



Efficacy of Phytoextracts on Female Reproduction and Impact on Diabetes Mellitus

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:	Abstract <p>Diabetes is linked to a wide range of reproductive health problems, including delayed puberty and menarche, irregular menstruation, decreased fertility, unfavorable pregnancy outcomes, and perhaps an early menopause. Depending on the age of the diabetes diagnosis, these issues may appear during puberty, later when fertility is desired, or even during the menopause transition. In the past, amenorrhea and infertility in women with type 1 diabetes were frequently brought on by central hypogonadism. Although these problems have decreased as a result of improvements in metabolic regulation and insulin therapy, they still exist. Other reproductive effects of modern diabetes therapy, like polycystic ovarian syndrome and hyperandrogenism, influenced by insulin's action on the ovaries, have also come to light. Type 2 diabetes is becoming increasingly common in young people, which suggests that more women who are of reproductive age will face difficulties getting pregnant as a result of their diabetes. Healthcare professionals need to be knowledgeable and ready to handle the difficulties of managing reproductive health issues across the lifetime as the number of young women with diabetes keeps growing. Plant-based phytoextracts have drawn interest as potential alternative therapies for controlling diabetes and enhancing reproductive outcomes. According to studies, several phytoextracts may have qualities including insulin sensitization, anti-inflammatory activity, and antioxidants that are good for female reproductive health. Understanding the interactions between female reproductive</p>
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<p>CC License CC-BY-NC-SA 4.0</p>	<p>physiology and diabetes can help overall, and phytoextract supplementation may offer valuable insights into developing personalized and effective interventions to enhance reproductive outcomes and the overall well-being of women with diabetes.</p> <p>This review aims to provide a comprehensive overview of the physiology of female reproduction in the context of diabetes mellitus and investigate the potential impact of phytoextract supplementation on reproductive outcomes. By synthesizing existing literature, the aim is to highlight the pathophysiological mechanisms underlying the adverse effects of diabetes on the female reproductive system and explore the potential benefits of natural plant-derived compounds in mitigating these effects</p> <p>Keywords: <i>Diabetes mellitus, Reproductive dysfunction, Central hypogonadism, Polycystic ovary syndrome (PCOS), Hyperandrogenism, Insulin-sensitizing</i></p>
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Introduction

The female reproductive system is a complex and delicately regulated physiological system responsible for gamete production, sex hormone secretion, and supporting the development of fertilized eggs into mature fetuses. However, this intricate process can be profoundly affected by metabolic disorders, such as diabetes mellitus. Diabetes, characterized by chronic hyperglycemia, poses unique challenges to female reproductive health, impacting various aspects of fertility and gestational outcomes (Nandi et al., 2013).

Reproductive dysfunction in diabetes is a well-recognized yet understudied complication. Women with diabetes may encounter a broad spectrum of reproductive health problems, ranging from delayed puberty and menarche to menstrual cycle abnormalities, unfavorable pregnancy outcomes, early menopause, and subfertility. These issues can emerge during puberty, later when fertility is desired, or even during the climacteric period, depending on the age of diabetes onset (Thong et al., 2020).

Historically, women with type 1 diabetes frequently experienced amenorrhea and infertility, often due to central hypogonadism resulting from disrupted hormonal regulation. However, advancements in insulin therapy and improved metabolic control have contributed to a decline in such complications, though they still persist (Codner et al., 2012). In addition to the well-known reproductive implications in diabetes, contemporary research is shedding light on new insights. Emerging evidence indicates a potential link between diabetes and reproductive conditions such as polycystic ovary syndrome (PCOS) and hyperandrogenism, with insulin's impact on the ovary being a key factor (Barthelmess et al., 2014). These findings further underscore the complexity of the relationship between diabetes and female reproductive health.

