

## Research Methods: Question Prompts for Research Papers



**Paper:** Original Pilot Research  
Prospective Observational Study

Assessment of the Fertile Window in Subfertile Patients Using the P-Type Crystallization Biomarker in Liquid Endocervical Biopsy: A Prospective Study

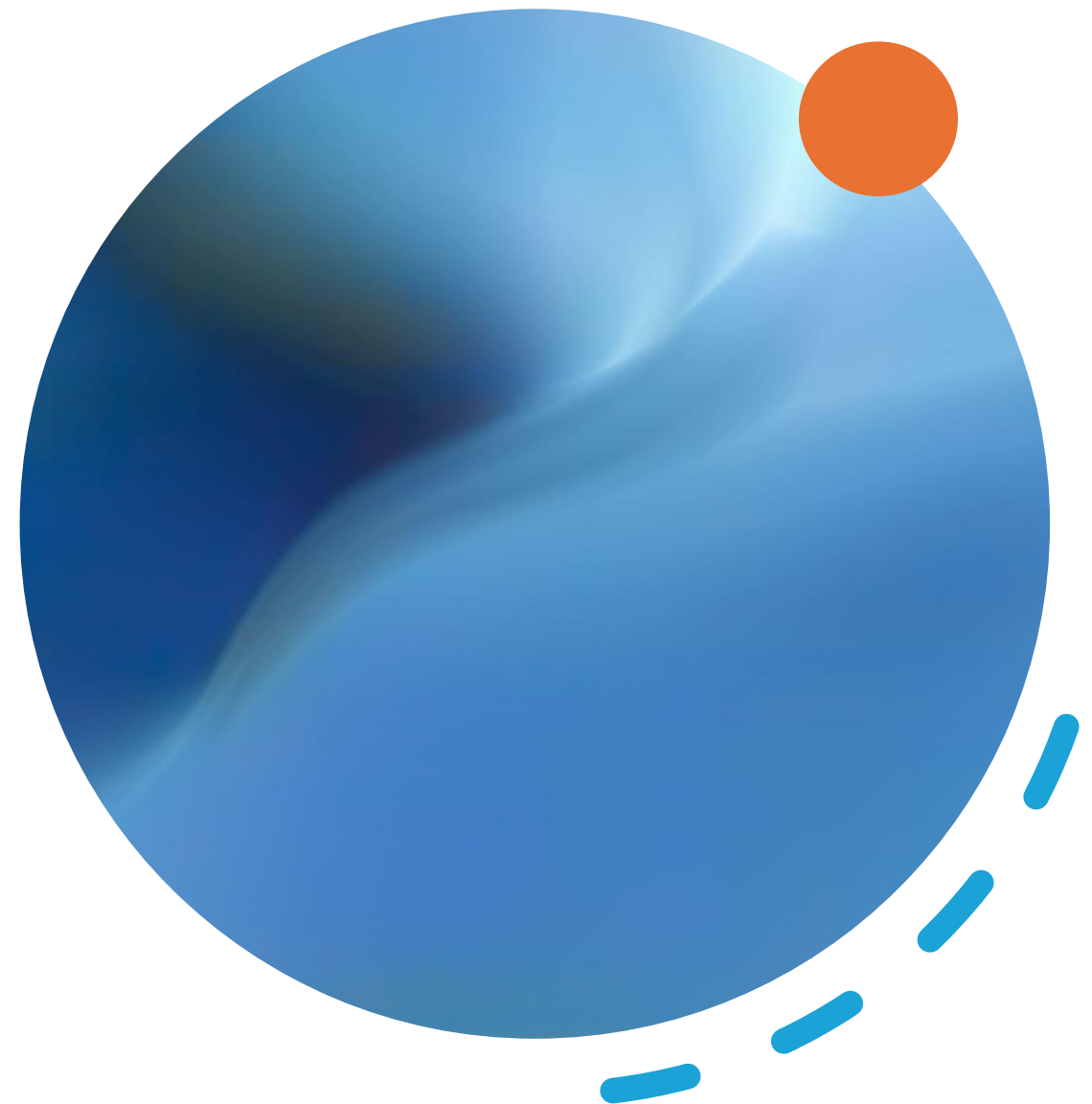
**Date: Published: 24 September 2025**

Murcia Lora JM, et al. Assessment of the fertile window in subfertile patients using the P-type crystallization biomarker in liquid endocervical biopsy: a prospective study. *Clin Exp Obstet Gynecol.* 2025;52(9):38124. doi:10.31083/CEOG38124.

What is the started research question or hypothesis?

*Could P-type crystallization prove useful in the study of patients who have difficulty conceiving?*

*Could P-type crystallization contribute to research into patients with fertility problems?*



What is the started research question or hypothesis?

Main study objective:



The working hypothesis of the study could be whether the evaluation of P-type crystallization in cervical secretions, together with the assessment of the fertile period in subfertile patients, can help detect the time of greatest fertility?

Other study objective:



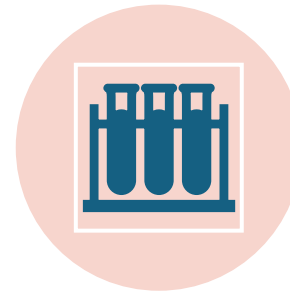
Or help patients get pregnancy?

Or provide another tool in the diagnostic arsenal to guide them through the fertile window?

## Research Methods: Question Prompts for Research Papers



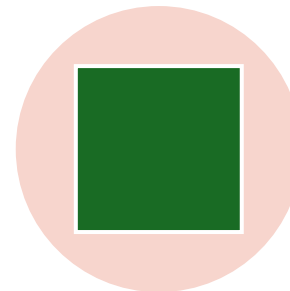
**Paper:** Assessment of the Fertile Window in Subfertile Patients (1)



