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REPRODUKTIV YOSHDAGI AYOLLARDA SEMIZLIKNING METABOLIK, ENDOKRIN VA REPRODUKTIV OQIBATLARI



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Annotatsiya. Semizlik reproduktiv yoshdagi ayollarda metabolik, endokrin va reproduktiv jarayonlarga ta'sir qiladigan geterojen surunkali kasallik sifatida qaralmoqda. Ushbu narrativ sharhda 2021–2026-yillarda chop etilgan xalqaro ilmiy manbalar asosida visseral yog'lanish, insulinrezistentlik, kompensator giperinsulinemiya, dislipidemiya va past intensivlikdagi yallig'lanishning tuxumdon steroidogenezi, follikulogenezi, ovulyatsiya, endometriy funksiyasi va fertilitet bilan munosabati tahlil qilindi. Tahlil semizlik polikistik tuxumdonlar sindromi, hayz sikli buzilishlari, anovulyatsiya, yordamchi reproduktiv texnologiyalar natijalarining pasayishi va homiladorlik asoratlari bilan assotsiatsiyalanishini ko'rsatdi. Tana massasi indeksi individual metabolik va reproduktiv xavfni to'liq ifodalamaydi; bel aylanasi, glyukoza almashinuvi, lipid profili, arterial bosim va reproduktiv anamnez qo'shimcha axborot beradi. Vaznni boshqarish metabolik ko'rsatkichlarni yaxshilaydi, biroq pregravidar vazn kamayishining tirik tug'ilish ko'rsatkichiga ta'siri barcha tadqiqotlarda bir xil emas.

Kalit so'zlar: insulinrezistentlik, giperinsulinemiya, dislipidemiya, giperandrogenizm, polikistik tuxumdonlar sindromi, fertilitet.

METABOLIC, ENDOCRINE AND REPRODUCTIVE CONSEQUENCES OF OBESITY IN WOMEN OF REPRODUCTIVE AGE

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Abstract. Objective. This narrative review synthesizes recent evidence on the metabolic, endocrine, and reproductive consequences of obesity in women of reproductive age and clarifies the clinical implications for assessment and weight management. Methods. We reviewed English-language peer-reviewed publications issued mainly between 2021 and 2026 and indexed in PubMed, ScienceDirect, and SpringerLink. Priority was given to international guidelines, systematic reviews, meta-analyses, and clinically relevant reviews addressing insulin resistance, dyslipidemia, chronic low-grade inflammation, polycystic ovary syndrome, fertility, assisted reproduction, and pregnancy outcomes. Results. Current evidence characterizes obesity as a heterogeneous chronic disease in



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which visceral adiposity, altered adipokine signaling, insulin resistance, compensatory hyperinsulinemia, and inflammatory pathways interact with the hypothalamic-pituitary-ovarian axis, ovarian steroidogenesis, folliculogenesis, and endometrial function. These mechanisms may contribute to menstrual irregularity, hyperandrogenism, anovulation, polycystic ovary syndrome, prolonged time to pregnancy, and lower effectiveness of some assisted reproductive procedures. Obesity is also associated with higher risks of gestational diabetes, hypertensive disorders of pregnancy, preeclampsia, cesarean delivery, and adverse neonatal outcomes. Body mass index alone does not fully describe metabolic or reproductive risk; waist-based measures, glucose metabolism, lipid profile, blood pressure, clinical hyperandrogenism, menstrual characteristics, and individual reproductive plans provide additional information. Lifestyle-based weight management improves cardiometabolic parameters and may restore ovulation in some women, whereas evidence that preconception weight loss consistently increases live-birth rates remains heterogeneous. New anti-obesity medications expand therapeutic options but require careful pregnancy planning and individualized risk-benefit assessment. Conclusions. Clinical care should integrate anthropometric, metabolic, endocrine, and reproductive assessment rather than rely on body mass index as a single marker. The most defensible strategy is individualized, multidisciplinary management that considers obesity phenotype, polycystic ovary syndrome status, fertility goals, comorbidities, and the timing of conception.

Keywords: insulin resistance, hyperinsulinemia, dyslipidemia, hyperandrogenism, polycystic ovary syndrome, fertility.

