

# **AUSTRALIAN PRODUCT INFORMATION – MELATONIN MR-TEVA (MELATONIN) MODIFIED RELEASE TABLETS**

## **1 NAME OF THE MEDICINE**

Melatonin

## **2 QUALITATIVE AND QUANTITATIVE COMPOSITION**

Melatonin MR-TEVA 2 mg modified release tablets.

The active ingredient in Melatonin MR-TEVA modified release tablets is a melatonin, NOT of plant or animal origin.

Excipient with known effect: Contains Lactose.

For the full list of excipients, see Section 6.1 LIST OF EXCIPIENTS.

## **3 PHARMACEUTICAL FORM**

Modified release tablet.

White to off-white, oval, biconvex tablets, with A6 on one side.

## **4 CLINICAL PARTICULARS**

### **4.1 THERAPEUTIC INDICATIONS**

Monotherapy for the short term treatment of primary insomnia characterized by poor quality of sleep in patients who are aged 55 or over.

### **4.2 DOSE AND METHOD OF ADMINISTRATION**

Oral use. Tablets should be swallowed whole.

The recommended dose is 2 mg once daily, 1-2 hours before bedtime and with or soon after food (or with a snack). This dosage may be continued for up to thirteen weeks.

### **4.3 CONTRAINDICATIONS**

Melatonin MR-TEVA modified release tablets are contraindicated in patients with a known hypersensitivity to any ingredient of the product (see Section 6.1 LIST OF EXCIPIENTS).

### **4.4 SPECIAL WARNINGS AND PRECAUTIONS FOR USE**

#### **Drowsiness**

Melatonin MR-TEVA may cause drowsiness. Therefore the product should be used with caution if the effects of drowsiness are likely to be associated with a risk to safety.

## **Autoimmune diseases**

No clinical data exist concerning the use of Melatonin MR-TEVA in individuals with autoimmune diseases. Therefore Melatonin MR-TEVA is not recommended for use in patients with autoimmune diseases.

## **Excipients**

The tablets contain lactose. Patients with rare hereditary problems of galactose intolerance, the LAPP lactase deficiency or glucose-galactose malabsorption should not take this medicine.

## **Hepatic impairment**

There is no experience of the use of Melatonin MR-TEVA in patients with liver impairment. Published data demonstrates markedly elevated endogenous melatonin levels during daytime hours due to decreased clearance in patients with hepatic impairment. Therefore, Melatonin MR-TEVA is not recommended for use in patients with hepatic impairment.

## **Renal insufficiency**

The effect of any stage of renal insufficiency on melatonin pharmacokinetics has not been studied. Caution should be used when melatonin is administered to such patients.

## **Use in the elderly**

Melatonin metabolism is known to decline with age. Across a range of doses, higher AUC and  $C_{max}$  levels have been reported in older subjects compared to younger subjects, reflecting the lower metabolism of melatonin in the elderly.

## **Paediatric use**

Melatonin MR-TEVA is not recommended for use in children and adolescents below 18 years of age due to insufficient data on safety and efficacy.

## **Effects on laboratory tests**

No information is available on the effect of melatonin on laboratory tests.

## **4.5 INTERACTIONS WITH OTHER MEDICINES AND OTHER FORMS OF INTERACTIONS**

### **Pharmacokinetic interactions**

#### Hepatic enzymes

Melatonin has been observed to induce CYP3A in vitro at supra- therapeutic concentrations. The clinical relevance of the finding is unknown. If induction occurs, plasma concentrations of concomitantly administered drugs can be reduced.

Melatonin does not appear to induce CYP1A enzymes in vitro at supra-therapeutic concentrations. Therefore, interactions between melatonin and other active substances as a consequence of melatonin's effect on CYP1A enzymes are not likely to be significant.

Melatonin's metabolism is mainly mediated by CYP1A enzymes. Therefore, interactions between melatonin and other active substances as a consequence of their effect on CYP1A enzymes is possible:

### Quinolones

CYP1A2 inhibitors such as quinolones may give rise to increased melatonin exposure.

### Carbamazepine and rifampicin

CYP1A2 inducers such as carbamazepine and rifampicin may give rise to reduced plasma concentrations of melatonin.

### Fluvoxamine

Caution should be exercised in patients on fluvoxamine, which increases melatonin levels (17-fold higher AUC and 12-fold higher serum C<sub>max</sub>) by inhibiting its metabolism by hepatic cytochrome P450 (CYP) isozymes CYP1A2 and CYP2C19. The combination should be avoided.

