

COMPETENCY 9.2

**Describe the biochemical basis
and clinical manifestations of
fluoride imbalance**

PRESENTED BY

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Specific Learning Objective

Explain the function and
related abnormalities of
Fluoride

Introduction to Fluoride



Fluoride is a naturally occurring element, present in trace amounts in water, soil, and certain foods.

Plays a crucial role in dental health by preventing dental caries.

Incorporated into hydroxyapatite to form fluorapatite, strengthening tooth enamel.

Sources: Tea, seafood, fluoridated water, toothpaste.

Biochemical Role & Clinical Importance

Biochemical Role

- Converts hydroxyapatite to fluorapatite in teeth and bones.
- Inhibits bacterial enzyme enolase, reducing acid production.

Clinical Importance

- Reduces dental caries by enhancing enamel resistance to acid demineralization.
- Promotes remineralization of early carious lesions.
- Used in toothpaste and topical treatments for caries prevention.

Fluorosis

Dental Fluorosis:

- Caused by excessive fluoride intake during enamel formation.
- Leads to mottled enamel, discoloration, pitting.

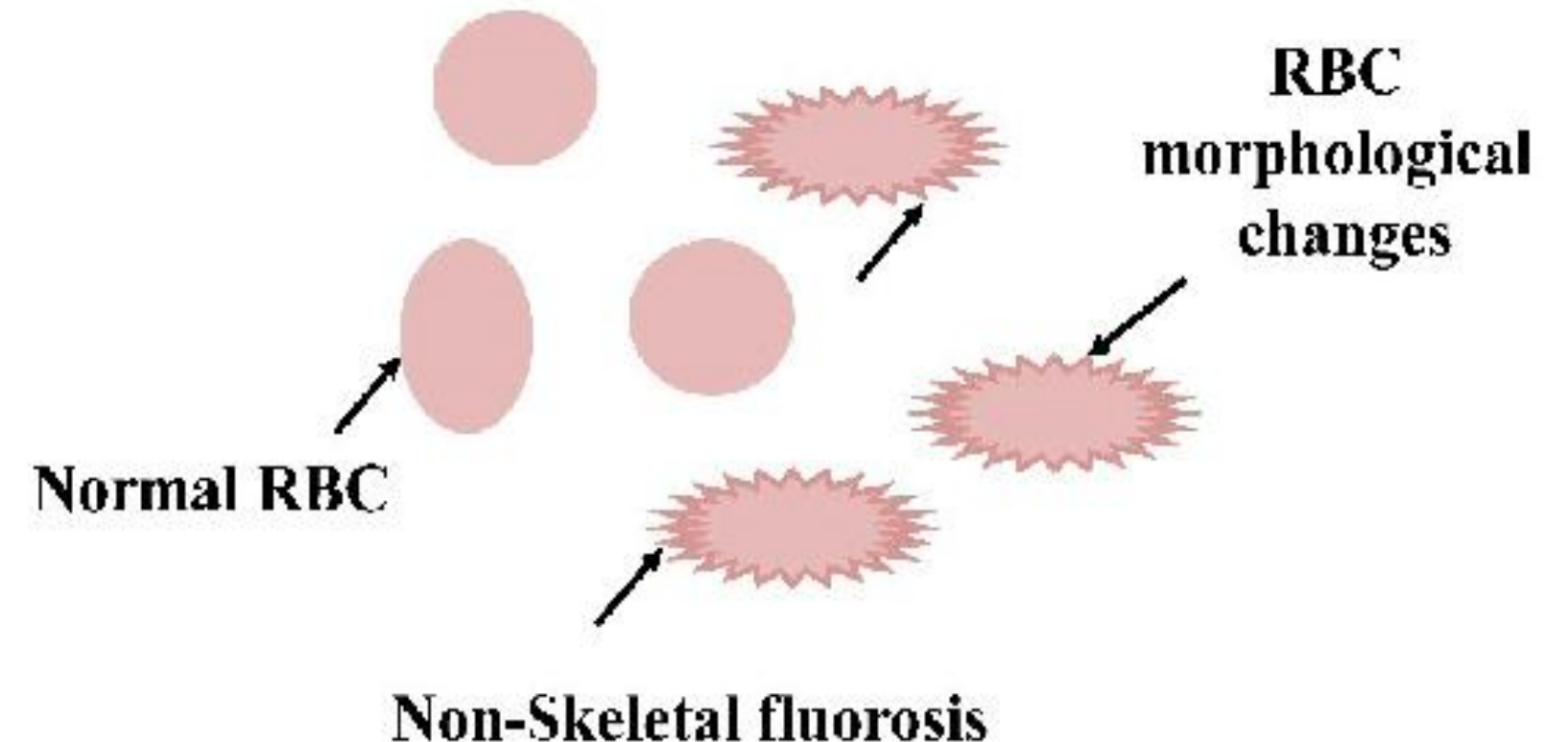
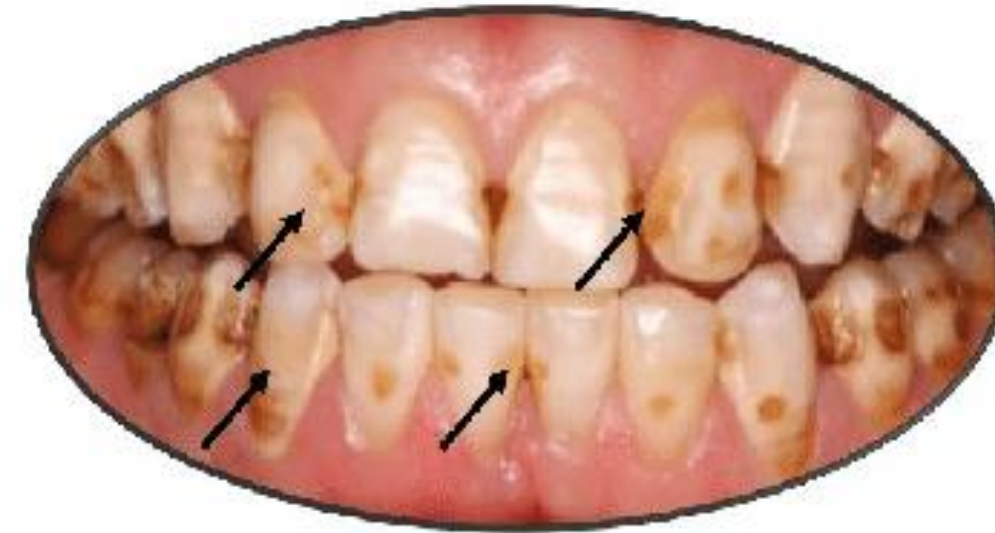
Skeletal Fluorosis:

