

## VIAGRA®

### 1. NAME OF THE MEDICINAL PRODUCT

VIAGRA®

### 2. QUALITATIVE AND QUANTITATIVE COMPOSITION

VIAGRA 50 mg: Each tablet contains sildenafil citrate equivalent to 50 mg sildenafil.

VIAGRA 100 mg: Each tablet contains sildenafil citrate equivalent to 100 mg sildenafil.

For excipients, see section 6.1.

### 3. PHARMACEUTICAL FORM

Film-coated tablet.

Blue, rounded-diamond shaped film-coated tablets equivalent to 50 mg or 100 mg of sildenafil for oral administration, marked "VIAGRA" on one side, and "VGR 50", or "VGR 100" on the other.

### 4. CLINICAL PARTICULARS

#### 4.1 Therapeutic indications

Sildenafil is indicated for the treatment of erectile dysfunction, which is the inability to achieve or maintain a penile erection sufficient for satisfactory sexual performance.

In order for sildenafil to be effective, sexual stimulation is required.

## **4.2 Posology and method of administration**

Sildenafil tablets are for oral administration.

### **Use in adults**

For most patients, the recommended dose is 50 mg taken, as needed, approximately 1 hour before sexual activity.

Based on effectiveness and toleration, the dose may be increased to a maximum recommended dose of 100 mg or decreased to 25 mg. The maximum recommended dose is 100 mg. The maximum recommended dosing frequency is once per day.

### **Use in patients with impaired renal function**

Dosage adjustments are not required in patients with mild to moderate renal impairment (creatinine clearance = 30-80 mL/min).

Since sildenafil clearance is reduced in patients with severe renal impairment (creatinine clearance <30 mL/min), a 25 mg dose should be considered.

### **Use in patients with impaired hepatic function**

Since sildenafil clearance is reduced in patients with hepatic impairment (e.g., cirrhosis), a 25 mg dose should be considered.

### **Use in patients using other medications**

Given the extent of the interaction with patients receiving concomitant therapy with ritonavir (see section 4.5 Interaction with other medicinal products and other forms of interaction - Effects of other medicinal products on sildenafil), it is recommended not to exceed a maximum single dose of 25 mg of sildenafil in a 48-hour period.

A starting dose of 25 mg should be considered in patients receiving concomitant treatment with the CYP3A4 inhibitors (e.g., erythromycin, saquinavir, ketoconazole, itraconazole). See section 4.5 Interaction with other medicinal products and other forms of interaction.

In order to minimize the potential for developing postural hypotension, patients should be stable on alpha-blocker therapy prior to initiating sildenafil treatment. In addition, initiation

of sildenafil at lower doses should be considered (see section 4.4 Special warnings and precautions for use and section 4.5 Interaction with other medicinal products and other forms of interaction).

#### **Use in children**

Sildenafil is not indicated for use in children (<18 years old).

#### **Use in elderly men**

Dosage adjustments are not required in elderly patients.

### **4.3 Contraindications**

Use of sildenafil is contraindicated in patients with a known hypersensitivity to any component of the tablet.

Sildenafil was shown to potentiate the hypotensive effects of acute and chronic nitrates, and its administration to patients who are concurrently using nitric oxide donors, organic nitrates or organic nitrites in any form either regularly or intermittently is therefore, contraindicated (see section 4.5 Interaction with other medicinal products and other forms of interaction).

The co-administration of PDE5 inhibitors, including sildenafil, with guanylate cyclase stimulators, such as riociguat, is contraindicated as it may potentially lead to symptomatic hypotension.

### **4.4 Special warnings and precautions for use**

A thorough medical history and physical examination should be undertaken to diagnose erectile dysfunction, determine potential underlying causes, and identify appropriate treatment.

There is a degree of cardiac risk associated with sexual activity; therefore, physicians may wish to consider the cardiovascular status of their patients prior to initiating any treatment for erectile dysfunction.

Agents for the treatment of erectile dysfunction should not be used in men for whom sexual activity is inadvisable (e.g., patients with severe cardiovascular disorders, such as unstable angina or severe cardiac failure).

