

# Summary of Product Characteristics

## 1 NAME OF THE MEDICINAL PRODUCT

Zinnat 125 mg/5 ml granules for oral suspension

## 2 QUALITATIVE AND QUANTITATIVE COMPOSITION

125 mg cefuroxime per 5 ml (as 150 mg cefuroxime axetil)

### Excipient(s) with known effect:

Contains 0.021 g aspartame (E951) per 5 ml dose

Contains 3.1 g of sucrose per 5 ml dose

Contains 6 mg of propylene glycol (E1520) per 5 ml dose

Contains 4.5 mg benzyl alcohol (E1519) per 5 ml dose

For the full list of excipients, see section 6.1.

## 3 PHARMACEUTICAL FORM

Granules for oral suspension

White to off-white granules

## 4 CLINICAL PARTICULARS

### 4.1 Therapeutic indications

Zinnat is indicated for the treatment of the infections listed below in adults and children from the age of 3 months (see sections 4.4 and 5.1).

- Acute streptococcal tonsillitis and pharyngitis.
- Acute bacterial sinusitis.
- Acute otitis media.
- Acute exacerbations of chronic obstructive pulmonary disease.
- Cystitis.
- Pyelonephritis.
- Uncomplicated skin and soft tissue infections.
- Treatment of early Lyme disease.

Consideration should be given to official guidance on the appropriate use of antibacterial agents.

### 4.2 Posology and method of administration

#### Posology

The usual course of therapy is seven days (may range from five to ten days). The dose of cefuroxime that is selected to treat an individual infection should take into account:

- The expected pathogens and their likely susceptibility to cefuroxime axetil
- The severity and the site of the infection
- The age, weight and renal function of the patient; as shown below. The duration of therapy should be determined by the type of infection and the response of the patient and should generally not be longer than recommended.

Table 1. Adults and children ( $\geq 40$  kg)

Indication	Dosage
Acute tonsillitis and pharyngitis, acute bacterial sinusitis	250 mg twice daily
Acute otitis media	500 mg twice daily
Acute exacerbations of chronic obstructive pulmonary disease	500 mg twice daily
Cystitis	250 mg twice daily
Pyelonephritis	250 mg twice daily
Uncomplicated skin and soft tissue infections	250 mg twice daily
Lyme disease	500 mg twice daily for 14 days (range of 10 to 21 days)

Table 2. Children (&lt;40 kg) (also see Table 3 and 4)

Indication	Dosage
Acute tonsillitis and pharyngitis	10 mg/kg twice daily to a maximum of 250 mg twice daily
Acute otitis media	15 mg/kg twice daily to a maximum of 250 mg twice daily
Acute bacterial sinusitis	10 mg/kg twice daily to a maximum of 250 mg twice daily
Cystitis	15 mg/kg twice daily to a maximum of 250 mg twice daily
Pyelonephritis	15 mg/kg twice daily to a maximum of 250 mg twice daily for 10 to 14 days
Uncomplicated skin and soft tissue infections	15 mg/kg twice daily to a maximum of 250 mg twice daily
Lyme Disease	15 mg/kg twice daily to a maximum of 250 mg twice daily for 14 days (range of 10 to 21 days).

There is no experience of using Zinnat in children under the age of 3 months.

In infants (from the age of 3 months) and children with a body mass of less than 40 kg, it may be preferable to adjust dosage according to weight.

Cefuroxime axetil tablets and cefuroxime axetil granules for oral suspension are not bioequivalent and are not substitutable on a milligram-per-milligram basis (see section 5.2).

The following two tables, divided by body weight, serve as a guideline for simplified administration, e.g. measuring spoon (5 ml), for the 125 mg/5 ml or the 250 mg/5 ml multi-dose suspension if provided.

