPsychosocialStress

Environmentalstressorssuchaspoverty,familyconflict,ortheabsenceofabiologicalfatherhave been associated with earlier menarche. These stressors can influence the hypothalamic-pituitary gonadal axis, leading to early puberty.

Increased caloric intake and improved nutrition In regions where nutrition has improved significantly,theaverageageofmenarchehas declined,as betterhealthandgrowthpatterns may accelerate puberty.(13)

1.1.8 Ethnicity

Some studies have found that African-American and Hispanic girls tend to experience earlier menarche compared to Caucasian orAsian girls, although this is also influenced by other factors such as socioeconomic status and body composition.

Ethnicityplaysacrucialroleinthetimingofmenarche,withsignificantvariationsobservedacross different ethnic and racial groups. Numerous studies have found that ethnic background, often intertwined with genetic, environmental, and socioeconomic factors, can significantly influence whengirlsbeginmenstruating.Inthisreview-basedexplanation,weexplorehowethnicityaffects the onset of menarche and the underlying factors

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associated with these differences.

1.1.8.1 BMI and Ethnicity:

Body Fat Composition: Ethnic differences in body fat composition and BMI significantly contribute to variations in menarche timing. African American and Hispanic girls tend to have higher BMI and greater body fat percentages compared to White andAsian girls. Since body fat playsacriticalroleintriggeringpuberty,thisdifferencei nfatdistributioncontributestotheearlier onset of menarche.14,15,16)

1.2 PREVENTIONANDMANAGEMENT

Preventingearlymenses(precociouspuberty)involves addressingunderlyingcauses,promotinga healthy lifestyle, and minimizing exposure to potential triggers.

1.2.1 EnvironmentalandHormonalTriggers:

1.2.1.1 Avoidendocrine-disruptingchemicals(EDCs):
Reduceexposure tosubstances likebisphenolA(BPA),phthalates,andpesticides,ofte nfoundin plastics, cosmetics, and non-organic produce.
UseBPA-freecontainersandavoidmicrowavingplastic. Choose organic foods when possible.
Limit processed foods and animal products with added hormones:
Opt for hormone-free dairy, meat, and poultry to avoid ingestion of synthetic hormones.(17,18)

1.2.2 Obesity and Weight Management:

1.2.2.1 Encourage a balanced diet:
Promote whole grains, fruits, vegetables, lean proteins, and healthy fats.
1.2.2.2 Maintain regular physical activity:
Encourage at least 60 minutes of physical activity daily to- maintain a healthy weight and regulate hormonal balance..

1.2.3 Genetic and Familial Factors:

1.2.3.1 Understand family history
If early puberty runs in the family, consult a healthcare provider to monitor signs early and consider medical advice on managing symptoms.(19,20,21,22)

1.2.4 Stress Management:

1.2.5.1 Provide emotional support:
High stress levels can disrupt hormone regulation. Ensure children have a supportive environment at home and school.
1.2.5.2 Teach coping strategies:
Encourage relaxation techniques, mindfulness, or therapy if needed.(23,24,25)

1.2.5 Chronic Medical Conditions:

1.2.6.1 Manage underlying health conditions:
Treat conditions like hypothyroidism or adrenal disorders promptly, as these can influence early puberty.
Limit processed foods and animal products with added hormones:
Opt for hormone-free dairy, meat, and poultry to avoid ingestion of synthetic hormones.

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1.2.8.1 Provide emotional support:
High stress levels can disrupt hormone regulation. Ensure children have a supportive environment at home and school.
1.2.8.2 Teach coping strategies:
Encourage relaxation techniques, mindfulness, or therapy if needed.

1.2.9 Chronic Medical Conditions:

1.2.9.1 Manage underlying health conditions:
Treat conditions like hypothyroidism or adrenal disorders promptly, as these can influence early puberty.
1.2.9.2 Ensure routine check-ups:
Regular pediatric check-ups can help detect and manage potential health issues early.(27)

1.2.10 Exposure to Sexual Content and Media :

1.2.10.1Monitor media consumption:Limit exposure to age-inappropriate content that might psychologically or hormonally influence a child.
1.2.10.2 open communication:

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Discuss media content and encourage critical thinking.

1.2.10.3 Adequate Sleep and Lifestyle Habits :

1.2.11. 1 Promote good sleep hygiene:

Ensure children get enough sleep for their age, as insufficient rest can disrupt hormonal balance.(28)

CONCLUSION

Early onset of menstruation, or precocious puberty, arises from a complex interplay of genetic, environmental, hormonal, and lifestyle factors. Contributing factors include exposure to endocrine-disrupting chemicals, increased rates of childhood obesity, chronic stress, underlying medical conditions, and hereditary influences. Modern lifestyle changes, such as higher consumption of processed foods and greater exposure to environmental toxins, have further heightened the occurrence of this condition.

Effectivelyaddressingearlymensesrequires acomprehensiveapproachthatcombinesprevention, early diagnosis, and targeted treatment. Public health initiatives should prioritize reducing exposure to harmful chemicals, encouraging healthy dietary and exercise habits, and ensuring timelymedicalevaluationswhensymptomsarise.Continuedresearchintothecontributingfactors is essential to advance prevention and treatment methods. Raising awareness and promoting education among parents, healthcare professionals, and policymakers are crucial for minimizing the immediate and long-term effects of early menses on children's physical and emotional wellbeing.

Addressingtheissueofearlymensesdemands aholistic,multidisciplinaryapproach.Thisinvolves implementing preventive strategies, ensuring early detection, and providing appropriate interventions.Publichealthmeasuresshouldfocuson minimizingexposuretoharmfulchemicals, fostering healthier dietary and exercise practices, and promoting routine medical evaluations to identifypotentialissuesearly.Further research iscriticaltounraveltheintricateinteractionsamong thesecausativefactorsandtodevelopinnovativeapproachestopreventionandtreatment.

Moreover, enhancing awareness and educating parents, caregivers, healthcare providers, and policymakers is vital to reducing the immediate and long-term effects of precocious puberty on children's health, development, and overall quality of life.

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