Knowledge, Beliefs, and Practices Among Adolescent Females Regarding Lifestyle Risk Factors for Osteoporosis

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ABSTRACT

While adult women are aware of the relationship between lifestyle practices and the prevention of osteoporosis, this awareness and subsequent practice is not known in the adolescent population. The primary purpose of this study was to evaluate knowledge, beliefs, and practices regarding osteoporosis lifestyle risk factors among the adolescent female population. A second purpose was to determine whether knowledge, beliefs, and practices would vary according to socio-economic status (SES). A third purpose was to assess whether lifestyle practices would cluster together. Two hundred twenty seven females aged 12 – 16 of high and low SES were randomly selected to participate in this study. Knowledge and beliefs toward osteoporosis lifestyle risk factors - physical activity, cigarette smoking, and nutrition were evaluated using a reliable questionnaire developed for this study. To assess physical activity, smoking, and nutrition, other reliable and valid questionnaires were used. Results indicated that adolescent females believed that an inactive lifestyle and inadequate calcium intake would predispose them to osteoporosis, although they were unaware that cigarette smoking is a risk factor. The majority of participants were also unable to identify specific activities and foods best for building strong bones. In terms of practices, 61% of the participants had daily calcium intakes less than the recommended adequate intake, and physical activity scores that reflected low to moderate activity levels. Twenty-five percent of the young women were current smokers. These findings suggest that although adolescent females in this study held positive beliefs towards lifestyle practices that lead to osteoporosis, they lacked the specific knowledge necessary to make informed lifestyle decisions. In addition,
findings showed that physical activity knowledge and beliefs, as well as smoking knowledge and practice varied according to SES. Furthermore, physical inactivity and cigarette smoking were the only factors found to cluster together. In conclusion, an immediate need exists to promote osteo-protective lifestyle practices among adolescent females. Future research should investigate whether other factors play a role in the relationship between knowledge and practice among adolescent females. Information from this study could also be used to assist in developing and evaluating osteoporosis intervention programs for the adolescent female population.
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CHAPTER 1
LITERATURE REVIEW

1.1 INTRODUCTION
One of the most serious disorders in the elderly is osteoporosis (Turner, Taylor, & Hunt, 1998). Although osteoporosis can affect either gender, it is much more common in women than in men (Cassidy, 1999). A conservative estimate is that one out of every four women over age fifty has osteoporosis, with more women dying from osteoporosis each year than from breast and ovarian cancer combined (The Osteoporosis Society of Canada, 2001). The reduced quality of life for those with this disease is enormous. Osteoporosis can result in disfigurement, lowered self-esteem, reduction or complete loss of mobility, decreased independence, and even death (The Osteoporosis Society of Canada, 2001).

Three factors have been hypothesized to explain the prevalence of osteoporosis. These include: 1) failure to maximize peak bone mass during the growing years; 2) failure to maintain peak bone mass for a sufficient period of time during the adult years; and 3) accelerated bone loss in the post-menopausal years (Dombrowski, 2000). Bailey and Martin (1994) suggest that bone fragility may result from a combination of these three factors. Past research has focused on the management and treatment of bone loss in the post-menopausal years. As a result of problems associated with reversing this disease, prevention directed at maximizing peak bone mass (i.e., the non-pharmacological option), is considered the most logical
and cost-effective approach for osteoporosis (Anderson, Tylavsky, Halioua, & Metz, 1993; Armstrong & Wallace, 1994; Groosthausen, Siemer, Kemper, Twisk, & Welten, 1997). Therefore, recent research has been directed toward the development of a high peak bone mass during the growing years (Cassidy, 1999; Jamal, Ridout, Chase, Fielding, Rubin, & Hawker, 1999).

Adult bone mass at any age is a reflection of bone gained during growth and the amount lost in later years (Bailey & Martin, 1994; Ralston, 1997). Since bone loss is a normal consequence of aging, the attainment of a greater peak bone mass should reduce the risk of health problems associated with bone fragility in later life. In females, peak bone mass is achieved at some sites as early as 15 - 16 years of age (Cassidy, 1999; Ribot, Tremoillieres, & Pouilles, 1995), and at least 90% of total adult bone mass has already been deposited by age 18 (Matkovic, Fonatana, Tominac, Goel, & Chesnut, 1990; Ribot et al., 1995). If peak bone mass is not established during these years, one will enter young adulthood with osteopenia (reduced bone mass) and increased fracture risk (Eisman, Kelly, Morrison, Pocock, Yeoman, Birmingham, & Sambrook, 1993; Ribot et al., 1995; Rubin, Hawker, Peltekova, Fielding, Ridout & Cole, 1999). Thus, it seems that osteoporosis has its origins in childhood and adolescence (Cassidy, 1999), as the establishment of an optimal peak bone mass during the growing years is crucial in terms of lifelong skeletal health.