P-Type Crystallization Biomarker in Liquid Endocervical Biopsy

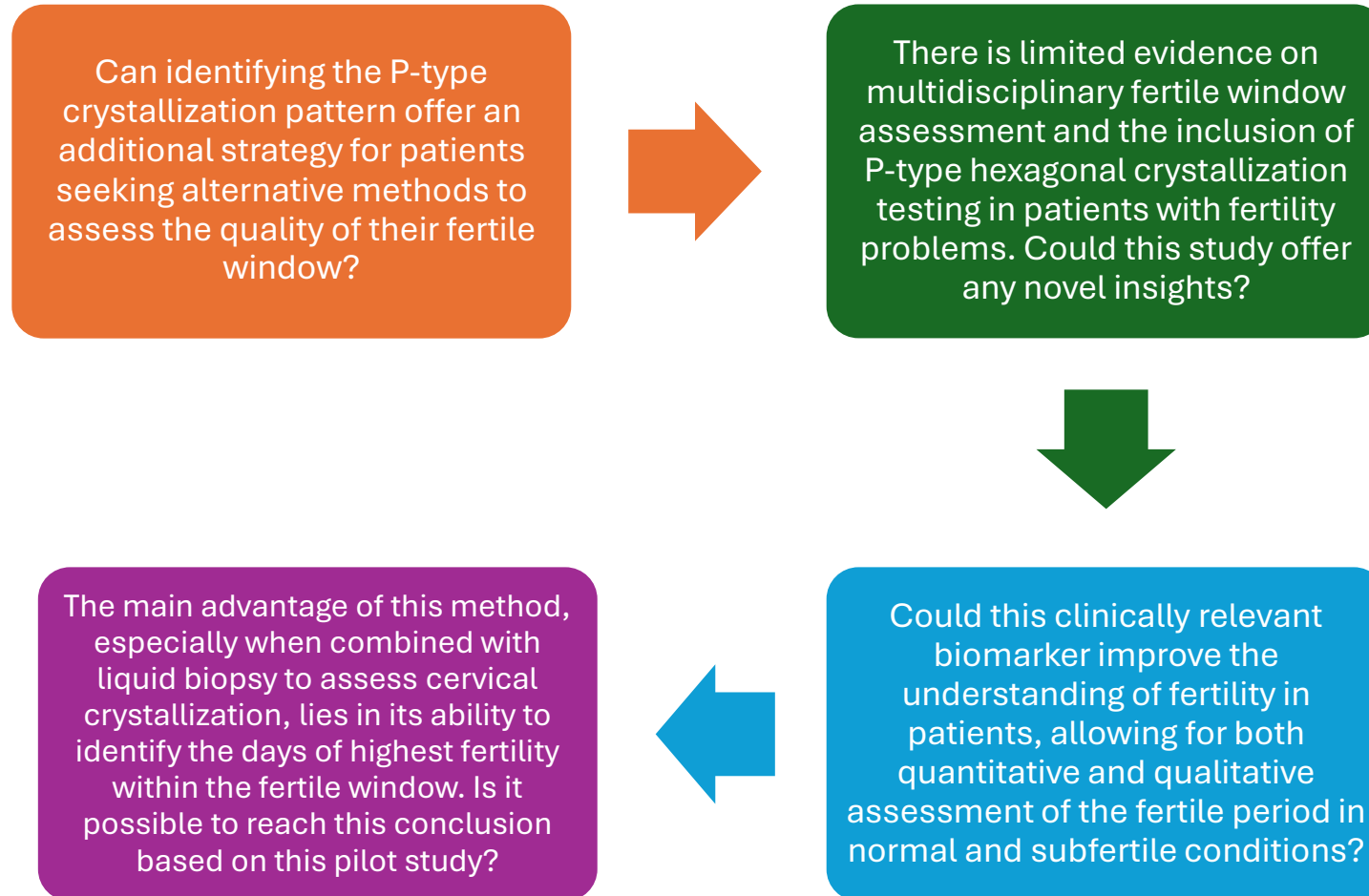


A: Prospective Study



**Artificial Intelligence (AI) of a P-Type Crystallization Biomarker Prompt in Original Pilot Study in Subfertility Patients with NaProTechnology and Reproductive Restorative Medicine (RRM) Approach: A Comparative Analysis**

In what ways is the research question or hypothesis relevant (or not) to your clinical practice or to public health?



What is the study design?



**Study  
information**

Study design

Prospective observational  
study

Primary study design

Observational

Secondary study  
design

Case series

Study type

Diagnostic

# What were the study procedures?

*Patient Eligibility and Fertile-Window Assessment*

*Patient Eligibility and Fertile-Window Assessment*

*Definition of Fertile Window*

*Assessing the Quality of Cervical Secretion by Samples Taken during the Fertile Window*

*Sampling for Endocervical Liquid Biopsy in Subfertile Patients*

*Methods for Testing and Analyzing*

*Informatic Analysis to Define Mean Outcome Measure*

*Outcome of the Study*

# Patient Eligibility and Fertile-Window Assessment

**CONCEPT:** Natural Procreative Technology (NaProTechnology) is a specific form of Restorative Reproductive Medicine (RRM) developed for couples using the Creighton Model of Fertility Care (CrMS) [1].

RRM refers to therapeutic approaches that seek to restore or support the underlying reproductive function and fertility to promote natural conception without recourse to in-vitro fertilization (IVF) or intrauterine insemination (IUI) (2).

45 Subfertile patients who had undergone a Work-up study of fertility in which the NaProTechnology and the RRM approaches were considered + Fertile Window Assessment.

Clinical history, lower genital tract examination, cervicovaginal cytology, colposcopy, and transvaginal ultrasound. The presence of tubal patency was confirmed by standard hysterosalpingography, when necessary. Follicular maturation was verified by ultrasound monitoring. Mature follicles were considered to have a mean follicular diameter  $\geq 18$  mm and partial emptying of  $>50\%$ .

1-Hilgers TW. The Medical & Surgical Practice of NaProTechnology. 1st ed. Omaha, Nebraska: Pope Paul VI Institute Press; 2004.

2- Boyle PC, de Groot T, Andralojc KM, Parnell TA. Healthy Singleton Pregnancies From Restorative Reproductive Medicine (RRM) After Failed IVF. *Frontiers in Medicine*. 2018; 5: 210. <https://doi.org/10.3389/fmed.2018.00210>.

# What were the procedures of the study?

## Table 1. Fertile window and monitoring the quality of follicular development (1)

### Table 1. Fertile window and monitoring the quality of follicular development (1)

Identification of the fertile window by using the estimated day of ovulation (EDO) considering the midpoint of the fertile window and EDO strategies.

Evaluation of the progression of cervical secretion during the fertile window, considering the elasticity and transparency of cervical secretion according to fertility awareness scales, considering the Billings Ovulation Method (BOM) and the Creighton Model of Fertility Care (CrMS).

Identification of follicular maturation by monitoring follicular development up to 18–20 mm of follicular diameter and diagnosis of follicular rupture by identifying follicular emptying.

Identification of endometrial receptivity using an endometrial line with a triple-layered endometrial pattern and a total endometrial thickness  $>6$  mm.

Identification of P-type pattern crystallization by studying endocervical secretion.

Identification of indirect signs of progesterone's action as the main chemotactic factor through a corpus luteum measuring 18–20 mm in diameter and a regularly secretory endometrium  $\geq 6$  mm.

Ovulatory checkpoints (POP) through identification of the urinary luteinizing hormone (LH) surge, luteal phase progesterone levels greater than 8 ng/mL, high-quality cervical mucus around the midpoint of the fertile window. Serum progesterone and estradiol levels to identify ovulatory quality around peak day +7.

Identification of sperm swimming potential in cervical secretion by postcoital test and sperm quality score (SQS) according to percentage of spermatozoa/mL/motile/normal forms.

1- Murcia Lora JM, Murcia Esparza M, Murcia Esparza M, Zeromski CH, Martínez Martínez O, Martínez Calvo MÁ. Assessment of the Fertile Window in Subfertile Patients Using the P-Type Crystallization Biomarker in Liquid Endocervical Biopsy: A Prospective Study. Clin Exp Obstet Gynecol. 2025;52(9):38124. <https://doi.org/10.31083/CEOG38124>

# *Definition of Fertile Window*

## *Assessing the Quality of Cervical Secretion by Samples Taken During the Fertile Window*

### *Definition of Fertile Window*

The fertile window was defined as 6 days before Peak Day (P-Day) according to CrMS. Peak (P)-Day. P-day was the last day in subfertile patients with fertile type mucus according to CrMS.