- Chronic high fluoride intake (>10–20 ppm).
- Osteosclerosis, joint stiffness, bone pain.
- Advanced cases may show ligament calcification and limited joint movement.
- Genu valgum is the characteristic feature of skeletal fluorosis

Skeletal fluorosis



Dental fluorosis

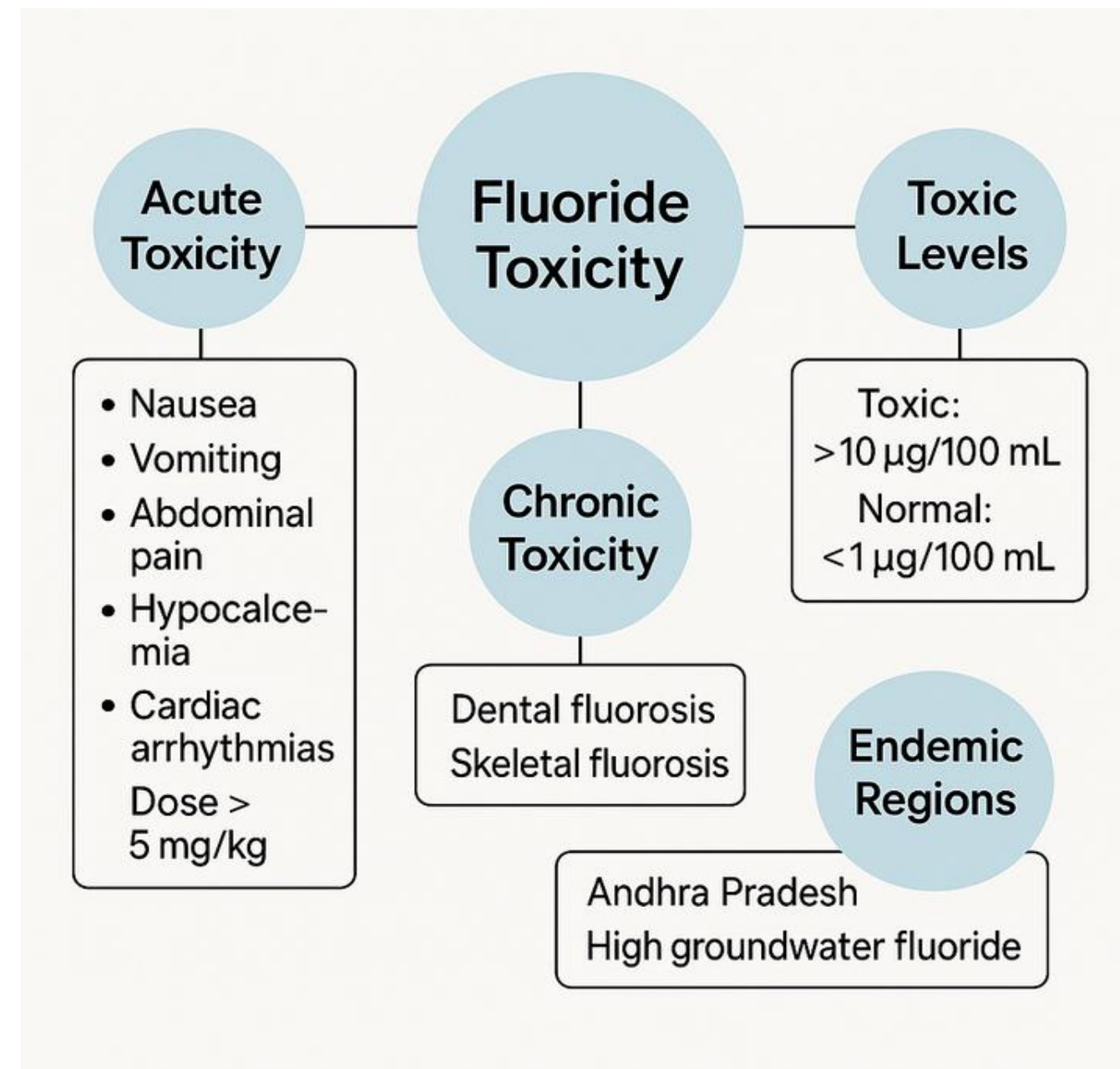


Prevention of fluorosis

- Provide Fluoride free water
- Restrict intake of jowar
- Supplementation of vitamin C
- Regulation of fluoride containing toothpaste

FLUORIDE TOXICITY

- Acute toxicity: Nausea, vomiting, abdominal pain, hypocalcemia, cardiac arrhythmias (dose > 5 mg/kg).
- Chronic toxicity: Fluorosis (dental and skeletal).



- Blood fluoride level >10 µg/100 mL is considered toxic (normal: <1 µg/100 mL).
- Endemic in areas with high groundwater fluoride (e.g., Andhra Pradesh, Punjab).

Fluorosis is More Dangerous than Caries

- Fluoride level more than 2 ppm will cause chronic intestinal upset, gastroenteritis, loss of appetite and loss of weight.
- Level more than 5 ppm causes mottling of enamel, stratification and discoloration of teeth.
- A level more than 20 ppm is toxic, leading to alternate areas of osteoporosis and osteosclerosis, with brittle bones. This is called **fluorosis**

Conclusion

Fluoride: Essential Yet Risky

Why It's Needed

- Fluoride strengthens enamel and prevents dental caries, especially during tooth development.
- Small amounts (0.7–1.2 ppm in water) are effective and safe.

What Happens in Excess

- Dental fluorosis: White or brown stains on teeth.
- Skeletal fluorosis: Bone/joint pain and stiffness from long-term high exposure.
- Sources: High-fluoride water, swallowed toothpaste, and over-supplementation.

Public Health Measures

- Water fluoridation is used to maintain optimal levels.
- WHO recommends fluoride in drinking water ≤ 1.5 mg/L.
- Education on safe fluoride use, especially in kids.

Balance is Key

“Too little promotes caries; too much causes fluorosis.”

Previous Year Questions

- **Fluoride - Fluorosis Toxicity - Typical features and mechanism of protection of teeth**
- **Toxicity Clinical features of fluorosis**

Thank you