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Comparison between dutasteride and finasteride in hair regrowth and reversal of miniaturization in male and female androgenetic alopecia: a systematic review

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Abstract

Nowadays androgenetic alopecia (AGA) has become a common concern of affected subjects of both sexes. Finasteride is approved by the Food and Drug Administration for the treatment of male AGA. There is no clear evidence to support the use of dutasteride in male AGA. In female AGA, the effectiveness of dutasteride and finasteride is still under debate, and there is no clear evidence to use any of them in female AGA. A systematic review was conducted to compare between dutasteride and finasteride in treating both male and female AGA, and their efficacy, safety, side effects with effective dosage. The review was done using several databases including: PubMed, Ovid Medline, Google Scholar, and Cochrane using the following search terms/keywords: "Dutasteride" AND "Finasteride" AND "Male pattern hair loss" AND "Female pattern hair loss" AND "Efficacy", "Tolerability" AND "Side effects" AND "Comparison". To search for articles related to efficacy, tolerability, side effects, used doses of dutasteride and finasteride in the treatment of male and female AGA. The review encompassed a total of nine studies. Four randomized controlled trials, one single-arm trial, two prospective cohorts, and two retrospective cohort studies. Seven studies exclusively enrolled male participants, while only two included female participants. All groups receiving various doses of dutasteride and finasteride exhibited a significant increase in hair count compared to the placebo group. Notably, dutasteride (0.5 mg) and dutasteride (2.5 mg) were significantly more effective than finasteride (1 mg) in increasing hair counts. Furthermore, no significant difference in adverse events was observed between finasteride and dutasteride. Dutasteride is more potent than finasteride in treating AGA in both males and females. All the adverse events between finasteride and dutasteride were comparable.

Introduction

Androgenetic alopecia (AGA) in males and females is one of the common hair disorders that affects different populations worldwide. It is a common, partially reversible cause of a significant decrease in hair density in females and total baldness in males, which significantly impacts patients' quality of life.[1] AGA is an androgen-dependent inherited hair loss disorder.[1] The main etiologic factor in male AGA is dihydrotestosterone (DHT). There are multiple stages of male AGA, hair loss typically starts from both sides of the temporal scalp and gradually moves upward until it reaches the vertex.[2] Female AGA mostly affects females who are ≥40 years-old and affects 40% of women aged >70 years. In addition, it may be seen in adolescent females.[3] Testosterone is the main androgen in the pathogenesis of male AGA. It exerts its maximum activity in the hair follicles of the scalp by its conversion into DHT, which is the principal pathogenic androgen of male AGA, through catalysis by 5-alpha reductase enzyme. Finasteride and dutasteride are inhibitors of the 5-alpha-reductase enzymes, which

will inhibit the conversion of testosterone to dihydrotestosterone. Oral dutasteride inhibits both type I and type II 5-alpha-reductase enzymes (dual inhibitor), while oral finasteride inhibits only type II 5-alpha-reductase enzyme.[4,5]

Finasteride is approved by the food and drug administration (FDA) for the treatment of male AGA by reversal of hair shedding and increasing the density and length of the hair. There is no clear evidence to support the use of dutasteride in male AGA, however some male patients experienced a great improvement in hair shedding and hair density by using 0.5 mg once daily for a period of 6 months.[4] The effectiveness of dutasteride and finasteride in female AGA is still under debate, and there is no clear evidence to use any of them in female AGA. However, female patients experienced a great improvement in hair thickness after using either finasteride or dutasteride.[3] Dutasteride is more potent than finasteride in the treatment of male and female AGA (Figure 1) due to its dual inhibiting effect on both type I and type II 5-alpha-reductase enzymes; the safety and efficacy of dutasteride were evaluated, and based on previous studies, it is safe to use for more than 5 years compared to finasteride which has many side effects including sexual dysfunction (erectile, ejaculatory dysfunctions, and infertility), depression, suicidal ideation, and pruritus. Because of these side effects, dutasteride is preferable to finasteride.[6,7] We conducted the present systematic review to compare between dutasteride and finasteride in treating both male and female AGA and their efficacy, safety, and side effects.