### *Assessing the Quality of Cervical Secretion by Samples Taken During the Fertile Window*

When patients experienced a wet sensation, by Billings (1) distinct from dryness or the absence of noticeable discharge, they were instructed to apply the Hilgers (2) scale, which evaluates two parameters: elasticity and transparency of cervical secretion.

Four points were assigned for cervical discharge  $\geq 2.5$  cm, and another four points for clear transparent discharge, coded as K according to CrMS. The examiner took this score into account during the examination when performing the endocervical biopsy.

1- Billings JJ. The validation of the Billings ovulation method by laboratory research and field trials. *Acta Europaea Fertilitatis*. 1991; 22: 9–15.

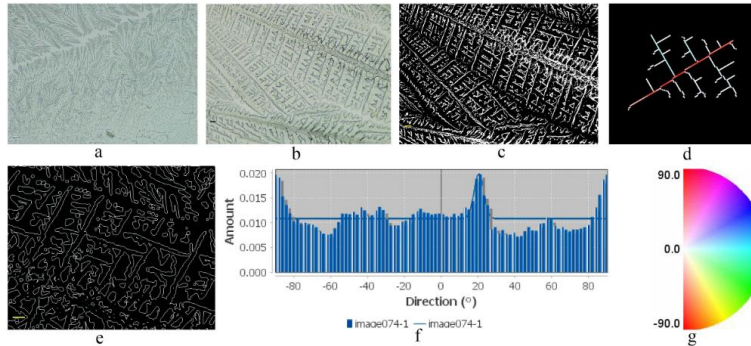
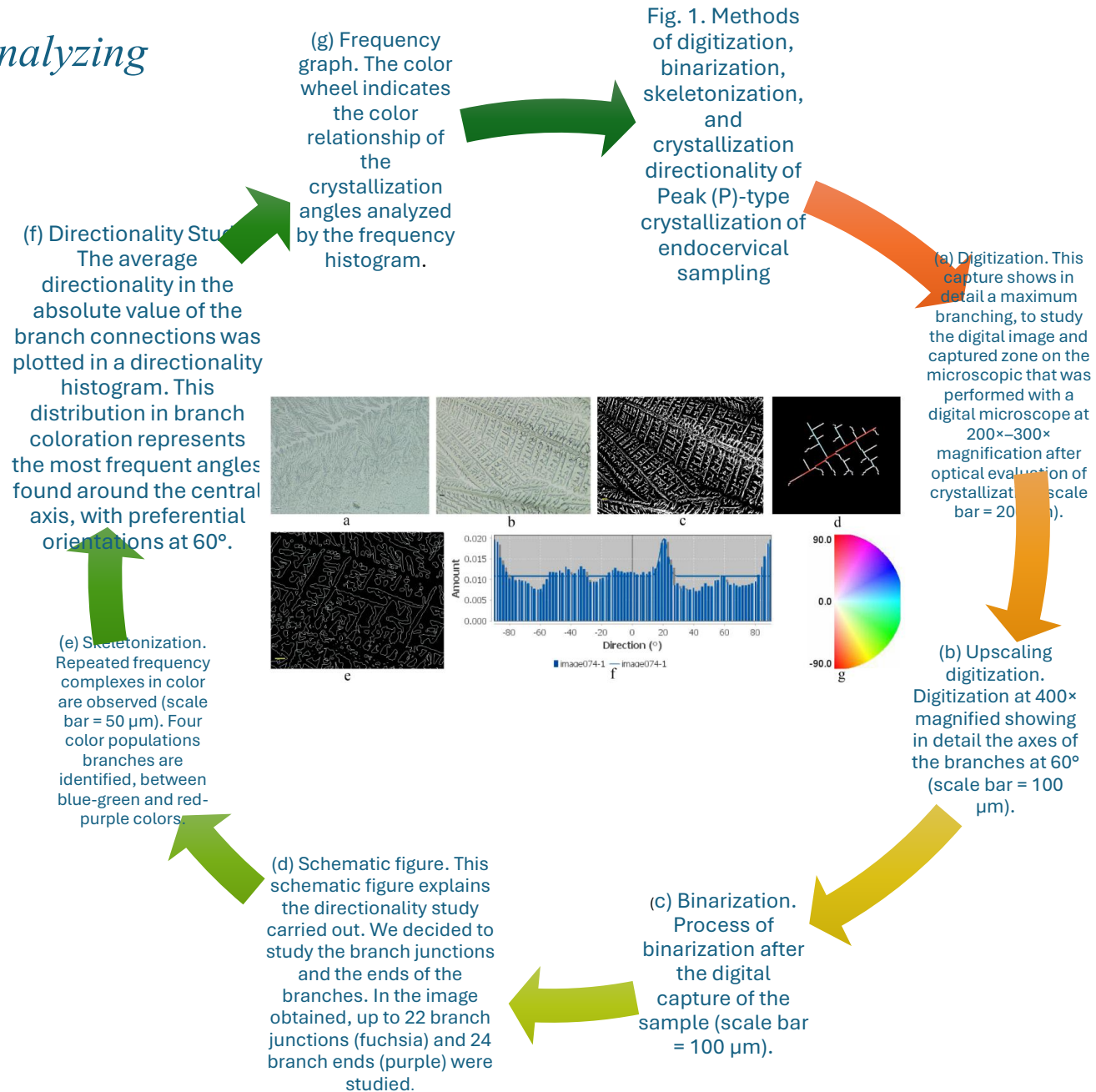
2- Hilgers TW. *The Medical & Surgical Practice of NaProTechnology*. 1st edn. Pope Paul VI Institute Press: Omaha, Nebraska, USA. 2004



## *Sampling for Endocervical Liquid Biopsy in Subfertile Patients*

The endocervical liquid biopsy was collected at the following intervals: from -3 estimated day of ovulation (EDO) until Peak (P)-Day.

# Methods for Testing and Analyzing



# Informatic Analysis to Define Mean Outcome Measure

- Fig. 1. Definition of the main outcome measure: P-type crystallization with maximum branching and tricolor pattern in the hexagonal configuration.
- (a) Digitization of the maximum branching. Digitization of maximum branching in an endocervical crystallization sample (scale bar = 200  $\mu\text{m}$ ).
- (b) Binarization. The figure corresponds to the binarization of the digital image scan (scale bar = 100  $\mu\text{m}$ ).
- (c) Frequency histogram shows the distribution of the preferred frequencies. The average directionality in the absolute value of the branch connections was then plotted in a directionality histogram.
- (d) Skeletonization and coloration of crystallization frequencies. Repeated frequency complexes are observed in detail with maximum branching. Several repeated frequency complexes as seen in the histogram, which resemble a pattern of sequential frequency peaks consistent with a hexagonal shape as seen in the study. This type of pattern is characteristic of a P-type branching (scale bar = 50  $\mu\text{m}$ ). When coloring the preferred frequencies, tricolor coloration of the frequencies of several 60° arborescence axes typical of a P-type hexagonal crystallization pattern were observed.
- (e) Color disc corresponds to the frequency angles on the chromatic disk to indicate the color relationship of the crystallization angles.