Moreover, the escalating incidence of type 2 diabetes among young individuals raises concerns about a higher prevalence of diabetes-related reproductive problems among women of reproductive age (Thong et al., 2020). As the population of young women living with diabetes continues to grow, healthcare professionals must be equipped to address the challenges associated with navigating reproductive health concerns across the lifespan. This review aims to explore the physiology of female reproduction with diabetes, encompassing the potential impacts on fertility, gestational outcomes, and overall reproductive health. Additionally, the review will discuss the emerging role of phytoextract supplementation as a potential adjunctive approach in managing diabetes-related reproductive issues. Phytoextracts, derived from plant sources, have garnered attention due to their possible medicinal properties, particularly their ability to reduce inflammation, antioxidant, and insulin-sensitizing actions.

Physiology of Female Reproduction

The female reproductive system has the essential role of producing gametes, commonly known as eggs or ova, along with specific sex hormones. Additionally, it provides the necessary environment for fertilized eggs to mature into fully developed fetuses, preparing them for delivery. A woman's reproductive years span from menarche, which is her first menstrual cycle, until menopause, defined as the cessation of menstruation for 12 consecutive months (Xing et al., 2022). Throughout this reproductive phase, a cyclic expulsion of eggs occurs

from the ovaries, creating the potential for fertilization by male gametes, or sperm. This periodic release of eggs is a natural and integral aspect of the menstrual cycle.

Table 1: Anatomical Features of the Female Reproductive System

Organ	Description
Ovaries	Female gonads responsible for producing eggs and sex hormones. Outer cortex - site of follicular development. Inner medulla - blood vessels and connective tissue.
Fallopian Tubes	Ducts providing a pathway for oocytes from ovaries to uterus. Segments: fimbria, ampulla, isthmus, and interstitial portion.
Uterus	Muscular organ where fertilized egg implants and fetus grows during pregnancy. Consists of corpus and cervix.
Vagina	Fibromuscular tube extending from vulvar vestibule to uterine cervix. Functions as canal for menstrual fluid and childbirth.
Vulva	External female genitalia, including labia majora, labia minora, clitoris, vulvar vestibule, urethral meatus, and vaginal orifice.

This table provides a detailed description of the key organs and structures comprising the female reproductive system. It outlines the main functions and roles of each component, highlighting their contributions to the complex process of female reproduction.

Physiology of Female Reproduction with Diabetes

Diabetes, whether Type 1 or Type 2, can have significant impacts on female reproductive health (Galicia-Garcia et al., 2022) due to its effect on hormonal regulation, metabolic processes, and vascular function (Cai et al., 2022). Here are some key points related to the physiology of female reproduction with diabetes:

Menstrual Irregularities: Diabetes can lead to hormonal imbalances, affecting the menstrual cycle and leading to irregular periods or anovulation (lack of ovulation).

Infertility: Uncontrolled diabetes can negatively impact fertility by reducing the chances of successful conception.

Gestational Diabetes: Women who have diabetes already or who develop gestational diabetes during pregnancy are more likely to experience complications that could harm the unborn child.

Vascular Complications: Blood artery damage from diabetes may impact the blood supply to the reproductive organs, potentially resulting in pregnancy difficulties.

Increased Risk of Birth Defects: Poorly controlled diabetes during pregnancy can increase the risk of birth defects in the baby.

Description:

Ovaries: The diagram starts with two oval shapes representing the ovaries, which are the primary female reproductive organs responsible for producing eggs (ova) and sex hormones.

Menstrual Cycle: A curved arrow connects the ovaries to a horizontal line representing the menstrual cycle. The follicular phase and the luteal phase are two separate periods of the menstrual cycle. These phases are regulated by hormonal changes, which result in the cyclical ejection of eggs from the ovaries.

Menarche: A vertical arrow pointing downward represents menarche, which is the onset of the first menstrual cycle during puberty.

Hormonal Imbalances: A wavy line with upward and downward arrows indicates hormonal imbalances, this can cause irregular menstruation cycles and trouble getting pregnant.

Fertility: An icon representing a baby or a pregnant woman signifies fertility, it relies on ovulation, fertilization, and embryo development going well.

Gestational Diabetes: A pregnant woman with a "+" sign indicates gestational diabetes, a condition that can develop during pregnancy and affect maternal and fetal health.

Adverse Pregnancy Outcomes: Two icons representing a pregnant woman with a sad face and a baby with a "-" sign indicate adverse pregnancy outcomes, which may occur due to diabetes-related complications.