### 5-or 8-methoxypsoralen

Caution should be exercised in patients on 5- or 8- methoxypsoralen (5 and 8-MOP), which increases melatonin levels by inhibiting its metabolism.

### Cimetidine

Coadministration of Melatonin MR-TEVA with cimetidine resulted in a 1.7 fold increase in exposure to melatonin with no change in the exposure to cimetidine.

Caution should be exercised in patients on cimetidine, a CYP2D inhibitor which increases plasma melatonin levels by inhibiting its metabolism.

### Cigarette smoking

Cigarette smoking may decrease melatonin levels due to induction of CYP1A2.

### Oestrogens

Caution should be exercised in patients on oestrogens (e.g. contraceptives or hormone replacement therapy), which increase melatonin levels by inhibiting its metabolism by CYP1A1 and CYP1A2.

### Other

There is a large amount of data in the literature regarding the effect of adrenergic agonists/antagonists, opiate agonists/antagonists, antidepressant medicinal products, prostaglandin inhibitors, benzodiazepines, tryptophan and alcohol, on endogenous melatonin secretion. Whether or not these active substances interfere with the dynamic or kinetic effects of Melatonin MR-TEVA or vice versa has not been studied.

## **Pharmacodynamic interactions**

### Alcohol

Alcohol should not be taken with Melatonin MR-TEVA, because it reduces the effectiveness of Melatonin MR-TEVA on sleep. The modified release characteristics of Melatonin MR-TEVA may be altered by alcohol, resulting in immediate release of melatonin.

## Hypnotics

Melatonin MR-TEVA may enhance the sedative properties of benzodiazepines and non benzodiazepine hypnotics, such as zaleplon, zolpidem and zopiclone. In a clinical trial, there was clear evidence for a transitory pharmacodynamic interaction between Melatonin MR-TEVA and zolpidem one hour following co dosing. Concomitant administration resulted in increased impairment of attention, memory and co-ordination compared to zolpidem alone.

## Thioridazine and imipramine

Melatonin MR-TEVA has been co administered in studies with thioridazine and imipramine, active substances which affect the central nervous system. No clinically significant pharmacokinetic interactions were found in each case. However, Melatonin MR-TEVA co administration resulted in increased feelings of tranquillity and difficulty in performing tasks compared to imipramine alone, and increased feelings of “muzzy- headedness” compared to thioridazine alone.

## **4.6 FERTILITY, PREGNANCY AND LACTATION**

### **Effects on fertility**

No significant effects on fertility or reproductive performance were observed in rats given oral melatonin prior to mating through to early gestation at doses over 900-fold the recommended clinical dose, based on body surface area.

### **Use in pregnancy – Pregnancy Category B3**

*Category B3:* Drugs which have been taken by only a limited number of pregnant women and women of childbearing age, without an increase in the frequency of malformation or other direct or indirect harmful effects on the human fetus having been observed.

Studies in animals have shown evidence of an increased occurrence of fetal damage, the significance of which is considered uncertain in humans.

No significant effects on embryofetal development were observed in rats given oral melatonin during the period of organogenesis at doses over 900-fold the recommended clinical dose, based on body surface area.

No clinical data on exposed pregnancies are available. In view of the lack of clinical data, use in pregnant women and by women intended to become pregnant is not recommended.

### **Use in lactation**

Maternal transfer of exogenous melatonin to the fetus via the placenta or milk has been demonstrated in several animal species including rats, hamsters, goats, monkeys and cows. A slight reduction in post-natal growth, viability and development was found in rats given oral melatonin during gestation through weaning at doses over 900-fold the recommended clinical dose, based on body surface area; the no-effect dose was over 250-fold the clinical dose.

Endogenous melatonin has been detected in human breast milk, thus exogenous melatonin is likely excreted into human milk. The effects of melatonin on the nursing infant have not been established. Therefore, breast-feeding is not recommended in women under treatment with melatonin.

## **4.7 EFFECTS ON ABILITY TO DRIVE AND USE MACHINES**

Melatonin MR-TEVA has negligible influence on the ability to drive and use machines. Nevertheless,

patients should avoid engaging in hazardous activities (such as driving or operating machinery) after taking Melatonin MR-TEVA.

