Smokeless tobacco use accelerates age-related loss of bone mineral density among older women in a multi-ethnic rural community

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Abstract. Cigarette smoking is a recognized risk factor for low bone mineral density (BMD) and osteoporosis. Despite the prevalence of smokeless tobacco (ST) use by women in some areas of the United States, minority groups in the United Kingdom, and populations in South Asia and Africa, no data exist to evaluate its effect on bone health. The objective of the study is to identify risk factors for low BMD among older women in a multi-ethnic population, with particular attention to smoking and ST use. Data were collected in Robeson County, North Carolina. ST use from childhood is common among women in this community. Two hundred-forty women aged 60 years and older (approximately equal numbers of African Americans, Native Americans and whites) were recruited at a variety of community events to obtain a cross-section of the demographic composition of the county. The main outcome was BMD measured in the heel using a portable dual energy x-ray absorptiometry. Twenty-nine percent of women were current or former smokers, and 26% current or former ST users. Increased BMD was predicted by greater body mass index, estrogen use in the past year, and African American and Native American ethnicity. There was a significant interaction between ST use and age, and between smoking and nutritional supplement use. BMD declined with age; the decline with age was greater for women who were current or former ST users than for those who never used ST. Women who formerly smoked and did not use supplements had a decreased BMD. ST should be considered as an additional risk factor for osteoporosis in populations where its use is prevalent.

Keywords: aging, minority health, osteoporosis, tobacco, women’s health

Introduction

Osteoporosis and osteopenia affect millions of people worldwide. In the United States, an estimated 30 million persons are affected (Looker et al., 1997). Osteoporosis research and treatment has traditionally focused on white women and on several well-established risk factors (NIH Consensus Statement, 2000; Snelling et al., 2001). Non-modifiable factors include older age, small body build, and white or Asian ethnicity. Modifiable risk factors include declining estrogen levels (Kanis, Delmas, Burkhardt, Cooper, & Torgerson,
diet (Dawson-Hughes, Harris, Krall, & Dallal, 1997), alcohol use, smoking, (Baron et al., 2001; Williams, Weiss, Ure, Ballard, & Daling, 1982; Jensen & Christiansen, 1985, 1988) and certain medications and chronic diseases (Schneider & Shane, 2001). In recent years, there has been an increasing call for attention to osteoporosis and its risk factors across the total population, particularly among women in minority ethnic groups (Kanis et al., 1997; Bohannon, 1999; Kessenich, 2000; Perry et al., 1998). The NIH Consensus Conference on Osteoporosis Prevention, Diagnosis, and Therapy concluded that, while osteoporosis is “more prevalent in white postmenopausal females, it often goes unrecognized in other populations” (p. 2) (NIH Consensus Statement, 2000). The National Osteoporosis Risk Assessment found that Native American women had a risk similar to white women of both osteoporosis and osteopenia. While low bone mineral density (BMD) was significantly less prevalent in African American women, the prevalence of osteoporosis and especially osteopenia was substantial and suggests that absolute risk of fracture was significant (Siris et al., 2001).

As osteoporosis research extends to include a wider group of women, it may be necessary to broaden the range of recognized risk factors. Smoking tobacco has been linked to decreased BMD, osteoporosis and fractures (Krall & Dawson-Hughes, 1999; Riebel, Boden, Whitesides, & Hutton, 1995; Baron, 1984; Mellstrom, Rundgren, Jagenburg, Steen, & Svanborg, 1982; Law & Hackshaw, 1997). Several lines of evidence suggest that one pathway by which smoking affects bone is mediated through estrogen. Cigarette smoking opposes the beneficial effects of estrogen on bone, resulting in earlier menopause because of lower estrogen levels and altered estrogen metabolism (Jensen & Christiansen, 1985; Lindquist et al., 1981; McKinlay et al., 1985). Other studies suggest that smoking may decrease calcium absorption and that nicotine impairs formation of new bone (Riebel et al., 1995). We and others have previously noted the high prevalence of smokeless tobacco (ST) use among women in the southern United States and elsewhere in the world (Bell et al., 2000; Spangler, Dignan, & Michielutte, 1997; Spangler, Bell, Dignan, & Michielutte, 1997; Spangler et al., 1998, 1999, 2001; CDC, 1994, 1995; USDHHS, 1998, 2001; Glover, O’Brien, & Holbert, 1987; Yunis & Khan, 1997; Chaturvedi et al., 1998; Gupta, Sinor, Bhonsle, Pawar, & Mehta, 1998; Idris et al., 1996; Bedi & Gilthorpe, 1995; Williams, Summers, Ahmed, & Prendergast, 1996). We have hypothesized that the effect of smokeless tobacco on bone may be similar to that of smoking tobacco (Spangler et al., 2001). Such an effect might be mediated by tobacco-induced metabolism of estrogen into biologically inactive forms, as is seen among cigarette smokers (Jensen & Christiansen, 1985, 1988). However, there have been no human studies to date of this association. This study focuses on a multi-ethnic rural