Kirish

Semizlik reproduktiv yoshdagi ayollarda faqat tana vaznining ortishi bilan cheklanmaydigan, metabolik va reproduktiv fenotipga turlicha ta'sir qiladigan geterogen surunkali kasallikdir. Zamonaviy sharhlar ortiqcha yog' to'qimasi gipotalamus-gipofiz-tuxumdon tizimi, tuxumdon va ootsit, endometriy hamda homiladorlik jarayonlariga bir vaqtning o'zida ta'sir ko'rsatishi mumkinligini qayd etadi (Armstrong et al., 2022; Schon et al., 2024; Zheng et al., 2024; Efstratiou et al., 2026). Shu sababli tana massasi indeksini reproduktiv xavfning yagona ko'rsatkichi sifatida talqin qilish yetarli emas; yog' to'qimasining taqsimlanishi va metabolik fenotip ham hisobga olinishi kerak (Filippi-Arriaga et al., 2025).

Visseral yog' to'qimasi adipokinlar, erkin yog' kislotalari va yallig'lanish mediatorlari orqali insulin signalizatsiyasi hamda energiya almashinuviga ta'sir qiladi. Past intensivlikdagi surunkali yallig'lanish va insulinrezistentlik bir-birini kuchaytiruvchi jarayonlar sifatida kechishi mumkin (Kim and Lee, 2021). Reprodukativ tizimda bu metabolik fon tuxumdon steroidogenezi, follikulogenez va endometriyning implantatsiyaga tayyorlanish jarayonlari bilan kesishadi; klinik va eksperimental ma'lumotlar semizlik sharoitida endometriy retseptivligi ham o'zgarishi mumkinligini ko'rsatadi (Bellver et al., 2021; Galio et al., 2023).

Polikistik tuxumdonlar sindromida semizlik va insulinrezistentlik klinik fenotipning og'irligini oshirishi mumkin, ammo sindromni faqat ortiqcha tana vazni bilan izohlash mumkin emas. 2023-yilgi xalqaro tavsiyalar metabolik xavfni, hayz siklini, giperandrogenizmni va reproduktiv maqsadlarni birgalikda baholashni tavsiya qiladi (Teede et al., 2023). Ortiqcha vaznli yoki semiz polikistik tuxumdonlar sindromi bo'lgan ayollarda insulin sezgirligini yaxshilashga qaratilgan yondashuvlar metabolik va ayrim reproduktiv ko'rsatkichlarga ta'sir qilishi mumkin, biroq samaradorlik davolash turiga va boshlang'ich fenotipga bog'liq (Samarasinghe et al., 2024; Kim and Lee, 2022).

Semizlik tabiiy fertilitet va yordamchi reproduktiv texnologiyalar natijalari bilan ham assotsiatsiyanlanadi. Meta-tahlillar tana massasi indeksining ortishi klinik homiladorlik va tirik tug'ilish ehtimolining pasayishi bilan bog'lanishi mumkinligini ko'rsatgan, lekin ushbu



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bog'lanishning kattaligi tadqiqot dizayni va bemorlar xususiyatlariga qarab o'zgaradi (Ribeiro et al., 2022; Xiong et al., 2021). Pregravidar vazn kamaytirish homiladorlikka erishish ehtimolini ayrim guruhlarda oshirishi mumkin, ammo tirik tug'ilish ko'rsatkichiga ta'siri izchil tasdiqlanmagan (Vitek and Hoeger, 2022; Boyle et al., 2023; Caldwell et al., 2024).

Homiladorlik davrida semizlik gestatsion qandli diabet, gipertenziv buzilishlar, preeklampsiya, kesarcha kesish va ayrim neonatal asoratlar bilan assotsiatsiyalanadi (Creanga et al., 2022; Barbouni et al., 2025). Polikistik tuxumdonlar sindromi va homiladorlikdan oldingi ortiqcha vazn birga kelganda ayrim noxush akusherlik natijalari uchun xavf ortishi mumkin (Chatzakis et al., 2022; Yang et al., 2022). Shu fonda reproduktiv davr davomida vaznni boshqarish, homiladorlikdan oldingi maslahat va individual xavfni baholash klinik yordamning uzluksiz qismi sifatida qaralmoqda (Ogunwole et al., 2021; Filippi-Arriaga et al., 2025; Duah and Seifer, 2025; Maslin et al., 2024).