Serious cardiovascular events, including myocardial infarction, sudden cardiac death, ventricular arrhythmia, cerebrovascular hemorrhage and transient ischemic attack have been reported post-marketing in temporal association with the use of sildenafil for erectile dysfunction. Most, but not all, of these patients had pre-existing cardiovascular risk factors. Many of these events were reported to occur during or shortly after sexual activity, and a few were reported to occur shortly after the use of sildenafil without sexual activity. Others were reported to have occurred hours to days after the use of sildenafil and sexual activity. It is not possible to determine whether these events are related directly to sildenafil, to sexual activity, to the patient's underlying cardiovascular disease, to a combination of these factors, or to other factors.

In clinical trials, sildenafil has been shown to have systemic vasodilatory properties that result in transient decreases in blood pressure (see section 5.1 Pharmacodynamic properties - Clinical studies). This is of little or no consequence in most patients. However, prior to prescribing sildenafil, physicians should carefully consider whether their patients with certain underlying conditions could be adversely affected by such vasodilatory effects, especially in combination with sexual activity. Patients with increased susceptibility to vasodilators include those with left ventricular outflow obstruction (e.g., aortic stenosis, hypertrophic obstructive cardiomyopathy), or those with the rare syndrome of multiple system atrophy manifesting as severely impaired autonomic control of blood pressure.

Non-arteritic anterior ischemic optic neuropathy (NAION), a rare condition and a cause of decreased vision or loss of vision, has been reported rarely post-marketing with the use of all PDE5 inhibitors, including sildenafil. Most of these patients had risk factors, such as low cup to disc ratio ("crowded disc"), age over 50, diabetes, hypertension, coronary artery disease, hyperlipidemia and smoking. An observational study evaluated whether recent use of PDE5 inhibitors, as a class, was associated with acute onset of NAION. The results suggest an approximate 2-fold increase in the risk of NAION within 5 half-lives of PDE5 inhibitor use. Based on published literature, the annual incidence of NAION is 2.5-11.8 cases per 100,000 males aged  $\geq 50$  per year in the general population. In case of sudden visual loss, patients should be advised to stop taking sildenafil and consult a physician

immediately.

Individuals who have already experienced NAION are at increased risk of NAION recurrence. Therefore, physicians should discuss this risk with these patients and whether they could be adversely affected by use of PDE5 inhibitors. PDE5 inhibitors, including sildenafil, should be used with caution in these patients and only when the anticipated benefits outweigh the risks.

Caution is advised when sildenafil is administered to patients taking an alpha-blocker, as the co-administration may lead to symptomatic hypotension in a few susceptible individuals (see section 4.5 Interaction with other medicinal products and other forms of interaction). In order to minimize the potential for developing postural hypotension, patients should be hemodynamically stable on alpha-blocker therapy prior to initiating sildenafil treatment. Initiation of sildenafil at lower doses should be considered (see section 4.2 Posology and method of administration). In addition, physicians should advise patients what to do in the event of postural hypotensive symptoms.

A minority of patients with the inherited condition retinitis pigmentosa have genetic disorders of retinal phosphodiesterases. There is no safety information on the administration of sildenafil to patients with retinitis pigmentosa, therefore, sildenafil should be administered with caution to these patients.

*In vitro* studies with human platelets indicate that sildenafil potentiates the antiaggregatory effect of sodium nitroprusside (a nitric oxide donor). There is no safety information on the administration of sildenafil to patients with bleeding disorders or active peptic ulceration, therefore, sildenafil should be administered with caution to these patients.

Agents for the treatment of erectile dysfunction should be used with caution in patients with anatomical deformation of the penis (such as angulation, cavernosal fibrosis or Peyronie's disease), or in patients who have conditions which may predispose them to priapism (such as sickle cell anemia, multiple myeloma, or leukemia).

