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OBESITY AND INFERTILITY: HOW CAN WEIGHT REDUCTION IMPROVE YOUR CHANCES OF PREGNANCY?

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Background: Infertility and obesity are growing health concerns both in Poland and globally. Obesity, as a chronic disease, adversely affects the functioning of the neuroendocrine system and metabolism, which can lead to impaired fertility.

Aim of the study: The aim of this study was to compile and organize current knowledge on the impact of obesity on female fertility and to assess the effectiveness of various therapeutic strategies used in overweight and obese women.

Material and methods: This analysis was based on a literature review of sources from PubMed, the National Institute of Mental Health, and Google Scholar. Three independent reviewers included 69 studies, excluding those without full-text availability, those not directly related to the topic, and those of low methodological quality.

Results: Obesity impairs fertility through multiple mechanisms, including disruption of the hypothalamic–pituitary–ovarian axis, chronic inflammation, and alterations in the microbiome. These factors negatively affect oocyte maturation, menstrual regularity, and the success rates of assisted reproductive technologies. Weight loss, lifestyle modification, pharmacotherapy, and bariatric surgery significantly improve fertility, ovulation rates, and pregnancy outcomes.

Conclusions: Obesity is a significant contributor to female infertility. Hormonal imbalances and chronic inflammation play a key role in reducing oocyte quality. Weight reduction, particularly through comprehensive interventions, is an effective strategy for improving fertility outcomes in overweight and obese women.
KEYWORDS: infertility, obesity, pharmacotherapy, ART, lifestyle

Background

Infertility has recently become a global problem, affecting millions of people worldwide. It is estimated that it may affect one in six individuals. According to the World Health Organization (WHO), infertility is a disease of the female or male reproductive system, defined as the failure to conceive after 12 months of regular unprotected sexual intercourse. The World Health Organization emphasizes the importance of a healthy lifestyle that influences reproductive success. Among the factors that reduce the chances of conception are obesity, smoking, and excessive alcohol consumption. A report published in 2023 indicates that infertility affects 17.5% of the global population [1], while in Poland this problem concerns approximately 20% of the population [2].

Obesity is an equally important problem in today's world. Overweight is diagnosed in individuals with a Body Mass Index (BMI) ≥ 25, while obesity is diag-

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nosed at BMI ≥ 30. According to WHO data, in 2022 every eighth person worldwide was obese. Among adults, 2.5 billion individuals were overweight, and 890 million were diagnosed with obesity [3]. It is estimated that by 2035, overweight or obesity will affect approximately 4 billion people worldwide. In Poland, obesity is projected to affect 35% of men and 25% of women [4]. A broader concept is obesity disease, defined as a chronic, complex condition that does not resolve spontaneously, tends to relapse, and results from a prolonged positive energy balance [5]. This disease requires identifying the pathophysiological mechanisms leading to excessive fat accumulation and preventing further progression. Defining obesity as a disease has changed the perception of obesity and contributed to the development of targeted treatment strategies. Non-pharmacological therapy, pharmacotherapy, and bariatric surgery are used in its management. Currently, surgical methods are increasingly being replaced by targeted pharmacotherapy, while patient care is provided by multidisciplinary teams, which increases treatment effectiveness [6,7]. The impact of obesity on infertility is well documented, clearly demonstrating the negative influence of overweight and obesity on reproductive outcomes [8–10]. Incorrect body weight adversely affects the endocrine system and metabolism, significantly contributing to infertility in this population [11].

Due to the growing prevalence of obesity and infertility worldwide, the authors of this study aimed to organize current knowledge on the mechanisms through which obesity contributes to infertility. The impact of obesity on reproductive success using assisted reproductive techniques and the influence of weight reduction on reproductive outcomes were also analyzed.

Figure 1 presents the projected number of births in Poland according to three scenarios (low, medium, high) for 2022–2060, compared with the actual number of births in 2022 (305.1 thousand). A decline in birth numbers is observed in all scenarios, though to varying degrees. The findings indicate that in the coming years, increasingly higher fertility rates would be required to maintain the current birth levels.

Figure 2 shows the percentage of women over 15 years of age in Poland in 2009, 2014, and 2019, categorized by BMI ranges: overweight (25.0–27.49), overweight (27.5–29.99), and obesity (BMI ≥ 30). An increase in the prevalence of overweight and obesity was observed across all age groups, particularly among older women [12].

The data was obtained from the Central Statistical Office [13].

Figure 3 illustrates the number of births in Poland in 2015–2023, by maternal age group. The number of births has been decreasing since 2017 due to demographic and socio-economic factors. Women aged 30–34 constitute the largest maternity group, reflecting a shift toward later motherhood, while the number of births among women aged 25–29 has steadily declined [13].