Although genetic factors (e.g., age, race, family history, and sex) are the major determinants in peak bone mass and subsequent bone status (Rubin et al., 1999; Ralston, 1999), there is considerable evidence that lifestyle factors also affect bone at any stage in life (Bailey & Martin, 1994; Eisman et al., 1993; Jamal et. al., 1999;
Rubin et al., 1999; The Osteoporosis Society of Canada, 2001). It has been reported that lifestyle risk factors such as physical activity, nutrition, and cigarette smoking can account for as much as 20-30% of the variance in peak bone mass attained during the growing years (Krall & Dawson-Hughes, 1993; Slemenda, Christian, Williams, Norton, & Johnston, 1991). Ironically, studies have shown that, among adolescent females, physical inactivity, poor nutrition, and cigarette smoking are on the rise (Aaron, Dearwater, Anderson, Olsen, Kriska, & Laporte, 1995; Boreham, Twisk, Savage, Cran, & Strain, 1997; Fox, 1994; French, Story, Downes, Resnick, & Blum, 1995). If these health-compromising lifestyle practices initiated in adolescence continue long term, they may lead to serious health problems (Kelder, Perry, Klepp, & Lytle, 1994) such as osteoporosis. Due to the importance of maximizing peak bone mass in early life, evidence suggests that comprehensive educational interventions targeted at young women for the prevention of osteoporosis are warranted (Kasper, Peterson, Allegrante, Galsworthy, & Gutin, 1994; Taggart & Connor, 1995). In order for health educators to promote healthy lifestyle practices to prevent osteoporosis, it may be beneficial to assess knowledge and beliefs regarding osteoporosis lifestyle risk factors in the adolescent female population.

1.2 REVIEW OF RELATED LITERATURE

1.2.1 Osteoporosis

Osteoporosis is a disease of the skeleton, characterized by low bone mass and deterioration of bone tissue (The Osteoporosis Society of Canada, 2001). When the loss of bone continues to the point where the skeleton is no longer able to withstand
the mechanical stresses of everyday life, the bones easily break. As a result, 
osteoporosis affects the ability to function, reducing an individual’s independence and 
quality of life.

Osteoporosis is an increasing health care problem in any aging society (Eisman 
et. al., 1993). According to the Osteoporosis Society of Canada (2001), osteoporosis 
affects approximately 1.4 million Canadians and is the major cause of approximately 
25,000 hip fractures every year. The reduced quality of life associated with these 
fractures makes osteoporosis an enormous health problem. Furthermore, the cost for 
osteoporosis-related health care in Canada alone is approximately $1.3 billion each 
year (The Osteoporosis Society of Canada, 2001). Without effective action on 
osteoporosis prevention strategies, it is estimated that Canada will spend at least $32.5 
billion in the next 25 years (The Osteoporosis Society of Canada, 2001).

The average woman has a higher risk of osteoporosis than the average man 
(Armstrong & Van Mechelen, 2000). One of the reasons for this is that women reach 
a lower peak bone mass in their youth (Armstrong & Van Mechelen, 2000). On 
average, women have less bone mass than men because their skeletons are physically 
smaller (Bonjour, Theintz, Buchs, Slosman & Rizzoli, 1991). However, the greater 
bone mass in males is related to a larger volume of bone rather than a difference in 
bone mineral density (Ribot et al., 1995). The second reason for the increased risk of 
osteoporosis in females is that women lose bone density at a high rate after menopause 
when their bodies stop producing estrogen (Armstrong & Van Mechelen, 2000). Men, 
on the other hand, never reach a particular age when their bodies stop producing bone 
preserving hormones such as estrogen, equivalent to testosterone in men (Armstrong
Van Mechelen, 2000). If they did, men might be equally prone to osteoporosis as women.

Bone mass is regulated by a process called remodelling (Armstrong & Van Mechelen, 2000). In this maintenance process, bone is constantly broken down and then reformed in a continuous cycle. Bone remodelling is important for growth, repair, and adaptations to everyday life. Two specialized cells, osteoclasts and osteoblasts, continuously destruct and reform bone in the remodelling process (Wardlaw, 1993). Osteoclasts remove bone, forming very tiny holes in order to release small amounts of calcium into the bloodstream. During a phase called deposition or formation, osteoblasts rebuild the skeleton by filling the holes with new bone.