Research methodology

This review was reported in the light of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement (Figure 1).[8]

Search strategy

On 1st of November 2022, we searched several databases including: PubMed, Ovid Medline, Cochrane, Google Scholar, and Medline, for the relevant articles using the following keywords: "Dutasteride" AND "Finasteride" AND "Male pattern hair loss" AND "Female pattern hair loss" AND "Efficacy", "Tolerability" AND "Side effects" AND "Comparison".

Inclusion criteria

Any study reporting the safety and efficacy of dutasteride and finasteride for the treatment of AGA without restriction to method of administration, sex, dose and age groups.

Exclusion criteria

We excluded case reports, review articles, treatment agents other than dutasteride and finasteride and conference abstracts.

Screening and data extraction

After conducting a literature search, the authors conducted an initial screening for the titles of the retrieved articles and their abstracts. Then, the papers that were relevant to the topic of interest were reviewed regarding their full texts before being considered for inclusion in the systematic literature review. The final list of papers included for review was determined according to the predetermined criteria for inclusion and exclusion of the research studies. Both steps of screening and extraction were done by three members and a fourth member if necessary. If disagreement occurred a senior author was incorporated for solving conflicts between all members. We extracted demographic data of the included papers (study design, age, compared treatment arms, sample size and male prevalence). The primary outcome was treatment efficacy demonstrated by hair thickness and hair count. The secondary outcome was side effects of the included treatment arms.

Risk of bias

Due to the different study designs of the included papers, we used the National Institute of Health quality assessment tool. Further description of the tool, rating of each study and method of rating was detailed in (Table S1).

Results

We screened 60 records from the title and abstract screening and only 19 records were eligible for another round of screening. Of those, 6 full texts were included, and another 3 papers were added via manual search trials (Figure 1).

Study characteristics

We included a total of nine studies; four randomized controlled trials, one single arm trial, two prospective cohorts and two retrospective cohort studies. Studies were conducted in the period between the years 2006 - 2016, and all studies were written in English (Table 1).[2–5,9–13] Seven studies included only male participants while only two studies included female participants only. Three studies were conducted in Korea, and one for each of the following countries: USA, Japan, India, Egypt, Singapore and Netherlands. All the cohort studies were high quality and four trials were good quality. While the single arm trials were of poor quality (Table S1).

Efficacy

Hair count

Six studies discussed hair count outcome. Dutasteride (0.5 mg) was associated with a significant increase in the hair count than placebo in Eun et al (Table 2).[10] In addition, Moftah et al indicated that 60.5% of the dutasteride (0.5 mg) group had a significant rise in the hair count number rather than 27.5% in the placebo group.[12] Moreover, dutasteride (0.5 mg) was significantly superior to finasteride (1 mg) in increasing hair count.[11] Two studies compared various doses of dutasteride against finasteride and placebo. All groups that received various doses of dutasteride and finasteride had a significant increase in hair count rather than placebo group.[5,13] However, dutasteride (0.5 mg) and dutasteride (2.5 mg), were significantly superior to finasteride (1 mg) in increasing hair counts.[5]

Hair thickness

Dutasteride (0.5 mg) showed a significant effect in increasing hair thickness against finasteride (1 mg).[11] Furthermore, another study indicated that dutasteride (0.5 mg) was associated with a significant increase in AGA patients who experienced an improvement in their hair thickness compared placebo group.[12] The third study did not find a significant difference between dutasteride (0.15 mg) and finasteride (1.25 mg), in terms of hair thickness.[3]

Adverse events

All the adverse events were comparable among the treatment arms. List of all side effects were reported in (Table 3).