From the analysis of the data presented in Figures 2 and 3 it can be concluded that the increase in health problems, such as overweight or obesity in the female population, may result in a decrease in fertility, which in the long term intensifies the decline in the number of births.

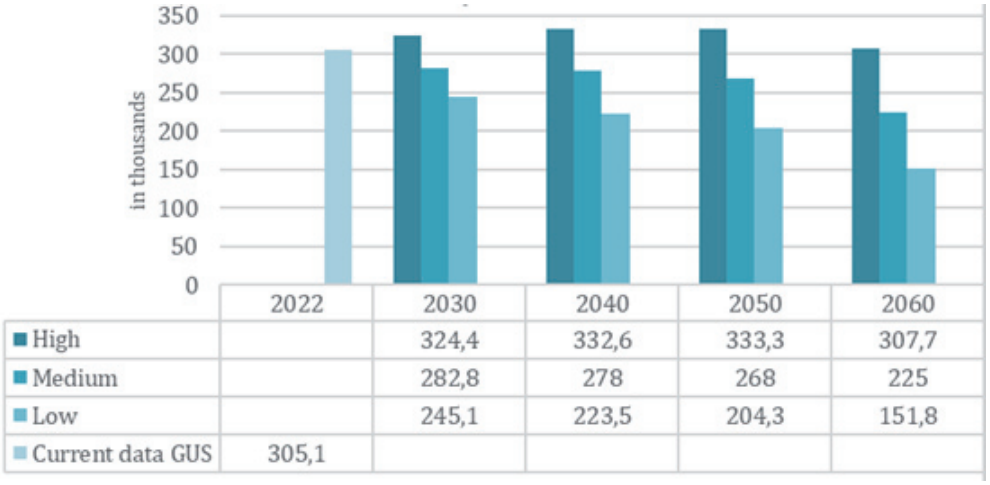
Aim of the study

The aim of this article was to collect and organize knowledge on the impact of obesity on female fertility and to assess the effectiveness of different therapeutic strategies in the treatment of infertility in patients with excess body weight. Particular attention was paid to identifying the pathophysiological mechanisms through which obesity affects oocyte quality and reproductive processes, as well as analyzing the effects of interventions including lifestyle changes and pharmacological treatment (including the use of GLP-1 analogues) on improving fertility parameters. The review aimed to indicate the optimal, holistic therapeutic approach in the treatment of infertility associated with obesity.

Material and methods

Publications were reviewed in the PubMed, National Institute of Mental Health, and Google Scholar databases. To select papers for further analysis, the following MeSH terms and keywords were used: “obesity and fertility”, “obesity and oocyte quality”, “obesity treatment and fertility”, “ART and obesity”, and “mechanism of obesity and infertility”. Review papers, research papers, and meta-analyses in Polish and English were included. Additionally, statistical data from the Central Statistical Office and the National Health Fund, WHO guidelines, recommendations, and reports on obesity disease were used.

The review was conducted by three independent reviewers who included 72 items in total (29 review papers, 28 research papers, 3 meta-analyses, and 12 items such as statistical reports, WHO and NFZ data, and recommendations on obesity and infertility). The selection of papers was performed according to the PRISMA scheme presented in Figure 4. Publications without free full-text access, those containing no information on the impact of obesity on infertility in women, and studies of low methodological quality were excluded. The CASP (Critical Appraisal Skills Programme) tool was used to assess the quality and reliability of the selected studies.



	2022	2030	2040	2050	2060
High		324,4	332,6	333,3	307,7
Medium		282,8	278	268	225
Low		245,1	223,5	204,3	151,8
Current data GUS	305,1				

Figure 1. Number of births in Poland according to three scenarios in selected years. Data were obtained from the Central Statistical Office [12]

