CASE REPORT WITH SCOPING REVIEW DISCUSSION

Hyperspermia, the Often-Neglected Semen Abnormality Affecting Fecundability

Markus Christian Hartanto[1], Cennikon Pakpahan[2*], Aleksander Try Utomo[3]
[1]Andrology Study Program, Department of Biomedical Sciences, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.
[2]Department of Biomedical Sciences, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.
[3]Faculty of Medicine, Universitas Indonesia, Depok, Indonesia.

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***Corresponding author**:
Cennikon Pakpahan
cennikon.pakpahan
@fk.unair.ac.id

ABSTRACT

Background: Hyperspermia is defined as a seminal volume greater than 6.3 ml. This definition is often ignored by physicians, while it may affect fecundability. **Objective:** To report a case of an adult with hyperspermia that affects his fecundability and to discuss it with the scoping review's result. **Case:** A 30-year-old man came desiring to have a child. He had regular sexual intercourse with his wife for the last 3 months, after living in different cities before. Based on the semen analysis, it was found that he had hyperspermia (volume 8.2 ml) and oligozoospermia (sperm concentration 4.25 million/ml). After taking antioxidants, the seminal volume was lowered, and the couple got pregnant. **Method:** A scoping review was conducted by using guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR). After a comprehensive search based on the inclusion and exclusion criteria, only 3 original research were retrieved due to the rarity of articles regarding this topic. **Discussion:** According to previous studies, hyperspermia can affect fecundability by diluting the sperm, causing sperm concentration to be decreased as in this case. Genetic mutation and male accessory gland infection may be contributing factors to hyperspermia. No consensus and studies about the treatment are available. **Conclusion:** Hyperspermia is a semen parameter alteration that needs to be taken care of to increase fecundability.

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Highlights

1. Hyperspermia is often ignored, but it can affect fecundability by diluting sperm and reducing sperm concentration.
2. Hyperspermia might be associated with genetic causes and male accessory gland infections, but no specific treatment is mentioned to treat this condition.

BACKGROUND

Fecundability (the probability of achieving a pregnancy within a single menstrual cycle) and fecundity (the ability to obtain live birth from one menstrual cycle) can be decreased because of female factors, male factors, or both (The ESHRE Capri Workshop Group, 2001). Age, lifestyle, sexual frequency, sexual dysfunction, ovulation disorder, tubal disorder, endometrial disorder, and sperm quality may all contribute to fecundability (Konishi, et al., 2020). Sperm analysis, as the cornerstone of male fecundability, offers a lot of information regarding the chance of achieving pregnancy. Basic semen analysis consists of macroscopic evaluation (liquefaction, volume, pH, color, odor, and viscosity) and microscopic evaluation (motility, concentration, total sperm number, and morphology) (World Health Organization, 2021). Any abnormalities in the semen evaluation can also affect fecundability.

Semen volume abnormality may be varied from a complete absence of semen (aspermia), low semen volume (hypospermia), or excessive volume (hyperspermia). The latter condition is often forgotten, although the clinical aspect of this finding still needs further evaluation. Hyperspermia has been defined as seminal volume greater than 6.3 mL, although this definition is not included in the 6th WHO semen analysis manual (Mason, et al., 2022). A study in 2012 revealed the prevalence of hyperspermia was 7.88% from 1521 patients (Khan, et al., 2012). Hyperspermia is often associated with male accessory gland infections (MAGI). Although it is not mentioned in the clinical criteria of diagnosing MAGI, hyperspermia is included in proposed structured interview about MAGI (La Vignera, et al., 2012). Hypersperma can alter sperm concentration, and then affect fecundability. However, this finding is often neglected.

OBJECTIVE

The aim of this study was to report a case of an adult with hyperspermia affecting his fecundability and discuss the case with the result of a scoping review.

CASE REPORT

A 30-year-old man came to our andrology outpatient clinic with his wife for wanting to have a child. They have been married for 1 year and 8 months, but they did not routinely have sex in the first 17 months of their marriage because the husband worked in different city. In the last 3 months, the couple has had sexual intercourse regularly (2-3 times per week). This was the first marriage for both. No fertility problems were found in the wife after gynecologist's examination and the menstrual cycles were regular, but the husband's semen analysis result was hyperspermia. The man did not have sexual problems and puberty disorder before. He did not have another sexual partner beside his wife. Furthermore, other medical conditions, such as urinary tract infections, sexually transmitted diseases, injuries, or systemic diseases, were all denied.