Ishning maqsadi reproduktiv yoshdagi ayollarda semizlikning metabolik, endokrin va reproduktiv oqibatlarini tavsiflash, ular o'rtasidagi patogenetik bog'lanishlarni aniqlashtirish hamda klinik baholash va vaznni boshqarishga oid zamonaviy yondashuvlarni tizimlashtirishdan iborat.

Adabiyotlarni tanlash va tahlil usuli

Maqola narrativ adabiyotlar sharhi sifatida tayyorlandi. 2026-yil sentabr holatiga PubMed, ScienceDirect va SpringerLink platformalarida 2021–2026-yillarda chop etilgan ingliz tilidagi ilmiy nashrlar izlandi. Qidiruvda “obesity”, “women of reproductive age”, “female fertility”, “insulin resistance”, “polycystic ovary syndrome”, “endometrial receptivity”, “assisted reproduction”, “pregnancy outcomes” va “weight loss” atamaları turli kombinatsiyalarda qo'llandi. So'nggi besh yildagi xalqaro klinik tavsiyalar, sistematik sharhlar, meta-tahlillar va mavzuga bevosita daxldor klinik sharhlarga ustuvorlik berildi.

Tahlilga reproduktiv yoshdagi ayollarda semizlikning uglevod va lipid almashinuvi, yallig'lanish, gormonal regulatsiya, polikistik tuxumdonlar sindromi, fertilitet, yordamchi reproduktiv texnologiyalar va homiladorlik natijalari bilan munosabatini yoritgan maqolalar kiritildi. Faqat erkaklar, bolalar yoki eksperimental hayvonlar populyatsiyasiga bag'ishlangan ishlar, mavzuga bilvosita aloqador maqolalar va takroriy nashrlar asosiy tahlildan chiqarildi. Narrativ dizayn sababli maqola sistematik sharh sifatida talqin qilinmaydi; keltirilgan xulosalar mavjud dalillarning yo'nalishi va cheklovlarini qiyosiy baholashga asoslanadi.

Semizlikning metabolik fenotipi va uglevod almashinuvi

Insulinrezistentlik semizlikning metabolik fenotipida tez-tez uchraydi. Skelet mushaklari, jigar va yog' to'qimasida insulin ta'sirining susayishi kompensator giperinsulinemiya yuzaga keltiradi; kompensatsiya yetarli bo'lmay qolganda glyukoza gomeostazi buziladi. Visseral yog' to'qimasida lipolizning kuchayishi va erkin yog' kislotalarining ko'payishi jigar hamda mushaklardagi insulin signalizatsiyasiga qo'shimcha yuk tushiradi. Yallig'lanish hujayralari va sitokinlarining yog' to'qimasida faollashuvi bu jarayonni davom ettirishi mumkin (Kim and Lee, 2021; Schon et al., 2024).

Reproduktiv nuqtai nazardan giperinsulinemiya tuxumdon teka hujayralarida androgen sintezini kuchaytirishi va jigarda jinsiy gormonlarni bog'lovchi globulin sintezining pasayishi bilan birga kechishi mumkin. Erkin androgenlar ulushining ortishi follikullarning yetilishi va ovulyatsiya bilan bog'liq jarayonlarga ta'sir qiladi. Ushbu mexanizm polikistik tuxumdonlar sindromida ayniqsa dolzarb, biroq sindromning genetik, neyroendokrin va ovarial komponentlari ham mustaqil rol o'ynaydi (Teede et al., 2023; Samarasinghe et al., 2024).

HOMA-IR indeksi epidemiologik va klinik tadqiqotlarda insulinrezistentlikni bilvosita tavsiflaydi, ammo uning universal diagnostik chegarasi mavjud emas. Populyatsiya, yosh, laborator usul va tana tarkibi natijani o'zgartiradi. Shu sababli HOMA-IRni alohida hukm chiqaruvchi test emas, balki klinik kontekst, glikemik ko'rsatkichlar va boshqa metabolik belgilar bilan birga talqin qilish maqsadga muvofiq (Teede et al., 2023).