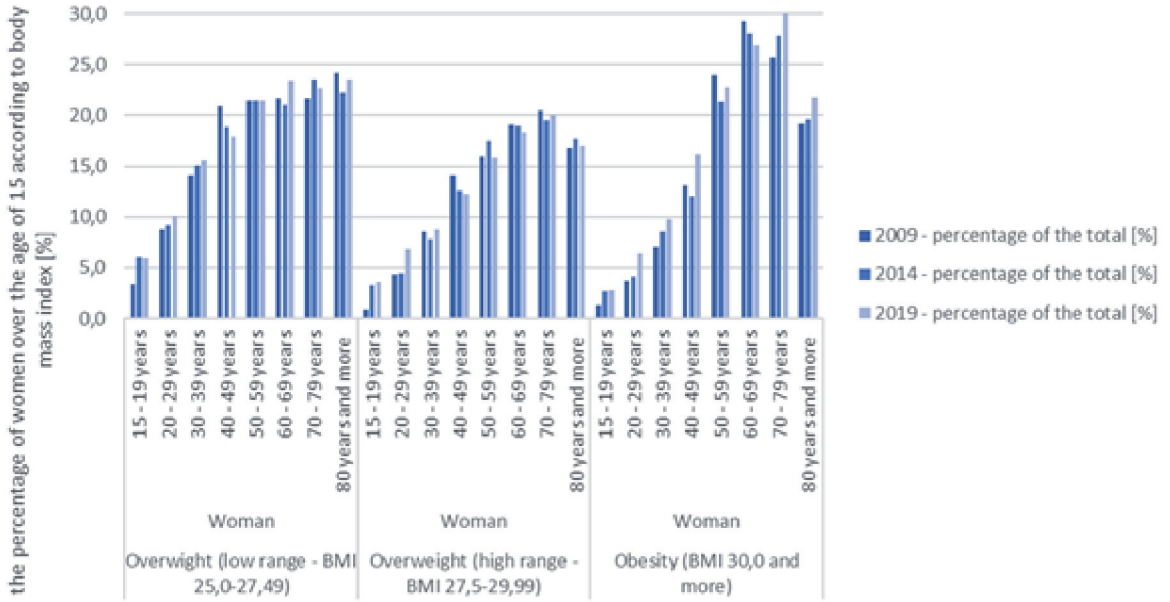


Figure 2. Percentage of people over 15 years of age by body mass index (BMI)

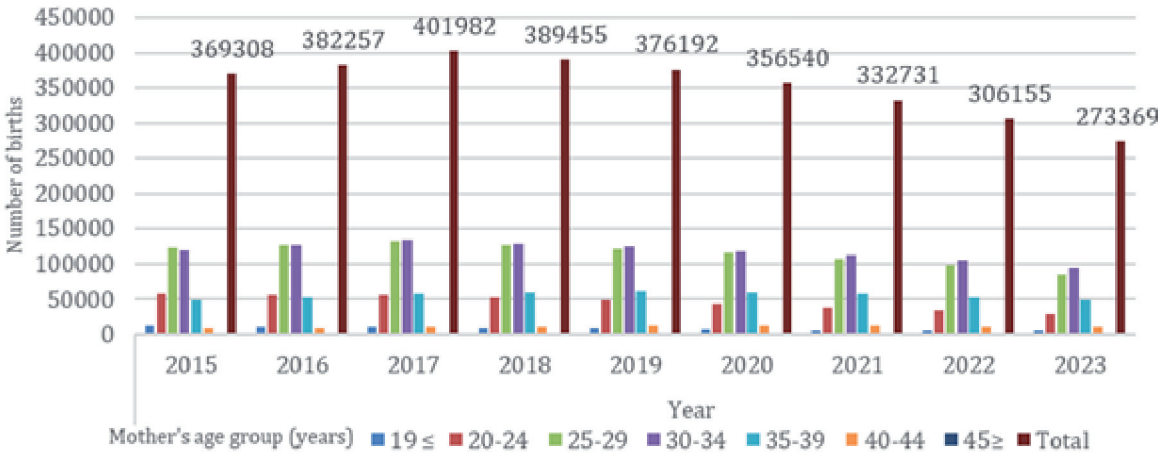


Figure 3. Births in Poland in 2015-2023. Data obtained from the Central Statistical Office [14]