He was a healthy worker with a body mass index (BMI) of 23.16 kg/m^2. His physical examination including the external genitalia was essentially normal, with normal size of penis and testes, and no obstruction or enlargement was found in his reproductive tract. Semen analysis was performed, and the result showed high seminal volume (8.2 ml), hyperviscosity (3 cm), low sperm concentration (4.25 million/mL), normal total motility, low number of normal sperm morphology and normal leukocytes number. The patient was given supplement consisted of L-carnitine and zinc. The patient was suggested to continue having regular sexual intercourse. One month later, the patient came for follow-up. Hyperviscosity was not found again. The seminal volume decreased to 6.8 mL and the concentration increased to 9.9 million/ml. Two months after that, the couple got pregnancy and subsequently having a healthy baby.

The patient and his wife had already given their consent before this article was made. Any data except their real name was permitted by the patient to be presented in this case report.

SCOPING REVIEW

This scoping review was performed by using guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR).

Search strategy and eligibility criteria

PubMed, Cochrane, Web of Science, and Scopus databases were queried for studies indexed up to November 28, 2023, without limitation of old studies. Combinations of the following keywords were used: "hyperspermia", "hyperspermic", and "high semen volume". Our inclusion criteria were: (1) original articles, systematic review and meta-analysis, and case report; (2) hyperspermia as the main topic or included in data analysis. The exclusion criteria were: (1) Review articles, editorials, abstracts from conferences or meetings, and letters; (2) full text not available; (3) articles that did not match our topic; (4) study on animals.

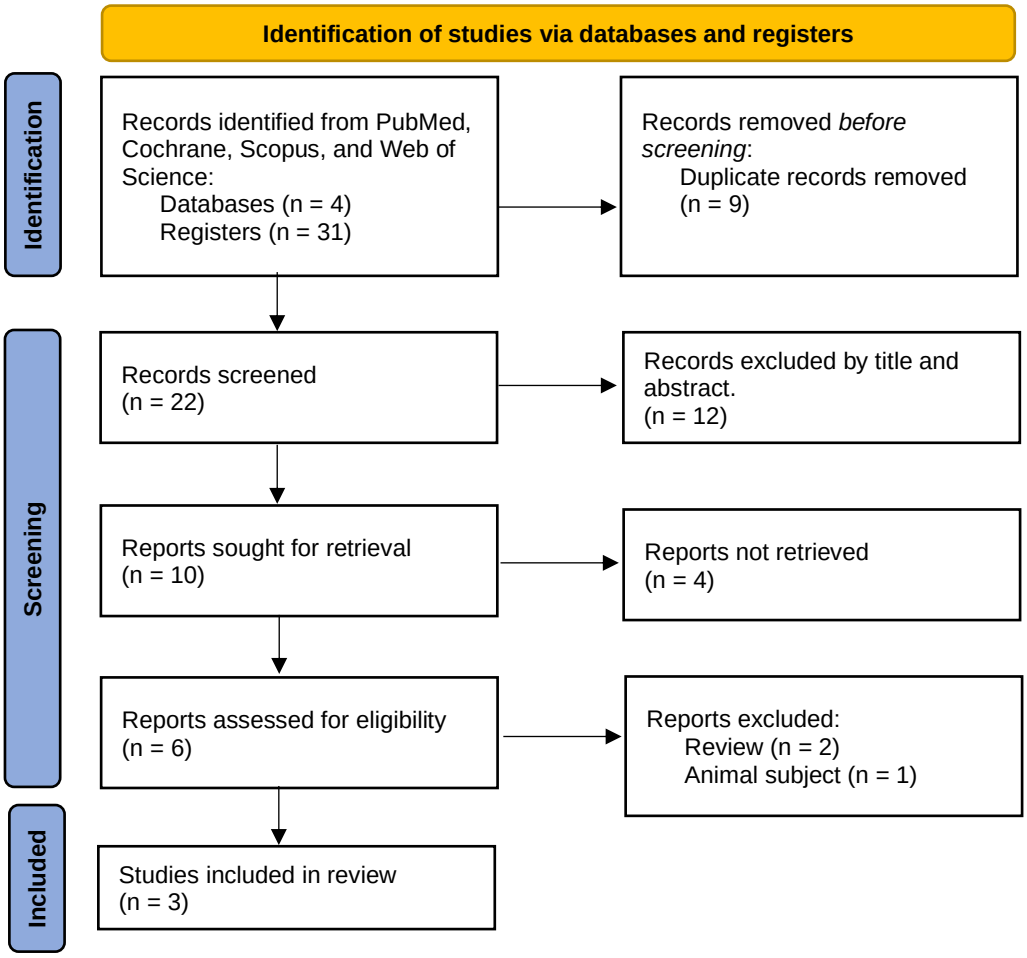

Figure 1. PRISMA flowchart of the article selection process.