Table 3 10 mg/kg dosage for children aged 3 months and older, and weight &lt;40 kg

Weight range (kg)	Dose (mg) twice daily	Volume of reconstituted suspension per dose (ml)	
		125 mg /5ml	250 mg/ 5ml
4 to 6	40 to 60	2.5	-
6 to 12.5	60 to 125	2.5 to 5	-
12.5 to 25	125 to 250	5 to 10	2.5 to 5
Greater than 25	250	10	5

Table 4. 15 mg/kg dosage for children aged 3 months and older, and weight &lt;40 kg

Weight range (kg)	Dose (mg) twice daily	Volume of reconstituted suspension per dose (ml)	
		125 mg /5ml	250 mg/ 5ml
4 to 6	60 to 90	2.5 to 5	-
6 to 12	90 to 180	5 to 7.5	2.5 to 5
12 to 16	180 to 250	7.5 to 10	5
Greater than 16	250	10	5

To enhance compliance and improve the dosing accuracy in very young children, a dosing syringe can be supplied with a multidose bottle.

If required, the dosing syringe may also be used in older children (please refer to the dosing tables below).

For dosing 10 mg/kg using 125 mg/5 ml suspension in child weighing "W" kg; the ml of suspension required would be:  $(10 \times W \times 5)/125$

For dosing 10 mg/kg using 250 mg/5 ml suspension in child weighing "W" kg; the ml of suspension required would be:  $(10 \times W \times 5)/250$

Some examples of doses calculated for the paediatric dosing syringe expressed in ml or mg based on child's body weight in kg are provided in table below

Table 5. 10 mg/kg/dose (Paediatric dosing syringe)

Childs weight (kg)	Dose twice daily (mg)	Volume of reconstituted suspension per dose (ml)	
		125 mg/5 ml dose twice daily	250 mg/5 ml dose twice daily
4	40	1.6	0.8
6	60	2.4	1.2
8	80	3.2	1.6
10	100	4.0	2.0
12	120	4.8	2.4
14	140	5.6	2.8

For dosing 15 mg/kg using 125 mg/5 ml suspension in child weighing "W" kg; the ml of suspension required would be:  $(15 \times W \times 5)/125$

For dosing 15 mg/kg using 250 mg/5 ml suspension in child weighing "W" kg; the ml of suspension required would be:  $(15 \times W \times 5)/250$

Some examples of doses calculated for the paediatric dosing syringe expressed in ml or mg based on child's body weight in kg are provided in table below

Table 6. 15 mg/kg/dose (Paediatric dosing syringe)

Childs weight (kg)	Dose twice daily (mg)	Volume of reconstituted suspension per dose (ml)	
		125 mg/5 ml dose twice daily	250 mg/5 ml dose twice daily
4	60	2.4	1.2
6	90	3.6	1.8
8	120	4.8	2.4
10	150	6.0	3.0
12	180	7.2	3.6
14	210	8.4	4.2

#### Renal impairment

The safety and efficacy of cefuroxime axetil in patients with renal failure have not been established.

Cefuroxime is primarily excreted by the kidneys. In patients with markedly impaired renal function it is recommended that the dosage of cefuroxime should be reduced to compensate for its slower excretion. Cefuroxime is effectively removed by dialysis.

Table 7. Recommended doses for Zinnat in renal impairment

Creatinine clearance	T <sub>1/2</sub> (hrs)	Recommended dosage
≥30 ml/min/1.73 m <sup>2</sup>	1.4–2.4	no dose adjustment necessary standard dose of 125 mg to 500 mg given twice daily
10–29 ml/min/1.73 m <sup>2</sup>	4.6	standard individual dose given every 24 hours
<10 ml/min/1.73 m <sup>2</sup>	16.8	standard individual dose given every 48 hours
During haemodialysis	2–4	A single additional standard individual dose should be given at the end of each dialysis

#### Hepatic impairment

There are no data available for patients with hepatic impairment. Since cefuroxime is primarily eliminated by the kidney, the presence of hepatic dysfunction is expected to have no effect on the pharmacokinetics of cefuroxime.

#### Method of administration

##### Oral use

For optimal absorption cefuroxime axetil suspension should be taken with food.

For instructions on reconstitution of the medicinal product before administration, see section 6.6.

Depending on the dosage, there are other presentations available.