#### 4.8 ADVERSE EFFECTS (UNDESIRABLE EFFECTS)

In clinical trials (in which a total of 1931 patients were taking Melatonin MR-TEVA and 1642 patients were taking placebo), 48.8% of patients receiving Melatonin MR-TEVA reported an adverse reaction compared with 37.8% taking placebo. Comparing the rate of patients with adverse reactions per 100 patient weeks, the rate was higher for placebo than Melatonin MR-TEVA (5.743 - placebo vs. 3.013 – Melatonin MR-TEVA). The most common adverse reactions were headache, nasopharyngitis, back pain, and arthralgia, which were common, by MedDRA definition, in both the Melatonin MR-TEVA and placebo treated groups. In the Melatonin MR-TEVA group, there were 72 cases (2.9% of the safety population) of adverse events leading to discontinuation of the patient. In the placebo group there were 62 cases (4.0% of the safety population) of adverse events leading to discontinuation of the patient.

**Table 1: Overall adverse experience for adverse events occurring with a frequency  $\geq$  1%**

| Body System/Adverse Experience                       | Melatonin MR-TEVA %<br>(N=1931) | Placebo %<br>(N=1642) |
|------------------------------------------------------|---------------------------------|-----------------------|
| Gastrointestinal disorders                           |                                 |                       |
| Abdominal Pain                                       | 1.1                             | 0.7                   |
| Abdominal Pain Upper                                 | 1.0                             | 1.2                   |
| Constipation                                         | 1.2                             | 0.9                   |
| Diarrhoea                                            | 3.1                             | 1.8                   |
| Nausea                                               | 1.8                             | 1.7                   |
| Vomiting                                             | 1.5                             | 0.9                   |
| General Disorders and administration site conditions |                                 |                       |
| Asthenia                                             | 1.9                             | 1.2                   |
| Infections and infestations                          |                                 |                       |
| Influenza                                            | 1.5                             | 0.9                   |
| Lower respiratory tract infection                    | 1.9                             | 1.2                   |
| Nasopharyngitis                                      | 4.0                             | 3.0                   |
| Pharyngitis                                          | 1.9                             | 1.2                   |
| Upper respiratory tract infection                    | 2.9                             | 1.2                   |
| Urinary tract infection                              | 2.1                             | 0.7                   |
| Musculoskeletal and connective tissue disorder       |                                 |                       |
| Arthralgia                                           | 3.5                             | 1.8                   |
| Back Pain                                            | 3.8                             | 1.5                   |
| Muscle cramp                                         | 1.1                             | 0.6                   |
| Neck pain                                            | 1.1                             | 0.6                   |
| Pain in extremity                                    | 1.6                             | 1.1                   |
| Nervous system disorders                             |                                 |                       |
| Dizziness                                            | 1.6                             | 1.2                   |
| Headache                                             | 5.7                             | 6.2                   |
| Migraine                                             | 1.1                             | 1.2                   |
| Psychiatric disorders                                |                                 |                       |
| Anxiety                                              | 1.0                             | 1.2                   |

| Body System/Adverse Experience                  | Melatonin MR-TEVA %<br>(N=1931) | Placebo %<br>(N=1642) |
|-------------------------------------------------|---------------------------------|-----------------------|
| Respiratory, thoracic and mediastinal disorders |                                 |                       |
| Cough                                           | 2.2                             | 1.3                   |
| Pharyngolaryngeal pain                          | 1.5                             | 0.9                   |
| Rhinitis                                        | 1.1                             | 0.9                   |

The adverse reactions in the table below were reported in clinical trials and were defined as possibly, probably or definitely related to treatment. A total of 9.5% of subjects receiving Melatonin MR-TEVA reported an adverse reaction compared with 7.4% of subjects taking placebo. Only those adverse events occurring in subjects at an equivalent or greater rate than placebo have been included.

Within each frequency grouping, undesirable effects are presented in order of decreasing seriousness.

Very common ( $\geq 1/10$ ); Common ( $\geq 1/100$  to  $<1/10$ ); Uncommon ( $\geq 1/1,000$  to  $<1/100$ ); Rare ( $\geq 1/10,000$  to  $<1/1,000$ ); Very rare ( $<1/10,000$ ), Not known (cannot be established from the available data).