Result of the scoping review

The studies selection used in the scoping review can be seen on Figure 1. Initially, we obtained 31 studies, consisted of 14 studies from PubMed, 2 from Cochrane, 15 studies from Scopus database, and 0 from Web of Science. The duplicates were eliminated, resulting in 22 studies. After the removal of the duplicates, all obtained manuscripts were initially screened by their title and abstract, excluding 12 studies. Further review of the full-text articles was performed to determine which studies would be included. Finally, 3 studies were included in the scoping review. Based on the search strategy which was not restricted by the year of publications, no case review was found and only 3 original articles

were published. Two of the original research were mainly focusing on hyperspermia, and the other one was only providing data about hyperspermia in their study. This extremely rare finding was supported by the fact that the newest article was published in 2015, while the others were published in 1994 and 1995.

Table 1. The results of the scoping review (n = 3).

Reference	Type of study	Population	Focus	Results
Zhang, et al., (2015)	Cross-sectional (secondary data)	133 men with hyperspermia (> 6 mL)	Hyperspermia and sperm parameters	Increasing volume can alter sperm count, but not other parameters.
Cooke, et al., (1995)	Cross-sectional (primary data)	4223 men with no dysfunction affecting male accessory glands	Defining hyperspermia and the incidence of low sperm concentration among hyperspermic patient	Hyperspermia defined as seminal volume ≥ 6.3 ml. 49% of men with hyperspermia had low sperm count.
Bornman, et al., (1994)	Cross-sectional (secondary data)	1726 men suspected with infertility	Descriptive study on male infertility causes in South Africa	The number of patients with hyperspermia was 4%.

DISCUSSION

Sexual intercourse and fecundability

In this case, the couple were seldom to have sexual intercourse initially, but during the last three months before the first consultation, they had had sex more regularly. This scenario would affect their fecundability as the frequency and timing of intercourse are associated with the time to get pregnancy (Stanford & Dunson, 2007). More frequent unprotected intercourse is associated with a higher probability of conception in a menstrual cycle (Konishi, et al., 2021). The timing of intercourse should be concerned to get a higher chance of getting pregnancy. The ovum lives 12-24 hours after being ovulated (EL-Gharib & Albehoty, 2018). The highest chance to have pregnancy is when the intercourse occurred 2 days before the day of ovulation, while having sex ≥6 days prior to ovulation or ≥1 days after ovulation gives low probability (Dunson, 2002).

Hyperspermia and fecundability

The semen analysis of this patient showed hyperspermia on several examination, accompanied with low sperm concentration (oligozoospermia). Based on the examinations, higher seminal volume would be in concordance with lower sperm concentration. This finding was in line with previous study by Zhang, et al., (2015), where patients with semen volume ≥7 ml had significantly lower sperm concentration than the ones with semen volume 6-6.9 ml. They concluded that sperm had been diluted with more seminal volume, hence the lower sperm concentration was obtained.

Semen normally consists of 95% seminal fluid and 5% sperm. While the sperm was made from seminiferous tubules in the testes, seminal fluid is consisted of secretion from seminal vesicle (65%), prostate (25%), and small portion of the bulbourethral gland and epididymis (10%) (Ricardo, 2018). The volume of semen is the quantity or amount of semen produced during ejaculation. According to the World Health Organization (WHO), the amount of semen expelled can range from 1.4 mL to 6.2 mL (World Health Organization, 2021).

During ejaculation, contractions of the smooth muscle of the epididymis propel sperm into the vas deferens, located in the spermatic cord. The vas deferens carries sperm to the ejaculatory duct with secretion from the seminal vesicle. The vesicle produces fructose which is essential for sperm motility. After passing through the ejaculatory duct, semen enters the prostate, which releases an alkaline fluid that helps to coagulate semen, allowing sperm to survive in the vagina and cervix. Semen then passes through the Cowper's gland, which produces a thick fluid that lubricates the urethra and cleans leftover

urine from the urethra. Semen then enters the female reproductive system and may fertilize the oocyte (Mawhinney & Mariotti, 2013).