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Lipid almashinuvi, markaziy yog'lanish va kardiometabolik xavf

Semizlikda triglitseridlar miqdorining ortishi, past zichlikdagi lipoprotein xolesterinining ko'payishi va yuqori zichlikdagi lipoprotein xolesterinining pasayishi bilan tavsiflanadigan aterogen profil uchrashi mumkin. Bu o'zgarishlar insulinrezistentlik, arterial gipertenziya va boshqa kardiometabolik omillar bilan birga kelganda uzoq muddatli xavfni kuchaytiradi (Schon et al., 2024; Filippi-Arriaga et al., 2025).

Tana massasi indeksi umumiy tana massasi va bo'y nisbatini ifodalaydi, lekin visseral yog' to'qimasini bevosita o'lchamaydi. Zamonaviy ma'lumotlar belga asoslangan antropometrik o'lchovlar reproduktiv va metabolik xavf haqida qo'shimcha axborot berishi mumkinligini ko'rsatadi. Fertilitet bo'yicha sistematik sharhda markaziy semizlik ko'rsatkichlari, ayniqsa bel aylanasi, homiladorlikka erishish muddati va bepustlik xavfi bilan assotsiatsiyalangan (Efstratiou et al., 2026). EASO pozitsion bayonoti ham tana massasi indeksidan tashqari kamida bitta qo'shimcha antropometrik mezondan foydalanishni tavsiya qiladi (Filippi-Arriaga et al., 2025).

Endokrin va reproduktiv mexanizmlar

Semizlik gipotalamus-gipofiz-tuxumdon tizimiga adipokinlar, insulin, yallig'lanish mediatorlari va energiya almashinuvi orqali ta'sir etadi. Klinik oqibatlar bir xil emas: ayrim ayollarda hayz sikli saqlanadi, boshqalarida oligomenoreya, anovulyatsiya yoki giperandrogenizm paydo bo'lishi mumkin. Shu sababli semizlikni ovulyator disfunksiyaning avtomatik ekvivalenti deb hisoblash xato; reproduktiv fenotip individual metabolik va gormonal xususiyatlarga bog'liq (Armstrong et al., 2022; Zheng et al., 2024).

Polikistik tuxumdonlar sindromida vazn ortishi va insulinrezistentlik mavjud giperandrogenizm hamda metabolik xavfni kuchaytirishi mumkin. 2023-yilgi xalqaro klinik tavsiyalar ushbu sindromda vazn stigmasidan qochish, metabolik xavfni muntazam baholash va hayot tarziga oid yondashuvlarni individual reja bilan birlashtirish zarurligini ta'kidlaydi (Teede et al., 2023). Ortiqcha vaznli yoki semiz polikistik tuxumdonlar sindromi bo'lgan ayollarda insulin sezgirligini oshiruvchi davolash vositalari tana vazni va ayrim metabolik ko'rsatkichlarni yaxshilashi mumkin, ammo fertilitet natijalariga ta'sir dalillari bir xil darajada kuchli emas (Samarasinghe et al., 2024).

Endometriy ham semizlik bilan bog'liq metabolik muhitning nishon to'qimalaridan biridir. Klinik ma'lumotlar implantatsiya oynasining siljishi ehtimolini ko'rsatgan, hujayra darajasidagi tadqiqotlar esa semizlikda stromal hujayralarning decidualizatsiyasi va trofoblast invaziyasini boshqaruvchi signallarda farqlar bo'lishi mumkinligini aniqlagan (Bellver et al., 2021; Galio et al., 2023). Bu natijalar sababiy mexanizmni to'liq isbotlamaydi, ammo semizlik bilan bog'liq bepustlikni faqat anovulyatsiya bilan tushuntirish yetarli emasligini ko'rsatadi.

Fertilitet va yordamchi reproduktiv texnologiyalar

Semizlik tabiiy homiladorlikka erishish muddati uzayishi va bepustlik xavfining ortishi bilan assotsiatsiyalanadi. 2026-yilgi sistematik sharhda tana massasi indeksi va bel aylanasi me'yoriy chegaradan oshganda fertilitet ko'rsatkichlari yomonlashishi qayd etilgan, biroq bel-son nisbati bo'yicha natijalar bir xil bo'lmagan (Efstratiou et al., 2026). Bunday farqlar antropometrik ko'rsatkichlarning reproduktiv natijalarni turli darajada aks ettirishini ko'rsatadi.