Prolonged erections and priapism have been reported with sildenafil in post-marketing experience. In the event of an erection that persists longer than 4 hours, the patient

should seek immediate medical assistance. If priapism is not treated immediately, penile tissue damage and permanent loss of potency could result.

The safety and efficacy of combinations of sildenafil with other PDE5 inhibitors, or other pulmonary arterial hypertension (PAH) treatments containing sildenafil, or other treatments for erectile dysfunction have not been studied, and the use of such combinations is not recommended.

Sudden decrease or loss of hearing has been reported in a small number of post-marketing and clinical trials cases with the use of all PDE5 inhibitors, including sildenafil. Most of these patients had risk factors for sudden decrease or loss of hearing. No causal relationship has been made between the use of PDE5 inhibitors and sudden decrease or loss of hearing. In case of sudden decrease or loss of hearing patients should be advised to stop taking sildenafil and consult a physician promptly.

#### **4.5 Interaction with other medicinal products and other forms of interaction**

##### **Effects of other medicinal products on sildenafil**

###### ***In vitro* studies:**

Sildenafil metabolism is principally mediated by the cytochrome P450 (CYP) isoforms 3A4 (major route) and 2C9 (minor route). Therefore, inhibitors of these isoenzymes may reduce sildenafil clearance and inducers of these isoenzymes may increase sildenafil clearance.

###### ***In vivo* studies:**

Population pharmacokinetic analysis of clinical trial data indicated a reduction in sildenafil clearance when co-administered with CYP3A4 inhibitors (such as ketoconazole, erythromycin, cimetidine).

Cimetidine (800 mg), a cytochrome P450 inhibitor and a non-specific CYP3A4 inhibitor, caused a 56% increase in plasma sildenafil concentrations when co-administered with sildenafil (50 mg) to healthy volunteers.

When a single 100 mg dose of sildenafil was administered with erythromycin, a moderate CYP3A4 inhibitor, at steady-state (500 mg twice daily for 5 days), there was a 182% increase in sildenafil systemic exposure (AUC). In addition, co-administration of the HIV

protease inhibitor saquinavir, also a CYP3A4 inhibitor, at steady-state (1,200 mg three times daily) with sildenafil (100 mg single dose) resulted in a 140% increase in sildenafil  $C_{max}$  and a 210% increase in sildenafil AUC. Sildenafil had no effect on saquinavir pharmacokinetics. See section 4.2 Posology and method of administration. Stronger CYP3A4 inhibitors, such as ketoconazole and itraconazole would be expected to have greater effects.

Co-administration with the HIV protease inhibitor ritonavir, which is a highly potent P450 inhibitor, at steady-state (500 mg twice daily) with sildenafil (100 mg single dose) resulted in a 300% (4-fold) increase in sildenafil  $C_{max}$  and a 1000% (11-fold) increase in sildenafil plasma AUC. At 24 hours, the plasma levels of sildenafil were still approximately 200 ng/mL, compared to approximately 5 ng/mL when sildenafil was dosed alone. This is consistent with ritonavir's marked effects on a broad range of P450 substrates. Sildenafil had no effect on ritonavir pharmacokinetics. See section 4.2 Posology and method of administration.

When the dose of sildenafil for subjects receiving potent CYP3A4 inhibitors was administered as recommended, the maximum free plasma sildenafil concentration did not exceed 200 nM for any individual and was consistently well tolerated. Single doses of antacid (magnesium hydroxide/aluminum hydroxide) did not affect the bioavailability of sildenafil.

In a study of healthy male volunteers, co-administration of the endothelin antagonist, bosentan, (an inducer of CYP3A4 [moderate], CYP2C9 and possibly of CYP2C19) at steady-state (125 mg twice a day) with sildenafil at steady-state (80 mg three times a day) resulted in 62.6% and 55.4% decrease in sildenafil AUC and  $C_{max}$ , respectively. Sildenafil increased bosentan AUC and  $C_{max}$  by 49.8% and 42%, respectively. Concomitant administration of strong CYP3A4 inducers, such as rifampin, is expected to cause greater decreases in plasma concentrations of sildenafil.

