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Terbinafine

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Terbinafine, sold under the brand name **Lamisil** among others, is an [antifungal medication](#) used to treat [ringworm](#), [pityriasis versicolor](#), and [fungal nail infections](#).^{[1][2]} It is either taken by mouth or applied to the skin as a cream or ointment.^{[1][3]} The cream and ointment are not effective for nail infections.^[4]

Common side effects when taken by mouth include nausea, diarrhea, headache, cough, rash, and [elevated liver enzymes](#).^[1] Severe side effects include [liver problems](#) and [allergic reactions](#).^[1] Use during [pregnancy](#) is not typically recommended.^[1] The cream and ointment may result in itchiness but are generally well tolerated.^[2] Terbinafine is in the [allylamines](#) family of medications.^[1] It works by decreasing the ability of fungi to make [sterols](#).^[1]

Terbinafine was discovered in 1991.^[5] It is on the [World Health Organization's List of Essential Medicines](#), the most effective and safe medicines needed in a [health system](#).^[6] The wholesale cost in the [developing world](#) is about 2.20 USD for a 20 gm tube.^[7] In the United States a course of treatment costs less than 25 USD and is available [over the counter](#).^[4]

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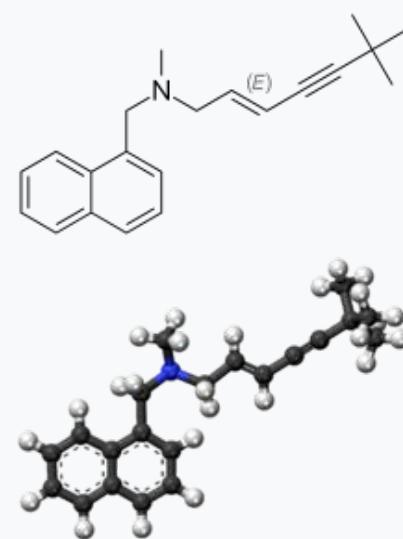
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Medical uses [\[edit\]](#)

Terbinafine is mainly effective on the [dermatophyte](#) group of fungi.

As a cream or powder, it is used [topically](#) for superficial skin infections such as [jock itch](#) (*tinea cruris*), [athlete's foot](#) (*tinea pedis*), and other types of [ringworm](#) (*tinea corporis*). Terbinafine cream works in about half the time required by other^[8]

Terbinafine



Clinical data

Trade names	Lamisil, others
AHFS/Drugs.com Monograph	[link]
MedlinePlus	a699061 [link]
Pregnancy category	US: B (No risk in non-human studies)
Routes of administration	by mouth and topical
ATC code	D01AE15 (WHO) D01BA02 (WHO)

Legal status

Legal status	Low-strength topical preparations available without prescription
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Pharmacokinetic data

Bioavailability	Readily absorbed: 70–90%
Protein binding	>99%
Metabolism	liver
Biological half-life	Highly variable

antifungals.

[Tablets](#) by mouth are often prescribed for the treatment of [onychomycosis](#), a fungal nail infection, typically by a dermatophyte or [Candida](#) species. Fungal nail infections are located deep under the nail in the [cuticle](#) to which topically applied treatments are unable to penetrate in sufficient amounts. The tablets may, rarely, cause [hepatotoxicity](#), so patients are warned of this and may be monitored with [liver function tests](#). Alternatives to by mouth administration have been studied.

Terbinafine hydrochloride may induce or exacerbate [subacute cutaneous lupus erythematosus](#). Persons with [lupus erythematosus](#) should first discuss possible risks with their doctor before initiation of therapy. [9]

FDA approval [\[edit\]](#)

Terbinafine first became available in Europe in 1991 and in the United States in 1996. The U.S. [Food and Drug Administration](#) has approved the first generic versions of prescription Lamisil (terbinafine hydrochloride) tablets. The remaining patent or exclusivity for Lamisil expired on June 30, 2007.

