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## FRESH VS. VITRIFIED OOCYTES: AN ANALYSIS OF THE LIVE BIRTH RATE *in vitro* FERTILIZATION

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## INTRODUCTION

According to the 2023 report published by the World Health Organization (WHO), around 17.5% of the adult population suffers from infertility. This percentage corresponds to 1 in 6 people worldwide, showing a high global prevalence of infertility. Given this scenario, there is a need to seek solutions for the prevention, diagnosis and treatment of infertility.<sup>1</sup>

Assisted reproductive technology (ART), such as in vitro fertilization (IVF), consists of extracorporeal fertilization, with the resulting embryos being transferred to the mother's uterus. IVF's high success rates and the possibility of circumventing problems have created great expectations for many people affected by infertility.<sup>2</sup>

The success of IVF depends on the quantity and quality of the oocytes obtained through controlled ovarian stimulation procedures.<sup>2</sup> Cryopreservation of oocytes offers the possibility of extending the reproductive capacity of young women with malignant diseases in cases where treatment may compromise the ovarian reserve, as well as offering alternatives for infertile patients or those who need oocyte donation.<sup>3</sup>

The vitrification method has revolutionized the field of cryopreservation, establishing this technique as a routine procedure in many IVF laboratories. During vitrification, cells are exposed to high cooling rates and high concentrations of cryoprotectant, preventing the formation of ice crystals and thus increasing the survival rates of oocytes and embryos.<sup>4</sup>

Although there is still debate about the best way to measure the success of assisted reproduction, it is undeniable that the ability to retrieve mature oocytes, select embryos and store embryos for future use has significantly increased the chances of achieving a viable pregnancy per treatment cycle.<sup>5</sup> The literature has discussed what would be the best criteria

for reporting success in ART cycles, proposing embryo transfer that results in full-term pregnancy with live birth, either by single cycle initiated or by complete IVF treatment, including pregnancy rates from frozen embryo transfer cycles, as appropriate criteria. However, these metrics, while relevant, do not fully capture the efficiency of ART procedures. A more accurate assessment would involve reporting the number of live births, considering all oocytes collected and all embryos obtained and used (including frozen embryos) for each ART cycle.<sup>6</sup>

## OBJECTIVE

This review aims to analyze the live birth rate of data available in the literature in order to establish a comparison between the method of oocyte vitrification or the use of fresh oocytes in the success of *in vitro* fertilization.

## METHODOLOGY

This is an integrative literature review, carried out in January 2024, with the aim of analyzing published articles on the consequences of oocyte vitrification in in vitro fertilization on clinical parameters such as the live birth rate. Thus, the refinement of the literature pertinent to the preparation of the review followed the following steps:

1. Firstly, the choice of the topic "*The consequences of vitrification on the oocyte in in vitro fertilization on the live birth rate*".
2. Search for theoretical references via the Embase and PubMed digital platforms of the *National Library of Medicine*, using the descriptors "*in vitro fertilization*", "*vitrification*" and "*oocytes*" and "*live birth*" and "*female infertility*" according to the Descriptors in Health Sciences (DeCS) and Medical Subject Heading (MESH) methodologies. This search resulted in 3 and 38 articles from each platform, respectively, which were carefully selected for inclusion or exclusion. In order

of priority, the analysis began with the titles, then the abstracts, and finally the content of the texts in their entirety.

3. Inclusion criteria were: articles available in full between 2014 and 2024, scientific studies based on evidence from scientific tests and randomized clinical trials that addressed the effects of vitrification in in vitro fertilization on the live birth rate, and that described its benefits and consequences when compared to other methods such as fresh in vitro fertilization. There were no language restrictions.

4. Exclusion criteria were: duplicate articles, abstracts on the subject, articles that dealt with the use of the technique in animals, articles that used any type of supplementation during the research, studies with unfinished results and with future completion, and reviews that did not meet the other inclusion criteria.

5. After applying the selection methods, 5 articles remained, which were subjected to a thorough reading to extract the relevant information in order to prepare the study in an expository and descriptive manner, answering the guiding question formulated.

Given that this research uses secondary data sources that are publicly accessible, it is not necessary to have the approval of a Research Ethics Committee to carry out the study. However, it should be emphasized that the ethical provisions regarding structuring, references and normativity were complied with.

## RESULTS

Six studies (1 prospective (Papatheodorou A, et al.) and 4 retrospective (Cohen Y. et al; Gursu T. et al ; Crawford S. et al ; Papaleo E. et al)) were included, allowing the analysis of a total of 1,101 patients and 105,517 embryo cycles. The reason for seeking female fertility treatment reported by the study was patients with polycystic ovary syndrome (PCOS)<sup>7</sup>,

advanced reproductive age, premature ovarian insufficiency (POI) and genetic diseases<sup>8</sup>. Three studies did not specify the reason for IVF. The ovarian stimulation protocol used was the GnRh agonist method<sup>7,10 e 11</sup>, the other studies did not mention the stimulation protocol used.