Pharmacokinetic data from patients in clinical trials showed no effect on sildenafil pharmacokinetics of CYP2C9 inhibitors (such as tolbutamide, warfarin), CYP2D6 inhibitors (such as selective serotonin reuptake inhibitors, tricyclic antidepressants), thiazide and related diuretics, angiotensin converting enzyme (ACE) inhibitors, and calcium channel blockers.

In healthy male volunteers, there was no evidence of an effect of azithromycin (500 mg daily for 3 days) on the AUC,  $C_{max}$ ,  $T_{max}$ , elimination rate constant, or subsequent half-life of sildenafil or its major circulating metabolite.

### **Effects of sildenafil on other medicinal products**

#### ***In vitro* studies:**

Sildenafil is a weak inhibitor of the cytochrome P450 isoforms 1A2, 2C9, 2C19, 2D6, 2E1 and 3A4 ( $IC_{50} >150 \mu M$ ).

Given sildenafil peak plasma concentrations of approximately 1  $\mu M$  after recommended doses, it is unlikely that sildenafil will alter the clearance of substrates of these isoenzymes.

#### ***In vivo* studies:**

Sildenafil was shown to potentiate the hypotensive effect of acute and chronic nitrates. Therefore, use of nitric oxide donors, organic nitrates, or organic nitrites in any form either regularly or intermittently with sildenafil is contraindicated (see section 4.3 Contraindications).

In three specific drug-drug interaction studies, the alpha-blocker doxazosin (4 mg and 8 mg) and sildenafil (25 mg, 50 mg, or 100 mg) were administered simultaneously to patients with benign prostatic hyperplasia (BPH) stabilized on doxazosin therapy. In these study populations, mean additional reductions of supine blood pressure of 7/7 mmHg, 9/5 mmHg, and 8/4 mmHg, and mean additional reductions of standing blood pressure of 6/6 mmHg, 11/4 mmHg, and 4/5 mmHg, respectively, were observed. When sildenafil and doxazosin were administered simultaneously to patients stabilized on doxazosin therapy, there were infrequent reports of patients who experienced symptomatic postural hypotension. These reports included dizziness and lightheadedness, but not syncope. Concomitant administration of sildenafil to patients taking alpha-blocker therapy may lead to symptomatic hypotension in a few susceptible individuals (see section 4.2 Posology and method of administration and section 4.4 Special warnings and precautions for use).

No significant interactions were shown when sildenafil (50 mg) was co-administered with tolbutamide (250 mg) or warfarin (40 mg), both of which are metabolized by CYP2C9.



Sildenafil (100 mg) did not affect the steady-state pharmacokinetics of the HIV protease inhibitors, saquinavir and ritonavir, both of which are CYP3A4 substrates (see above, Effects of other medicinal products on sildenafil).

Sildenafil at steady-state (80 mg three times a day) resulted in a 49.8% increase in bosentan AUC and a 42% increase in bosentan  $C_{max}$  (125 mg twice a day) (see above, Effects of other medicinal products on sildenafil).

Sildenafil (50 mg) did not potentiate the increase in bleeding time caused by aspirin (150 mg).

Sildenafil (50 mg) did not potentiate the hypotensive effect of alcohol in healthy volunteers with mean maximum blood alcohol levels of 0.08% (80 mg/dL).

No interaction was seen when sildenafil (100 mg) was co-administered with amlodipine in hypertensive patients. The mean additional reduction on supine blood pressure was 8 mmHg systolic and 7 mmHg diastolic.

Analysis of the safety database showed no difference in the side effect profile in patients taking sildenafil with and without antihypertensive medication.

#### **4.6 Fertility, pregnancy and lactation**

Sildenafil is not indicated for use in women.

No teratogenic effects, impairment of fertility or adverse effects on peri-/post-natal development were found in reproduction studies in rats and rabbits following oral administration of sildenafil.

There are no adequate and well-controlled studies in pregnant or lactating women.