Discussion

Nowadays AGA has become a common concern of affected subjects of both sexes. It affects 50% of Caucasian men and 19% of Caucasian women.[14] Moreover, AGA affects self-image and is a major cause of anxiety and depression, despite being recognized as a very minor dermatological issue with heredity, accounting for about 80% of all cases.[15] AGA is the most common type of hair loss in men. It is a genetically determined condition characterized by the progressive conversion of terminal hairs into indeterminate, and eventually into vellus hairs (a process known as follicular miniaturization).[15] This occurs by the action of DHT, the primary androgen in the pathogenesis of MPHL, resulting in loss of hair in a characteristic patterned distribution. In females, the mechanism through which follicular miniaturization occurs is not completely understood. Although it is well-accepted that androgens and genetic basis play the main roles in male androgenetic alopecia, the extent to which these factors play a role in female pattern hair loss (FPHL) in most women is less clear.[16] In contrast

to many cases of male pattern hair loss (MPHL), the loss of terminal hairs in affected areas is usually incomplete in FPHL, resulting in a visible reduction in hair density but no balding, and the frontal hairline is often spared.[17]

Dutasteride, which acts as a type 1 and 2 alpha-reductase inhibitor (dual inhibitor), leads to about 90% reduction of DHT compared to finasteride which reduces DHT by 70 % through the inhibition of only type II 5-alpha-reductase.[1,18] Dutasteride and finasteride result in a significant dose-related manner suppression of DHT serum and scalp concentrations compared with placebo.[5]

There are only two drugs approved for AGA treatment by the US Food and Drug Administration (FDA): minoxidil and finasteride. Dutasteride, although not FDA-approved for treatment of AGA is becoming increasingly used in the clinics and has been shown to have better efficacy and rapid effect compared with finasteride and placebo in several studies.[1,4,5,10,13] Dutasteride, which acts as a type 1 and 2 alpha-reductase inhibitor (dual inhibitor), leads to about 90% reduction of DHT compared to finasteride which reduces DHT by 70 % through the inhibition of only type II 5-alpha-reductase.[1],[18] Dutasteride and finasteride result in a significant dose-related manner suppression of DHT serum and scalp concentrations compared with placebo.[5] Dutasteride was demonstrated to be superior to finasteride in terms of the mean change in total hair count, investigator's assessment of global photographs as well as panel global photographic assessment for multiple views of the different regions of the scalp, in addition to subject's self-assessment.[1,4,5,13] In terms of AGA stage, dutasteride results in significant improvement in MPHL and FPHL clinical stages.[5,13,19] Olszewska and Rudnicka reported a significant improvement in the stage of FPHL in a 46-year-old woman after therapy with dutasteride for 9 months duration to the point that clinical diagnosis of FPHL could no longer be made.[19] Furthermore, dutasteride has been demonstrated to be a good alternative option to go for in MPHL and FPHL patients who happen to be finasteride-slow-responders, resulting in significant improvement.[11,19]

Our systematic review has found that current evidence is limited on the treatment of androgenetic alopecia in females. We could not find high-quality research in the literature studying the treatment in this patient group. A case report of a 46-year-old woman with androgenic alopecia that was recalcitrant to minoxidil, with only limited improvement on finasteride showed a substantial improvement on 0.5-mg oral dutasteride to the point that diagnosis of androgenetic alopecia could no longer be made after 9 months of therapy. In addition, no side effects were observed in the case.[19] Another clinical trial found that dutasteride mesotherapy resulted in significant improvement of androgenetic alopecia in females in terms of photography, hair pull test, hair diameter, and self-assessment in contrast to placebo.[12] Hair mesotherapy is being increasingly used by dermatologists around the world and has been found as a good alternative to systemic therapy to manage AGA with

minimal or no systemic absorption.[18] Moreover, Ids H. Boersma and his colleagues have found that women aged above 50 years had the highest benefit when treated by finasteride. In contrast with women below the age of 50 years who had the highest benefit with dutasteride. But they also emphasized the need of additional new, well-designed randomized controlled trial to support their findings.[3]

As these drugs act to inhibit 5-alpha-reductase, resulting in suppression of DHT, many side effects will subsequently develop, especially the risk of sexual adverse effects increasing about 1.57-fold with using oral 5α-reductase inhibitors.[20] Most studies comparing the tolerability of finasteride and dutasteride have found a good tolerability in both drugs with similar side effects profiles. One trial reported a higher incidence of sexual dysfunction with dutasteride compared to finasteride.[11] Interestingly, Harcha and colleagues found a similar incidence of adverse events and withdrawals between active treatment groups who were treated with dutasteride at doses of 0.02, 0.5, and 0.1 mg and finasteride dose of 1 mg and placebo group.[13]

