Alcohol and Bone Health Article Questions

- Read the Article “Alcohol can Inhibit the Formation of New Bone Cells Called Osteoblasts, Thereby Decreasing Bone Formation”
- Once you have finished reading answer the questions below.

1) Give a brief summary of the main idea of this article:

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2) What is the process called that helps human adults maintain healthy bone?

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3) What are the names of the two cell types involved in bone remodeling? Which cell removes old bone? Which cell forms new bone?

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4) What is another name for bone loss?

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5) What does the word ossify or calcify mean?

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6) According to the article, alcohol contributes to two problems in adults in relation to bone health. Write down a brief description of each issue.

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7) What is your opinion on the information presented in this article?

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Medical News Today

Alcohol Can Inhibit The Formation Of New Bone Cells Called Osteoblasts, Thereby Decreasing Bone Formation

18 Dec 2005

Chronic and heavy alcohol consumption is known to contribute to low bone mass, decreased bone formation, an increased incidence of fractures, and delays in fracture healing. A review of human, animal and cell-culture studies of alcohol's detrimental effects on bone has determined that osteoblast development and function are particularly at risk. The review is published in the December issue of Alcoholism: Clinical & Experimental Research.

"The maintenance of healthy bone in human adults occurs through a process called 'bone remodeling,'" said Dennis A. Chakhalalak, research scientist at the Omaha Veterans Affairs Medical Center, associate professor in the department of surgery at Creighton University, and sole author of the review. "At any given time during adult life, and in various parts of the skeleton, small portions of the 'old bone' are removed by cells called 'osteoclasts,' and new bone is formed by cells called 'osteoblasts.' In a healthy person, the two activities are in balance so that there is no net loss of bone."

However, chronic and heavy drinking can disrupt the balance by suppressing new bone formation. "The empty space created by normal bone-removing activity is inadequately filled by newly formed bone," said Chakhalalak. "This process continues at other skeletal sites during the next remodeling cycle. The cumulative effect of this process during several remodeling cycles is manifested as measurable bone loss over a period of just a few years."

"Many people know about alcohol's effects on the liver and the damage it can cause to this organ after years of heavy drinking," said Terrence M. Donohue, Jr., VA Research Career Scientist at the Omaha VA Medical Center and professor of internal medicine at the University of Nebraska Medical Center. "Considerably fewer people know about alcohol-induced bone disease."

Key highlights of the review include:
"Alcohol-induced bone disease" refers to two consequences of chronic alcohol abuse: bone loss (also known osteopenia), which results in increased fracture risk; and deficient bone repair.

"Alcohol-induced osteopenia is distinct from post-menopausal osteoporosis.

"Postmenopausal osteoporosis results from hormone ablation or insufficiency of the hormone estradiol, which regulates the rate of bone remodeling," said Donohue. "Thus, when estradiol levels drop after menopause, the rate of bone remodeling increases. Alcohol, in contrast, decreases the rate of bone remodeling."

-- Human, animal and cell-culture studies show that alcohol's toxic effects on osteoblast activity are dose-dependent.

"In human studies, the consensus is that alcohol's main effect is to inhibit new bone formation," said Chakkalakal. "In these studies, bone loss due to chronic consumption of excessive alcohol - that is, greater than approximately 100 grams per day - was generally greater with larger alcohol dose and/or longer duration of consumption. The dose and duration effects in experimental models, where a more accurate determination can be made, provide support for the findings in human studies. In cell-culture studies, where bone-forming cells are grown in a liquid, production of various bio-molecules that contribute to the formation of bone matrix in the living organism is suppressed when alcohol is added. Suppression is greater at higher doses, and at very high doses, cell death occurs."

-- Alcohol can suppress synthesis of an ossifiable matrix, which interferes with fracture healing.

"In order to heal properly, bone cells must first form a 'matrix' that later hardens or ossifies," said Donohue. "This is first formed as a soft tissue, containing biomolecules that are unique to bone, that later hardens or becomes calcified. Alcohol consumption changes the composition of this matrix by suppressing the formation of osteoblasts and/or decreasing their ability to respond to signals that normally trigger bone formation after a fracture."

-- Alcohol-induced bone loss is associated with abnormalities of cell dynamics in bone marrow.

"The marrow cavities of long bones contain precursor cells capable of becoming bone-forming cells or fat-tissue-forming cells," said Chakkalakal. "We know that in osteoporosis patients, the marrow contains less bone tissue and proportionately more fat tissue. It is believed that the shift toward less bone-forming cells and more fat-forming cells results in abnormalities in Basic Multicellular Units (BMUs), known as the 'workhorses' in bone remodeling."
Accumulation of fat tissue at the expense of bone tissue in the marrow has also been observed in experimental models of chronic consumption of excessive alcohol.

Chakikalakal said that, collectively speaking, evidence indicates there is a common thread that ties together skeletal abnormalities, such as bone loss and deficient bone healing, and chronic consumption of excessive alcohol. "In both cases, alcohol adversely affects osteoblast activity, thus suppressing new bone formation needed in both normal bone remodeling and fracture healing," he said. "We need future studies that focus on molecular mechanisms by which alcohol inhibits osteoblast activity. We also need a closer examination of the effects of other factors such as malnutrition, smoking and lack of physical activity as there are very few studies that evaluate the effects of these factors. Finally, we need more definitive, well-designed studies to sort out the age- and gender-related differences in the effects of moderate and excessive consumption of alcohol."

Donohue added that the evidence also supports the choice of abstinence from alcohol. "The review underscores the importance of abstinence from alcohol consumption by patients - alcoholics or teetotalers - with fractures and who may want to drink during their convalescence."

Alcoholism: Clinical & Experimental Research (ACER) is the official journal of the Research Society on Alcoholism and the International Society for Biomedical Research on Alcoholism. The ACER review, "Alcohol-Induced Bone Loss and Deficient Bone Repair," was funded by the Department of Veterans Affairs, and by Creighton University Medical Center.

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Alcoholism: Clinical & Experimental Research

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