Yordamchi reproduktiv texnologiyalarda ortiqcha vazn va semizlik klinik homiladorlik, implantatsiya va tirik tug'ilish ko'rsatkichlarining pasayishi bilan assotsiatsiyalangan. Meta-tahlillar bu bog'lanish doza-javob xususiyatiga ega bo'lishi mumkinligini ko'rsatadi, ammo kuzatuv tadqiqotlaridagi aralashuvchi omillar sababli tana massasi indeksini yagona sabab sifatida talqin qilish mumkin emas (Ribeiro et al., 2022; Xiong et al., 2021).

Vazn kamaytirish bo'yicha intervensiyalar metabolik profil va tabiiy homiladorlik ehtimolini yaxshilashi mumkin. Shunga qaramay, randomizatsiyalangan tadqiqotlarni birlashtirgan yangi meta-tahlil homiladorlik ko'rsatkichida foyda topgan bo'lsa-da, tirik tug'ilish uchun aniq ustunlikni tasdiqlamagan (Caldwell et al., 2024). Oldingi sharhlar ham shu ehtiyotkor xulosaga kelgan: vazn



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kamaytirish sog'liq uchun foydali, lekin fertilitet davolashini kechiktirishning foyda va zararini yosh, tuxumdon rezervi va individual reproduktiv reja bilan birga baholash kerak (Vitek and Hoeger, 2022; Boyle et al., 2023).

Akusherlik oqibatlari

Homiladorlikdan oldingi semizlik gestatsion qandli diabet, gipertenziv buzilishlar, preeklampsiya, kesarcha kesish va ayrim perinatal noxush natijalar bilan assotsiatsiyalanadi (Creanga et al., 2022; Barbouni et al., 2025). Biroq individual xavf faqat tana massasi indeksiga bog'liq emas; yosh, arterial bosim, glikemik holat, avvalgi akusherlik anamnezi va semizlik darajasi natijalarni sezilarli o'zgartiradi.

Polikistik tuxumdonlar sindromi mavjud ayollarda homiladorlikdan oldingi ortiqcha vazn yoki semizlik qo'shimcha xavf qatlamini yuzaga keltirishi mumkin. Meta-tahlillar bunday kombinatsiyada homila tushishi va ayrim boshqa noxush natijalar ko'proq uchrashini ko'rsatgan (Yang et al., 2022). Polikistik tuxumdonlar sindromining diagnostik mezonlari o'rtasidagi farqlar ham homiladorlik natijalari bo'yicha tadqiqotlar heterogenligiga hissa qo'shadi (Chatzakis et al., 2022).

Shu sababli pregravidar davrda arterial bosim, uglevod almashinuvi, semizlik fenotipi va hamroh kasalliklarni baholash homiladorlikni rejalashtirishning tarkibiy qismi bo'lishi kerak. Homiladorlik davrida esa vazn ortishi va metabolik xavfni kuzatish bemorning boshlang'ich holatiga moslashtiriladi (Filippi-Arriaga et al., 2025).

Klinik baholash tamoyillari

Reproduktiv yoshdagi semiz ayolni baholashda antropometrik, metabolik va reproduktiv ma'lumotlarni bir tizimda ko'rib chiqish maqsadga muvofiq. Tana massasi indeksi bilan birga bel aylanasi yoki boshqa markaziy yog'lanish ko'rsatkichini qayd etish metabolik fenotipni aniqroq tavsiflaydi (Filippi-Arriaga et al., 2025; Efstratiou et al., 2026).

Laborator baholash klinik vaziyatga mos tanlanadi. Och qoringa glyukoza yoki glyukozaga tolerantlikni baholash, lipid profili va zarurat bo'lganda insulin bilan bog'liq ko'rsatkichlar metabolik xavfni tavsiflaydi. Polikistik tuxumdonlar sindromi gumon qilinganda hayz sikli, klinik va biokimyoviy giperandrogenizm, tuxumdon morfologiyasi va boshqa sabablarni istisno qilish mezonlari xalqaro tavsiyalar asosida qo'llanadi (Teede et al., 2023).