The current study highlights the superiority of dutasteride over finasteride in terms of efficacy in the treatment of male and female pattern hair loss. The efficacy of dutasteride (0.5 mg) in promoting hair growth was demonstrated across several studies. In comparison to placebo, dutasteride resulted in a significant increase in hair count, as evidenced by Eun et al and Moftah et al, with percentages favoring dutasteride over placebo.[10,12] Moreover, dutasteride exhibited superiority over finasteride (1 mg) in enhancing hair count, as observed in multiple studies. Notably, various doses of dutasteride proved more effective than both placebo and finasteride, with the 0.5 mg and 2.5 mg doses particularly outperforming finasteride. Additionally, dutasteride (0.5 mg) showed significant improvement in hair thickness compared to finasteride (1 mg) in multiple trials, although one study found no significant difference between lower doses of dutasteride and finasteride.[3] Importantly, adverse events were similar across treatment groups, as detailed in (Table 3), suggesting a comparable safety profile for all medications.

Conclusions

Dutasteride is more potent than finasteride in the treatment of AGA in both males and females. All the adverse events between finasteride and dutasteride were comparable.

References

1 Zhou Z, Song S, Gao Z, et al. The efficacy and safety of dutasteride compared with finasteride in treating men with androgenetic alopecia: a systematic review and meta-analysis. Clin Interv Aging 2019; Volume 14:399–406.

2 Tsunemi Y, Irisawa R, Yoshiie H, et al. Long-term safety and efficacy of dutasteride in the treatment of male patients with androgenetic alopecia. J Dermatol 2016; 43:1051–8.

3 Verdonschot E, Boersma I, Oranje A, et al. The effectiveness of finasteride and dutasteride used for 3 years in women with androgenetic alopecia. Indian J Dermatology, Venereol Leprol 2014; 80:521.

4 Shanshanwal S., Dhurat R. Superiority of dutasteride over finasteride in hair regrowth and reversal of miniaturization in men with androgenetic alopecia: A randomized controlled open-label, evaluator-blinded study. Indian J Dermatology, Venereol Leprol 2017; 83:47.

5 Olsen EA, Hordinsky M, Whiting D, et al. The importance of dual 5α-reductase inhibition in the treatment of male pattern hair loss: Results of a randomized placebo-controlled study of dutasteride versus finasteride. J Am Acad Dermatol 2006; 55:1014–23.

6 Motofei IG, Rowland DL, Baconi DL, et al. Therapeutic considerations related to finasteride administration in male androgenic alopecia and benign prostatic hyperplasia [WWW Document]. Farmacia. 2017; 65:660–6.

7 Busanello EB, Turcatel E. Androgenic alopecia and dutasteride in hair mesotherapy: A short review. Our Dermatology Online 2018; 9:75–9.

8 Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. PLoS Med 2009; 6:e1000100.

9 Choi GS, Kim JH, Oh S-Y, et al. Safety and Tolerability of the Dual 5-Alpha Reductase Inhibitor Dutasteride in the Treatment of Androgenetic Alopecia. Ann Dermatol 2016; 28:444.

10 Eun HC, Kwon OS, Yeon JH, et al. Efficacy, safety, and tolerability of dutasteride 0.5 mg once daily in male patients with male pattern hair loss: A randomized, double-blind, placebo-controlled, phase III study. J Am Acad Dermatol 2010; 63:252–8.

11 Jung JY, Yeon JH, Choi JW, et al. Effect of dutasteride 0.5 mg/d in men with androgenetic alopecia recalcitrant to finasteride. Int J Dermatol 2014; 53:1351–7.

12 Moftah N, Moftah N, Abd-Elaziz G, et al. Mesotherapy using dutasteride-containing preparation in treatment of female pattern hair loss: photographic, morphometric and ultrustructural evaluation. J Eur Acad Dermatology Venereol 2013; 27:686–93.