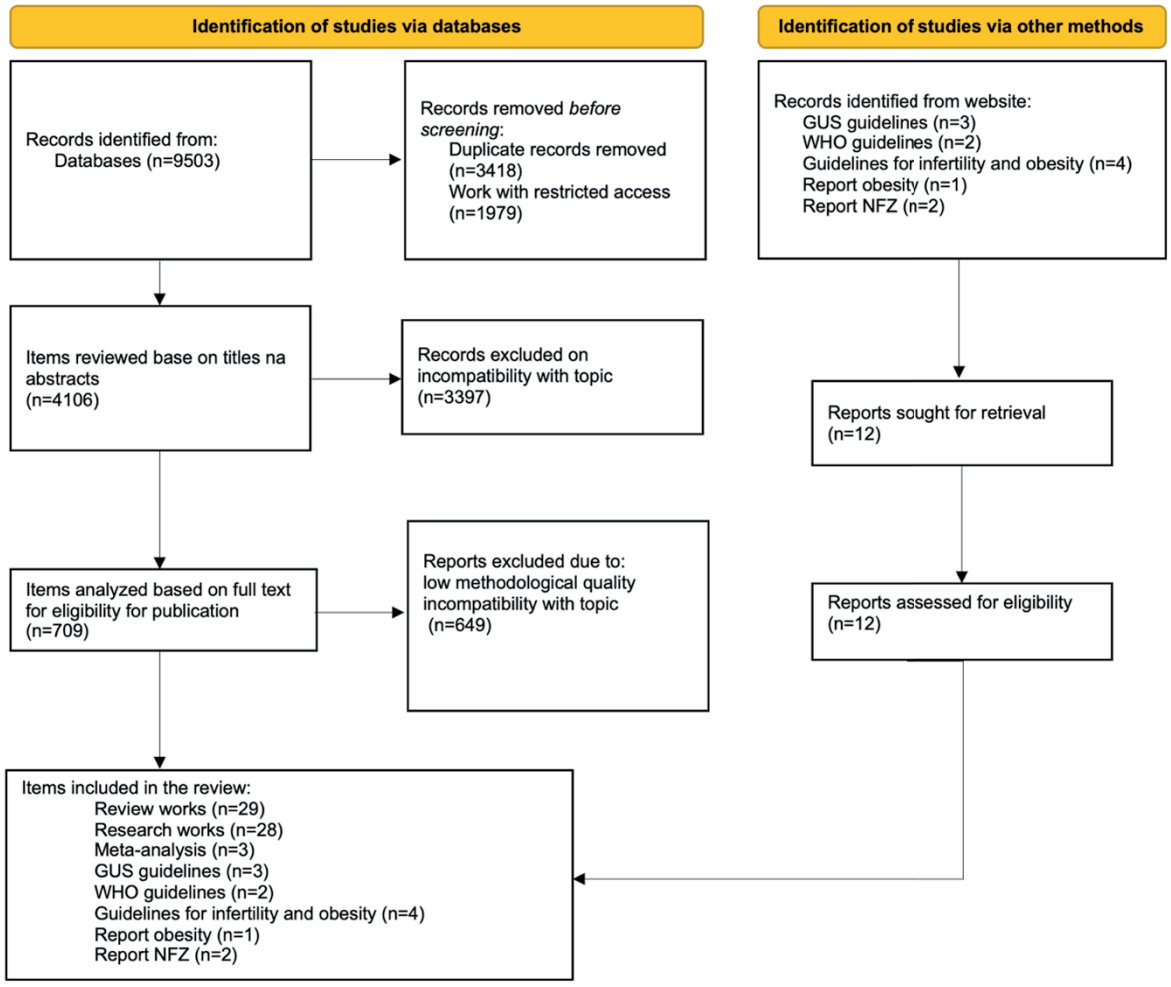


Figure 4. PRISMA 2020 flow diagram

The literature review was conducted between August 2024 and January 2025 by three independent reviewers. Studies published between 2019 and 2024 were included to ensure the most current scientific evidence. The aim of this review was to provide a comprehensive and up-to-date summary of knowledge on the impact of obesity on female infertility and to create a resource that could support practitioners in understanding the mechanisms underlying this phenomenon and the available therapeutic options.

Results

The paper discusses the results of the literature review addressing the impact of obesity on female fertility. Endocrine and metabolic mechanisms that impair oocyte quality in women with abnormal body weight are presented. Issues related to insulin resistance, hypothalamic–pituitary–ovarian axis dysfunction, the role of leptin, altered gut microbiota, and chronic inflammation – factors crucial for effective infertility management in this patient group – are also discussed. The impact of weight loss on improving fertility parameters is analyzed, and the benefits of health-promoting interventions before the initiation of infertility treatment are highlighted. In the subsequent sections, the biological mechanisms, clinical outcomes, and therapeutic interventions in the management of obesity will be discussed.

Pathophysiological mechanisms linking obesity with infertility

Despite the established association between obesity and infertility, the pathophysiological basis of this relationship remains incompletely understood [15]. A 2024 study of follicular fluid examined metabolites from major metabolic pathways, including oxidative phosphorylation, glycolysis, lipid metabolism, β–oxidation, ketogenesis, and nucleic acid synthesis. Based on metabolic profiling, infertile women were classified into two groups. The first group included women with infertility due to aging and endometriosis, and the second included women with polycystic

ovary syndrome (PCOS) and obesity. In the second group, glycolysis and lipid metabolism were downregulated as a compensatory response to mitochondrial dysfunction [16]. This demonstrates the adverse impact of these conditions on mitochondrial function and highlights the shared pathophysiological mechanisms of PCOS and obesity. This section presents the latest reports on mechanisms leading to infertility in obese women, excluding studies involving individuals with PCOS.