The balance between osteoclasts and osteoblasts is regulated by a combination of genetic and environmental factors (Ralston, 1997). In children, osteoblast activity (bone formation) must exceed osteoclast activity (bone removal), so that skeletal maturation can occur. In adults, however, the balance between bone removal and deposition is often disrupted. That is, osteoclast activity is often greater than osteoblast activity, meaning bone mineral density will decline. In other words, when an imbalance persists, bone loss can occur and osteoporosis may result (Delmas, 1997). Bone loss starts gradually, making the initial site of loss, time of onset, and rate of loss difficult to define. The extent of bone loss varies among individuals, but on average, women lose up to 40 percent or more of their total bone mass after menopause (Bemben, 1999). Thus, the initial amount of bone present (i.e. peak bone mass) before the loss occurs is extremely important (Dombrowski, 2000). These
findings emphasize the importance of maximizing peak bone mass during the adolescent years.

Peak bone mass is defined as the highest level of bone mass achieved at skeletal maturity, and is generally attained in young adulthood prior to age-related bone loss (Missouri Osteoporosis Foundation, 1997). One longitudinal study showed that the greatest gains in bone mineral density in healthy young women occur from 11-14 years of age, and that bone mass accumulation is limited after 16 years of age (Theintz, Buchs, Rizzoli, Slosman, Clavien, Sizonenko, & Bonjour, 1992). Similarly, evidence suggests that the age at which females achieve peak bone mass can be as early as 15-16 years (Cassidy, 1999; Ribot et al., 1995), and that at least 90% of total adult bone mass has been deposited by 18 years of age (Seeman, Tsalamandris, & Formica, 1993). Thus, efforts to maximize peak bone mass must be established well before the age of 15 for optimal skeletal health (Cassidy, 1999).

1.2.2 Lifestyle Practices Affecting Peak Bone Mass

Although genetics play a large part in determining peak bone mass and subsequent bone status (Rubin et al., 1999; Ralston, 1999; Turner et al., 1998), there is considerable evidence that lifestyle practices such as physical activity, nutrition, and cigarette smoking are also significant (Armstrong & Wallace, 1994; Bailey, Faulkner, & McKay, 1996; Eisman et al., 1993; Hopper & Seeman, 1994; McKay, Petit, Khan, & Schutz, 2000; Recker, Davies, Hinders, Heaney, Stegman, & Kimmel, 1992; Rubin et al., 1999). For example, Slemenda et al. (1991) reported that lifestyle practices can account for 20 – 30% of the variance in peak bone mass. In 1993, Krall & Dawson-
Hughes showed that, in a study of forty families, nearly half of the variance in bone mineral density was attributable to nonhereditary lifestyle practices. Furthermore, many health-compromising lifestyle practices that lead to serious health problems in adulthood can be traced to the adolescent years (Kelder et. al., 1994). For instance, osteoporosis, a disease of the elderly, may be linked to lifestyle practices in the younger years (Juliano-Burns, Whiting, Faulkner, & Bailey, 1999).

Studies have shown that cigarette smoking, physical inactivity, and poor nutrition have become increasingly common lifestyle practices among adolescent females (Aaron et. al., 1995; Boreham et. al., 1997; Fox, 1994; French et. al., 1995; Milligan, Burke, Dunbar, Spencer, Balde, Beilin, & Gracey, 1997). Kasper et al. (1994) reported that, in young college women, the vast majority engage in inadequate physical activity and calcium intake behaviours for building healthy bone. These findings suggest that there is an immediate need for young women (i.e. even those who are before the age of puberty) to improve their lifestyle practices, as osteoporosis prevention needs to begin decades before women experience menopause to delay its development (Heaney, 1987).

1.2.2.1 Physical Activity

It is widely accepted that physical activity has a beneficial impact on bone health (Bailey & Martin, 1994; Ralston, 1997; Recker et al., 1992). The effects of mechanical loading (physical activity) on bone health, particularly disuse, have been recognized for more than a century. Only recently, however, have studies focused on the mechanisms relating physical activity to the skeleton. Studies by Lanyon (1992),
for example, have shown that the key variable between mechanical loading (physical activity) and bone mass is the induced mechanical strain. Changes in bone strain appear to activate osteoblasts and osteoclasts, which alter the balance between bone formation and resorption (Lanyon, 1992). Overall, the optimal type of "bone promoting" physical activity has been found to provide a high level of strain and strain rate distributed throughout the skeleton (Lanyon, 1992). An example of an activity where the amount and rate of induced strain is high is running.