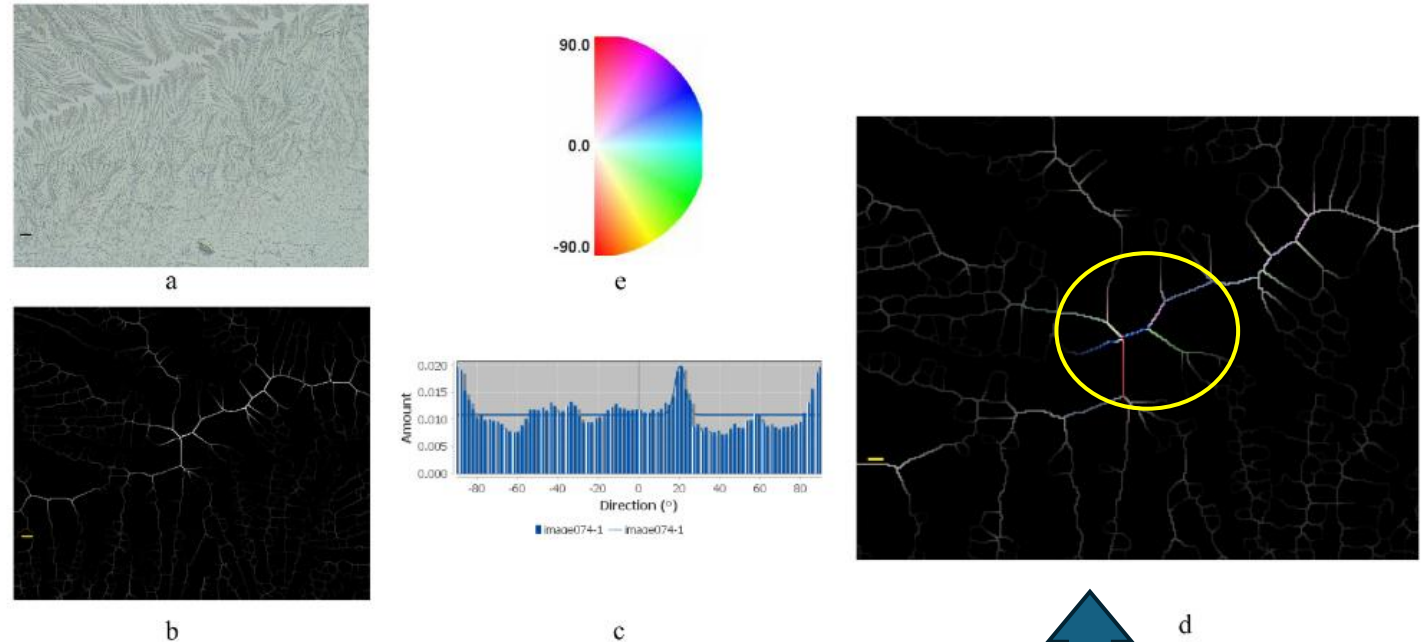
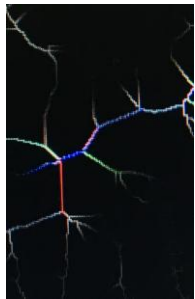
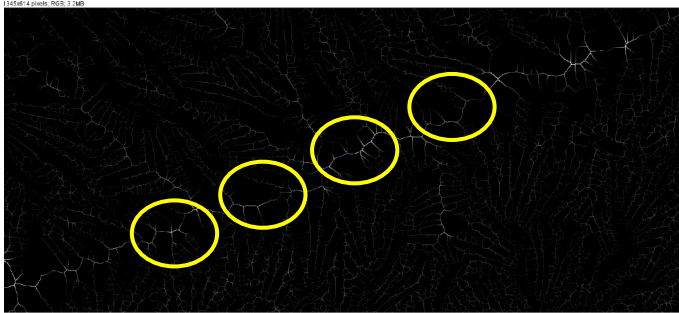


Fig 1. Definition of the main outcome measure: P-type crystallization with maximum branching and tricolor pattern in the hexagonal configuration.



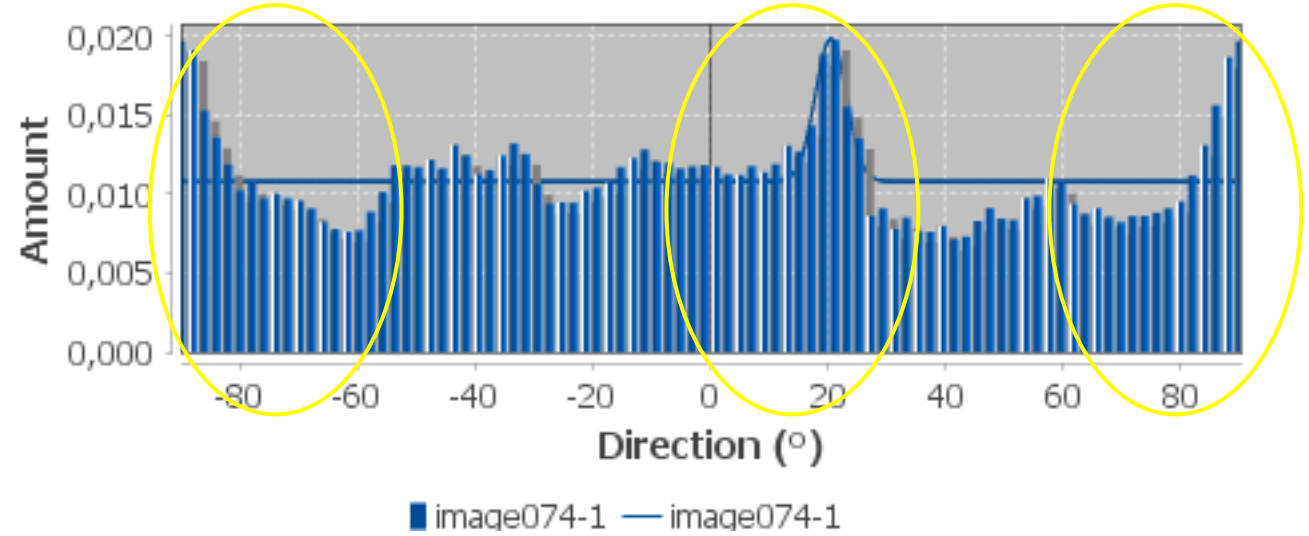


Digitization of maximum branching crystallization samples from an endocervical sample



Characteristic pattern of hexagonal branching in endocervical secretion that suggests the branching pattern of a Peak (P) type sample.


## Directionality histograms



Symmetrical populations with a preferential orientation are observed, repeating with several peaks of maximum frequency, demonstrating symmetry in the repetitive arborization. When the preferential frequencies are colored, a mixture of colors is observed corresponding to a 60° angle in the histogram.

