

## MAIN CAUSES OF BONE LOSS

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**Abstract:** Bone density loss is a condition characterized by the reduction in bone mass and strength, medically referred to as **osteopenia** and its more severe form, **osteoporosis**. As a result of this pathological process, bones become fragile, increasing their susceptibility to fractures. The disease usually progresses slowly and may not manifest any symptoms in its early stages, which is why it is often referred to as the "silent epidemic."

**Keywords:** osteoporosis, menopause, estrogen, testosterone, physical inactivity, alcohol

### Introduction

Bone tissue is one of the metabolically active tissues in the human body. It is continuously renewed through a process known as **bone remodeling**, where old bone is resorbed and new bone is formed. When this balance is disrupted, with bone resorption exceeding bone formation, bone density decreases.

### Primary Causes of Bone Loss

#### 1. Age-related changes

After the age of 30, natural bone mass loss begins. In women, this process accelerates after menopause due to a significant drop in estrogen levels.

#### 2. Hormonal disorders

- **Estrogen** (in women) and **testosterone** (in men) levels decline with age.
- **Hyperthyroidism** (overactive thyroid)
- **Cushing's syndrome** (increased cortisol production)

#### Hormones and their roles:

1. **Estrogen:** Promotes bone renewal and slows down bone resorption. Its decline after menopause significantly increases the risk of osteoporosis in women.
2. **Testosterone:** Maintains bone density in men. Reduced levels in older men contribute to bone loss.
3. **Parathyroid hormone (PTH):** Regulates blood calcium. Excess leads to calcium being drawn from bones, weakening them.
4. **Calcitonin:** Lowers blood calcium and helps retain calcium in bones.
5. **Vitamin D (in the form of calcitriol):** Facilitates calcium absorption in the intestines. Its deficiency is a leading cause of bone loss.

Hormonal imbalance, particularly deficiencies in estrogen and testosterone, along with low vitamin D levels and elevated PTH, are direct contributors to bone degeneration.

### Nutritional Factors

- **Calcium and Vitamin D deficiencies**
- **Protein malnutrition**
- **Eating disorders**

### Physical Inactivity

Bones require mechanical loading. Extended immobility or a sedentary lifestyle reduces bone density.

### Medication-related Causes

- **Corticosteroids**
- **Anticonvulsants**
- **Chemotherapy drugs**

### Chronic Diseases

- **Rheumatoid arthritis**
- **Kidney failure**
- **Liver and endocrine disorders**

### Clinical Signs

Early stages are often asymptomatic. However, as bone density significantly decreases, patients may report:

- Pain in the back, hip, and lumbar regions
- Loss of height (due to vertebral compression)
- Fragile fractures from minor trauma (especially in the hip, wrist, spine)

### Diagnosis

The most effective and widely used method for assessing bone density is **DEXA (Dual-Energy X-ray Absorptiometry)**. T-score results:

- $T > -1$ : Normal
- $T$  between  $-1$  and  $-2.5$ : Osteopenia
- $T < -2.5$ : Osteoporosis

### Additional tests:

- Blood tests (calcium, phosphorus, vitamin D)

- Hormonal evaluations
- X-ray and MRI (to detect fractures)

### Treatment and Prevention

#### Pharmacological:

- Calcium and Vitamin D supplements

#### Non-pharmacological:

- Active lifestyle
- Balanced diet
- Sun exposure for natural Vitamin D synthesis
- Avoiding smoking and alcohol

### 10 Ways to Strengthen Your Bones

1. **Eat plenty of vegetables** – Rich in Vitamin C and antioxidants, which help in bone cell production and protection.
2. **Engage in strength training and weight-bearing exercises** – Stimulates bone formation and maintains density.
3. **Consume enough protein** – Essential, as about 50% of bone mass is protein.
4. **Ensure sufficient calcium intake throughout the day** – Spread intake for better absorption; prefer food sources over supplements.
5. **Get enough Vitamin D and K** – Support calcium absorption and bone mineralization.
6. **Avoid very low-calorie diets** – Can cause bone loss, especially with prolonged restriction.
7. **Consider collagen supplements** – May support bone structure and reduce degradation.
8. **Maintain a stable, healthy weight** – Both underweight and obesity can harm bone health.
9. **Add magnesium and zinc-rich foods** – Support bone formation and calcium metabolism.

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