#### 4.7 Effects on ability to drive and use machines

As dizziness and altered vision were reported in clinical trials with sildenafil, patients should be aware of how they react to sildenafil, before driving or operating machinery. The effect of sildenafil on the ability to drive and use machinery has not been studied.

#### 4.8 Undesirable effects

The adverse events were generally transient and mild to moderate in nature.

In fixed-dose studies, the incidence of some adverse events increased with dose.

The nature of the adverse events in flexible-dose studies, which more closely reflect the recommended dosage regimen, was similar to that for fixed-dose studies.

The most commonly reported adverse reactions were headache and flushing.

**Table 1: ADRs by SOC and CIOMS frequency category listed in order of decreasing medical seriousness within each frequency category and SOC.**

<b>System Organ Class</b>	<b>Very Common ≥1/10</b>	<b>Common ≥1/100 to &lt;1/10</b>	<b>Uncommon ≥1/1000 to &lt;1/100</b>	<b>Rare ≥1/10,000 to &lt;1/1000</b>
Infections and infestations			Rhinitis	
Immune system disorders			Hypersensitivity	
Nervous system disorders	Headache	Dizziness	Somnolence	Seizure*; Seizure recurrence*; Syncope

<b>System Organ Class</b>	<b>Very Common ≥1/10</b>	<b>Common ≥1/100 to &lt;1/10</b>	<b>Uncommon ≥1/1000 to &lt;1/100</b>	<b>Rare ≥1/10,000 to &lt;1/1000</b>
Eye disorders		Vision blurred; Visual disturbance; Cyanopsia	Eye pain; Photophobia; Photopsia; Chromatopsia; Ocular hyperaemia; Visual brightness	Eye oedema; Eye swelling; Dry eye; Asthenopia; Halo vision; Xanthopsia; Erythropsia; Eye disorder; Conjunctival hyperaemia; Eye irritation; Abnormal sensation in eye; Eyelid oedema
Cardiac disorders			Tachycardia; Palpitations	
Vascular disorders		Hot flush; Flushing	Hypotension	
Respiratory, thoracic and mediastinal disorders		Nasal congestion	Epistaxis; Sinus congestion	Throat tightness; Nasal dryness; Nasal oedema
Gastrointestinal disorders		Nausea; Dyspepsia	Gastro oesophageal reflux disease; Vomiting; Abdominal pain upper; Dry mouth	Hypoaesthesia oral
Skin and subcutaneous tissue disorders			Rash	

<b>System Organ Class</b>	<b>Very Common ≥1/10</b>	<b>Common ≥1/100 to &lt;1/10</b>	<b>Uncommon ≥1/1000 to &lt;1/100</b>	<b>Rare ≥1/10,000 to &lt;1/1000</b>
Musculoskeletal and connective tissue disorders			Myalgia; Pain in extremity	
Reproductive system and breast disorders				Priapism*; Erection increased
General disorders and administration site conditions			Feeling hot	Irritability
Investigations			Heart rate increased	
*ADR identified post-marketing				

At doses above the recommended dose range, adverse events were similar to those detailed above but generally were reported more frequently.

In an analysis of double blind placebo-controlled clinical trials encompassing over 700 person-years of observation on placebo and over 1300 person-years on sildenafil, there were no differences in the incidence rate of myocardial infarction (MI) or in the rate of cardiovascular mortality for patients receiving sildenafil compared to those receiving placebo. The rates of MI were 1.1 per 100 person-years for men receiving sildenafil and for those receiving placebo. The rates of cardiovascular mortality were 0.3 per 100 person-years for men receiving sildenafil and those receiving placebo.

#### 4.9 Overdose

In studies with healthy volunteers of single doses up to 800 mg, adverse events were similar to those seen at lower doses but incidence rates and severities were increased.

In cases of overdose, standard supportive measures should be adopted as required.

Renal dialysis is not expected to accelerate clearance as sildenafil is highly bound to plasma proteins and it is not eliminated in the urine.