### 4.3 Contraindications

Hypersensitivity to cefuroxime or to any of the excipients listed in section 6.1.

Patients with known hypersensitivity to cephalosporin antibiotics.

History of severe hypersensitivity (e.g. anaphylactic reaction) to any other type of betalactam antibacterial agent (penicillins, monobactams and carbapenems).

### 4.4 Special warnings and precautions for use

#### Hypersensitivity reactions

Special care is indicated in patients who have experienced an allergic reaction to penicillins or other beta-lactam antibiotics because there is a risk of cross-sensitivity. As with all beta-lactam antibacterial agents, serious and occasionally fatal hypersensitivity reactions have been reported. There have been reports of hypersensitivity reactions which progressed to Kounis syndrome (acute allergic coronary arteriospasm that can result in myocardial infarction, see section 4.8). In case of severe hypersensitivity reactions, treatment with cefuroxime must be discontinued immediately and adequate emergency measures must be initiated.

Before beginning treatment, it should be established whether the patient has a history of severe hypersensitivity reactions to cefuroxime, to other cephalosporins or to any other type of beta-lactam agent. Caution should be used if cefuroxime is given to patients with a history of non-severe hypersensitivity to other beta-lactam agents.

#### Severe cutaneous adverse reactions (SCARS)

Severe cutaneous adverse reactions including: Stevens-Johnson syndrome (SJS), toxic epidermal necrolysis (TEN) and drug reaction with eosinophilia and systemic symptoms (DRESS), which can be life-threatening or fatal, have been reported in association with cefuroxime treatment (see section 4.8).

At the time of prescription patients should be advised of the signs and symptoms and monitored closely for skin reactions. If signs and symptoms suggestive of these reactions appear, cefuroxime should be withdrawn immediately and an alternative treatment considered. If the patient has developed a serious reaction such as SJS, TEN or DRESS with the use of cefuroxime, treatment with cefuroxime must not be restarted in this patient at any time.

#### Jarisch-Herxheimer reaction

The Jarisch-Herxheimer reaction has been seen following cefuroxime axetil treatment of Lyme disease. It results directly from the bactericidal activity of cefuroxime axetil on the causative bacteria of Lyme disease, the spirochaete *Borrelia burgdorferi*. Patients should be reassured that this is a common and usually self-limiting consequence of antibiotic treatment of Lyme disease (see section 4.8).

#### Overgrowth of non-susceptible microorganisms

As with other antibiotics, use of cefuroxime axetil may result in the overgrowth of *Candida*. Prolonged use may also result in the overgrowth of other non-susceptible microorganisms (e.g. enterococci and *Clostridioides difficile*), which may require interruption of treatment (see section 4.8).

Antibacterial agent-associated pseudomembranous colitis have been reported with nearly all antibacterial agents, including cefuroxime and may range in severity from mild to life threatening. This diagnosis should be considered in patients with diarrhoea during or subsequent to the administration of cefuroxime (see section 4.8). Discontinuation of therapy with cefuroxime and the administration of specific treatment for *Clostridioides difficile* should be considered. Medicinal products that inhibit peristalsis should not be given (see section 4.8).

#### Interference with diagnostic tests

The development of a positive Coombs Test associated with the use of cefuroxime may interfere with cross matching of blood (see section 4.8).

As a false negative result may occur in the ferricyanide test, it is recommended that either the glucose oxidase or hexokinase methods are used to determine blood/plasma glucose levels in patients receiving cefuroxime axetil.

#### Important information about excipients

The sucrose content of cefuroxime axetil suspension and granules should be taken into account when treating diabetic patients and appropriate advice provided.

Contains 0.021 g aspartame (E951) per 5 ml dose. Aspartame is a source of phenylalanine and so should be used with caution in patients with phenylketonuria.

Contains 3.1 g of sucrose per 5 ml dose Patients with rare hereditary problems of fructose intolerance, glucose-galactose malabsorption or sucrase-isomaltase insufficiency should not take this medicine.

Contains 6 mg of propylene glycol (E1520) per 5 ml dose.