On September 28, 2007, the FDA stated that terbinafine is a new [treatment](#) approved for use by [children](#) age four and up. The [antifungal granules](#) can be sprinkled on a child's food to treat [ringworm](#) of the scalp, [tinea capitis](#). [10]

Side effects [\[edit\]](#)

Many side effects and [adverse drug reactions](#) have been reported with oral terbinafine hydrochloride [11][12][13], possibly due to its extensive [biodistribution](#) and the often extended durations involved in antifungal treatment (longer than two months). A comprehensive list of adverse events associated with terbinafine use includes:

- Gastrointestinal problems: [Diarrhea](#), [constipation](#), [nausea](#), fullness, abdominal pain, [indigestion](#), [dyspepsia](#), [gastritis](#), [cholestasis](#), [flatulence](#), altered stool colour, abdominal muscular pain
- Central nervous system or neurological problems: [Headaches](#), [dizziness](#), [vertigo](#), light-headedness, decreased concentration levels, paraesthesia (pins and needles)
- Hepatic problems: Raised liver enzyme levels, liver [inflammation](#) ([hepatitis](#)), liver damage, liver failure
- Immune system problems: Decreased [white blood cell](#) counts including [pancytopenia](#), [leukopenia](#), [lymphopenia](#), [thrombocytopenia](#), [agranulocytosis](#), and [neutropenia](#), [autoimmune](#) reactions such as [lupus erythematosus](#)
- Psychological problems: [Depression](#), [anxiety](#), [insomnia](#), increased or unusual [dream](#) activity, [malaise](#)
- Sensory problems: Complete loss of taste ([ageusia](#)), decreased taste ([hypogeusia](#)) and distorted taste ([dysgeusia](#)), often involving a metallic taste sensation and dry mouth, visual disturbances including blurred vision, green vision and double vision. In extremely rare cases, the loss or impairment of taste is permanent [14]
- Skin problems: [Rashes](#), [hives](#) ([urticaria](#)), skin irritation, itching, [jaundice](#), [Stevens–Johnson syndrome](#)
- Other side effects: [Fatigue](#), increased heart rate ([tachycardia](#)), hair loss ([alopecia](#)), decreased [red blood cell](#) count ([anemia](#)), muscle pain ([myalgia](#)), joint pain ([arthralgia](#))

In 2015 physicians reported [15] that a patient with an [MTHFR](#) enzyme mutation (specifically the [C677T](#) variant) had developed an adverse reaction to Lamisil (headache, fatigue, and dizziness). Genetic testing revealed the MTHFR C677T mutation. It was noted that Lamisil interferes with the methylation cycle and that this can cause side effects in individuals with the MTHFR C677T mutation.

Pharmacology [\[edit\]](#)

Identifiers	
IUPAC name	[show]
CAS Number	91161-71-6 78628-80-5
PubChem CID	1549008
DrugBank	DB00857
ChemSpider	1266005
UNII	G7RIW8S0XP
KEGG	D02375
ChEBI	CHEBI:9448
ChEMBL	CHEMBL822
ECHA InfoCard	100.119.605
Chemical and physical data	
Formula	C ₂₁ H ₂₅ N
Molar mass	291.43 g/mol
3D model (JSmol)	Interactive image
SMILES	[show]
InChI	[show]
(what is this?) (verify)	

Terbinafine [hydrochloride](#) is a white fine crystalline powder that is freely soluble in [methanol](#) and [dichloromethane](#), soluble in [ethanol](#), and slightly soluble in water. It is highly [hydrophobic](#) and tends to accumulate in [hair](#), skin, [nails](#), and [fatty tissue](#).

Like other allylamines, terbinafine inhibits [ergosterol](#) synthesis by inhibiting [squalene epoxidase](#), an enzyme that is part of the fungal [cell membrane](#) synthesis pathway. Because terbinafine prevents conversion of [squalene](#) to [lanosterol](#), [ergosterol](#) cannot be synthesized. This is thought to change cell membrane permeability, causing fungal cell [lysis](#).