**Table 2: Adverse events related to treatment occurring with a frequency < 1%**

| System Organ Class                   | Uncommon                                                                                | Rare                                                                                                                                                | Not known                 |
|--------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Infections and Infestations          |                                                                                         | Herpes zoster                                                                                                                                       |                           |
| Blood and Lymphatic System Disorders |                                                                                         | Leukopenia, Thrombocytopenia                                                                                                                        |                           |
| Cardiac Disorders                    |                                                                                         | Angina pectoris, Palpitations                                                                                                                       |                           |
| Immune System Disorders              |                                                                                         |                                                                                                                                                     | Hypersensitivity reaction |
| Metabolism and Nutrition Disorders   |                                                                                         | Hypertriglyceridaemia, Hypocalcaemia, Hyponatraemia                                                                                                 |                           |
| Psychiatric Disorders                | Irritability, Nervousness, Restlessness, Insomnia, Abnormal dreams, Anxiety, Nightmares | Mood altered, Aggression, Agitation, Crying, Stress symptoms, Disorientation, Early morning awakening, Libido increased, Depressed mood, Depression |                           |
| Nervous System Disorders             | Migraine, Lethargy Psychomotor hyperactivity, Dizziness, Somnolence, Headache           | Syncope, Memory impairment, Disturbance in attention, Dreamy state, Restless legs syndrome, Poor quality sleep, Paraesthesia                        |                           |
| Eye Disorders                        |                                                                                         | Visual acuity reduced, Vision blurred, Lacrimation increased                                                                                        |                           |
| Ear and Labyrinth Disorders          |                                                                                         | Vertigo positional, Vertigo                                                                                                                         |                           |
| Vascular Disorders                   | Hypertension                                                                            | Hot flush                                                                                                                                           |                           |

|                                                      |                                                                                      |                                                                                                                                                                                                                                                                      |                                            |
|------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Gastrointestinal Disorders                           | Abdominal pain, Abdominal pain upper, Dyspepsia, Mouth ulceration, Dry mouth, Nausea | Gastro-oesophageal Reflux disease, Gastrointestinal disorder, oral Mucosal blistering, Tongue ulceration, Gastrointestinal upset, Vomiting, Bowel sounds abnormal, Flatulence, Salivary hypersecretion, Halitosis, Abdominal discomfort, Gastric disorder, Gastritis |                                            |
| Hepatobiliary Disorders                              | Hyperbilirubinaemia                                                                  |                                                                                                                                                                                                                                                                      |                                            |
| Skin and Subcutaneous Tissue Disorders               | Dermatitis, Night sweats, Pruritus, Rash, Pruritus generalised, Dry skin             | Eczema, Erythema, Hand dermatitis, Psoriasis, Rash generalised, Rash pruritic, , Nail disorder                                                                                                                                                                       | Angioedema, Oedema of mouth, Tongue oedema |
| Musculoskeletal and Connective Tissue Disorders      | Pain in extremity                                                                    | Arthritis, Muscle spasms, Neck pain, Night cramps                                                                                                                                                                                                                    |                                            |
| Reproductive System and Breast Disorders             | Menopausal symptoms                                                                  | Priapism, Prostatitis                                                                                                                                                                                                                                                | Galactorrhoea                              |
| General Disorders and Administration Site Conditions | Asthenia, Chest Pain                                                                 | Fatigue, Pain, Thirst                                                                                                                                                                                                                                                |                                            |
| Renal and Urinary Disorders                          | Glycosuria, Proteinuria                                                              | Polyuria, Hematuria, Nocturia                                                                                                                                                                                                                                        |                                            |
| Investigations                                       | Liver Function Test Abnormal, Weight increased                                       | Hepatic enzyme increased, Blood electrolytes abnormal, Laboratory test abnormal                                                                                                                                                                                      |                                            |

## Post-marketing data

Psychiatric Disorders: Nightmares.

## Reporting suspected adverse effects

Reporting suspected adverse reactions after registration of the medicinal product is important. It allows continued monitoring of the benefit-risk balance of the medicinal product.

Healthcare professionals are asked to report any suspected adverse reactions at [www.tga.gov.au/reporting-problems](http://www.tga.gov.au/reporting-problems).

## 4.9 OVERDOSE

In general, the main therapy for all overdoses is supportive and symptomatic care.

### Symptoms

No case of overdose has been reported. Melatonin MR-TEVA has been administered at 5 mg daily doses in clinical trials over 12 months without significantly changing the nature of the adverse reactions reported.

Administration of daily doses of up to 300 mg of melatonin without causing clinically significant adverse reactions have been reported in the literature.