Contains 4.5 mg benzyl alcohol (E1519) per 5 ml dose. Benzyl alcohol may cause allergic reactions. Benzyl alcohol must be used with caution in patients with renal or hepatic impairment, or in patients who are pregnant or breast-feeding, because of the risk of accumulation and toxicity (metabolic acidosis). High volumes of benzyl alcohol should be used with caution and only if necessary, especially in subjects with liver or kidney impairment because of the risk of accumulation. In addition, use of cefuroxime axetil suspension for more than a week in young children (less than 3 years old) should be avoided unless clinically needed due to the risk of accumulation.

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

Drugs which reduce gastric acidity may result in a lower bioavailability of cefuroxime axetil compared with that of the fasting state and tend to cancel the effect of enhanced absorption after food.

Cefuroxime is excreted by glomerular filtration and tubular secretion. Concomitant use of probenecid is not recommended. Concurrent administration of probenecid significantly increases the peak concentration, area under the serum concentration time curve and elimination half-life of cefuroxime.

Concomitant use with oral anticoagulants may give rise to increased INR.

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

##### Pregnancy

There are limited data from the use of cefuroxime in pregnant women. Studies in animals have shown no harmful effects on pregnancy, embryonal or foetal development, parturition or postnatal development. Zinnat should be prescribed to pregnant women only if the benefit outweighs the risk.

##### Breastfeeding

Cefuroxime is excreted in human milk in small quantities. Adverse effects at therapeutic doses are not expected, although a risk of diarrhoea and fungus infection of the mucous membranes cannot be excluded. Breastfeeding might have to be discontinued due to these effects. The possibility of sensitisation should be taken into account. Cefuroxime should only be used during breastfeeding after benefit/risk assessment by the physician in charge.

##### Fertility

There are no data on the effects of cefuroxime axetil on fertility in humans. Reproductive studies in animals have shown no effects on fertility.

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

No studies on the effects on the ability to drive and use machines have been performed. However, as this medicine may cause dizziness, patients should be warned to be cautious when driving or operating machinery.

#### **4.8 Undesirable effects**

The most common adverse reactions are *Candida* overgrowth, eosinophilia, headache, dizziness, gastrointestinal disturbances and transient rise in liver enzymes.

The frequency categories assigned to the adverse reactions below are estimates, as for most reactions suitable data (for example from placebo-controlled studies) for calculating incidence were not available. In addition the incidence of adverse reactions associated with cefuroxime axetil may vary according to the indication.

Data from large clinical studies were used to determine the frequency of very common to rare undesirable effects. The frequencies assigned to all other undesirable effects (i.e. those occurring at <1/10,000) were mainly determined using

post-marketing data and refer to a reporting rate rather than true frequency. Placebo-controlled trial data were not available. Where incidences have been calculated from clinical trial data, these were based on drug-related (investigator assessed) data. Within each frequency grouping, undesirable effects are presented in order of decreasing seriousness.

Treatment related adverse reactions, all grades, are listed below by MedDRA body system organ class, frequency and grade of severity. The following convention has been utilised for the classification of frequency: 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  $< 1/10,000$  and not known (cannot be estimated from the available data).

<b>System organ class</b>	<b>Common</b>	<b>Uncommon</b>	<b>Not known</b>
<u>Infections and infestations</u>	<i>Candida</i> overgrowth		<i>Clostridioides difficile</i> overgrowth
<u>Blood and lymphatic system disorders</u>	eosinophilia	positive Coomb's test, thrombocytopenia, leukopenia (sometimes profound)	haemolytic anaemia
<u>Cardiac disorders</u>			Kounis syndrome
<u>Immune system disorders</u>			drug fever, serum sickness, anaphylaxis, Jarisch-Herxheimer reaction
<u>Nervous system disorders</u>	headache, dizziness		
<u>Gastrointestinal disorders</u>	diarrhoea, nausea, abdominal pain	vomiting	pseudomembranous colitis (see section 4.4)
<u>Hepatobiliary disorders</u>	transient increases of hepatic enzyme levels		jaundice (predominantly cholestatic), hepatitis
<u>Skin and subcutaneous tissue disorders</u>		skin rashes	urticaria, pruritus, erythema multiforme, Stevens-Johnson syndrome, toxic epidermal necrolysis (exanthematic necrolysis) (see <i>Immune system disorders</i> ), angioneurotic oedema, Drug Reaction with Eosinophilia and Systemic Symptoms (DRESS)
<i>Description of selected adverse reactions</i> Cephalosporins as a class tend to be absorbed onto the surface of red cells membranes and react with antibodies directed against the drug to produce a positive Coombs test (which can interfere with			