Several studies have found that physical activity, with the resultant increases in muscle strength and lean body mass are correlated with peak bone mass, and therefore greater bone density in adults (Lehtonen-Veromaa, Mottonen, Nuotio, Heinonen, & Viikari, 2000; Welten, Kemper, Post, VanMechelen, Twisk, Lips, & Teule, 1994; Witzke & Snow, 1999). In a review by Gutin and Kasper (1992), appropriate levels of physical activity were found to contribute to bone mineral density and the prevention of osteoporosis. Thus, physical activity or mechanical loading generally has a positive effect in both the development and maintenance of bone (Bailey & Martin, 1994; Eisman et al, 1993; Smith, Gilligan, McAdam, Ensign, & Smith, 1989).

Studies with children and adolescents and the effects of physical activity have shown similar results. McCulloch, Bailey, Houston, and Dodd (1990) and Tylavsky, Anderson, Talmage, & Taft (1992) reported a significant relationship between childhood physical activity and adult bone mineral density. Slemenda, Miller, Hui, Reister, and Johnston (1991) found that an important increment in skeletal mass might result from physical activity in childhood; specifically, that more active children may emerge from adolescence with 5 - 10% greater bone mass. Similarly, Bailey, McKay,
Mirwald, Crocker, and Faulkner (1999) found that the growing skeleton responds to everyday physical activity with increased bone mineral accrual. In the Physical Activity Guidelines for Adolescents Consensus Statement, Sallis and Patrick (1994) emphasized the importance of physical activity for health and suggest that active adolescents have better skeletal health than their less active counterparts. A cross sectional study by Lehtonen-Veromaa et al. (2000) indicated that heavy musculo-skeletal loading produces positive responses in peri-pubertal girls. Similarly, one longitudinal study showed that regular weight bearing physical activity in adolescence is of key importance in maximizing peak bone mass (Welten et al., 1994).

Participation in high school sports has been found to be a significant predictor of femoral neck bone mineral density (Teegarden, Proulx, Kern, Sedlock, Weaver, Johnston, & Lyle, 1996). Lloyd, Chinchilli, Johnson-Rollings, Kieselhorst, Eggli, and Marcus (2000) reported that the amount of physical activity that distinguishes a primarily sedentary teenager from one who engages in some form of exercise on a near daily basis is related to a significant increase in peak hip bone mineral density.

Furthermore, Anderson (2000) suggested that because optimal amounts of calcium are consumed by only small percentages of youths, the beneficial effect of physical activity might dominate as a determinant of bone mass and bone density early in life. Thus, participation in regular weight bearing physical activity during physical education class and/or leisure time is considered a very important factor in maximizing peak bone mass (Teegarden et al., 1996).

Several studies have been conducted to determine the effect of various types of physical activity on bone development. Consistent with the hypothesis that physical
activity and bone mass are positively related are the results from a unilateral limb study on tennis players (Jacobson, Beaver, Grubb, Taft, & Talmage, 1984). Evidence also suggests that vigorous, high impact, weight bearing physical activity such as gymnastics (Fehling, Alekel, Clasey, Rector, & Stillman, 1995), soccer (McCulloch, Bailey, Whalen, Houston, Faulkner, & Craven, 1992), or volleyball (Risser, Lee, Leblanc, Poindexter, Risser, & Schneider, 1990), is most beneficial to the young skeleton. Meanwhile, sports such as swimming have a negligible effect on bone development (Grimston & Hanley, 1992; McCulloch et al., 1992; Rourke, Bowering, Turkki, Buckenmeyer, Thomas, Keller, & Sforzo, 1998).

The positive effect of physical activity on bone development can be quite powerful, making physical activity the most important controllable determinant of peak bone mass. On the other hand, reduction of the mechanical stress on bone leads to rapid loss of bone mineral density, and has a detrimental effect on the skeleton (Rourke et al., 1998). For example, space flight, limb casting, and bed rest have a negative effect on the skeleton (Turner, 2000). Similarly, physically inactive individuals who are not regularly placing mechanical stress on their bones will exhibit a loss of bone mineral density (Gutin & Kasper, 1992; Ralston, 1997).

