



# The Association between Cycling and Male Infertility: A Systematic Review of Current Research

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## ABSTRACT

**Introduction:** Cycling is a popular sport and also has various health benefits. However, cycling carries health risks, including fertility problems. This research aims to explore the association between cycling and infertility in men. **Methods:** This systematic review was conducted according to a PROSPERO protocol (ID: CRD42024509255) and PRISMA guidelines using the PubMed, Cochrane, and ScienceDirect databases. Keywords "(Bicycle) AND (Infertility)" are used. The risk of bias was assessed based on the Cochrane risk of bias tool for cohort studies. **Results:** The final two cohort studies were included with a total of 487 cyclists. Regular cycling of more than 1.5 hours/week was associated with 34% (95% CI 4-55%) lower sperm concentration compared to control. Regular cycling of more than 5 hours/week was associated with lower sperm concentration (OR 1.92, 95% CI 1.03-3.56) and lower total sperm motility (OR 2.05, 95% CI 1.19-3.56) compared to the control group. **Conclusion:** There is a relationship between cycling and male infertility; a decrease in sperm concentration in men who cycle at least 1.5 hours/week and lower sperm motility in men who cycle for at least 5 hours/week. The direct effect of cycling on the incidence of infertility as a consequence needs to be explored further.

**Keywords:** Cycling, male infertility, sperm concentration.

## ABSTRAK

**Pendahuluan:** Bersepeda merupakan olahraga yang digemari dan juga memiliki berbagai manfaat kesehatan. Namun, bersepeda membawa risiko kesehatan termasuk masalah kesuburan. Tinjauan ini bertujuan untuk mengetahui hubungan antara bersepeda dan infertilitas pria. **Metode:** Tinjauan sistematik berdasarkan protokol PROSPERO (ID: CRD42024509255) dan pedoman PRISMA menggunakan *database* PubMed, Cochrane, dan ScienceDirect dengan kata kunci "(Bicycle) DAN (Infertility)". Risiko bias dinilai berdasarkan alat risiko bias Cochrane untuk studi kohort. **Hasil:** Dua studi kohort dilibatkan dalam penelitian ini dengan total 487 pengendara sepeda. Bersepeda teratur lebih dari 1,5 jam/minggu dikaitkan dengan 34% (95% CI 4%-55%) konsentrasi sperma yang lebih rendah dibandingkan kontrol. Bersepeda teratur lebih dari 5 jam/minggu dikaitkan dengan konsentrasi sperma yang lebih rendah (OR 1,92, 95% CI 1,03-3,56) dan total sperma motil yang lebih rendah (OR 2,05, 95% CI 1,19-3,56) dibandingkan kontrol. **Simpulan:** Ada hubungan antara bersepeda dengan infertilitas pria; penurunan konsentrasi sperma pada pria yang bersepeda minimal 1,5 jam/minggu dan penurunan motilitas sperma pada pria yang bersepeda minimal 5 jam/minggu. Pengaruh langsung bersepeda terhadap kejadian infertilitas perlu dikaji lebih lanjut. **Kemal Akbar Suryoadji, Alifaturrasyid Syafaatullah Ridwan, Ahmad Fauzi, Kieran Pasha Ivan Sini, Akmal Taher. Asosiasi Bersepeda dengan Infertilitas Pria: Sebuah Tinjauan Sistematis.**

**Kata Kunci:** Bersepeda, infertilitas pria, konsentrasi sperma.



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## INTRODUCTION

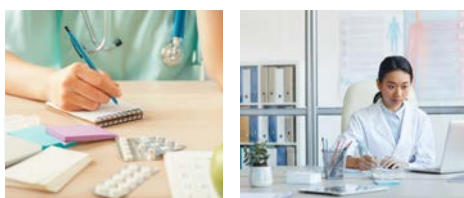
Studies demonstrate a consistent correlation between health and physical activity. The World Health Organization (WHO) recommends regular 150-300 minutes of moderate-intensity aerobic physical activity per week to achieve the benefits.<sup>1</sup> Regular physical activity can prevent diseases, especially non-communicable and cardiovascular

diseases. As one of the most popular physical exercises, cycling has been found to reduce cancer mortality and cardiovascular, cancer, and obesity morbidity.<sup>2,3</sup> Cycling also becomes a convenient and efficient mode of transportation in several countries, such as Canada, and also reduces greenhouse gas emissions.<sup>4</sup> However, cycling is also related to some health problems; the most common are

genitourinary problems. Male infertility is one of the unwelcome effects seen in cyclists.<sup>5</sup>