Insulin resistance and hyperinsulinemia

The excessive adipose tissue that occurs in obesity consists of adipocytes that do not properly fulfill their metabolic functions. This leads to macrophage recruitment and the induction of pro-inflammatory states. Adipose tissue cells release free fatty acids (FFA), the excess of which enters organs such as the liver, where it is stored ectopically and exerts a toxic effect by dysregulating hepatocyte organelles. This increases the release of reactive oxygen species and pro-inflammatory cytokines, contributing to low-grade systemic inflammation, which over time can impair insulin signaling and consequently lead to insulin resistance [17].

A study conducted in the United States showed an increased incidence of infertility in women with high triglyceride-glucose body mass index (TyG-BMI), one of the novel surrogate markers of insulin resistance [18]. Several mechanisms may explain this relationship. In a study by Weng et al., individuals with insulin resistance demonstrated a significantly lower percentage of mature oocytes and cryopreservable blastocysts per obtained embryo compared to women without insulin resistance. An increased risk of multiple follicular response to exogenous gonadotropins and ovarian hyperstimulation syndrome was also observed [19]. Other studies indicate that insulin resistance contributes to menstrual cycle disorders by altering hormone secretion and lengthening the cycle, which correlates with infertility [20]. Additionally, insulin resistance reduces the inhibitory effect of insulin on FFA release from adipose tissue. High FFA levels in plasma correlate with their levels in follicular fluid, which affects follicular growth and development [21].

Hypothalamic-pituitary-ovarian axis disorders

Obesity leads to insulin resistance and hyperandrogenism, which exacerbate immune responses and negatively affect all levels of the hypothalamic–pituitary–ovarian axis. As a result, ovarian dysfunction occurs, leading to irregular menstrual cycles and impaired ovulation [22]. Obesity in adolescent girls is associated not only with increased menstrual irregularities but also with earlier puberty and menarche onset. This relationship may be explained by the activity of hormones such as leptin, kisspeptin, and insulin, which act on the hypothalamic–pituitary–ovarian axis [23].

Kisspeptin, BMP15, and GDF9 play key roles in folliculogenesis and fertilization. A study of 90 reproductive-age women demonstrated significantly lower levels of kisspeptin and BMP15 in obese women compared to women of normal weight, suggesting that obesity may reduce the levels of these hormones and contribute to infertility [24].

Estradiol plays an important role in body weight regulation: it decreases appetite and increases satiety. Normal periovulatory estradiol levels have an anorexigenic effect, while reduced levels – such as in menopause – promote weight gain. Elevated estradiol levels, for example during pregnancy, increase the risk of obesity and gestational diabetes. Estradiol interacts with hormones such as leptin, insulin, and GLP-1, highlighting its potential importance in obesity treatment [25].

In a study by D. Khan et al. in rats, a high-fat diet induced insulin resistance and prolonged the estrous cycle by 50% compared to controls. Sixteen percent of the rats on the high-fat diet were unable to conceive, and 80% required 35 days to achieve pregnancy, compared to 35% in the control group. These animals showed higher insulin, testosterone, and progesterone levels, reduced FSH levels, and histological changes in ovaries and adrenal glands. These findings correlated with altered incretin receptor gene expression, suggesting a potential genetic mechanism linking obesity to infertility [26].

Changes in leptin and other adipokines and their effects on ovaries and oocytes. Adipose tissue dysfunction alters the profile of secreted adipokines and impairs steroidogenesis [27], leading to hyperestrogenism and hyperleptinemia. Ovarian cells and oocytes express leptin receptors, such as ObRb mRNA and protein, suggesting that leptin levels influence metabolic substrate availability necessary for oocyte development [28]. Hyperleptinemia disrupts mitochondrial dynamics and metabolism, impairing meiosis resumption and cytoplasmic maturation. In addition, ovarian leptin resistance can occur in obese women, potentially due to overexpression of mediators such as SOCS3. As a result, leptin may suppress follicular activation by influencing steroidogenesis and communication between granulosa cells and the oocyte [29].

Recent cohort studies suggest that hyperleptinemia may induce epigenetic alterations in gametes [28], potentially via mitochondrial dysfunction, altered metabolite availability, histone modification,

microRNA regulation, and DNA methylation [30]. A review by W. Zhang et al. highlights the importance of abnormal DNA methylation patterns in obese animal oocytes, although further studies are needed to clarify this mechanism [31]. Beyond impairing ovulation, obesity negatively affects endometrial development and implantation [32].