Despite these findings, evidence suggests that the majority of Canadians, particularly females, are physically inactive (Canadian Fitness and Lifestyle Research Institute, 2002). In 2002 the Canadian Fitness and Lifestyle Research Institute (CFLRI) reported that only one in three Canadians engage in regular physical activity, with more women (67%) than men (54%) considered inactive. Further, CFLRI (2002) reported that over half of children and youth, aged 5 – 17, are not active enough for
optimal growth and development (active enough is defined as being equivalent to an
energy expenditure of at least 8 kilocalories per kilogram of body weight per day).
Previous studies from Fox (1994), Health Canada (1999), Pate, Long, & Heath (1994),
Telama & Yang (2000), and Van Mechelen, Twisk, Post, Snel, & Kemper (2000) have
similarly reported that there is a significant decline in the level and frequency of
physical activity as adolescence approaches. Likewise, Canadian statistics have
shown that 43% of 5-12 year olds vs. 33% of 13-17 year olds are regularly physically
active (CFLRI, 1998). Many studies show that a negative association does exist
between physical activity and age, and that males seem to be more physically active
than females (Aaron, Kriska, Dearwater, Anderson, Olsen, Cauley, & Laporte, 1993;
Caspersen, Pereika, & Curran, 2000; Crespo, Ainsworth, Keteyian, Heath, & Smit,
1999; and Telama & Yang, 2000). Boreham et al. (1997) and Sallis (2000) also
reported a significant decline in physical activity in females during adolescence. In
1998, the CFLRI revealed that while 40% of boys were physically active enough for
optimal health benefits, only 25% of girls aged 13-17 were considered active enough
to receive optimal health benefits. Pate, Long, & Heath (1994) reported that the
majority of female adolescents were not meeting the guideline for moderate to
vigorous physical activity. More specifically, another study (Kasper et al., 1994)
found that the majority of young women were lacking sufficient osteo-protective
physical activity for building healthy bone. Thus, with the increased risk of
osteoporosis in females compared to males, the low levels of beneficial bone loading
physical activity prevalent in adolescent females presents a problem for health
professionals.
1.2.2.2 Nutrition

It is worthwhile to note that the optimal positive effects of physical activity will not occur if nutrition is inadequate (Bailey & Martin, 1994), as the relationship between physical activity and nutrition is synergistic. That is, the lifestyle factors that influence bone mass during adolescence all interact (Bailey & Martin, 1994). This interaction frequently occurs when physical activity is combined with nutritional deficiency (Yeager et al., 1993). As a result, the positive effect of physical activity is dampened due to poor hormonal and nutritional status. For example, the mechanical load placed on bone during physical activity can lead to an increase in bone mineral density. On the other hand, when physical activity (i.e., mechanical loading) is absent, calcium alone is ineffective in terms of even bone maintenance (Kanis, 1991). Thus, both a balanced diet, including adequate calcium, and regular physical activity should be encouraged at an early age in order to improve optimal peak bone mass and skeletal health (Cadogan, 1997; Gunnes & Lehmann, 1996; and Kanis, 1991).

Nutrition in the form of calcium is crucial for skeletal health and a key factor in the development of a high peak bone mass (Iuliano-Burns et al., 1999; Lloyd, Martel, Rollings, Andon, Kulin, Demers, Eggli, Kieselhorst, & Chinchilli, 1996; Ralston, 1997). For example, it has been suggested that individuals with a high calcium intake maintain a greater bone mass throughout life, presumably due to a larger bone mass attained in the younger years. One study reported a positive relationship between radial bone mineral density in post-menopausal women and self-
reported consumption of milk during childhood and adolescence (Sandler, Slemenda, LaPorte, Cauley, Schramm, Barresi, & Kriska, 1985). Several other studies have indicated that calcium requirement is very high during the first two decades of life (Kanis, 1991; Matkovic et al, 1990). Peak bone mineral accrual follows peak height velocity by approximately one year and occurs around 13 years of age in Canadian girls (Martin, Bailey, McKay, & Whiting, 1997). During this period of rapid growth, calcium intake should be high in order to meet calcium requirements and to assure, within genetic limits, maximal peak bone mass (Eisman et al., 1993).

Given the above findings, it is concerning that calcium intake among teenagers begins to decline at the time of puberty and continues thereafter (Fleming & Heimbach, 1994; Iuliano-Bums et al., 1999; Kasper et al., 1994). Barr (1994) reported that more than half of the students in a study done on adolescents had calcium intakes below the recommended intake, particularly in females. Iuliano-Bums et al. (1999) found that older girls (aged 15 through 19) consumed significantly less calcium compared to younger girls (aged 8 through 14). Older girls also demonstrated a marked decline in calcium intake from milk products compared to young girls (Iuliano-Bums et al., 1999). A possible explanation for this may be that intake of low nutrient beverages, such as soda pop, have replaced milk beverages (Whiting, Healey, Psiuk, Mirwald, Kowalski, & Bailey, 2000). Thus, during adolescence girls appear to be decreasing calcium intake rather than increasing it to meet their high calcium needs (Iuliano-Bums et al., 1999), placing them at a greater risk of developing osteoporosis.
1.2.2.3 Cigarette Smoking