## 5. PHARMACOLOGICAL PROPERTIES

### 5.1 Pharmacodynamic properties

Sildenafil, an oral therapy for erectile dysfunction, is the citrate salt of sildenafil, a selective inhibitor of cyclic guanosine monophosphate (cGMP)-specific phosphodiesterase type 5 (PDE5).

**Mechanism of Action:** The physiologic mechanism of erection of the penis involves release of nitric oxide (NO) in the corpus cavernosum during sexual stimulation.

NO then activates the enzyme guanylate cyclase, which results in increased levels of cyclic guanosine monophosphate (cGMP), producing smooth muscle relaxation in the corpus cavernosum and allowing inflow of blood.

Sildenafil has no direct relaxant effect on isolated human corpus cavernosum, but enhances the effect of nitric oxide (NO) by inhibiting phosphodiesterase type 5 (PDE5), which is responsible for degradation of cGMP in the corpus cavernosum.

When sexual stimulation causes local release of NO, inhibition of PDE5 by sildenafil causes increased levels of cGMP in the corpus cavernosum, resulting in smooth muscle relaxation and inflow of blood to the corpus cavernosum.

Sildenafil at recommended doses has no effect in the absence of sexual stimulation.

Studies *in vitro* have shown that sildenafil is selective for PDE5.

It's effect is more potent on PDE5 than on other known phosphodiesterases (10-fold for PDE6, >80-fold for PDE1, >700-fold for PDE2, PDE3, and PDE4, PDE7-PDE11).

The approximately 4000-fold selectivity for PDE5 versus PDE3 is important because PDE3 is involved in control of cardiac contractility.

## **Clinical studies**

### ***Cardiac***

Single oral doses of sildenafil up to 100 mg produced no clinically relevant changes in the ECGs of normal male volunteers.

The mean maximum decreases in supine systolic blood pressure following 100 mg oral dosing was 8.3 mmHg. The corresponding change in supine diastolic blood pressure was 5.3 mmHg.

Larger but similarly transient effects on blood pressure were recorded among patients receiving concomitant nitrates (see section 4.3 Contraindications and section 4.5 Interactions with other medicinal products and other forms of interaction).

In a study of the hemodynamic effects of a single oral 100 mg dose of sildenafil in 14 patients with severe coronary artery disease (CAD) (>70% stenosis of at least one coronary artery), the mean resting systolic and diastolic blood pressures decreased by 7% and 6%, respectively, compared to baseline. Mean pulmonary systolic blood pressure decreased by 9%. Sildenafil showed no effect on cardiac output, and did not impair blood flow through the stenosed coronary arteries, and resulted in improvement (approximately 13%) in adenosine-induced coronary flow reserve (in both stenosed and reference arteries).

In a double-blind, placebo-controlled trial, 144 patients with erectile dysfunction and stable angina, who were taking their regular antianginal medications (except nitrates) were exercised until limiting angina occurred. The duration of treadmill exercise was statistically significantly longer (19.9 seconds; 95% confidence interval: 0.9-38.9 seconds) in the evaluable patients who had taken a single dose of sildenafil 100 mg compared to patients who had taken a single dose of placebo. The mean exercise times (adjusted for baseline) to the onset of limiting angina were 423.6 and 403.7 seconds for sildenafil and placebo, respectively.

A randomized, double-blind, placebo-controlled, flexible-dose study (sildenafil up to

100 mg) in males (N = 568) with erectile dysfunction and arterial hypertension taking two or more antihypertensive agents was conducted. Sildenafil improved the erections in 71% of men compared to 18% in the placebo group, and 62% of attempts at sexual intercourse were successful with sildenafil compared to 26% on placebo. The incidence of adverse events was consistent with observations in other patient populations, as well as in the subjects taking three or more antihypertensive agents.

### **Visual**

Mild and transient differences in color discrimination (blue/green) were detected in some subjects using the Farnsworth-Munsell 100 hue test at 60 minutes following a 100 mg dose, with no effects evident after 120 minutes post-dose. The postulated mechanism for this change in color discrimination is related to inhibition of PDE6, which is involved in the phototransduction cascade of the retina. *In vitro* studies show that sildenafil is 10-fold less potent against PDE6 than PDE5. Sildenafil has no effect on visual acuity, contrast sensitivity, electroretinograms, intraocular pressure, or pupillometry.