13 Gubelin Harcha W, Barboza Martínez J, Tsai T-F, et al. A randomized, active- and placebo-controlled study of the efficacy and safety of different doses of dutasteride versus placebo and finasteride in the treatment of male subjects with androgenetic alopecia. J Am Acad Dermatol 2014; 70:489-498.e3.

14 Salman KE, Altunay IK, Kucukunal NA, Cerman AA. Frequency, severity and related factors of androgenetic alopecia in dermatology outpatient clinic: hospital-based cross-sectional study in Turkey. An Bras Dermatol 2017; 92:35–40.

15 Asfour L, Cranwell W, Sinclair R. Male Androgenetic Alopecia. , 2000URL http://www.ncbi.nlm.nih.gov/pubmed/14819896.

16 Yip L, Rufaut N, Sinclair R. Role of genetics and sex steroid hormones in male androgenetic alopecia and female pattern hair loss: An update of what we now know. Australas J Dermatol 2011; 52:81–8.

17 LUDWIG E. Classification of the types of androgenetic alopecia (common baldness) occurring in the female sex. Br J Dermatol 1977; 97:247–54.

18 Traish AM. Health Risks Associated with Long-Term Finasteride and Dutasteride Use: It's Time to Sound the Alarm. World J Mens Health 2020; 38:323.

19 Olszewska M, Rudnicka L. Effective treatment of female androgenic alopecia with dutasteride. J Drugs Dermatol 2005; 4:637–40.

20 Lee S, Lee Y, Choe S, Lee W. Adverse Sexual Effects of Treatment with Finasteride or Dutasteride for Male Androgenetic Alopecia: A Systematic Review and Meta-analysis. Acta Derm Venereol 2018. doi:10.2340/00015555-3035.