# Assessment of the Fertile Window in Subfertile Patients Using the P-Type Crystallization Biomarker in Liquid Endocervical Biopsy: A Prospective Study

## OUTCOME OF STUDY



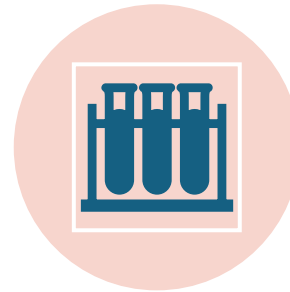
Primary outcome measure	Hexagonal crystallization pattern type P, measured using endocervical liquid biopsies collected within the fertile window from 3 days before the Peak Day (P Day) until P Day, which is the last day with fertile mucus according to The Creighton Model Fertility Care System (CrMS).
Secondary outcome measures	The final pregnancy outcome is determined by recording a positive urine of human chorionic gonadotropin (HCG) pregnancy in the patient's medical history, or by confirmation by the patient that she has become pregnant.

ISRCTN18705969; registration link: <https://www.isrctn.com/ISRCTN18705969>).

## Research Methods: Question Prompts for Research Papers



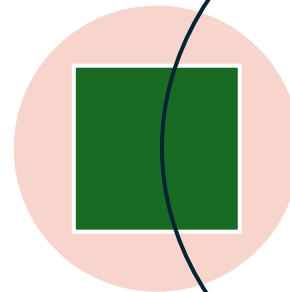
**Paper:** Assessment of the Fertile Window in Subfertile Patients



P-Type Crystallization Biomarker in Liquid Endocervical Biopsy



A: Prospective Study



**Artificial Intelligence (AI) of a P-Type Crystallization Biomarker Prompt in Original Pilot Study in Subfertility Patients with NaProTechnology and Reproductive Restorative Medicine (RRM) Approach: A Comparative Analysis**

**Date: Published: 24 September 2025**



# Research Article: Comparative Analysis of AI-Assisted ChatGPT Results from an Original Pilot Study in Subfertile Patients with a Restorative Reproductive Medicine Approach

**Introduction:** Generative artificial intelligence (AI) is a powerful tool; however, it requires expert input to reliably interpret scientific research in complex fields. To date, no studies in Restorative Reproductive Medicine (RRM) have evaluated critical analyses performed by AI.

**Materials and Methods:** A critical analysis was conducted of the assessment generated by Google's AI in October 2025. The analysis focused on the 30 October version of ChatGPT (Extended Language Model) in relation to the original research of the prospective pilot study entitled: "Assessment of the fertile period in patients with subfertility using the P-type crystallization biomarker in liquid endocervical biopsy". Some key questions were introduced according to RRM approach. The AI's interpretation was then evaluated as either correct or incorrect based on the scientific article and available information on the topic.

**Results:** The AI correctly interpreted 28/45 (62.2%) of the results. Generative AI incorrectly interpreted 17/45 (37,7%) of the items. The results are broken down into seven sections. The differences and explanations are presented and corrected through strategic, critical and ethical analysis, based on human scientific analysis.

**Conclusion:** This study demonstrates that AI analysis, guided by a methodological tracking strategy, can effectively evaluate and organize critical insights regarding the prompt of the analysis. While the evaluation currently performed by AI in this context is useful, it should be reviewed by qualified scientific personnel to avoid errors.

In conclusion, the optimal approach lies in integrating rigorous scientific and ethical evaluation with the organizational efficiency offered by AI-assisted critical analysis. This hybrid model builds on the strengths of human experience and artificial intelligence while overcoming the limitations of AI.

**Keywords:** Fertile Window; Generative Artificial Intelligence ChatGPT; NaProTechnology; Restorative Reproductive Medicine (RRM); Subfertility; P-Type Crystallization

**Citation:** Murcia Lora José María., et al. "Comparative Analysis of AI-Assisted ChatGPT Results from an Original Pilot Study in Subfertile Patients with a Restorative Reproductive Medicine Approach". *EC Gynaecology* 15.4 (2026): 01-15.

# PROMT: “Assessment of the fertile period in patients with subfertility using the P-type crystallization biomarker in liquid endocervical biopsy”

How was the study conducted?

**Table 1.**  
**Statements about**  
**the Prompt was**  
**conducted in the**  
**study: Correct vs.**  
**Incorrect**  
**Statements**

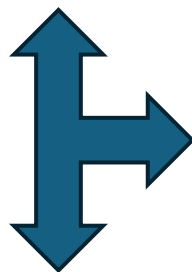
Correct Statements	Incorrect Statements
<p>“The study involved 45 subfertile patients, with 18 completing the full assessment based on Natural Procreative Technology (NaProTechnology) and Restorative Reproductive Medicine (RRM) principles”.</p> <p>“Cervical mucus samples were analyzed for the presence of a specific, estrogen-dependent P-type crystallization pattern, which has maximal branching and a hexagonal configuration”.</p>	<p>“The study, registered under ISRCTN18705969, sought to establish a reliable test for assessing cervical mucus quality”:</p> <p><b>Clarification:</b> This interpretation is incorrect. The assessment of cervical mucus quality was based on observation of patients’ secretions, incorporating some elements of the Billings Method and the Creighton Model of Fertility Care (CrMS), which are used to indicate fertile secretions. The classification and observation were made at the time of the endocervical examination.</p>
<p>“Researchers collected liquid endocervical biopsies during the fertile window, defined as the period from three days before the estimated day of ovulation (EDO) until the “Peak day,” which is the last day of fertile-quality mucus”.</p>	<p>“Researchers assessed the fertile window by taking liquid biopsies from the endocervix”.</p> <p><b>Clarification:</b> The statement is incorrect. This is because, although the biopsy was used to obtain cervical mucus samples for crystallization analysis, it was not used to assess the fertile window.</p>
<p>“The study also assessed pregnancy outcomes for a subgroup of six patients with positive P-type crystallization results”.</p>	

**Table 1:** AI-assisted analysis of the ChatGPT prompt: Assessment of the fertile window in patients with subfertility using the P-type crystallization biomarker in liquid endocervical biopsy: a prospective study, with a summary of how the study was conducted: Correct vs. incorrect statements.

**Citation:** Murcia Lora José María, *et al.* “Comparative Analysis of AI-Assisted ChatGPT Results from an Original Pilot Study in Subfertile Patients with a Restorative Reproductive Medicine Approach”. *EC Gynaecology* 15.4 (2026): 01-15.

Artificial intelligence (AI)  
analysis in the original pilot  
study in subfertility  
patients focused with  
NaProTechnology and the  
restorative reproductive  
medicine (RRM) approach:  
a comparative analysis.

# Table 2. Analysis of the claims about the design and methodology of the study based on Prompt: correct versus incorrect claims.



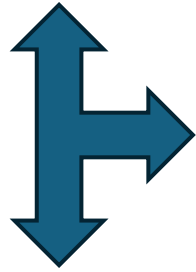
Artificial intelligence (AI) analysis in the original pilot study in subfertility patients focused with NaProTechnology and the restorative reproductive medicine (RRM) approach: a comparative analysis.

