

INPLASY

Prevalence and Associated Factors of Gynecomastia Among Male Nonmedical Anabolic-Androgenic Steroid Users: A Systematic Review

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Tawanwongsri, W; Eden, C; Manunyanon, S; Yincharoen, P.

Corresponding author:
Weeratian Tawanwongsri

weeratian.ta@gmail.com

Author Affiliation:
Walailak University.

ADMINISTRATIVE INFORMATION

Support - No support.**Review Stage at time of this submission** - Preliminary searches.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY2026100064

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 14 October 2026 and was last updated on 14 October 2026.

INTRODUCTION

Review question / Objective This systematic review aims to determine the reported prevalence and frequency of gynecomastia among males with current or previous nonmedical anabolic-androgenic steroid (AAS) use and to identify factors associated with its occurrence.

The primary objective is to summarize study-specific gynecomastia frequencies according to outcome ascertainment methods, reference periods, and AAS-use status.

The secondary objective is to synthesize reported factors associated with gynecomastia, including AAS type, dose, duration, patterns of use, and other relevant characteristics.

The review will include original observational studies, primarily cross-sectional and cohort studies. No comparator is required for prevalence estimation; comparisons between subgroups of male AAS users will be considered for associated-factor analyses.

Condition being studied Gynecomastia is a benign proliferation of glandular breast tissue in males. It may occur due to an imbalance between estrogenic and androgenic activity. Nonmedical anabolic-androgenic steroid (AAS) use may contribute to gynecomastia through hormonal alterations, including the aromatization of certain androgens to estrogens.

Gynecomastia is a recognized adverse effect among male AAS users and may cause physical discomfort, psychological distress, and cosmetic concerns. However, reported frequencies vary across studies because of differences in study populations, AAS exposure patterns, outcome assessment methods, and reference periods. This systematic review will examine the reported frequency of gynecomastia and associated factors among males with current or previous nonmedical AAS use.

METHODS

Participant or population Male individuals of any age with current or previous nonmedical anabolic

androgenic steroid (AAS) use, including athletes, bodybuilders, and recreational users. Studies involving mixed-sex populations or participants with different types of androgen exposure will be eligible only if data specific to male nonmedical AAS users can be directly extracted from the published article or supplementary materials. Studies exclusively involving medically prescribed AAS for therapeutic indications will be excluded.

Intervention Current or previous nonmedical use of anabolic-androgenic steroids (AAS), including various AAS types, doses, durations, and patterns of use for performance enhancement, muscle development, or cosmetic purposes. AAS use will be considered an exposure rather than a therapeutic intervention.

Comparator No comparator is required for prevalence estimation. For analyses of associated factors, comparisons between subgroups of male nonmedical anabolic-androgenic steroid users will be considered when available, including differences in AAS type, dose, duration, and patterns of use.

Study designs to be included Original observational studies, including cross-sectional studies and prospective or retrospective cohort studies, will be included. Other comparative observational studies, including case-control studies, will be eligible for analyses of gynecomastia-associated factors when relevant data are extractable. Case reports, case series without a defined source population, reviews, and publications without original data will be excluded.

Eligibility criteria Studies published in English from database inception to 15 October 2026 will be considered. Eligible studies must report gynecomastia frequency or gynecomastia-specific associated factors among male nonmedical anabolic-androgenic steroid (AAS) users. For prevalence assessment, studies must provide an identifiable number of participants with gynecomastia and the corresponding denominator, or sufficient directly reported information to calculate the frequency. Mixed-sex or mixed-exposure studies will be included only if relevant data for male nonmedical AAS users can be separately extracted from the published article or supplementary materials. Studies recruiting participants specifically because they have gynecomastia will be excluded from prevalence estimation. Case-control studies may contribute to the synthesis of associated factors when appropriate data are available. Studies reporting

only general adverse effects without gynecomastia-specific data, therapeutic AAS use without separable nonmedical-use data, or non-original findings will be excluded. No unpublished data will be requested from study authors. For studies with overlapping populations, the most complete or appropriate dataset will be selected for each outcome to avoid double-counting participants.