Cystic populations may develop epididymal cysts, scrotal calculi, or other findings similar to male infertility during ultrasonography screening.<sup>5</sup> Sperm-wise, cyclists are also more likely to have tapered-like morphological features than non-cyclist populations,

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indicating abnormalities. The changes in scrotal temperature due to tight-fitting uniforms, reduction of testosterone level due to prolonged exercise, microtrauma of the testis, epididymis, and vas deferens due to prolonged compression, and possible involvement of the hypothalamic-pituitary-gonadal (HPG) axis may become the possible pathophysiological mechanisms.<sup>6</sup>

Studies that explore the specific correlation between cycling and male infertility are still lacking despite their possible correlation. This systematic review aims to explore the correlation between cycling and male infertility using the PRISMA method from three databases: PubMed, Science Direct, and Cochrane.

## METHOD

### Protocol and Registration

A research protocol was made before the

creation of this review, and it was entered into the International Prospective Register of Systematic Reviews (PROSPERO) on the 2nd of February 2024 with the ID CRD42024509255.

### Eligibility Criteria

The inclusion criteria were: (a) Original research study type, (b) Suitability to the topic of infertility because of cycling, (c) The study has at least one control group and one physical activity group, and (d) clear extraction and statistical analysis method.

The exclusion criteria were: (a) Full text is not available, and (b) Using languages other than English.

### Search Strategy

This study used the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.<sup>7</sup> Three electronic databases were searched: PubMed, Science

Direct, and Cochrane. We used the term of "(Bicycle) AND (Infertility).

### Study Selection and Data Extraction

Four researchers screened the title and abstract independently and excluded irrelevant studies. The final retrieved studies were screened for duplicates and systematically evaluated according to inclusion and exclusion criteria. Subject characteristics (cycling hours per week), the outcomes of the study (sperm characteristics), and other relevant information were assessed by the four researchers. The fifth researcher (supervisor) was included in the case of a 'draw score'. Final decisions are based on the majority of votes.

### Risk of Bias Assessment

Methodological quality was assessed by the three researchers according to the Joanna Briggs Institute (JBI) critical appraisal.<sup>8</sup> Risk of bias for all studies was assessed using the Review Manager (RevMan 5.4; Cochrane, London, UK)<sup>9</sup> based on Cochrane Risk of Bias for cohort studies. Each study was classified as low risk, unclear risk, or high risk of bias. The fifth researcher (supervisor) was included in cases of 'draw score'. Final decisions are based on the majority of votes.

## RESULTS

### Study Selection

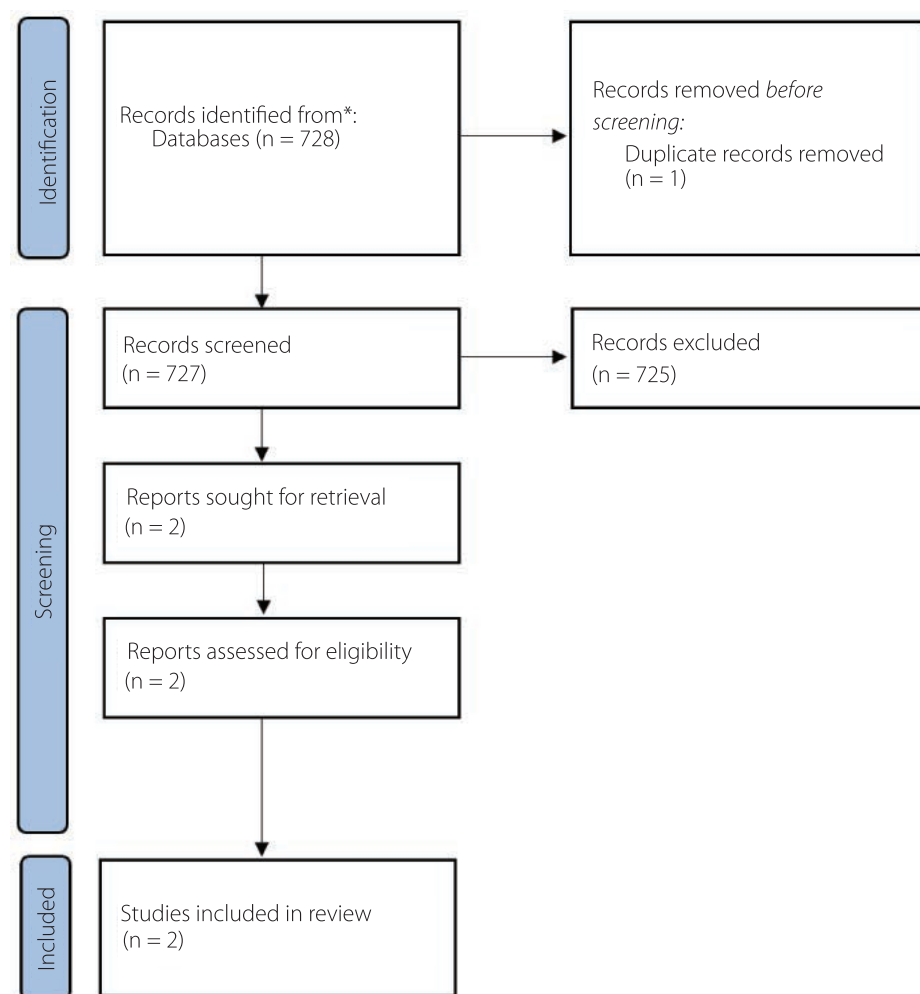
A total of 728 studies were retrieved based on the keywords from PubMed (n=18), ScienceDirect (n=708), and Cochrane Library (n=2). After screening for abstract and title, 725 studies were excluded. The studies were then compared for duplicates, and one study was removed. The remaining two studies applied the inclusion and exclusion criteria; none were removed. The final sample was 2 studies that underwent systematic review. The flowchart of the study selection can be seen in **Scheme**.