According to several investigators, cigarette smoking is detrimental to bone mineral density and a risk factor for osteoporosis (Brot, Jensen, & Sorensen, 1997; Hopper & Seeman, 1994; Laitinen & Valimaki, 1993; Mazess & Barden, 1991; Pocock, Eisman, Kelly, Sambrook, & Yeates, 1989; Takada, Washino, & Iwata, 1997; Tudor-Locke & McColl, 2000). In 1989, Pocock et al. studied identical twins discordant for tobacco use and found significant bone loss of the spine and femoral neck in the smoking twin. In the same study, the effect of heavy smoking showed a small but significant effect on lumbar spine and proximal femur bone mineral density, equivalent to 3-4 years of normal postmenopausal bone loss (Pocock et al., 1989). Similarly, Hopper and Seeman (1994) found that bone mineral density was 0.9% - 2% lower for every 10 pack - years of smoking. This suggests that individuals who smoke approximately one pack of cigarettes per day will have an average deficit of 5 to 10% in bone mineral density.

Although the mechanisms by which smoking influences bone mass are unknown, several theories have been proposed. Krall and Dawson-Hughes (1991) suggest that smoking is associated with decreased calcium absorption. Jensen (1986) reported that women who smoke are typically thinner than their non-smoking counterparts and have reduced body weight, placing less stress on their bones. In addition, cigarette smoking may have a direct negative effect on estrogen metabolism (Jensen, Christianson, & Rodbro, 1985; Longcope & Johnston, 1988). The protective effect of estrogen on bone has been well established in women (Bailey & Martin, 1994). Estrogen affects the balance between osteoclasts and osteoblasts to suppress
bone turnover (Yeh, Liu, & Aloia, 1993), and slows the rate of bone loss by improving
the intestinal absorption of calcium (Heaney, Recher, Stegman, & Moy, 1989). This
allows individuals to maintain a higher calcium level in the blood, which reduces the
chance of losing calcium from the bones in order to replenish blood calcium levels. In
states where estrogen levels are very low, such as post-menopause or amenorrhea,
rapid bone loss may occur. Thus, age at menopause has also been positively linked to
bone mineral density (Osei-Hyiman, Satoshi, Ueji, Hideto, & Kano, 1998). Since
women who smoke typically reach menopause earlier (Andersen, Transbol, &
Christiansen, 1982), it has been proposed that smokers may be at greater risk of
developing osteoporosis.

Research suggests that there is an increased incidence of cigarette smoking
during adolescence (Boreham et al, 1997; Byrne, Byrne, & Reinhart, 1995). In
addition, statistics from Health Canada have confirmed that the onset of cigarette
smoking takes place primarily in adolescence. For instance, data from Health Canada
(1996/97) reported that 26% of females began smoking before age 13, 83% began
before age 16, and almost all females in their study began smoking before age 18. In
1998/99, a National health survey administered by Health Canada stated that 10% of
youth aged 12 - 17 were daily smokers, with an increase to 32% by 15 – 19 years
(Health Canada, 1998/99). Current reports show that 27% of females aged 15 – 19 are
presently smoking, and that these females are smoking an average of 12 cigarettes per
day (Health Canada, 2000). This trend towards smoking behaviour in young females
is of particular concern since adolescents who adopt smoking behaviour early in life
are at high risk of becoming regular smokers as adults, thus placing adolescent

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females who smoke at higher risk of developing early osteoporosis (Chassen, Presson, Sherman, & Edwards, 1990).

1.2.3 Knowledge and beliefs among adolescent females

Since the above unhealthy lifestyle practices (i.e., physical inactivity, low calcium intake and cigarette smoking) are evident among adolescent females, one would suspect that knowledge and subsequent beliefs concerning these osteoporosis lifestyle risk factors also would be lacking among this population.

The area of knowledge and beliefs is complex. Knowledge is a construct relating to the cognitive processes of an individual (Shepherd, 1987). In the present study, knowledge refers to the cognitive processes related to information about physical activity, nutrition, and smoking, or the range of awareness or the degree of understanding of these risk factors. On the other hand, a belief is the probability or improbability that a particular relationship exists between the object of beliefs and some other object, concept, or goal (Fishbein, 1967). The construct of belief is often used interchangeably with attitudes (Sims, 1981), but is defined differently from an attitude (Fishbein, 1967). Beliefs represent the information an individual may have about an object, which may or may not be correct. Therefore, a distinction of a belief from an attitude is that beliefs may be probable or improbable, correct or incorrect, while attitudes cannot be judged as correct or incorrect and are simply based upon an individual’s feelings (Sims, 1981). Thus, in the present study, the term ‘belief’ refers to the probability or improbability that a particular relationship exists between osteoporosis and lifestyle practices such as physical activity, cigarette smoking, and
nutrition. In 1975, Fishbein and Ajzen suggested that an individual's knowledge about an object is used to form their beliefs. The belief formed is related to an individual's intentions to perform a variety of behaviours with respect to the object. These intentions transform into actual behaviours or practices (Fishbein & Ajzen, 1975). Given the relations between knowledge, beliefs, and practices, it would be worthwhile to assess these three constructs.