Inflammation

The influence of diet seems to be extremely important in the induction of inflammation in obesity, which has not been omitted in recent studies. A cross-sectional study of a validated dietary inflammatory index (DII) of 3071 women aged 20-44 years showed a correlation between DII and the likelihood of infertility (OR=1.71, 95% CI=1.17–2.51) [33]. In turn, in an American cross-sectional study of 940 women aged 20-45 years, no association was found between high-sensitivity CRP and self-reported infertility [34]. The same conclusions were drawn in a prospective cohort study with a group of 727 women without a history of infertility. Importantly, the same results were obtained regardless of the BMI level of the participants [35]. Interestingly, studies conducted in rhesus macaques in which diet-induced weight gain was induced did not demonstrate systemic inflammation [36]. Secondary analysis of the prospective cohort study, although it did not show a linear relationship between CRP values and cycle length, indicated a three-fold increased odds of a prolonged menstrual cycle (lasting more than 35 days) and an average 1.7-day longer follicular phase in women with CRP >10 mg/L compared to those with CRP<1 mg/L [37].

Microbiome

Obesity also affects the vaginal microbiota. Most studies indicate greater microbial diversity in obese women compared to normal-weight women, in whom Lactobacillus strains typically predominate [38]. This may be due to lower estradiol levels, reductions in SHBG, or decreased inhibin B release. The gut microbiota may also influence estrogen metabolism; bacterial β-glucuronidase activity can reduce estrogen reactivation, lowering circulating estrogen and altering the vaginal microbiota [39]. These changes may contribute to bacterial vaginosis, which is more common among obese women [40].

In a study by L. Shang et al. in mice, gut microbiota dysbiosis was linked to abnormalities in the meiotic apparatus and maternal mRNA in oocytes, as well as changes in cytosine and cytidine metabolism, impairing embryonic developmental competence [41].

The impact of obesity on the results of infertility treatment

The impact of obesity on female fertility is the subject of numerous studies, which indicate a link between excess body weight and fertility disorders. The following section presents selected research findings regarding oocyte quality, hormone levels, fertilization success, and the incidence of spontaneous abortion in obese women.

A retrospective case-control study aimed to determine the relationship between obesity and infertility included 363 infertile, obese patients. Some of the women (249) underwent weight reduction, while the remaining 114 people served as controls. A significant increase in confirmed pregnancies was observed in the group of women assisted by reproductive techniques, as well as natural conceptions in patients with interventional weight reduction. The authors attributed the beneficial effect of visceral fat reduction on improving fertility in obese women [42]. In the literature review scientists have observed that obese women have low levels of progesterone during pregnancy. It has been noted that among patients with abnormal body weight and low levels of progesterone, the frequency of miscarriages is increased, and the implantation rate during the in vitro procedure is significantly lower, compared to patients with normal body weight. Therefore, it is recommended to monitor the level of progesterone and possibly supplement it in obese women with diagnosed infertility [43]. Another equally important parameter of reproduction is the quality of oocytes, which are one of the most important features giving the potential ability to conceive offspring. It has been noted that low oocyte quality may be caused by high concentration of fats in the blood, which can affect various defects during fetal development. In the following work, a literature review was conducted to examine the effect of a high-fat diet on oocyte structure disorders in humans and animal models. Among these individuals, a smaller number of oocytes, an increased number of functional defects in mitochondria, causing oxidative stress and energy disorders in the oocyte, as well as defects in chromosomes and the karyokinetic spindle were observed [44]. Comparable results were obtained in a literature review, where it was noted that obese women have a reduced number of mature oocytes or oocytes have a reduced quality, compared to patients with normal body weight [45]. Scientists from the University of Michigan in the United States reviewed publications looking for a relationship between the impact of obesity on infertility in women. The results of the analysis revealed that an increase in the BMI of patients correlates with a decrease in the quality of oocytes, and consequently a decrease in the number of fertilized cells. It was revealed that the

etiology of the deteriorated oocyte morphology is inflammation and impaired metabolism in the follicle caused by obesity. In connection with the above, a low conception rate is also observed in obese women undergoing in vitro procedures. The literature review included a study in which an embryo from donors with a normal BMI was implanted in recipients with obesity. It showed no statistical differences in the number of embryo implantations, compared to the number of implantations in the group with a normal BMI [46].

According to the authors of the following review, ovulation disorders caused by increased body weight also have an impact on infertility in obese women. It was noted that ovulation disorders occur more often in the group with an abnormally high BMI compared to patients with a normal weight [47]. According to retrospective cohort studies, optimal BMI (21.2–25.8 kg/m^2) before ART conception reduces the risk of early pregnancy loss, while a body mass index above 25.8 kg/m^2 increases the risk by 3% for each 1-unit increase in BMI [48].