### Study Characteristics and Outcome

The characteristics of the included studies (research design, research location, population, and outcome) were summarized in **Table**. A study by Wise LA, *et al*,<sup>10</sup> records the outcome in odds ratio (OR), while a study by Gaskins AJ, *et al*,<sup>11</sup> records the outcome in mean difference.

### Risk of Bias Assessment

**Figure** shows details on the risk of bias in the

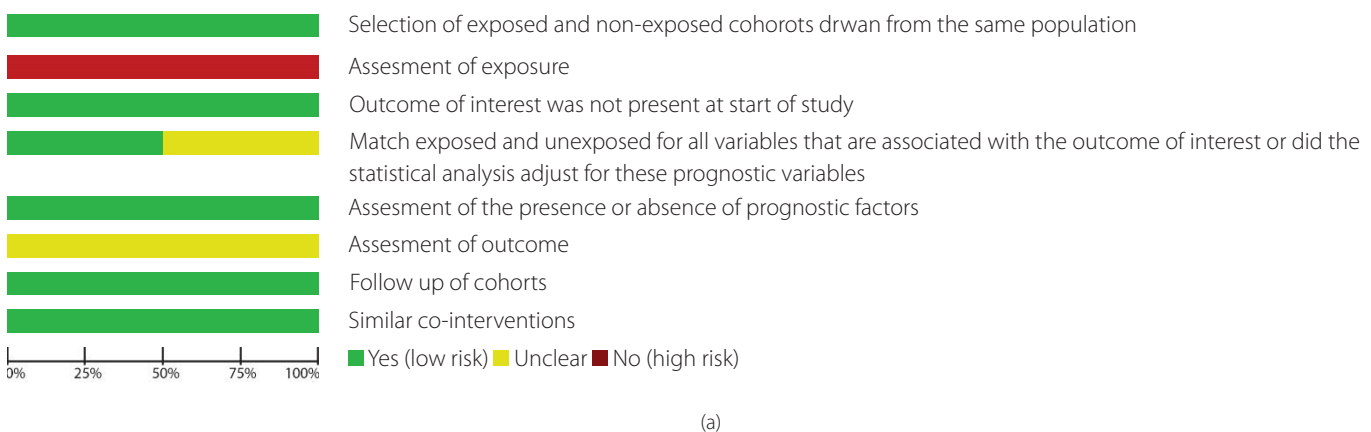


**Scheme.** Article search and selection flowchart according to PRISMA guidelines.



Author and Year	Research Design	Location	Study Population	Results
Wise LA, <i>et al</i> , 2011. <sup>10</sup>	Retrospective cohort study	USA	256 men regularly exercise bicycle more than five times a week and 1,951 men without regular exercise.	Cycling $\geq 5$ hours/week was at risk of having low sperm concentration (OR 1.92, 95% CI 1.03-3.56) and low total sperm motile (OR 2.05, 95% CI 1.19-3.56).
Gaskins AJ, <i>et al</i> , 2014. <sup>11</sup>	Prospective cohort study	USA	231 men with bicycle activity $\geq 1.5$ h/week and not bicycling	Men who cycled 1.5 hours/week had sperm concentrations 34% (95% CI 4-55%) lower than men who did not cycle.