To date, no study has assessed knowledge or beliefs regarding osteoporosis and these controllable lifestyle risk factors among adolescent women. Earlier studies have only focused on the knowledge and/or beliefs and attitudes concerning osteoporosis among middle-aged to older women (Hsieh, Novielli, Diamond, & Cheruva, 2001; Magnus, Joakimsen, Bernsten, Tollan, & Sogaard, 1996) and among college women (Kasper et al., 1994; Kaspar, Peterson, & Allegrante, 2001; Wallace, 2001). For example, a study done on the knowledge, beliefs, and behaviours concerning osteoporosis among college women showed that one third of the participants in their study were lacking knowledge concerning risk factors for osteoporosis, that the majority believed that osteoporosis was less serious than other common causes of morbidity and mortality in women, and that less than 10% reported getting both adequate osteo-protective exercise and nutrition (i.e. calcium) for someone their age (Kasper et al., 1994). More recent work by Kasper, Peterson, and Allegrante (2001) using an osteoporosis prevention survey assessing knowledge, beliefs, and behaviours has reported very similar findings to their earlier study. For instance, among the college women who responded to the survey, 86% had heard about osteoporosis, but the overwhelming majority believed that they were unlikely to
develop osteoporosis. Moreover, only 4% were getting enough exercise and calcium per day to prevent osteoporosis. Thus, Kasper et al. (2001) concluded that the majority of young college women in their study were at risk for developing premature osteoporosis. Likewise, a study on osteoporosis prevention in young college women by Sedlak, Doheny, and Jones (1998) found that knowledge and beliefs were initially lacking among the young women in their study. However, this same study reported that, after a knowledge based intervention involving an osteoporosis prevention program, the young women in the experimental group had significantly higher knowledge and health belief scores than those in the control group. The study concluded that there is a need for osteoporosis intervention programs to increase awareness and subsequent beliefs in women, and that future research should include developing osteoporosis programs at an earlier age when girls are in grade school and junior high school. Thus, there seems to be a gap pertaining to adolescent women and knowledge, beliefs, and practices concerning osteoporosis lifestyle risk factors in the existing literature.

1.2.4 Clustering of Health Risk Behaviours and the Impact of Socio-economic Status

It has been suggested that if an individual is practicing one health risk behaviour he/she is more likely to be involved in another (Blair, Jacobs, & Powell, 1985; Kelder et. al., 1994; Pate, Heath, Dowda, & Trost, 1996), as it has been shown that lifestyle practices tend to cluster together (Hars, Stacy, & DeMatteo, 1984; Winnail, Valois, McKeown, Saunders, & Pate, 1995). For example, health
compromising practices such as unhealthy eating, physical inactivity, and cigarette smoking cluster together (Blair et al., 1985). Alternatively, it has been suggested that physical activity promotes healthy behaviour, as physically active individuals are less likely to participate in health compromising practices such as cigarette smoking and poor nutrition (Blair et al., 1985; Health and Welfare Canada, 1992). Several studies support these findings. Faulkner, Bailey, and Mirwald (1987) found that fit adults involved in vigorous physical activity are more likely to be non-smokers. In addition, physically active individuals generally report higher caloric intake and healthier food choices than their less active counterparts (Blair et al, 1985; Kelder et al., 1994; Pate et al, 1996).

The clustering of health-related behaviours is also prevalent among adolescents. The likelihood that youth will never smoke is directly related to the level of physical activity, as more than 80% of Canadians (aged 10 – 24) who are regularly physically active have never smoked (Sport Nova Scotia, 1997). Results from United States and Finland showed a significant inverse relationship between physical activity and cigarette smoking among adolescents. Physical activity was related to less smoking in both sexes in a study on Finnish adolescents by Raitakari, Porkka, Taimela, Telama, Rasanen, and Viikari (1994). Pate et al. (1996) found that low active American youth were 1.4 times more likely than active students to have smoked one or more cigarettes in the past thirty days. Kelder and colleagues (1994) noted similar trends, as the prevalence of smoking among low active students was at least 14% higher than students in the highest physical activity tertile. In female adolescents, a low level of physical activity is also associated with cigarette smoking
Burke, Milligan, Beilin, Dunbar, Spence, Balde, & Gracey, 1997). Raitakari, Leino, Raikkenon, Porkka, Taimela, Rasanen, and Viikari (1995) found females who remained sedentary over a 6 year follow up were significantly more likely than active females to either begin smoking (25.9% vs. 4.6%) or smoke on a daily basis (45.5% vs 8.7%). Aaron et. al. (1995) found the percentage of females reporting smoking among the highest tertile (10%) for physical activity was significantly lower than the percent observed for the moderate (23%) and the low (22%) physical activity tertile. Likewise, smoking initiation was found to be the lowest in the females who reported high leisure time activity or had high aerobic fitness compared to females who reported moderate to low levels of physical activity or aerobic fitness (Aaron et al., 1995). Thus, females who are regularly physically active may be less likely to smoke.