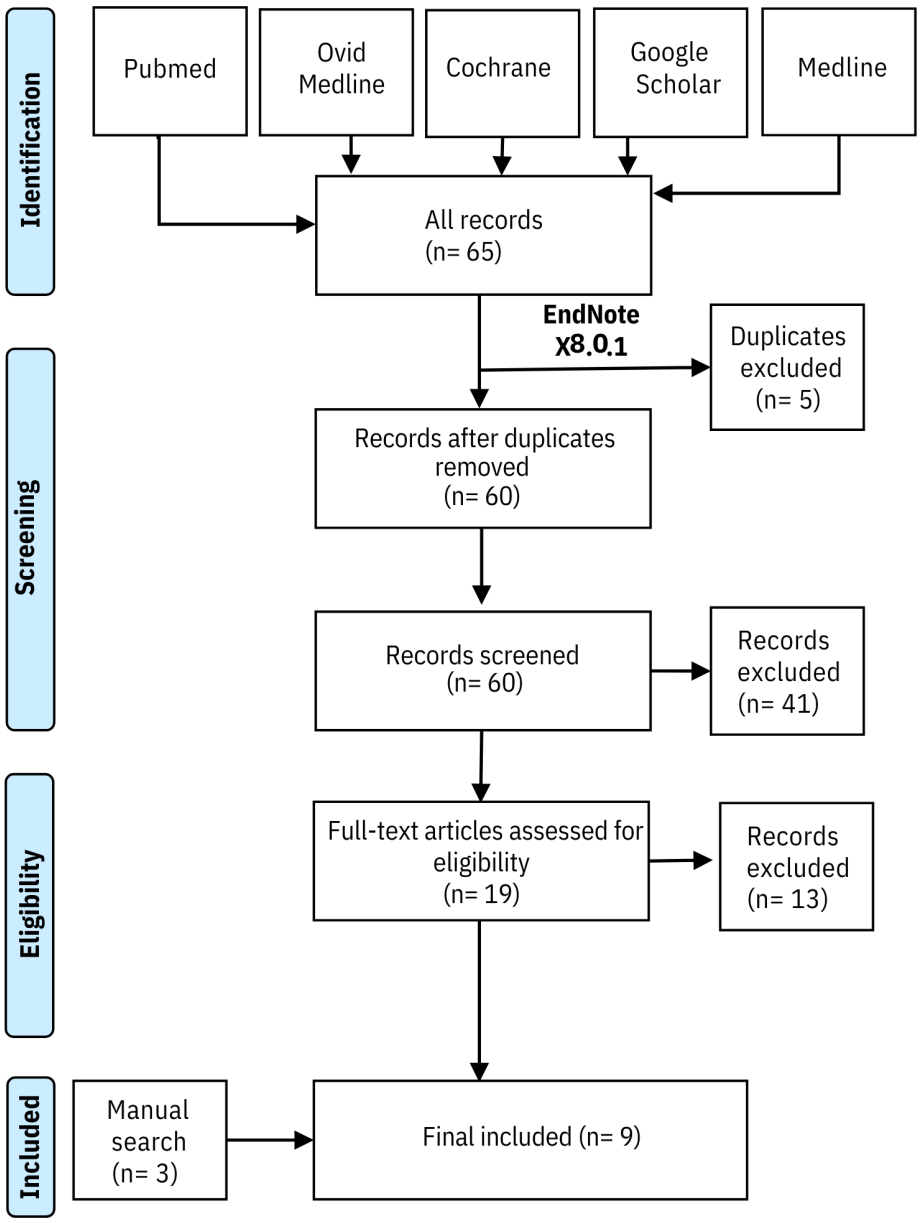

Figure 1. Flow diagram of the selection process.

Table 1. Characteristics of the included studies.

Study ID	Study design	Compared groups (doses)	Sample size	Mean age	Male (%)
Choi-2016-Korea	Prospective cohort	Dutasteride (0.5 mg)	712	29.3	100%
TSUNEMI-2016-Japan	SACT	Dutasteride (0.5 mg)	120	42.2	100%
Eun-2010-Korea	RCT	Dutasteride (0.5 mg) Placebo	73 73	37.8 38.4	100%
Moftah-2012-Egypt	Prospective cohort	Dutasteride (0.5 mg) Placebo	86 40	34.1 34.8	0%
Boersma-2014-Netherlands	Retrospective cohort	Dutasteride (0.15 mg) Finasteride (1.25 mg)	60 120	16-48*	0%
Jung-2014-Korea	Retrospective cohort	Dutasteride (0.5 mg) Finasteride (1 mg)	31	33.7	100%
Shanshanwal-2007-India	RCT	Dutasteride (0.5 mg) Finasteride (1 mg)	35 37	18-40*	100%
Olsen-2006-USA	RCT	Dutasteride (0.05 mg) Dutasteride (0.1 mg) Dutasteride (0.5 mg) Dutasteride (2.5 mg) Finasteride (5 mg) Placebo	71 72 68 71 70 64	35.5 36.4 36.1 35.8 38.5 35.8	100%
Harcha-2013-Singapore	RCT	Dutasteride (0.02 mg) Dutasteride (0.1 mg) Dutasteride (0.5 mg) Finasteride (1 mg) Placebo	185 188 184 179 181	38.5 38.7 38.6 38 38.7	100%

*range, RCT, Randomized clinical trial, SACT, single arm clinical trial.

Table 2. Treatment efficacy.

Study ID	Treatment arms	Hair count baseline (mean SD)	Hair count post treatment (mean SD)	Mean change in hair count post treatment	Hair count increase prevalence	Hair thickness baseline (mean SD)	Hair thickness post treatment (mean SD)	Hair thickness increase prevalence
Eun-2010-Korea	Dutasteride (0.5 mg)	148.1 (36.3)	162.3 (35.5)*	-	-	-	-	-
	Placebo	144.3 (32.3)	149.6 (34.4)*	-	-	-	-	-
Boersma-2014-Netherlands	Dutasteride (0.15 mg)	-	-	-	-	-	-	81.7%
	Finasteride (1.25 mg)	-	-	-	-	-	-	82.5%
Jung-2014-Korea	Dutasteride (0.5 mg)	87 (12)	96 (12)*	-	-	53 (12)	63 (11)*	-
	Finasteride (1 mg)	84 (13)	87 (12)*	-	-	52 (12)	53 (12)*	-
Moftah-2012-Egypt	Dutasteride (0.5 mg)	-	-	-	60.5%*	-	-	60.5%*
	Placebo	-	-	-	27.5%*	-	-	22.5%*
Olsen-2006-USA	Dutasteride (0.05 mg)	1000 (302)	-	25*	-	-	-	-
	Dutasteride (0.1 mg)	908 (224)	-	79*	-	-	-	-