Correct Statements	Incorrect Statements
<p><b>“How it works:</b> The study involved collecting samples of cervical mucus to look for a specific P-type crystallization pattern. Computer analysis and expert review were used to identify and confirm the pattern in the mucus samples. This pattern is characterized by maximal branching and a tricolor hexagonal arrangement, as seen in the study”.</p>	<p><b>“Pattern:</b> P-type crystallization has a unique hexagonal configuration with maximal branching and a tricolor pattern, which appears during the most fertile days of the menstrual cycle”.</p> <p><b>Clarification:</b> The tricolor unique pattern is incorrect.</p>
	<p><b>“Sample collection:</b> The study collected samples through a non-invasive liquid endocervical biopsy, which involves obtaining a sample of cervical fluid”.</p> <p><b>Clarification:</b> A biopsy is, by definition, an invasive procedure, not non-invasive.</p>
<p><b>“Fertile period:</b> The study identified the most fertile window as the period from three days before the estimated day of ovulation (EDO) until the peak-day (P-Day)”.</p>	<p><b>“Fertile window identification:</b> The most fertile days were identified as occurring between three days before the estimated day of ovulation (EDO) and the day of peak P-type crystallization”.</p> <p><b>Clarification:</b> The study identified the fertile window as ending on the peak-day (P-Day), not the day of peak P-type crystallization.</p>
<p><b>“Success rate:</b> In a subgroup of patients, 83% of those with a positive P-type crystallization result achieved a live-birth pregnancy. This highly positive result is limited to the subgroup that could be analyzed due to multiple factors that prevented a larger follow-up sample from being obtained. This information requires further elucidation, which the AI algorithm will provide subsequently.”</p> <p><b>Clarification.</b> The statement is correct, but the algorithm did not provide any explanation for this throughout the study.</p>	<p><b>“Analysis:</b> The samples were analyzed to identify P-type crystallization, a hexagonal pattern in the cervical mucus that indicates peak fertility”.</p> <p><b>Clarification:</b> While P-type crystallization is a key biomarker, peak fertility is identified through a combination of biomarkers, not just this one pattern in isolation.</p>
<p><b>“Approach:</b> Researchers used the Restorative Reproductive Medicine (RRM) and NaProTechnology approaches, which rely on monitoring and evaluating biomarkers of reproductive function to identify the underlying cause of subfertility”.</p>	<p><b>“Correlation:</b> Results were compared against the Creighton Model System (CrMS) of cervical mucus observation, a standard method for identifying the fertile window”.</p> <p><b>Clarification:</b> The study did not specify a comparison against CrMS as described here. The CrMS model was used to extract two variables for study in combination with the Billings method.</p>
<p><b>“Follow-up:</b> Pregnancy outcomes were assessed in a randomly selected subgroup of patient”.</p>	<p><b>“Potential:</b> This method is presented as a simple, affordable, and reliable tool that, when combined with other tests, could improve the accuracy of fertility assessments for subfertile women”.</p> <p><b>Clarification:</b> The method, involving a specialized biopsy and analysis, is not necessarily “simple and affordable”.</p>
<p><b>“Accuracy:</b> The method demonstrated 100% sensitivity and 100% specificity, with no false positives or false negatives observed. However, it does not provide a detailed description of the specific interpretation to which it refers. This can sometimes result in misinterpretations. As it takes the intended outcome of statistical analysis out of context”.</p>	

Table 2: AI-assisted analysis of ChatGPT about the prompt: Assessment of the fertile window in patients with subfertility using the P-type crystallization biomarker in liquid endocervical biopsy: a prospective study and a comparative Analysis of study design and study

methodology statements: Correct vs. incorrect.

# Table 3. Correct versus incorrect statements about the study results according to the Prompt question



Artificial intelligence (AI) analysis in the original pilot study in subfertility patients focused with NaProTechnology and the restorative reproductive medicine (RRM) approach: a comparative analysis.

Correct Statements	Incorrect Statements
<p><b>“Positive pregnancy outcomes:</b> In a small subgroup of six patients who showed the P-type pattern, 83% (5 out of 6) achieved a live-birth pregnancy. This is a prudent statement that is consistent with the study results”.</p>	<p><b>“Accurate identification of fertile window:</b> The P-type crystallization biomarker, observed in the liquid endocervical biopsy, accurately identified the most fertile days for all participant”.</p> <p><b>Clarification:</b> The phrase “ accurately identified the most fertile days for all participants” is an overgeneralization. The optimal fertile window was identified between three days before the estimated day of ovulation (EDO) and the day of peak fertility (P-Day).</p>
<p><b>“High pregnancy rate:</b> In the subgroup assessed for outcomes, 83% of patients (5 out of 6) with positive P-type crystallization results achieved a live-birth pregnancy”.</p> <p><b>Clarification:</b> Labeling the outcome as a “High pregnancy rate” is a strong interpretation. Given the very small sample size (n=6), this is a significant outcome within that specific group but is not necessarily indicative of a high success rate for all patients.</p>	<p><b>“High accuracy:</b> The P-type crystallization biomarker showed a 100% sensitivity and 100% specificity for detecting the fertile window in the selected patient group. The type P-Type crystallization biomarker showed 100% sensitivity and 100% specificity for detecting the fertile window in the selected group of patients”.</p> <p><b>Clarification:</b> Although the study achieved 100% sensitivity and specificity in its analysis, this cannot be generalized. A result of 100% on a small sample size does not guarantee the same outcome in a larger, more diverse population, and it is statistically less robust. Biomarkers do not detect fertile windows. The biomarker is inside the fertile window.</p>
	<p><b>“Fertile window prediction:</b> The P-type crystallization pattern was observed in all participants and accurately pinpointed the fertile window, which was identified as the period from three days before the estimated day of ovulation (EDO) until the peak day (P-Day)”.</p> <p><b>Clarification:</b> The first sentence is correct, but the second is not. P-type crystallization occurs within the fertile window, which could coincide with the day of peak fertility. This is what can be concluded from the study.</p>

*Table 3: AI-assisted analysis of ChatGPT about the prompt: Assessment of the fertile window in patients with subfertility using the P-type crystallization biomarker in liquid endocervical biopsy: a prospective study: A Comparative results statements: Correct vs. incorrect regarding the study's results.*

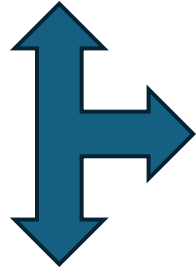
**Table 4.  
Interpretation of  
the Study:  
Correct vs.  
Incorrect  
statements of  
the Promt**

**Artificial intelligence (AI) analysis in the original pilot study in subfertility patients focused with NaProTechnology and the restorative reproductive medicine (RRM) approach: a comparative analysis.**