The live birth rate in three selection studies was slightly lower in the vitrified oocyte group (GV) when compared to the fresh oocyte group (GF), however the percentage differences were not significant<sup>7,9 e 11</sup>. The study by Papatheodorou A, et al. showed no differences in the live birth rate between the two groups, while the work by Cohen Y. et al. showed a large drop in the rate in the group of oocytes that had been cryopreserved.

Author	Vitrified oocytes (%)	Fresh oocytes (%)
Cohen Y, et al. <sup>7</sup>	8,7	27,1
Gursu T, et al. <sup>8</sup>	55,1	59,5
Crawford S, et al. <sup>9</sup>	43	49,40
Papatheodorou A, et al. <sup>10</sup>	50,05	49,94
Papaleo E, et al. <sup>11</sup>	45,5	52,4

**Table II.** Results of the live birth rate comparing the Vitrified Oocyte and Fresh Oocyte groups.

## DISCUSSION

This study aims to show the live birth rate per fresh and vitrified oocyte. There were no differences in live birth rates between the groups.

The live birth rate was slightly lower for vitrified oocytes in three studies, but without significant percentage differences: 4.4% for Gursu T. et al. (2022), 6.4% for Crawford S. et al. (2016) and 6.9% for Papaleo E. et al. (2016), respectively. These data suggest that vitrification is a promising method, but it still faces challenges to fully match the effectiveness of fresh oocytes in obtaining live births.

On the other hand, Papatheodorou A. et al. found no differences between the groups, with only a 0.11% difference, highlighting

Author	Type of study	Study population	Sample	Stimulation protocol	No. of oocytes retrieved	No. of mature oocytes
Cohen Y. et al <sup>7</sup>	Retrospective	Patients with (PCOS)	56 patients	-	V: 1070 F: 4781	Glazed: 713 Fresh: 2,661
Gursu T, et al <sup>8</sup>	Retrospective	Patients of advanced reproductive age, with (IOP) or genetic diseases	609 patients	Agonist	-	7,515
Crawford S, et al <sup>9</sup>	Retrospective	-	105,5017 cycles	-	-	-
Papatheodorou A, et al <sup>10</sup>	Prospective	-	184 patients	Agonist	F: 1,175 V: 1,150	Fresh: 982 Glazed: 984
Papaleo E, et al <sup>11</sup>	Retrospective	-	252 patients	Agonist	F median: 11 Median V: 13	-

**Table I.** Characteristics of the studies on live birth rates after vitrification for fertility preservation included in a systematic review.

the power of the vitrified method. However, Cohen Y. et al. observed a sharp drop in the live birth rate with cryopreserved oocytes (8.7%) compared to fresh ones (27.1%). This suggests that the existence of uncontrolled factors, such as laboratory and technical issues; and/or problems in the methodology, can negatively influence the results of vitrification.<sup>12,13</sup>

The choice between fresh or vitrified oocytes in IVF should be based on the specific circumstances of each patient. Vitrification is a valuable alternative, especially for women who need to preserve their fertility before treatments that may affect ovarian reserve<sup>3</sup>, or for those who opt for elective fertility preservation<sup>14</sup>.

When looking at the results, it should be borne in mind that sample sizes, the diversity of the methods used in the TRA, medical and laboratory quality<sup>13</sup>, as well as factors such as maternal age<sup>14</sup>, are limitations of the study and may interfere with the analysis of the results.

When analyzing the timeline of ART, it is clear that vitrification techniques have improved over the last few years, resulting in higher success rates<sup>15</sup>. Despite this, it is essential that more studies are carried out in order to ascertain and improve the technique and obtain better results, as well as higher live birth rates in the fresh group, and especially in the vitrified group.

## CONCLUSION

This study reviewed the literature on the comparison between fresh and vitrified oocytes in in vitro fertilization (IVF). Oocyte vitrification represents a significant advance in fertility preservation, but the technique still needs improvement to maximize its potential. Clinical practice should consider each patient's history, balancing the individualized benefits and challenges between fresh and vitrified methods.

More research is needed to develop a more precise vitrification pattern and to identify factors that may interfere with the results. By ensuring these advances in assisted reproduction, it will be possible to achieve higher success rates and offer better treatments for patients

In summary, fresh and vitrified oocytes play a crucial role in IVF. The decision between the two should be made based on an individual analysis of each patient's needs and conditions, always seeking to achieve the best practices and results in reproductive medicine.

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