Information sources PubMed/MEDLINE, Scopus, and Web of Science Core Collection will be searched from database inception to 15 October 2026. Reference lists of included studies and relevant reviews will also be screened to identify additional eligible studies. Only published English-language studies will be considered. Grey literature will not be systematically searched, and study authors will not be contacted for unpublished data.

Main outcome(s) The primary outcome is the reported prevalence or frequency of gynecomastia among male individuals with current or previous nonmedical anabolic-androgenic steroid (AAS) use. Gynecomastia frequency will be expressed as the proportion of affected participants among eligible male AAS users, with 95% confidence intervals where calculable. Outcomes will be categorized according to ascertainment methods (self-report, clinical examination, or medical records) and reference periods (point prevalence, period occurrence, or lifetime history). Study-specific estimates will be reported separately according to outcome definition and assessment timing. Incidence measures, when available, will be distinguished from prevalence estimates.

Quality assessment / Risk of bias analysis The risk of bias of included studies will be assessed using the Joanna Briggs Institute (JBI) critical appraisal tools appropriate to each study design and outcome. The JBI Checklist for Prevalence Studies will be used to assess prevalence estimates, while the relevant analytical cross-sectional, cohort, or case-control checklists will be applied to studies reporting associated factors. Two reviewers will independently assess methodological quality, including participant selection, sample size, exposure and outcome measurement, confounding, and completeness of reporting, as applicable. Disagreements will be resolved through discussion or consultation with a third reviewer. Each applicable item will be rated according to the JBI guidance. Findings will be presented at the item and study levels without calculating an overall numerical quality score. Risk-of-bias assessments

will inform the interpretation of findings and sensitivity analyses where feasible.

Strategy of data synthesis Data will be synthesized descriptively, with study characteristics and findings summarized in tables. Gynecomastia frequency will be presented as study-specific proportions with 95% confidence intervals, calculated using the Wilson score method where appropriate. Forest plots without overall pooled estimates will be used to illustrate individual study findings.

Studies will be grouped according to gynecomastia ascertainment methods (self-report, clinical examination, or medical records), reference periods (point prevalence, period occurrence, or lifetime history), and current or previous anabolic-androgenic steroid (AAS) use. Incidence measures will be summarized separately.

Given the anticipated clinical and methodological heterogeneity, an overall meta-analysis is not planned. Subgroup meta-analysis may be considered if studies have sufficiently comparable populations, outcome definitions, assessment methods, and reference periods. If appropriate, a random-effects model will be applied, with heterogeneity assessed using relevant statistical measures.

Factors associated with gynecomastia will be synthesized narratively, including reported effect estimates, 95% confidence intervals, and statistical significance where available. Adjusted and unadjusted findings will be distinguished.

Sensitivity analyses will be conducted where feasible to examine the influence of outcome ascertainment methods and studies with methodological limitations. Risk-of-bias findings will inform the interpretation of results. Statistical analyses and visualizations will be performed using R software.

Subgroup analysis Where sufficient data are available, descriptive subgroup analyses will be conducted according to gynecomastia ascertainment method (self-report, clinical examination, or medical records), reference period (point prevalence, period occurrence, or lifetime history), and AAS-use status (current or former users).

Additional subgroup analyses may examine AAS type, dose, duration, and patterns of use when directly reported data are available. Subgroup findings will be presented as study-specific frequencies and 95% confidence intervals. Quantitative comparisons or subgroup meta-analyses will be considered only when studies are

sufficiently comparable and data are adequate. Exploratory findings will be interpreted cautiously.

Sensitivity analysis Where sufficient data are available, descriptive subgroup analyses will be conducted according to gynecomastia ascertainment method (self-report, clinical examination, or medical records), reference period (point prevalence, period occurrence, or lifetime history), and AAS-use status (current or former users).

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Language restriction English.

Country(ies) involved Thailand.

Keywords Gynecomastia; Anabolic-androgenic steroids; Prevalence; Associated factors; Nonmedical use; Systematic review.

Contributions of each author

Author 1 - Weeratian Tawanwongsri.

Email: weeratian.ta@gmail.com

Author 2 - Chime Eden.

Author 3 - Saranrat Manunyanon.

Author 4 - Pirada Yincharoen.