cross-matching of blood) and very rarely haemolytic anaemia.			
Transient rises in serum liver enzymes have been observed which are usually reversible.			

*Paediatric population*

The safety profile for cefuroxime axetil in children is consistent with the profile in adults.

Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation 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 via HPRC Pharmacovigilance; website: [www.hpra.ie](http://www.hpra.ie).

**4.9 Overdose**

Overdose can lead to neurological sequelae including encephalopathy, convulsions and coma. Symptoms of overdose can occur if the dose is not reduced appropriately in patients with renal impairment (see sections 4.2 and 4.4).

Serum levels of cefuroxime can be reduced by haemodialysis and peritoneal dialysis.

**5 PHARMACOLOGICAL PROPERTIES****5.1 Pharmacodynamic properties**

Pharmacotherapeutic group: antibacterials for systemic use, second-generation cephalosporins, ATC code: J01DC02

Mechanism of action

Cefuroxime axetil undergoes hydrolysis by esterase enzymes to the active antibiotic, cefuroxime. Cefuroxime inhibits bacterial cell wall synthesis following attachment to penicillin binding proteins (PBPs). This results in the interruption of cell wall (peptidoglycan) biosynthesis, which leads to bacterial cell lysis and death.

*Mechanism of resistance*

Bacterial resistance to cefuroxime may be due to one or more of the following mechanisms:

- hydrolysis by beta-lactamases; including (but not limited to) by extended-spectrum beta-lactamases (ESBLs), and AmpC enzymes that may be induced or stably derepressed in certain aerobic Gram-negative bacteria species;
- reduced affinity of penicillin-binding proteins for cefuroxime;
- outer membrane impermeability, which restricts access of cefuroxime to penicillin binding proteins in Gram-negative bacteria;
- bacterial efflux pumps.

Organisms that have acquired resistance to other injectable cephalosporins are expected to be resistant to cefuroxime.

Depending on the mechanism of resistance, organisms with acquired resistance to penicillins may demonstrate reduced susceptibility or resistance to cefuroxime.

*Cefuroxime axetil breakpoints*

Minimum inhibitory concentration (MIC) breakpoints established by the European Committee on Antimicrobial Susceptibility Testing (EUCAST) version 13, valid from 01 January 2023, are as follows:

Microorganism	Breakpoints (mg/L)	
	S <sub>≤</sub>	R <sub>≥</sub>
<i>Enterobacterales</i> <sup>1,2</sup>	8	8
<i>Staphylococcus</i> spp.	Note <sup>3</sup>	Note <sup>3</sup>
Streptococcus groups A, B, C and G	Note <sup>4</sup>	Note <sup>4</sup>
<i>Streptococcus pneumoniae</i>	0.25	0.25
<i>Haemophilus influenzae</i>	0.001	1
<i>Moraxella catarrhalis</i>	0.001	4
<p><sup>1</sup> The cephalosporin breakpoints for <i>Enterobacterales</i> will detect all clinically important resistance mechanisms (including ESBL and plasmid mediated AmpC). Some isolates that produce beta-lactamases are susceptible to 3rd or 4th generation cephalosporins with these breakpoints and should be reported as tested, i.e. the presence or absence of an ESBL does not in itself influence the categorization of susceptibility. ESBL detection and characterization are recommended for public health and infection control purposes.</p> <p><sup>2</sup> Uncomplicated urinary tract infection (UTI) only, <i>E. coli</i>, <i>Klebsiella</i> spp. (except <i>K. aerogenes</i>), <i>Raoultella</i> spp. and <i>P. mirabilis</i>.</p> <p><sup>3</sup> Susceptibility of staphylococci to cephalosporins is inferred from the ceftaxime susceptibility except for ceftazidime, ceftazidime-avibactam, ceftibuten, and ceftolozane-tazobactam, which do not have breakpoints and should not be used for staphylococcal infections. For agents given orally, care to achieve sufficient exposure at the site of the infection should be exercised. If cefotaxime and ceftriaxone are reported for methicillin-susceptible staphylococci, these should be reported "Susceptible, increased exposure" (I). Some methicillin-resistant <i>S. aureus</i> are susceptible to ceftaroline and ceftobiprole.</p> <p><sup>4</sup> The susceptibility of streptococcus groups A, B, C and G to cephalosporins is inferred from the benzylpenicillin susceptibility.</p>		