Weight reduction as a key factor in improving fertility in women with weight disorders

Other factors that cause fertility disorders include diet, amount of sleep, physical activity, obesity, and stress levels. A diet rich in plant products, moderate physical activity, and adequate sleep duration had a positive effect on fertility [49]. In turn, weight loss may be a causal treatment for obesity-induced endocrine dysfunction by reducing metabolic inflammation and normalizing steroidogenesis and adipokine secretion [27]. Therefore, it is important to select optimal treatment strategies, such as diet, exercise, surgical interventions or pharmacotherapy, which are mainly aimed at reducing body weight, as it can also increase the chances of getting pregnant [50]. The following chapters address various methods of body weight reduction, including dietary interventions, pharmacotherapy, and bariatric surgery.

Can nutritional interventions and lifestyle changes improve women's fertility?

Lifestyle modifications – including healthy eating, increased physical activity, smoking cessation, and reduced alcohol consumption – can significantly improve fertility [51]. Three-month nutritional and exercise interventions increased the number and quality of oocytes and embryos, as well as pregnancy rates in women with infertility [52]. Six-month programs improved reproductive hormone profiles, lipid metabolism, and reduced ovarian volume, improving ovulation and pregnancy outcomes [53].

A meta-analysis of four studies (123 women, BMI >25 kg/m^2, infertility diagnosis) showed that lifestyle interventions increased ovulation rates 11-fold compared to controls. Positive effects were also noted for live birth rates (OR=1.51; p=0.099) and pregnancy rates (OR=1.49; p=0.032) [54]. Regular physical activity in women contributes to an increase in the level of sex hormone binding globulin (SHBG), low values of which are associated with insulin resistance, glucose and lipid metabolism disorders [55].

Pharmacotherapy for weight loss as a tool to support fertility improvement in overweight and obese women

Current guidelines of the Polish Society for the Treatment of Obesity recommend pharmacotherapy for individuals with BMI ≥30 kg/m^2, or BMI ≥27 kg/m^2 in the presence of obesity-related comorbidities [56]. Pharmacotherapy is recommended in patients who do not achieve ≥5% weight loss after 6 months of lifestyle intervention.

Food and Drug Administration (FDA) approved 9 commercially available weight loss medications for use in two time periods. Short-term use (3 months) includes phentermine and diethylpropion. Long-term use approved: orlistat, phentermine-topiramate, bupropion-naltrexone, liraglutide, gelesis100, setmelanotide, semaglutide, and tirzepatide [57]. Drug therapy aimed at reducing body weight in overweight or obese women may have a beneficial effect on fertility, but its effects depend on many factors. GLP-1 receptors (GLP-1R) expressed within structures of the reproductive system suggest a potential role as mediators linking metabolism with reproductive function. Both preclinical and clinical studies indicate that GLP-1 agonists may modulate central as well as peripheral mechanisms regulating fertility. GLP-1RAs may exert protective effects through their anti-inflammatory properties, which are also observed within reproductive organs, thereby representing an important mechanism with the potential to improve reproductive function in patients with obesity. These substances may also beneficially modify hormonal parameters, including reducing levels of free androgens and increasing concentrations of sex hormone-binding globulin (SHBG), which provides additional benefits [58].

Studies presented in a systematic review have shown that drugs such as orlistat, metformin, dulaglutide or GLP-1 analogues (e.g. liraglutide) can support weight loss, which in turn leads to improved reproductive parameters, such as regularity of menstrual cycles, ovulation and pregnancy rates. Orlistat

has a beneficial effect on the hormonal profile of reproduction and ovulation, and compared to metformin it gives better results in terms of fertilization. GLP-1 analogues, although they are new therapeutic options available on the market, have already shown promising results in regulating the menstrual cycle with accompanying improvement in ovulation rates [59]. It is important to note, however, that a four-week period of discontinuation of GLP-1 medication is recommended before attempting to conceive [60]. There is no clear answer to the question: is the improvement in fertility solely the result of weight loss or can it be due to the direct effect of pharmacotherapy on the female reproductive system [59]. Significant value is attributed to combining different methods of weight loss in order to optimize the effects of treatment. A meta-analysis conducted by D. Ruiz-Gonzalez et al. involving 9910 women showed that the best results in BMI reduction were achieved with diet combined with weight loss drugs (mean difference [MD]: -2.61 kg/m^2; 95% CI: -3.04 to -2.19) and with a combination of physical exercise (MD: -2.35 kg/m^2; 95% CI: -2.81 to -1.89). The greatest improvement in ovulation rate was achieved by exercise combined with diet and ovulation inducers (risk ratio [RR]: 7.15; 95% CI: 1.94-26.40) or with diet supported by weight loss medications (RR: 4.80; 95% CI: 1.67-13.84). Ranking analyses showed that diet with weight loss medications was the most effective in reducing BMI (94%), and exercise with diet supported by ovulation inducers in improving ovulation (89%) [61].