Early Menopause: A clock symbol near the ovaries represents early menopause, which can occur earlier than usual due to hormonal imbalances associated with diabetes (Xing et al., 2022).

Table 2: Impact of Diabetes on Different Aspects of Female Reproduction

Aspect of Female Reproduction	Physiology	Potential Impacts of Diabetes
Menarche	Onset of the first menstrual cycle	Delayed menarche due to hormonal imbalances
Menstrual Cycle	Cyclical expulsion of eggs from the ovaries	Menstrual irregularities and anovulation
Fertility	Ability to conceive	Reduced fertility and difficulty in conceiving
Pregnancy Outcomes	Development of fertilized eggs into fetuses	Increased risk of adverse pregnancy outcomes, including gestational diabetes
Early Menopause	Cessation of menses for 12 consecutive months	Potential for early onset of menopause due to hormonal imbalances
Amenorrhea and Infertility	Absence of menstrual periods and inability to conceive	Historically common in type 1 diabetes due to central hypogonadism, but improved with modern management
Polycystic Ovary Syndrome (PCOS)	Hormonal and metabolic disorder affecting the ovaries	Emerging link between diabetes and PCOS, possibly due to insulin impact on the ovaries
Hyperandrogenism	Excess androgens in the female body	Potential link between diabetes and

This table presents a comprehensive overview of the physiological aspects of female reproduction and their potential impacts due to diabetes. The table provides information on its normal physiology and the potential effects that diabetes can have on it.

Phytoextract Supplementation and Reproductive Outcomes

Phytoextracts, derived from plants, have been studied for their potential health benefits, including their effects on reproductive health. We can use phytoextracts as a complementary approach to manage diabetes and its potential impact on female reproductive outcomes. These extracts may have antioxidant, characteristics that are both anti-inflammatory and insulin-sensitizing that could potentially improve reproductive health in women with diabetes (Kooti et al., 2016). Phytoextract supplementation has garnered attention as a potential adjunctive therapy for improving reproductive outcomes in women. Derived from plant sources, phytoextracts contain bioactive compounds that may exert beneficial effects on reproductive health.

Several studies have explored the impact of phytoextract supplementation on various aspects of female reproduction, including menstrual regularity, hormone balance, and fertility. Some phytoextracts have demonstrated antioxidant and anti-inflammatory properties, which could help reduce oxidative stress and inflammation associated with reproductive disorders (Kooti et al., 2016).

Moreover, certain phytoextracts have been studied for their potential to regulate hormone levels, particularly in conditions like polycystic ovary syndrome (PCOS). Menstrual abnormalities and subfertility can result from

the prevalent endocrine condition PCOS. Some phytoextracts, such as those derived from Cinnamon and Fenugreek, have shown promising effects on menstrual regularity and hormone profiles in women with PCOS. Additionally, phytoextracts like Chaste Tree Berry (*Vitex agnus-castus*) have been studied for their potential to support ovulation and improve pregnancy rates in women with infertility (Antoine et al., 2019). Phytoextract supplementation holds promise as a natural approach to support reproductive health and improve outcomes in women. However, further well-designed clinical trials are necessary to validate these findings and provide evidence-based recommendations.

Future Perspectives

The exploration of the physiology of female reproduction with diabetes and the potential use of phytoextract supplementation opens up exciting avenues for future research and clinical practice. Several promising future perspectives emerge from the current state of knowledge:

- 1. Personalized Approaches:** Future research should focus on personalized approaches to managing reproductive health in women with diabetes. As each individual may respond differently to diabetes and phytoextract supplementation, tailored interventions based on genetic, hormonal, and metabolic profiling could lead to more effective and targeted treatments.
- 2. Mechanistic Studies:** A deeper understanding of the underlying mechanisms linking diabetes and female reproductive health is essential. Mechanistic studies can help identify specific molecular pathways affected by diabetes and how phytoextracts modulate these pathways. This knowledge will pave the way for developing novel therapies and more targeted interventions.
- 3. Clinical Trials:** Rigorous and well-designed clinical trials are needed to evaluate the safety and efficacy of various phytoextract supplements for improving reproductive outcomes in women with diabetes. Large-scale, multicenter trials will provide valuable data to guide evidence-based clinical recommendations.
- 4. Long-Term Outcomes:** Investigating the long-term effects of diabetes and phytoextract supplementation on female reproductive health is critical. Studies that follow women with diabetes over extended periods can provide insights into the cumulative impact of these factors on fertility, pregnancy outcomes, and menopause-related issues.
- 5. Integrative Care:** Emphasizing the importance of an integrative and holistic approach to care is essential. Comprehensive and patient-centered management will be ensured through cooperative efforts amongst healthcare professionals with specialties in endocrinology, gynecology, nutrition, and reproductive medicine.
- 6. Nutritional Interventions:** Apart from phytoextract supplementation, research should explore the role of dietary interventions in optimizing female reproductive health with diabetes. Identifying specific dietary patterns and nutrients that support fertility and hormonal balance could complement existing treatment strategies.
- 7. Telemedicine and Digital Health:** Leveraging telemedicine and digital health technologies can enhance accessibility to reproductive health care for women with diabetes, particularly those living in remote or underserved areas. Remote monitoring and teleconsultations can improve patient engagement and facilitate regular follow-up.
- 8. Patient Education and Awareness:** Raising awareness among women with diabetes about the potential impact of their condition on reproductive health is crucial. Providing comprehensive education and resources can empower them to make informed decisions regarding family planning and fertility preservation.
- 9. Preconception Counseling:** Integrating preconception counseling into routine diabetes care can help identify potential risks and provide early interventions to optimize reproductive outcomes for women planning to conceive.
- 10. Psychological Support:** Acknowledging the emotional and psychological aspects of living with diabetes and its impact on reproductive health is vital. Offering counseling and support services can alleviate stress and anxiety, positively influencing overall reproductive outcomes.

In future perspectives in the field of female reproduction with diabetes and phytoextract supplementation hold great promise in advancing our understanding and management of reproductive challenges. By embracing a multifaceted and patient-centric approach, researchers and healthcare providers can contribute to empowering women with diabetes to lead fulfilling reproductive lives while ensuring the best possible outcomes for their reproductive health.

Conclusion

The physiological aspects of female reproduction in the context of diabetes present a complex interplay of hormonal imbalances, metabolic disturbances, and potential reproductive challenges. Female reproductive health can be affected by diabetes at many stages, including delayed puberty and menarche, irregular menstrual cycles, subfertility, unfavorable pregnancy outcomes, and even early menopause. While advancements in diabetes management have led to improvements in reproductive outcomes for women with type 1 diabetes, the increasing incidence of type 2 diabetes in younger women raises concerns about the potential impact on their reproductive health.

In recent years, the role of phytoextract supplementation in improving reproductive outcomes in females with diabetes has gained attention. Phytoextracts, derived from various plant sources, have been studied for their potential benefits in managing conditions like polycystic ovary syndrome (PCOS), symptoms of menopause with infertility. According to studies, several phytoextracts may help maintain menstrual regularity, ovulation, and hormonal balance, offering promising avenues for enhancing fertility and overall reproductive health.

However, it is essential to approach phytoextract supplementation with caution, as individual responses may vary, and potential interactions with diabetes medications need careful consideration. Additionally, healthcare providers should remain vigilant about monitoring potential side effects and contraindications, especially in pregnant or breastfeeding women. The complexity of the female reproductive system and the multifaceted nature of diabetes call for interdisciplinary collaboration between endocrinologists, gynecologists, and reproductive specialists. Such collaborations will enable comprehensive assessments and tailored interventions to optimize reproductive outcomes for women with diabetes. Integrating lifestyle modifications, effective diabetes management, and evidence-based phytoextract supplementation may hold promise in enhancing fertility and reproductive health in this vulnerable population.

In conclusion, the study of the physiology of female reproduction with diabetes and the potential benefits of phytoextract supplementation opens new avenues for understanding and managing reproductive challenges in women with diabetes. Continued research and clinical trials will contribute to the development of safe and effective strategies for optimizing reproductive outcomes, ultimately empowering women to make informed decisions about their reproductive health journey in the context of diabetes.

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