S=susceptible, standard dosing regimen; I=susceptible, increased exposure; R=resistant

### Microbiological susceptibility

The prevalence of acquired resistance may vary geographically and with time for selected species and local information on resistance is desirable, particularly when treating severe infections. As necessary, expert advice should be sought when the local prevalence of resistance is such that the utility of cefuroxime axetil in at least some types of infections is questionable.

Cefuroxime is usually active against the following microorganisms *in vitro*.

Commonly susceptible species
<p><u>Gram-positive aerobes:</u>  <i>Staphylococcus aureus</i> (methicillin susceptible)*  <i>Coagulase negative staphylococcus</i> (methicillin susceptible)  <i>Streptococcus pyogenes</i>  <i>Streptococcus agalactiae</i></p>
<p><u>Gram-negative aerobes:</u>  <i>Haemophilus influenzae</i>  <i>Haemophilus parainfluenzae</i>  <i>Moraxella catarrhalis</i></p>
<p><u>Spirochaetes:</u>  <i>Borrelia burgdorferi</i></p>
Microorganisms for which acquired resistance may be a problem
<p><u>Gram-positive aerobes:</u>  <i>Streptococcus pneumoniae</i></p>
<p><u>Gram-negative aerobes:</u></p>

<i>Citrobacter freundii</i> <i>Klebsiella aerogenes</i> <i>Enterobacter cloacae</i> <i>Escherichia coli</i> <i>Klebsiella pneumoniae</i> <i>Proteus mirabilis</i> <i>Proteus spp.</i> (other than <i>P. vulgaris</i> ) <i>Providencia spp.</i>
<u>Gram-positive anaerobes:</u> <i>Peptostreptococcus spp.</i> <i>Propionibacterium spp.</i>
<u>Gram-negative anaerobes:</u> <i>Fusobacterium spp.</i> <i>Bacteroides spp.</i>
<b>Inherently resistant microorganisms</b>
<u>Gram-positive aerobes:</u> <i>Enterococcus faecalis</i> <i>Enterococcus faecium</i>
<u>Gram-negative aerobes:</u> <i>Acinetobacter spp.</i> <i>Campylobacter spp.</i> <i>Morganella morganii</i> <i>Proteus vulgaris</i> <i>Pseudomonas aeruginosa</i> <i>Serratia marcescens</i>
<u>Gram-negative anaerobes:</u> <i>Bacteroides fragilis</i>
<u>Others:</u> <i>Chlamydia spp.</i> <i>Mycoplasma spp.</i> <i>Legionella spp.</i>

\*All methicillin-resistant *S. aureus* are resistant to cefuroxime.

## 5.2 Pharmacokinetic properties

### Absorption

After oral administration cefuroxime axetil is absorbed from the gastrointestinal tract and rapidly hydrolysed in the intestinal mucosa and blood to release cefuroxime into the circulation. Optimum absorption occurs when it is administered shortly after a meal.