	Dutasteride (0.5 mg)	928 (220)	-	95*	-	-	-	-
	Dutasteride (2.5 mg)	972 (247)	-	110*	-	-	-	-
	Finasteride (5 mg)	902 (263)	-	76*	-	-	-	-
	Placebo	920 (236)	-	-32	-	-	-	-
Shanshanwal-2007-India	Dutasteride (0.5 mg)	223 (51)	246 (50)	23.8*	-	-	-	-
	Finasteride (1 mg)	227 (49)	231 (50)	4*	-	-	-	-
Harcha-2013-Singapore	Dutasteride (0.02 mg)	774 (226)	-	17*	-	-	-	-
	Dutasteride (0.1 mg)	721 (220)	-	63*	-	-	-	-
	Dutasteride (0.5 mg)	768 (218)	-	90*	-	-	-	-
	Finasteride (1 mg)	764 (181)	-	57*	-	-	-	-
	Placebo	761 (227)	-	-4.9	-	-	-	-

*significant difference.

Table 3. Prevalence of AE in the included studies (%)

Side effect	Study ID	Dutasteride 0.02 mg	Dutasteride 0.05 mg	Dutasteride 0.1 mg	Dutasteride 0.15 mg	Dutasteride 0.5 mg	Dutasteride 2.5 mg	Finasteride 1 mg	Finasteride 1.25 mg	Finasteride 5 mg	Placebo
All AE	Eun-2010-Korea	-	-	-	-	49%	-	-	-	-	43%
	Shanshanwal-2007-India	-	-	-	-	23%	-	19%	-	-	-
	Harcha-2013-Singapore	49%	-	51%	-	54%	-	53%	-	-	52%
	TSUNEMI-2016-Japan	-	-	-	-	53%	-	-	-	-	-
	Choi-2016-Korea	-	-	-	-	15%	-	-	-	-	-
Drug related AE	Eun-2010-Korea	-	-	-	-	7%	-	-	-	-	9%
	Harcha-2013-Singapore	48%	-	52%	-	41%	-	48%	-	-	40%
	TSUNEMI-2016-Japan	-	-	-	-	17%	-	-	-	-	-
Serious AE	Eun-2010-Korea	-	-	-	-	0%	-	-	-	-	1%
	Harcha-2013-Singapore	0%	-	2%	-	1%	-	1%	-	-	1%
Sexual dysfunction	Eun-2010-Korea	-	-	-	-	4%	-	-	-	-	3%
	TSUNEMI-2016-Japan	-	-	-	-	3%	-	-	-	-	-
	Choi-2016-Korea	-	-	-	-	0.6%	-	-	-	-	-
Erectile dysfunction	Eun-2010-Korea	-	-	-	-	0%	-	-	-	-	1%
	Shanshanwal-2007-India	-	-	-	-	9%	-	3%	-	-	-

	Harcha-2013-Singapore	4%	-	4%	-	6%	-	5%	-	-	4%
	TSUNEMI-2016-Japan	-	-	-	-	15%	-	-	-	-	-
Ejaculation disorder	Eun-2010-Korea	-	-	-	-	0%	-	-	-	-	1%
	Olsen-2006-USA	-	0%	3%	-	1%	1%	-	-	3%	0%
	TSUNEMI-2016-Japan	-	-	-	-	4%	-	-	-	-	-
	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
libido disorders	Jung-2014-Korea	-	-	-	-	17%	-	-	-	-	-
	Olsen-2006-USA	-	3%	3%	-	1%	13%	-	-	4%	3%
	Shanshanwal-2007-India	-	-	-	-	3%	-	8%	-	-	-
	Harcha-2013-Singapore	5%	-	5%	-	3%	-	5%	-	-	1%
	TSUNEMI-2016-Japan	-	-	-	-	8%	-	-	-	-	-
	Choi-2016-Korea	-	-	-	-	1.3%	-	-	-	-	-
Impotence	Olsen-2006-USA	-	3%	0%	-	0%	0%	-	-	1%	5%
	Choi-2016-Korea	-	-	-	-	1%	-	-	-	-	-
Pain	Moftah-2012-Egypt	-	-	-	-	83%	-	-	-	-	80%
Headache	Moftah-2012-Egypt	-	-	-	-	22%	-	-	-	-	30%
	Harcha-2013-Singapore	4%	-	4%	-	6%	-	3%	-	-	9%
	TSUNEMI-2016-Japan	-	-	-	-	3%	-	-	-	-	-