If overdose occurs, drowsiness is to be expected.

## **Treatment**

Clearance of the active substance is expected within 12 hours after ingestion. No special treatment is required.

For information on the management of overdose, contact the Poisons Information Centre on 13 11 26 (Australia).

## **5 PHARMACOLOGICAL PROPERTIES**

### **5.1 PHARMACODYNAMIC PROPERTIES**

Pharmacotherapeutic group: Melatonin Receptor Agonists, ATC code: N05CH01

Melatonin is a naturally occurring hormone produced by the pineal gland and is structurally related to serotonin. Physiologically, melatonin secretion increases soon after the onset of darkness, peaks at 2-4 am and diminishes during the second half of the night. Melatonin is associated with the control of circadian rhythms and entrainment to the light-dark cycle. It is also associated with a hypnotic effect and increased propensity for sleep.

#### **Mechanism of action**

The activity of melatonin at the MT1 and MT2 receptors is believed to contribute to its sleep-promoting properties via their distinct actions on the circadian clock. The MT1 receptors are thought to inhibit neuronal firing, while the MT2 receptors have been implicated in the phase-shifting response.

#### Rationale for use

Because of the role of melatonin in sleep and circadian rhythm regulation, and the age related decrease in endogenous melatonin production, melatonin may effectively improve sleep quality particularly in patients who are over 55 with primary insomnia.

#### **Clinical trials**

Three Phase 3 studies and a sleep laboratory study were considered pivotal. These studies enrolled patients with primary insomnia who were aged at least 55 years. Patients suffering from severe neurological, psychiatric or neurosurgical diseases or taking CNS medications including benzodiazepines or other hypnotic agents were excluded.

The primary assessment tool was the Leeds Sleep Evaluation Questionnaire (LSEQ), comprising 10 self-rated 100 mm-line analogue questions concerning aspects of sleep and early morning behaviour. The LSEQ measures ease of getting to sleep (GTS), quality of sleep (QOS), ease of waking from sleep (AFS) and behaviour following wakefulness (BFW). The primary outcome variable in the pivotal clinical trials was QOS, or a combination on QOS and BFW, where a patient had to show a clinically relevant improvement on both QOS and BFW. Time to onset of sleep and duration of sleep were measured objectively only in a polysomnography study. Efficacy of Melatonin MR-TEVA in combination with other hypnotic agents has not been assessed.

In a polysomnographic (PSG) study (N=40; 20 Melatonin MR-TEVA, 20 placebo) with a run-in of 2 weeks (single-blind with placebo treatment), followed by a treatment period of 3 weeks (double-blind, placebo-controlled, parallel group design) and a 3-week withdrawal period, time to onset of sleep was shortened significantly by 9 minutes compared to placebo. A statistically significant difference favouring Melatonin

MR-TEVA was seen for total duration of time awake prior to sleep onset (approximate para change from 10 to 11 minutes for Melatonin MR-TEVA and from 21 to 20 minutes for placebo). There were no modifications of sleep architecture and no effect on REM sleep duration by Melatonin MR-TEVA. Modifications in diurnal functioning did not occur with Melatonin MR-TEVA 2 mg. Melatonin MR-TEVA did not prolong the duration of sleep significantly compared to placebo.

In the outpatient studies patients who failed to meet the inclusion criteria at the end of the run-in period due to the instability of their disorder (16% of the total population) were not included in the efficacy analysis.

In an outpatient study (Neurim VII: N=170; 82 Melatonin MR-TEVA, 88 placebo) with two week run in baseline period with placebo, a randomised, double blind, placebo controlled, parallel group treatment period of 3 weeks and two week withdrawal period with placebo, the primary efficacy endpoint was Quality of Sleep (QOS). The rate of patients who showed a clinically significant improvement in both quality of sleep and morning alertness was 47% in the Melatonin MR-TEVA group as compared to 27% in the placebo group. There was a mean difference of approximately 6 mm in quality of sleep and approximately 9 mm in morning alertness, both favouring Melatonin MR-TEVA compared to placebo. Sleep variables gradually returned to baseline with no rebound, no increase in adverse events and no increase in withdrawal symptoms.