A study by Shi, et al., (2018). reveals that semen volume is significantly associated with age ($p < 0.001$) and daily coffee intake ($p<0.001$). The significant relationships are described as follows: (1) semen volume has a non-linear relationship with age, with no significant changes in volume before the age of 55.5 years, but a significant decline occurs thereafter; (2) there are no significant changes when coffee intake is less than 550 ml/day, but it continues to decrease when coffee consumption exceeds 550 ml/day. Semen volume can also be increased by longer period of abstinence, and at the same time affect the concentration and motility (Mayorga-Torres, et al., 2015).

The prevalence of hyperspermia is adequately consistent. Based on a study by Cooke, et al,. (1995) on 4223 men, it was revealed that 229 men (around 5%) had seminal volume above their 95th percentile value (6.3 ml). Research by Bornman, et al., (1994) stated that the prevalence of the patients with semen volume > 6 ml was 4% in South Africa population. Newer study also had similar result, with 7.88% out of 1521 patients were hyperspermic (Khan, et al., 2012). Excessive secretion of seminal fluid cannot be conducive to couple's fertility, since the number of sperm is not changed. The sperm density will decrease, therefore reducing the chance of conception (Khan, et al., 2012). Increased seminal volume also had statistically significant correlation with time to conception to occur ($r = 0.22$, p value <0.01) (Bostofte, et al., 1982). However, there is no published literature establishing a direct correlation between hyperspermia and pregnancy outcomes.

The cause of hyperspermia is not clear until now, although according to clinical data, there might be genetic influence. After exome sequencing, it was found that there were 13 genes (SPATA3, MICALCL, ALMS1, PPP2R2B, TBP, HTT, CELSR2, ADAMTS2, TCP11, ZAN, ODF1, REC8 and VCX3B) which are contributing to hyperspermia (Zhang, et al., 2018). Hyperspermia may also be associated with male accessory gland infection (MAGI) and might cause sexual dysfunction (Noweir, et al., 2022). Ultrasound examination of patients with MAGI showed thickening of seminal vesicle and increasing the production of the seminal fluid secretion, and subsequently cause premature ejaculation (Calogero, et al., 2017). In this case, genetic testing was not performed. The patient did not have urinary tract infection symptoms, no obstruction or enlargement was found in the patient through physical examination, and there was not leukocytospermia in the semen analysis. Therefore, MAGI might not be the cause of hyperspermia in this case.

There has not been a consensus for treating hyperspermia until now. The antioxidant treatment given for this patient was mainly for the oligozoospermia. L-carnitine and zinc are selected antioxidants for increasing sperm count, besides vitamin E, vitamin C, selenium, and coenzyme Q10 (Majzoub & Agarwal, 2018). However, in this case the patient got higher sperm concentration and lower semen volume as well, one month after starting the treatment. After 3 months of taking antioxidant, the couple got natural pregnancy. Assisted reproductive technologies can also be the option for treating hyperspermia. Sperm preparation techniques for intrauterine insemination can remove seminal fluid, therefore the sperm can be more concentrated to enter the female reproductive tracts (Boomsma, et al, 2019).

Strength and limitations

This is the first article to report a case of hyperspermic man with affected fecundability with his partner. Limited number of studies and reports might be our limitations to discuss this case. The available articles were mostly published more than 10 years ago.

CONCLUSION

In this case report, we studied how hyperspermia may be the cause of longer time to get pregnancy in a couple. This was consistent with our scoping review, stating hyperspermia can cause oligozoospermia by diluting the sperm in excessive seminal fluid. The findings of the review bring a new perspective to our understanding of the underlying mechanisms of decreasing fecundability affected by hyperspermia, although there is no avalaible study correlating hyperspermia and pregnancy outcome. The exact pathophysiology of hyperspermia still needs to be researched. The treatment of hyperspermia is still not

yet agreed, but sperm preparation techniques and antioxidants may be the options. Further investigation is still required.

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Conflict of Interest
All authors have no conflict of interest.

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Author Contribution
MCH contributes to cenception and design, analysis and interpretation of the data, drafting of the article, critical revision of the article for important intellectual content, final approval of the article, and provision of study materials. CP contributes to cenception and design, analysis and interpretation of the data, drafting of the article, critical revision of the article for important intellectual content, final approval of the article, provision of study materials and collection and assembly of data. ATU contributes to to cenception and design, drafting of the article, critical revision of the article for important intellectual content, and final approval of the article.

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