Itching	Moftah-2012-Egypt	-	-	-	-	4%	-	-	-	-	0%
Nasopharyngitis	Harcha-2013-Singapore	10%	-	8%	-	13%	-	8%	-	-	9%
	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
	TSUNEMI-2016-Japan	-	-	-	-	15%	-	-	-	-	-
Abdominal pain	Harcha-2013-Singapore	3%	-	4%	-	1%	-	1%	-	-	1%
URTI	Harcha-2013-Singapore	3%	-	1%	-	3%	-	1%	-	-	5%
	TSUNEMI-2016-Japan		-		-	3%	-	-	-	-	
Back pain	Harcha-2013-Singapore	3%	-	2%	-	2%	-	2%	-	-	2%
Diarrhea	Harcha-2013-Singapore	1%	-	4%	-	1%	-	0%	-	-	2%
	Choi-2016-Korea		-	-	-	0.3%	-	-	-	-	
Allergic rhinitis	Harcha-2013-Singapore	1%	-	1%	-	2%	-	3%	-	-	1%
Influenza	Harcha-2013-Singapore	3%	-	2%	-	2%	-	1%	-	-	1%
	TSUNEMI-2016-Japan	-	-	-	-	4%	-	-	-	-	-
Gingivitis	TSUNEMI-2016-Japan	-	-	-	-	3%	-	-	-	-	-
Prostatic-specific	TSUNEMI-2016-Japan	-	-	-	-	3%	-	-	-	-	-

antigen increased											
Rash	Choi-2016-Korea	-	-	-	-	0.6%	-	-	-	-	-
Pruritus	Choi-2016-Korea	-	-	-	-	0.4%	-	-	-	-	-
Acne	Choi-2016-Korea	-	-	-	-	0.3%	-	-	-	-	-
Alopecia	Choi-2016-Korea	-	-	-	-	0.3%	-	-	-	-	-
Folliculitis	Choi-2016-Korea	-	-	-	-	0.3%	-	-	-	-	-
Dermatophytosis	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Seborrhea	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Verruca	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Dyspepsia	Choi-2016-Korea	-	-	-	-	1.1%	-	-	-	-	-
Psychiatric disorders	Choi-2016-Korea	-	-	-	-	1.8%	-	-	-	-	-
Depression	Choi-2016-Korea	-	-	-	-	0.3%	-	-	-	-	-
Insomnia	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Somnolence	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
SGPT increased	Choi-2016-Korea	-	-	-	-	0.6%	-	-	-	-	-
SGOT increased	Choi-2016-Korea	-	-	-	-	0.3%	-	-	-	-	-
Bilirubinaemia	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Fatigue	Choi-2016-Korea	-	-	-	-	0.7%	-	-	-	-	-
Epistaxis	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Hypertriglyceridemia	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Weight increase	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-

Paraesthesia	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Dizziness	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Gynaecomastia	Choi-2016-Korea	-	-	-	-	0.3%	-	-	-	-	-
Testosterone decreased	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Palpitation	Choi-2016-Korea	-	-	-	-	0.3%	-	-	-	-	-
Taste perversion	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-
Surgical intervention	Choi-2016-Korea	-	-	-	-	0.1%	-	-	-	-	-

AE, adverse events, #decrease or loss, URTI, upper respiratory tract infection.

Supplementary material:

Figure S1. Flow diagram of the selection process.

Table S1. Characteristics of the included studies.

Table S2. Treatment efficacy.

Table S3. Prevalence of AE in the included studies (%).