In a second outpatient study (N=334; 169 Melatonin MR-TEVA, 165 placebo) with two week run in baseline period with placebo and a randomised, double blind, placebo controlled, parallel group treatment period of 3 weeks, the rate of patients who showed a clinically significant improvement in both quality of sleep and morning alertness was 26% in the Melatonin MR-TEVA group as compared to 15% in the placebo group. Melatonin MR-TEVA shortened patients' reported time to onset of sleep by 24.3 minutes vs 12.9 minutes with placebo. In addition, patients' self-reported quality of sleep, number of awakenings and morning alertness significantly improved with Melatonin MR-TEVA compared to placebo. Quality of life was improved significantly with Melatonin MR-TEVA 2 mg compared to placebo.

A third study involved more than 600 patients over 55, over 400 of whom were on Melatonin MR-TEVA treatment for up to 6 months. Patients given Melatonin MR-TEVA demonstrated a difference from placebo in mean change from baseline in subjective sleep latency, assessed using a sleep diary, of -7.8 minutes after 3 weeks ( $p=0.014$ ). Small differences in sleep latency were generally maintained over 13 weeks of placebo-controlled treatment.

The percentage of patients showing both remission of insomnia (PSQI of  $<6$ ) and a clinically relevant improvement of 10% in quality of life scores (WHO-5 index) increased from 16.7% (cf. 10.6% placebo,  $p=0.044$ ) at week 3 to 25.8% at week 13 (cf. 15.7% placebo,  $p=0.006$ ).

This study also examined the effect of Melatonin MR-TEVA on sleep latency in younger subjects with primary insomnia and low excretion of melatonin. Clinically significant effects on sleep latency were not demonstrated in these patients.

Long term safety: The safety profile both during 3 weeks and during the 26 week periods was comparable to placebo with no withdrawal and rebound effects.

In an open study where 96 subjects completed 12 months treatment with Melatonin MR-TEVA no tolerance, rebound or withdrawal effects were reported.

## **5.2 PHARMACOKINETIC PROPERTIES**

### **Absorption**

The absolute bioavailability of melatonin from Melatonin MR-TEVA has not been assessed. Other oral

formulations of melatonin have an absolute bioavailability in the region of 15% but this is highly variable with high first-pass metabolism. The relative bioavailability of melatonin from Melatonin MR-TEVA is comparable to that of an oral melatonin solution.

Data from other formulations of melatonin indicate that the absorption of orally ingested melatonin is complete in adults and may be decreased by up to 50% in the elderly. The kinetics of melatonin is linear over the range of 2-8 mg as obtained from published results using a formulation other than Melatonin MR-TEVA.

Bioavailability as assessed from other oral formulations of melatonin is in the order of 15%. There is a significant first pass effect with an estimated first pass metabolism of 85% as assessed from other oral formulations of melatonin.  $T_{max}$  occurs after 2.6 hours in a fed state. The rate of melatonin absorption following Melatonin MR-TEVA 2 mg oral administration is affected by food. The presence of food delayed the absorption of the melatonin resulting in a later  $T_{max}$  ( $T_{max}$  = 2.6 hours versus  $T_{max}$  = 1.6 hours).  $C_{max}$  and AUC levels were not affected by food.

## **Distribution**

The *in vitro* plasma protein binding of melatonin is approximately 60%. Melatonin is mainly bound to albumin,  $\alpha_1$ -acid glycoprotein and high density lipoprotein. The binding to the other serum proteins is insignificant. The melatonin binding was constant over the range of the studied concentrations in serum. Literature data indicates that melatonin is distributed in all body fluids and is accessible at all tissues.

## **Metabolism**

Experimental data suggest that isoenzymes CYP1A1, CYP1A2 and possibly CYP2C19 of the cytochrome P450 system are involved in melatonin metabolism. The principal metabolite is 6-sulphatoxy-melatonin (6-S-MT), which is inactive. The site of biotransformation is the liver. The excretion of the metabolite is completed within 12 hours after ingestion.

## **Excretion**

Terminal half life ( $t_{1/2}$ ) is 3.5-4 hours. Elimination is by renal excretion of metabolites, 89% as sulphated and glucuronide conjugates of 6-hydroxymelatonin and 2% is excreted as melatonin (unchanged drug).

## **Gender**

A 3-4-fold increase in  $C_{max}$  is apparent for women compared to men. A five-fold variability in  $C_{max}$  between different members of the same sex has also been observed.

However, no pharmacodynamic differences between males and females were found despite differences in blood levels.