Correct Statements	Incorrect Statements
<p><b>“Potential as a diagnostic aid:</b> The method offers a quantitative and qualitative assessment of fertility that can enhance the diagnostic process in subfertile patients, particularly those using Restorative Reproductive Medicine (RRM) and NaProTechnology”.</p>	<p>“Research published in 2025 in the Clinical and Experimental Obstetrics and Gynecology journal assessed the fertile window in subfertile women using P-type crystallization of liquid endocervical biopsies, finding it to be a reliable and simple method”.</p> <p><b>Clarification:</b> The procedure itself is not straightforward, meaning the general statement overestimates the scope of the study.</p>
<p><b>“Limitations and next steps:</b> While the results are promising, this was a pilot study. The subgroup for pregnancy outcomes was small (6 patients), and further research with a larger sample size is needed to confirm the high success rate seen in this initial cohort”.</p> <p><b>“Benefits for patients:</b> By precisely identifying the most fertile days, this approach could help couples time intercourse more effectively, potentially improving their chances of conception. The liquid biopsy also represents a less invasive option than other fertility diagnostic procedures”.</p>	<p><b>“Findings:</b> The P-type pattern, characterized by maximal branching and a tricolor hexagonal configuration, was observed on fertile days and correctly identified fertile periods with 100% sensitivity and specificity. Patients with a positive P-type crystallization result achieved live-birth pregnancy in 83% of cases”.</p> <p><b>Clarification:</b> The P-type pattern falls within the fertile window analyzed, which invalidates the first part of the statement, and the second part relating to pregnancy requires context, as it is based on a small subset of the study and cannot be generalized in this way.</p>

*Table 4: AI-assisted analysis of ChatGPT about the prompt: Assessment of the fertile window in patients with subfertility using the P-type crystallization biomarker in liquid endocervical biopsy: a prospective study: A comparative analysis of the study interpretation: Correct vs. incorrect statements.*

## Table 5. Key Findings: Correct vs. Incorrect statements of the Prompt



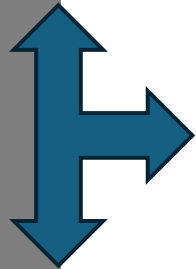
Artificial intelligence (AI) analysis in the original pilot study in subfertility patients focused with NaProTechnology and the restorative reproductive medicine (RRM) approach: a comparative analysis.

Correct Statements	Incorrect Statements
<p><b>“Potential for treatment:</b> The findings suggest that focusing on the P-type pattern, high-quality cervical secretion, and accurate timing could significantly increase the chances of pregnancy for subfertile patients”.</p>	<p><b>“Advantageous for subfertile patients:</b> The study highlighted that this biomarker and technique offer an additional tool for subfertile patients seeking non-invasive methods to better understand their fertility. The study combines a non-invasive technique, consisting of digital observation of cervical secretion, with an invasive endocervical test”.</p> <p><b>Clarification:</b> The AI’s interpretation is flawed because it incorrectly labels endocervical biopsy as non-invasive, leading to a misleadingly positive assessment of the technique’s advantages. A biopsy is an invasive procedure. However, the rest of the argument is correct.</p>
<p><b>“Enhanced fertility assessment:</b> The study highlights the potential of combining cervical secretion crystallization analysis with traditional fertility observations to improve fertile window diagnosis. This is a statement that must be verified in the future with studies involving a larger number of patients”.</p> <p><b>Clarification:</b> The statement is prudent as it acknowledges the need for future research, which is a standard scientific practice, making it a cautious and correct conclusion based on the study’s scope.</p>	

*Table 5: AI-assisted analysis of ChatGPT about the prompt: Assessment of the fertile window in patients with subfertility using the P-type crystallization biomarker in liquid endocervical biopsy: a prospective study and a comparative analysis of key findings: Correct vs. incorrect statements.*

*Citation:* Murcia Lora José María., et al. “Comparative Analysis of AI-Assisted ChatGPT Results from an Original Pilot Study in Subfertile Patients with a Restorative Reproductive Medicine Approach”. *EC Gynaecology* 15.4 (2026): 01-15.

**Table 6.  
Future  
Outlook:  
Correct vs.  
Incorrect  
statements of  
the Prompt**



**Artificial Intelligence (AI) of a P-Type  
Crystallization Biomarker Prompt in  
Original Pilot Study in Subfertility  
Patients with NaProTechnology and  
Reproductive Restorative Medicine  
(RRM) Approach: A Comparative  
Analysis**

Correct Statements	Incorrect Statements
<p><b>“Potential as a diagnostic aid:</b> The method offers a quantitative and qualitative assessment of fertility that can enhance the diagnostic process in subfertile patients, particularly those using Restorative Reproductive Medicine (RRM) and NaProTechnology”.</p>	<p>“This study provides evidence that P-type crystallization in a liquid endocervical biopsy is a reliable biomarker for identifying the fertile window in subfertile women”.</p> <p><b>Clarification:</b> While the pattern is a significant biomarker to be inside the most fertile days, it does not constitute a recommendation accepted by the scientific community in isolation to identify the entire fertile window. The evaluation must combine multiple observations, as the study itself indicates, and not rely solely on crystallization.</p>
<p><b>“Benefits for patients:</b> By precisely identifying the most fertile days, this approach could help couples time intercourse more effectively, potentially improving their chances of conception. The liquid biopsy also represents a less invasive option than other fertility diagnostic procedures”.</p> <p><b>“Limitations and next steps:</b> While the results are promising, this was a pilot study. The subgroup for pregnancy outcomes was small (6 patients), and further research with a larger sample size is needed to confirm the high success rate seen in this initial cohort”.</p>	

*Table 6: AI-assisted analysis of ChatGPT about the prompt: Assessment of the fertile window in patients with subfertility using the P-type crystallization biomarker in liquid endocervical biopsy: a prospective study, a comparative analysis of outlook: Correct vs. incorrect statements.*

*Citation:* Murcia Lora José María., et al. “Comparative Analysis of AI-Assisted ChatGPT Results from an Original Pilot Study in Subfertile Patients with a Restorative Reproductive Medicine Approach”. *EC Gynaecology* 15.4 (2026): 01-15.

## Correct statements

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**A new fertility assessment tool:** The P-type crystallization analysis offers an additional objective, quantifiable, and qualitative biomarker for assessing the quality of the fertile window.

**Evidence for biophysical properties:** The findings provide further evidence in support of the biophysical properties of cervical mucus as a reliable indicator of hormonal changes and fertile status.

**Enhanced fertility awareness:** The method allows for a more accurate identification of peak fertility days, improving the timing of intercourse or other interventions.

**Supports non-IVF approaches:** It provides a valuable strategy for patients seeking alternatives to in vitro fertilization (IVF) or intrauterine insemination (IUI).

**Potential as a new tool:** This technique has the potential to provide a new, objective tool for the assessment of cervical mucus quality and the identification of peak fertility. This could assist subfertile couples in better timing intercourse.