Following administration of cefuroxime axetil tablets peak serum levels (2.1 mcg/ml for a 125 mg dose, 4.1 mcg/ml for a 250 mg dose, 7.0 mcg/ml for a 500 mg dose and 13.6 mcg/ml for a 1000 mg dose) occur approximately 2 to 3 hours after dosing when taken with food. The rate of absorption of cefuroxime from the suspension is reduced compared with the tablets, leading to later, lower peak serum levels and reduced systemic bioavailability (4 to 17% less). Cefuroxime axetil oral suspension was not bioequivalent to cefuroxime axetil tablets when tested in healthy adults and therefore is not substitutable on a milligram-per-milligram basis (see section 4.2). The pharmacokinetics of cefuroxime is linear over the oral dosage range of 125 to 1000 mg. No accumulation of cefuroxime occurred following repeat oral doses of 250 to 500 mg.

### Distribution

Protein binding has been stated as 33 to 50% depending on the methodology used. Following a single dose of cefuroxime axetil 500 mg tablet to 12 healthy volunteers, the apparent volume of distribution was 50 L (CV%=28%). Concentrations of cefuroxime in excess of the minimum inhibitory levels for common pathogens can be achieved in the tonsilla, sinus tissues, bronchial mucosa, bone, pleural fluid, joint fluid, synovial fluid, interstitial fluid, bile, sputum and aqueous humor. Cefuroxime passes the blood-brain barrier when the meninges are inflamed.

#### Biotransformation

Cefuroxime is not metabolised.

#### Elimination

The serum half-life is between 1 and 1.5 hours. Cefuroxime is excreted by glomerular filtration and tubular secretion. The renal clearance is in the region of 125 to 148 ml/min/1.73 m<sup>2</sup>.

#### **Special patient populations**

##### Gender

No differences in the pharmacokinetics of cefuroxime were observed between males and females.

##### Elderly

No special precaution is necessary in the elderly patients with normal renal function at dosages up to the normal maximum of 1 g per day. Elderly patients are more likely to have decreased renal function; therefore, the dose should be adjusted in accordance with the renal function in the elderly (see section 4.2).

##### Paediatrics

In older infants (aged >3 months) and in children, the pharmacokinetics of cefuroxime are similar to that observed in adults.

There is no clinical trial data available on the use of cefuroxime axetil in children under the age of 3 months.

##### Renal impairment

The safety and efficacy of cefuroxime axetil in patients with renal failure have not been established. Cefuroxime is primarily excreted by the kidneys. Therefore, as with all such antibiotics, in patients with markedly impaired renal function (i.e. C<sub>1cr</sub> <30 ml/minute) it is recommended that the dosage of cefuroxime should be reduced to compensate for its slower excretion (see section 4.2). Cefuroxime is effectively removed by dialysis.

##### Hepatic impairment

There are no data available for patients with hepatic impairment. Since cefuroxime is primarily eliminated by the kidney, the presence of hepatic dysfunction is expected to have no effect on the pharmacokinetics of cefuroxime.

##### Pharmacokinetic/pharmacodynamic relationship

For cephalosporins, the most important pharmacokinetic-pharmacodynamic index correlating with *in vivo* efficacy has been shown to be the percentage of the dosing interval (%T) that the unbound concentration remains above the minimum inhibitory concentration (MIC) of cefuroxime for individual target species (i.e. %T>MIC).

### **5.3 Preclinical safety data**

Non-clinical data reveal no special hazard for humans based on studies of safety pharmacology, repeated dose toxicity, genotoxicity and toxicity to reproduction and development. No carcinogenicity studies have been performed; however, there is no evidence to suggest carcinogenic potential.

Gamma glutamyl transpeptidase activity in rat urine is inhibited by various cephalosporins, however the level of inhibition is less with cefuroxime. This may have significance in the interference in clinical laboratory tests in humans.

## 6 PHARMACEUTICAL PARTICULARS

### 6.1 List of excipients

Aspartame (E951)  
Xanthan gum  
Acesulfame potassium (E950)  
Povidone K30  
Stearic Acid  
Sucrose  
Tutti Frutti Flavour (contains propylene glycol (E1520) and benzyl alcohol (E1519))  
Purified Water

### 6.2 Incompatibilities

A positive Coombs' test has been reported during treatment with cephalosporins - this phenomenon can interfere with cross-matching of blood.