Reproduktiv anamnezda sikl muntazamligi, homiladorlikka urinish davomiyligi, avvalgi homiladorliklar, homila tushishi, bepustlik davolashlari va yaqin muddatdagi reproduktiv reja aniqlashtiriladi. Mazkur ma'lumotlar vaznni boshqarish intensivligi va davolash muddatini tanlashda tana massasi indeksidan ko'ra bevosita klinik qarorga yaqinroq bo'lishi mumkin (Schon et al., 2024; Ogunwole et al., 2021).

Vaznni boshqarish va reproduktiv rejalashtirish

Hayot tarzini modifikatsiya qilish semizlikni boshqarishning tayanch yo'nalishi bo'lib qoladi. Energiya iste'molini individual ehtiyojga moslashtirish, muntazam jismoniy faollik, uyqu va xulq-atvor omillarini korreksiya qilish metabolik salomatlikni yaxshilaydi. Polikistik tuxumdonlar sindromi bo'lgan semiz ayollarda hayot tarziga qaratilgan dasturlar tana vazni, bel aylanasi va ayrim metabolik ko'rsatkichlarni yaxshilashi mumkin (Kim and Lee, 2022).

Klinik qarorda vazn kamayishining o'zi emas, uning vaqti va reproduktiv maqsad bilan uyg'unligi ham hisobga olinadi. Ayrim ayollarda mo'tadil vazn kamayishi ovulyatsiya va tabiiy homiladorlik ehtimolini yaxshilashi mumkin, biroq pregravidar intervensiyaning tirik tug'ilishga ta'siri bo'yicha dalillar heterogen (Caldwell et al., 2024; Vitek and Hoeger, 2022). Yoshi katta yoki tuxumdon rezervi pasaygan bemorda uzoq vazn kamaytirish dasturi fertilitet davolashini asossiz kechiktirmasligi kerak.

Zamonaviy antiobezitar preparatlar reproduktiv yoshdagi ayollar uchun davolash imkoniyatlarini kengaytirdi, lekin homiladorlik rejalashtirilganda xavfsizlik, preparatni to'xtatish muddati va kontratsepsiya masalalarini alohida ko'rib chiqish zarur. Hozirgi adabiyotlarda reproduktiv natijalar bo'yicha ma'lumotlar tez kengayayotgan bo'lsa-da, ayrim preparatlar uchun



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dalillar hanuz cheklangan (Maslin et al., 2024; Duah and Seifer, 2025). Shuning uchun farmakoterapiya qarori individual risk-foйда nisbatiga va homiladorlik rejasiga asoslanadi.

Xulosalar

1. Reproktiv yoshdagi ayollarda semizlik metabolik, endokrin va reaktiv jarayonlar kesishadigan geterogen surunkali kasallikdir; uning klinik ta'sirini tana massasi indeksining o'zi bilan ifodalash yetarli emas.

2. Visseral yog'lanish, insulinrezistentlik, kompensator giperinsulinemiya va past intensivlikdagi yallig'lanish tuxumdon steroidogenezi, follikulogenezi va endometriy funksiyasiga ta'sir qilishi mumkin. Polikistik tuxumdonlar sindromida bu mexanizmlar klinik fenotipni kuchaytiradi, lekin sindromning yagona sababi hisoblanmaydi.

3. Semizlik tabiiy fertilitet, yordamchi reaktiv texnologiyalar va homiladorlik natijalari bilan assotsiatsiyalanadi. Ushbu assotsiatsiyalarning kattaligi yosh, markaziy yog'lanish, metabolik holat, polikistik tuxumdonlar sindromi va hamroh kasalliklar bo'yicha farqlanadi.

4. Vaznni kamaytirish kardiometabolik ko'rsatkichlarni yaxshilaydi va ayrim ayollarda ovulyatsiyani tiklashga yordam beradi. Biroq pregravidar vazn kamaytirishning tirik tug'ilish ko'rsatkichiga barqaror foydasi hozircha barcha tadqiqotlarda bir xil tasdiqlanmagan.

5. Klinik boshqaruv antropometrik, metabolik, endokrin va reaktiv ma'lumotlarni integratsiya qilishi hamda bemorning fertilitet maqsadi, yoshi, polikistik tuxumdonlar sindromi statusi va homiladorlik vaqtini hisobga olgan individual multidisiplinar reja asosida olib borilishi kerak.

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