Generic terbinafine hydrochloride pills

Brand names [\[edit\]](#)

Terbinafine is sold in India as Terboderm by Omega Pharma and Tyza (Abbott Healthcare),^[16] Lamisil in Argentina, Australia, Belgium, Brazil, Canada, Chile, Croatia, Egypt, Czech, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Mexico, the Netherlands, New Zealand, Norway, Pakistan (), Peru, the Philippines,^[17] Romania, Russia, Slovakia, Slovenia, South Africa, Sweden, Thailand, the United Kingdom, the United States, and Venezuela; also it is sold under the name Corbinal and Terbisil in Turkey, and Undofen in Poland. As a generic oral medication, it is sold as Sebifin, Tinasil, Terbisil, Terbicor, and Tamsil in Australia, whilst the generic topical medication is sold there as SolvEasyTinea and Tamsil.^{[18][19]} It is also available as a generic medication in the United States, the United Kingdom, Belgium, Switzerland, Brazil and Mexico. In India, terbinafine hydrochloride is available in topical form under the brand names Triabin by Medley Pharmaceuticals, Sebifin (Sun Pharma), Zimig (GSK Pharma) and mycoCeaze (Progrés Laboratories). MycoVa, developed by [Apricus Biosciences](#), is a topical nail solution of terbinafine and [DDAIP](#), which has completed three phase-III studies for the treatment of [onychomycosis](#). Other names include Terbinaforce ([Mankind Pharma](#)) and Tafine (Deurali Janta Pharmaceuticals Pvt Ltd.) Turbo (Apex Pharmaceuticals Pvt Ltd) in Nepal. The topical form is sold as LamisilAT in the United States.

Production [\[edit\]](#)

Terbinafine is produced from N-methyl-1-naphthalenemethanamine, 1,3-dichloropropene, and [neohexene](#).^[20]

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V · I · E · Antifungals (D01 and J02) [hide]			
Wall/	Ergosterol inhibitors	Azoles (lanosterol 14α-demethylase inhibitors)	Imidazoles
			<p>Topical:</p> <ul style="list-style-type: none"> bifonazole [†] . butoconazole . chlormidazole [‡] • clotrimazole [#] • croconazole [‡] • eberconazole • econazole . fenticonazole [‡] • flutrimazole . isoconazole [‡] . ketoconazole . luliconazole . miconazole [#] . neticonazole [‡] . omoconazole [‡] • oxiconazole . sertaconazole . sulconazole . tioconazole . <p>Systemic:</p> <ul style="list-style-type: none"> ketoconazole . <p>Topical:</p> <ul style="list-style-type: none"> efinaconazole . fluconazole [#] . fosfluconazole . terconazole . <p>Systemic:</p>

membrane	Triazoles	fluconazole# · hexaconazole† · isavuconazole · itraconazole · posaconazole · voriconazole · Unknown: albaconazole† · ravuconazole† ·
	Thiazoles	Topical: abafungin† ·
	Polyene antimycotics (ergosterol binding)	Topical: hamycin† · natamycin · nystatin# · Systemic: amphotericin B# · hamycin† ·
	Squalene monooxygenase inhibitors	Topical: naftifine · terbinafine · Systemic: terbinafine ·
	Benzylamines	Topical: butenafine ·
	Others	Topical: amorolfine ·
β-glucan synthase inhibitors	echinocandins (anidulafungin · biafungin · caspofungin · cilofungin · micafungin) ·	
Intracellular	Pyrimidine analogues/ thymidylate synthase inhibitors	flucytosine# ·
	Mitotic inhibitors	griseofulvin# ·
	Aminoacyl tRNA synthetase inhibitors	tavaborole ·
Others	bromochlorosalicylanilide · chlorophetanol · chlorphenesin · ciclopirox · crystal violet · dimazole · ethylparaben · halopropin† · polynoxylin · potassium iodide# · salicylic acid · selenium disulfide# · sodium thiosulfate# · sultentine · taurolidine · ticlatone · tolciolate · tolnaftate · tribromometacresol · undecylenic acid · Whitfield's ointment# · citronella oil · lemon grass · lemon myrtle · orange oil · patchouli · tea tree oil · PCP · atovaquone · dapson · pentamidine ·	

#WHO-EM · †Withdrawn from market · Clinical trials: (†Phase III) · §Never to phase III ·

Categories: [Antifungals](#) | [Novartis](#) | [World Health Organization essential medicines](#) | [Alkynes](#)