### 6.3 Shelf life

The shelf life of unconstituted Zinnat Suspension from date of manufacture is 24 months.  
The reconstituted suspension when refrigerated between 2 and 8°C can be kept for up to 10 days.

### 6.4 Special precautions for storage

Do not store above 30°C

For Storage conditions after reconstitution of the Zinnat oral suspension, see section 6.3

### 6.5 Nature and contents of container

#### *Multidose bottles:*

Zinnat Suspension is provided as a dry, white to off-white, tutti-frutti flavoured granule. When reconstituted as directed, it provides the equivalent of 125 mg or 250 mg of cefuroxime (as cefuroxime axetil) per 5 ml of suspension.

It is supplied in Ph. Eur. Type III amber glass bottles with an induction heat seal membrane containing 50 ml, 70 ml or 100 ml of the 125 mg/5 ml suspension, and 50 ml, 70 ml or 100 ml of the 250 mg/5 ml suspension.

Not all pack sizes may be marketed.

### 6.6 Special precautions for disposal and other handling

Any unused medicinal product or waste material should be disposed of in accordance with local requirements.

#### Reconstitution /Administration instructions

The bottle should be shaken vigorously before the medication is taken.

The reconstituted suspension when refrigerated between 2 and 8°C can be kept for up to 10 days.

If desired, Zinnat suspension from multidose bottles can be further diluted in cold fruit juices, or milk drinks and should be taken immediately.

**Please note that the time taken to prepare Zinnat suspension before administration of the first dose will take more than one hour. This includes time for the suspension to "settle" in the refrigerator**

1. Shake the bottle to loosen the content. Remove the bottle cap and the heat-seal membrane. If the latter is damaged or not present, the product should be returned to the pharmacist.

2. Add the total amount of cold water as stated on the label or up to the volume line on the measuring cup provided (if supplied). If the water was previously boiled it must be allowed to cool to room temperature before adding. Do not mix Zinnat granules for oral suspension with hot or warm liquids. Cold water must be used to prevent the suspension becoming too thick.
3. Pour the total amount of cold water into the bottle. Replace the bottle cap. Allow the bottle to stand to allow the water to fully soak through the granules; this should take about one-minute.
4. Invert the bottle and shake well (for at least 15 seconds) until all the granules have mixed with the water
5. Turn the bottle into an upright position and shake well for at least one-minute until all the granules have blended with the water. Store the Zinnat suspension in the refrigerator immediately at between 2 and 8C (do not freeze) and let it rest for at least one hour before taking the first dose. The reconstituted suspension should be refrigerated at all times; when refrigerated between 2 and 8C the reconstituted suspension can be kept for up to 10 days. Always shake the bottle well before taking the medication. A dosing syringe or spoon is provided for the administration of each dose.

Directions for using the dosing syringe (if supplied)

1. Remove the bottle cap and insert the syringe-collar assembly into the neck of the bottle. Press it down completely until the collar fits in the neck firmly. Invert the bottle and syringe.
2. Pull the plunger up the barrel until the barrels rim is aligned with the mark on the plunger corresponding to the required dose.
3. Turn the bottle and syringe into an upright position. While holding onto the syringe and the plunger to ensure that the plunger does not move, remove the syringe from the bottle, leaving the plastic collar in the bottle neck.
4. With the patient seated in an upright position, place the tip of the syringe just inside the patient's mouth, pointing towards the inside of the cheek.
5. Press the plunger of the syringe in slowly to expel the medicine without causing choking. Do NOT squirt the medicine out in a jet.
6. After giving the dose replace the bottle cap without removing the plastic collar. Dismantle the syringe and wash it thoroughly in clean water. Allow the plunger and the barrel to dry naturally.

The reconstituted suspension or granules should not be mixed with hot liquids.

**7 MARKETING AUTHORISATION HOLDER**

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