**Figure.** Risk of bias for the included studies. (a) Plot of risk of bias per categories; (b) Summary table of each studies risk of bias.



Wise LA, <i>et al</i> , 2011.	Gaskins AJ, <i>et al</i> , 2014.	
+	+	Selection of exposed and non-exposed cohorts drawn from the same population
!	!	Assessment of exposure
+	+	Outcome of interest was not present at start of study
?	+	Match exposed and unexposed for all variables that are associated with the outcome of interest or did the statistical analysis adjust for these prognostic variables
+	+	Assessment of the presence or absence of prognostic factors
?	?	Assessment of outcome
+	+	Follow up of cohorts
+	+	Similar co-interventions

(b)

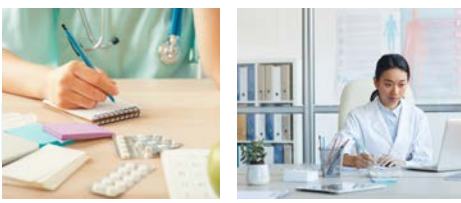
**Table.** Characteristic of included studies.

included studies. **Figure a** is a plot of the risk of bias according to the Cochrane risk of bias tool for cohort studies. **Figure b** is a summary table of the risk of bias in each study. Both studies<sup>10,11</sup> have a high risk of bias in the assessment of exposure before the intervention. The study by Wise LA, *et al*,<sup>10</sup> has an unclear method of matching the exposed and unexposed variables or adjusting the statistical analysis for the prognostic variables. Both studies<sup>10,11</sup> have unclear blinding methods of outcome assessment.

## DISCUSSION

In this systematic review, two studies were eligible. A study by Wise, *et al*, in the USA in 2011 showed that cycling 5 hours/week was at risk of having low sperm concentration ( $<20 \times 10^6/\text{mL}$ ) with OR 1.92 (95% CI 1.03-3.56) and low total sperm motility ( $<23 \times 10^6$ ) with OR 2.05 (95% CI 1.19-3.56).<sup>10</sup> A study by Gaskins, *et al*, in the USA in 2014 showed that men who cycled 1.5 hours/week had sperm concentrations 34% (95% CI 4%-55%) lower than men who did not cycle.<sup>11</sup>

These two studies implied that cycling activity can reduce sperm quality. Other studies showed long-term cycling can affect immune responses in the body, including an increase in IL-1 beta (up to 23%), IL-10 (up to 41%), IL-6 cytokines (up to 39%), and TNF alpha in blood and seminal plasma.<sup>12</sup> An increase in IL-6 has an effect on sperm quality in a decrease in concentration, motility, and normal sperm shape. Decreased sperm quality can be the basis of infertility.<sup>13</sup> Another possible pathophysiology is the use of tight



cycling underwear, which correlated with lower sperm concentration, motile count, and normal sperm morphology compared to non-tight underwear.<sup>14</sup> Cycling also increases the scrotal temperature, which may increase the heat stress in the testicle. However, this finding alone could not be clinically significant enough to become the main pathophysiology.<sup>5,15</sup> Intense and prolonged pressure on the testis can induce trauma to the testis. This hypothesis is supported by the scrotal ultrasound findings in cyclists,

which are similar to those in infertile males. Scrotal calculi, epididymal cysts, calcifications, hydroceles, varicoceles, and testicular microlithiasis can be found.<sup>16</sup>

## Limitation

This study has several limitations. We did not assess the bike characteristics such as the uniforms used and saddle type which may affect the etiologic factors. Second, the unclear risk of bias in outcome assessment and the high risk of bias in initial exposure assessment

indicate the high probability of reporting bias. Further studies on the pathophysiology of lower sperm quality in cyclists and the effect of different bike characteristics and sperm quality need to be conducted.

## CONCLUSION

Regular cycling at least 1.5 to 5 hours/week could decrease sperm concentration, motility, and normal morphology. However, the definite pathophysiology of these findings remains unclear.

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