In a placebo-controlled, crossover study of patients with documented early age-related macular degeneration (n = 9), sildenafil (single dose, 100 mg) was well-tolerated and demonstrated no clinically significant changes in the visual tests conducted (visual acuity, Amsler grid, color discrimination, simulated traffic light, Humphrey perimeter and photostress).

### **Efficacy**

The efficacy and safety of sildenafil was evaluated in 21 randomized, double-blind, placebo-controlled trials of up to 6 months duration. Sildenafil was administered to more than 3000 patients aged 19-87, with ED of various etiologies (organic, psychogenic, mixed). The efficacy was evaluated by global assessment question, diary of erections, the International Index of Erectile Function (IIEF, a validated sexual function questionnaire) and a partner questionnaire.

Sildenafil efficacy, determined as the ability to achieve and maintain an erection sufficient for sexual intercourse, was demonstrated in all 21 studies and was maintained in long-term extension studies (one year). In fixed-dose studies, the proportions of patients reporting that treatment improved their erections were 62% (25 mg), 74% (50 mg) and 82% (100 mg) compared to 25% on placebo. In addition to improvements in erectile

dysfunction, analysis of the IIEF showed that sildenafil treatment also improved the domains of orgasm, satisfaction with intercourse and overall satisfaction.

Across all trials, the proportions of patients reporting improvement on sildenafil were 59% of diabetic patients, 43% of radical prostatectomy patients and 83% of patients with spinal cord injury (versus 16%, 15% and 12% on placebo, respectively).

## 5.2 Pharmacokinetic properties

Sildenafil pharmacokinetics are dose-proportional over the recommended dose range.

It is eliminated predominantly by hepatic metabolism (mainly cytochrome P450 3A4) and is converted to an active metabolite with properties similar to the parent, sildenafil.

### Absorption

Sildenafil is rapidly absorbed after oral administration, with mean absolute bioavailability of 41% (range 25%-63%).

Sildenafil inhibits the human PDE5 enzyme *in vitro* by 50% at a concentration of 3.5 nM. In man, the mean maximum free plasma concentration of sildenafil following a single oral dose of 100 mg is approximately 18 ng/mL, or 38 nM.

Maximum observed plasma concentrations are reached within 30 to 120 minutes (median 60 minutes) of oral dosing in the fasted state.

When sildenafil is taken with a high fat meal, the rate of absorption of sildenafil is reduced, with a mean delay in  $T_{max}$  of 60 minutes and a mean reduction in  $C_{max}$  of 29%, however, the extent of absorption was not significantly affected (AUC decreased by 11%).

### Distribution

The mean steady-state volume of distribution ( $V_{ss}$ ) for sildenafil is 105 L, indicating distribution into the tissues.

Sildenafil and its major circulating N-desmethyl metabolite are both approximately 96% bound to plasma proteins.



Protein binding is independent of total drug concentrations.

Based upon measurements of sildenafil in semen of healthy volunteers 90 minutes after dosing, less than 0.0002% (average 188 ng) of the administered dose may appear in the semen of patients.

### **Metabolism**

Sildenafil is cleared predominantly by the CYP3A4 (major route) and CYP2C9 (minor route) hepatic microsomal isoenzymes.

The major circulating metabolite results from N-desmethylation of sildenafil, and is itself further metabolized.

This metabolite has a PDE selectivity profile similar to sildenafil and an *in vitro* potency for PDE5 approximately 50% of the parent drug.

In healthy volunteers, plasma concentrations of this metabolite are approximately 40% of those seen for sildenafil.

The N-desmethyl metabolite is further metabolized, with a terminal half-life of approximately 4 hours.

### **Elimination**

The total body clearance of sildenafil is 41 L/h with a resultant terminal phase half-life of 3-5 hours. After either oral or intravenous administration, sildenafil is excreted as metabolites predominantly in the feces (approximately 80% of administered oral dose) and to a lesser extent in the urine (approximately 13% of the administered oral dose).