The role of bariatric surgery in improving fertility in obese women

Bariatric surgery (BS) is an effective long-term weight loss treatment and has been shown to be superior to other weight reduction methods, such as diet and lifestyle interventions, which often provide only short-term results [62]. It is recommended for patients with a BMI ≥ 35 kg/m^2, and in individuals with obesity-related complications, it may be considered at a BMI of 30–34.9 kg/m^2 [63]. The results presented in reviews indicate that weight loss following BS leads to the restoration of menstrual cyclicity, improved ovulation, and a higher rate of spontaneous pregnancies, particularly in women with PCOS. Within 2.5 years after the procedure, 69% of infertile, obese women achieved pregnancy [64].

One meta-analysis evaluated the effectiveness of BS in the treatment of infertility in women. The data showed a significant reduction in menstrual irregularities in patients after the procedure (p=0.01; RR 0.22; 95% CI: 0.06–0.74) [65]. The surgery also significantly reduced infertility rates (p=0.00001; RR 0.55; 95% CI: 0.45–0.68) and the incidence of miscarriage (p=0.01; RR 0.51; 95% CI: 0.30–0.86). These effects are strongly attributed to weight loss, which helps restore ovulation and normalize menstrual cycles [66]. It has also been recognized that bariatric surgery is an effective therapeutic option for treating infertility in women of reproductive age, reducing the risk of miscarriage and improving reproductive parameters [67].

Laparoscopic sleeve gastrectomy (LSG) is considered an important bariatric method contributing to substantial weight reduction and improvements in fertility in women. Due to favorable metabolic and hormonal changes, LSG significantly increases the chances of conception. Within 12 months after surgery, 91.3% (21 patients) achieved pregnancy. A significant correlation was observed between lower BMI and the likelihood of conception (p=0.001).

The results suggest that LSG, in addition to effective control of body weight and diseases caused by excess weight, can also increase the number of pregnancies and births, through weight loss and hormone regulation in obese patients with infertility [68].

Weight loss after bariatric surgery has a positive effect on hormonal balance, while reducing insulin resistance and normalizing menstrual cycles and ovulation. This type of change increases the chances of pregnancy, especially in patients for whom other treatments have proven ineffective [69–72].

Conclusions

Infertility has recently become a global problem that affects every sixth person. Due to the growing number of infertile people, the factors influencing its occurrence have been systematized. One of them is obesity, which affects every eighth person in the world. In-depth analyses have allowed us to determine the pathomechanisms contributing to excessive body weight and to establish treatment, which has contributed to a new perspective on the problem of obesity and the introduction of the definition of obesity disease. Currently, obesity disease is treated by a multi-specialist team in a holistic manner.

Infertility remains an area of intense research, but many of the underlying mechanisms remain unclear. The impact of chronic inflammation and gut microbiota also remains unclear due to limited research in this area. Therefore, there is a need for further analysis to better understand these phenomena.

Studies have revealed the negative impact of obesity on female fertility. Increased body mass correlates with a reduced chance of conceiving naturally and with the use of assisted reproductive techniques. A high BMI level affects the deterioration of oocyte quality, a decrease in their number, an increased

number of defects in the mitochondria of reproductive cells, an increased number of chromosomal defects and spindle defects. The probable cause of the deterioration of oocyte quality is chronic inflammation of the body and impaired metabolism within this cell caused by obesity. However, weight reduction in obese patients improves fertility, which is why the treatment of obesity is essential.

Both lifestyle interventions and weight loss pharmacotherapy, especially with newer medications such as GLP-1 analogues, have the potential to improve fertility in overweight or obese women.

Limitations

The limitations of this study stem from the broad and complex nature of the topic. Therefore, the most significant and well-documented mechanisms contributing to infertility in obese women, along with therapeutic options, have been discussed. Due to the large number of available publications, the analysis focused on studies published within the last five years, while excluding research of low methodological quality or with small sample sizes to ensure the reliability of the presented conclusions.

This study is based on data from various scientific sources, including clinical trials, literature reviews, meta-analyses, and official reports and statistics published by the National Health Fund, the Central Statistical Office, and the WHO. The diversity and reliability of these sources enhances the credibility of the presented findings.

Discussion

The presented studies provide information on the possibilities of choosing the most beneficial model of therapy for infertile women struggling with excess body weight and draw attention to the essence of a comprehensive view of the discussed topic. The use of exercises in combination with a diet supported by pharmacological interventions is an effective strategy in reducing body weight, normalizing hormones in overweight or obese women and, most importantly, improving ovulation. These results suggest that a holistic approach should be the basis of treatment for women with excess body weight, and weight loss may be one of the therapies for treating infertility.

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