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## 7- Study Implications for subfertile patients. Correct statements of the Prompt

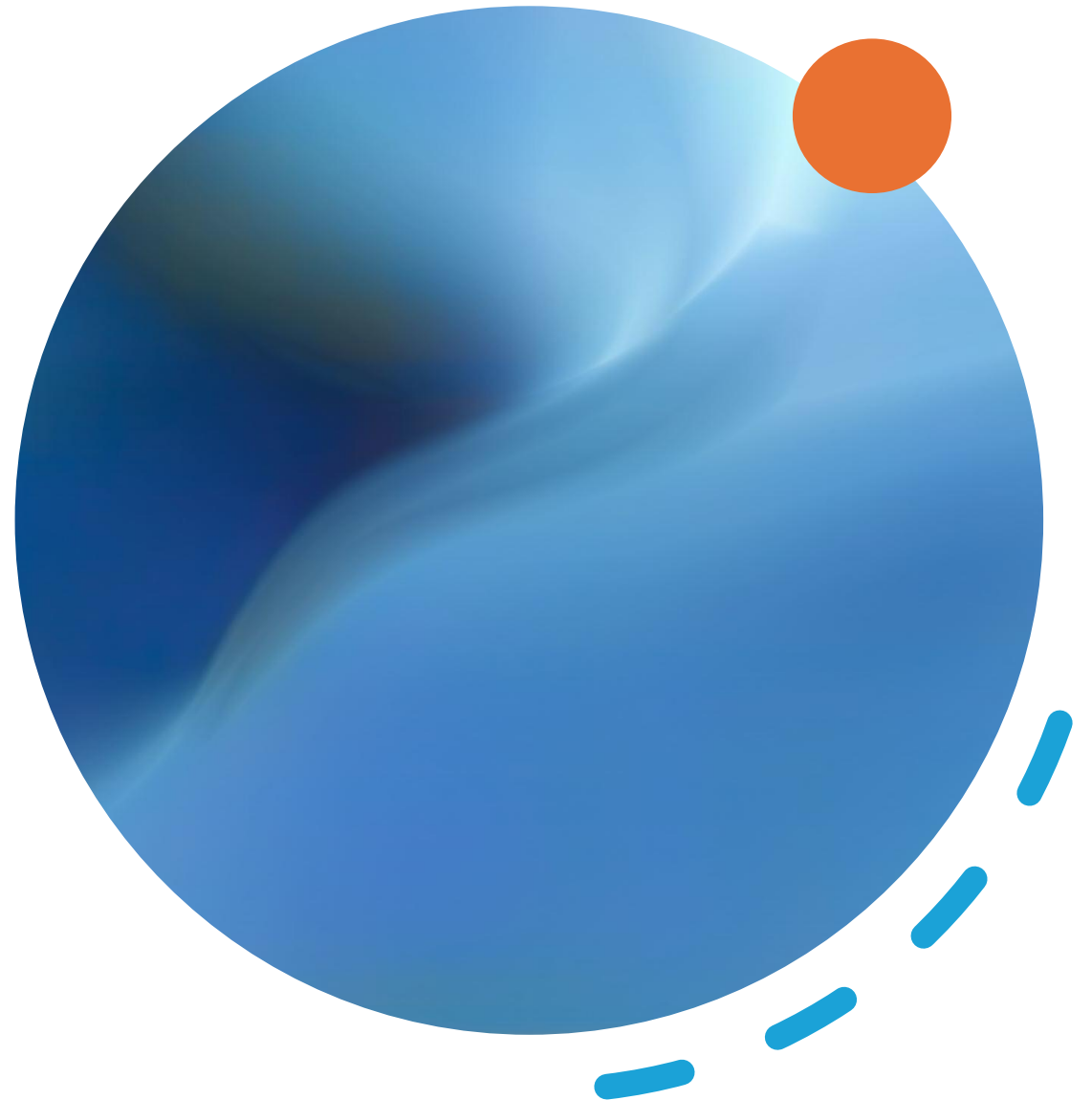


**Artificial Intelligence (AI) of a P-Type Crystallization Biomarker Prompt in Original Pilot Study in Subfertility Patients with NaProTechnology and Reproductive Restorative Medicine (RRM) Approach: A Comparative Analysis**

What is the answer to the research question or hypothesis?

*Could P-type crystallization prove useful in the study of patients who have difficulty conceiving?*

*Could P-type crystallization contribute to research into patients with fertility problems?*



## Why might we think that identifying the presence of type P cervical mucus could help patients conceive?

- P-type cervical mucus serves several important functions in the upper part of the cervix. It facilitates the rapid transport of sperm through the cervix to the uterus and fallopian tubes for fertilization of the egg. In this process, P-type secretion contains a liquefaction factor that facilitates transport.
- This factor combines with other Loaf “L”- and “S” -type secretions and enzymes to produce a liquefying effect. This dissolves the thicker strands of mucus, allowing sperm stored in the crypts to be released and continuing their journey quickly toward the egg.
- For this reason, we know that vulvar lubrication during the fertile window, which women perceive and which is included among the indicators of the fertile period, along with other parameters (according to some fertility awareness methods), helps to identify the days of highest fertility. Consequently, the presence of P-type cervical mucus crystallization, characterized by a hexagonal pattern with maximum branching, indicates peak estrogen levels in the body, which correlates with higher levels of fertility in P-type cervical mucus.
- Furthermore, it plays an important role in sperm selection: while Loaf "L"- and "S"-type cervical mucus act as a filter and guide for sperm, P-type cervical mucus is crucial in ensuring that only the most viable and motile sperm reach the egg, facilitating their rapid ascent at the optimal time. These characteristics and properties of P-type cervical mucus make it relevant and warrant further investigation of this concept, as has been done in this study. Therefore, based on the findings of this pilot study, it is reasonable to suggest that efforts to evaluate P-type cervical mucus crystallization could help patients conceive.



Finally, can we believe that identifying the presence of type P cervical mucus could help patients conceive?

**D** P-type cervical mucus serves several important functions in the upper part of the cervix. It facilitates the rapid transport of sperm through the cervix to the uterus and fallopian tubes for fertilization of the egg. In this process, P-type secretion contains a liquefaction factor that facilitates transport.

**E** Therefore, based on the findings of this pilot study, it is reasonable to state that efforts to assess the crystallization of type P mucus may help patients conceive.

**F** These characteristics and properties of P-type secretion make it relevant and justify further investigation of this concept, as has been done in this study.

**G** The integration of the three types of cervical mucus—type L (filtering) and type S (sperm-guiding)—with type P mucus is crucial to ensuring that only the most viable and motile sperm reach the egg, facilitating their rapid ascent at the optimal time. These characteristics are associated with increased fertility and peak estrogen levels around ovulation. Finally, type P cervical mucus is extremely lubricating and acts as a "push" for sperm from the cervical crypts into the uterine cavity, ensuring a rapid ascent and the arrival of the most viable sperm at the egg.

**A** We know that vulvar lubrication during the fertile window, which women perceive and which is included among the indicators of the fertile period, along with other parameters (according to some fertility awareness methods), helps to identify the days of highest fertility.

**B** Cervical secretions combines with Loaf-type "L" and "S" type (sperm-conducting) secretions and enzymes to produce a liquefaction effect. This dissolves the thicker strands of mucus, allowing sperm stored in the crypts to be released and quickly continue their journey toward the egg.

**C** The presence of P-type cervical mucus crystallization, characterized by a hexagonal pattern with maximum branching, indicates peak estrogen levels in the body, which has been correlated with higher fertility levels and associated with the presence of P-type cervical mucus.