### **Pharmacokinetics in special patient groups:**

#### ***Elderly***

Healthy elderly volunteers (65 years or over) had a reduced clearance of sildenafil, resulting in approximately 90% higher plasma concentrations of sildenafil and the active N-desmethyl metabolite compared to those seen in healthy younger volunteers

(18-45 years). Due to age-differences in plasma protein binding, the corresponding increase in free sildenafil plasma concentration was approximately 40%.

### ***Renal Insufficiency***

In volunteers with mild (creatinine clearance = 50-80 mL/min) and moderate (creatinine clearance = 30-49 mL/min) renal impairment, the pharmacokinetics of a single oral dose of sildenafil (50 mg) were not altered.

In volunteers with severe (creatinine clearance = <30 mL/min) renal impairment, sildenafil clearance was reduced, resulting in approximately doubling of AUC (100%) and  $C_{max}$  (88%) compared to age-matched volunteers with no renal impairment (see section 4.2 Posology and method of administration).

In addition, N-desmethyl metabolite AUC and  $C_{max}$  values were significantly increased by 200% and 79%, respectively, in subjects with severe renal impairment compared to subjects with normal renal function.

### ***Hepatic Insufficiency***

In volunteers with hepatic cirrhosis (Child-Pugh A and B), sildenafil clearance was reduced, resulting in increases in AUC (85%) and  $C_{max}$  (47%) compared to age-matched volunteers with no hepatic impairment (see section 4.2 Posology and method of administration). The pharmacokinetics of sildenafil in patients with severely impaired hepatic function (Child-Pugh class C) have not been studied.

## **5.3 Preclinical safety data**

No evidence of drug related carcinogenicity was revealed in a 24-month study in rats at doses up to 42 times the Maximum Recommended Human Dose (MRHD) on a mg/kg basis and approximately five times the MRHD on a mg/m<sup>2</sup> bases) and in an 18-21 month study in mice at doses up to 21 times the MRHD on a mg/kg basis (approximately two times the MRHD on a mg/m<sup>2</sup> basis).

Bacterial and *in vivo* mutagenicity tests were negative.

There was no effect on sperm motility or morphology after single 100 mg oral doses of sildenafil in healthy volunteers.

## **6. PHARMACEUTICAL PARTICULARS**

### **6.1 List of excipients**

In addition to the active ingredient, sildenafil citrate, each tablet contains the following inactive ingredients: microcrystalline cellulose, calcium hydrogen phosphate (anhydrous), croscarmellose sodium, magnesium stearate, hydroxypropyl methylcellulose (hypromellose), titanium dioxide (E171), lactose, triacetin, and FD & C Blue #2 aluminum lake [indigo carmine aluminum lake (E132)].

### **6.2 Incompatibilities**

Not applicable

### **6.3 Shelf-life**

Please see details on carton.

### **6.4 Special precautions for storage**

Store below 30°C

## **7. MARKETING AUTHORISATION HOLDER**

Viatrix (Thailand) Limited

### **Warnings (based on the Ministry of Public Health Announcement)**

1. The drug is not aphrodisiac.
2. Administration to patients with cardiac disease who are concurrently using nitrates is contraindicated because of possible fatal outcome.
3. Use of sildenafil is contraindicated in children, women and patients with hepatic or renal dysfunction.

PI Title: Sildenafil Citrate

PI rev no.: 17.4

PI Date: April 01, 2024

Country: Thailand

Reference CCDS ver: 15.0; date: July 02, 2018

4. VIAGRA must not be taken more than once a day.
5. Concomitant administration with other antiimpotent drugs is contraindicated.
6. Immediate consultation to physicians is recommended, should the following symptoms occur, e.g., abnormal vision, bone pain, chest pain, tachycardia, perspiration and collapse from exhaustion.

PI Revision no.: 17.4

PI date: April 01, 2024

Country: Thailand