## **Elderly**

Melatonin metabolism is known to decline with age. Across a range of doses, higher AUC and  $C_{max}$  levels have been reported in older subjects compared to younger subjects, reflecting the lower metabolism of melatonin in the elderly.  $C_{max}$  levels around 500 pg/mL in adults (18-45) versus 1200 pg/mL in the elderly (55-65); AUC levels around 3,000 pg\*h/mL in adults versus 6000 pg\*h/mL in the elderly.

## **Renal impairment**

Melatonin did not accumulate after repeated dosing with Melatonin MR-TEVA. This finding is compatible with the short half-life of melatonin in humans.

The levels assessed in the blood of patients at 23:00 (2 hours after administration) following 1 and 3 weeks of daily administration were  $411.4 \pm 56.5$  and  $432.00 \pm 83.2$  pg/mL respectively, and are similar to those found in healthy volunteers following a single dose of Melatonin MR-TEVA 2 mg.

### **Hepatic impairment**

The liver is the primary site of melatonin metabolism and therefore, hepatic impairment results in higher endogenous melatonin levels.

Plasma melatonin levels in patients with cirrhosis were significantly increased during daylight hours. Patients had a significantly decreased total excretion of 6-sulfatoxymelatonin compared with controls.

## **5.3 PRECLINICAL SAFETY DATA**

### **Genotoxicity**

Results from a standard battery of in vitro and in vivo assays showed no evidence of a genotoxic potential for melatonin.

### **Carcinogenicity**

An oral lifetime carcinogenicity study with melatonin in rats showed an increased incidence of thyroid follicular cell adenomas in males at doses around 700-fold the recommended clinical dose, based on body surface area. No neoplastic tissue histopathology was examined at lower doses and therefore the no-effect dose could not be determined. These effects were associated with liver enzyme induction in this species and are unlikely to be relevant to humans.

## **6 PHARMACEUTICAL PARTICULARS**

### **6.1 LIST OF EXCIPIENTS**

- ammonio methacrylate copolymer
- calcium hydrogen phosphate dihydrate
- lactose monohydrate
- colloidal anhydrous silica
- purified talc
- magnesium stearate

### **6.2 INCOMPATIBILITIES**

Refer to Section 4.5 Interactions with other medicines and other forms of interactions.

### **6.3 SHELF LIFE**

In Australia, information on the shelf life can be found on the public summary of the Australian Register of Therapeutic Goods (ARTG). The expiry date can be found on the packaging.

### **6.4 SPECIAL PRECAUTIONS FOR STORAGE**

Store below 25°C. Protect from light.

## 6.5 NATURE AND CONTENTS OF CONTAINER

Blister pack (PVC/PVdC/Al ) of 7 (sample pack), 15, 21, 30, and 60 tablets.

## 6.6 SPECIAL PRECAUTIONS FOR DISPOSAL

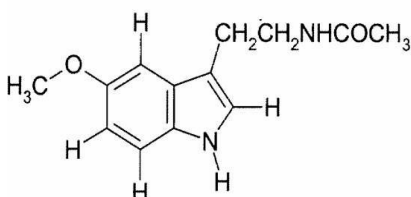
In Australia, any unused medicine or waste material should be disposed of by taking to your local pharmacy.

## 6.7 PHYSICOCHEMICAL PROPERTIES

Melatonin is a slightly off-white, odourless crystalline powder. Melatonin is very slightly soluble in water and in dilute hydrochloric acid.

### Chemical structure

Chemical name: N-[2-(5-Methoxyindol-3-yl)ethyl]acetamide. Structural formula:



Molecular formula: C<sub>13</sub>H<sub>16</sub>N<sub>2</sub>O<sub>2</sub> Molecular weight: 232.27

pKa: 12.3 - 12.7

### CAS number

73-31-4

## 7 MEDICINE SCHEDULE (POISONS STANDARD)

Schedule 3. Pharmacist Only Medicine, 7 (sample pack), 15, 21, and 30 tablets.

Schedule 4. Prescription Medicine, 60 tablets.

## 8 SPONSOR

Teva Pharma Australia Pty Ltd  
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Macquarie Park NSW 2113  
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Ph: 1800 288 382  
[www.tevapharma.com.au](http://www.tevapharma.com.au)

## 9 DATE OF FIRST APPROVAL

15 February 2022

## 10 DATE OF REVISION

01 July 2026

### Summary table of changes

| Section changed | Summary of new information       |
|-----------------|----------------------------------|
| 6.5             | Updated to remove PVC/PE/PVdc/Al |