Another example of clustering that seems to exist in the adolescent female population is the relationship between physical activity and nutrition. Active individuals generally report higher caloric intakes and healthier food choices than their less active counterparts (Blair et al., 1985; Kelder et al., 1994; Pate et al., 1996). In the Cardiovascular Risk in Young Finns Study, physical inactivity was associated with a diet with excess fat (Raitakari et al., 1995). In a cross-sectional study among 18 year-old Australians, smoking, unhealthy dietary habits, and physical inactivity were all associated with each other (Burke et al., 1997; Milligan et al., 1997). Among both males and females, participation in leisure sports and conditioning sports was correlated with healthy food choices and healthy food preferences (French, Perry, Leon, & Fulkerson, 1994). Pate et al. (1996) found that adolescents who did not eat vegetables on the previous day were twice as likely to be physically inactive than
those who reported eating at least one serving of vegetables. In another study, students in the highest quintile for healthy food choices exhibited significantly higher levels of physical activity than students in the lowest two quintiles (Lytle, Kelder, Perry, & Klepp, 1995). This difference was most evident among females.

Lifestyle practices also vary according to socio-economic status (SES) (CFLRI, 1998). Data from the 1990 Ontario Health Survey were used to investigate SES and health behaviours in adults. Results showed that unhealthy behaviours (i.e., smoking, high fat diet, and physical inactivity) were inversely associated with socioeconomic indices (educational achievement, household income status, source of household income, and occupational prestige) (Pomerleau, Pederson, Ostebye, Speechley, & Speechley, 1997). Ratanen, Prakatti, and Heikkinen (1992) also found that in adults, greater muscle strength and, therefore, greater physical activity level, was reported among the more highly educated compared to the less educated. Similarly, Crespo et al. (1999) found that social class was associated with physical inactivity; specifically, that inactivity was more common among those adults who were less educated, and living below the poverty line (Crespo et al., 1999). A study done by Seccareccia, Menotti, and Prati (1991) showed that adults with the highest socio-economic class seemed to be associated with better health behaviors toward coronary heart disease prevention, specifically, non-smoking and regular physical activity.

A similar relationship between SES and health behaviors has also been suggested among adolescents. A study done on Swedish adolescents reported that low physical fitness (Zakarian et al., 1994) and daily cigarette smoking (Bergstrom,
Hernell, & Persson, 1996) were more pronounced in girls from families of a low SES. In addition, Neumark-Sztainer, Story, Dixon, Resnick, and Blum (1997) found that low SES was a significant factor for inadequate consumption of dairy foods, as in their study, nearly twice as many adolescents from low SES backgrounds had low intakes of calcium and dairy foods compared to adolescents of high SES. A survey done by Health Canada in 1996/1997 reported that the prevalence of cigarette smoking among individuals 15 years and older was inversely related to income. This same study showed that there were nearly twice as many current smokers in the lowest income group as there were in the highest income group. A similar pattern was seen for different education levels (Health Canada, 1996/1997). All of the above-mentioned studies provide evidence of an inverse relationship between unhealthy lifestyle practices and SES. Local findings support these studies showing that only 25% of Saskatoon residents with less than grade 12 educations participate in regular physical activity (Saskatoon In Motion Survey, 2000).

1.3 SUMMARY

Numerous studies have reported that osteoporosis lifestyle risk factors such as cigarette smoking, physical inactivity, and poor nutrition are common practices among adolescent women, yet no studies have focused on the degree of knowledge and the strength of beliefs concerning osteoporosis risk factors within this population. Little is also known about the relationship between these variables (knowledge, beliefs, and practices) and SES among the adolescent female population. It has been suggested that adolescent females who come from families with low education and/or low
income are at greater risk of developing chronic diseases (Pomerleau et. al, 1997), but no study has directly addressed the relative risk of osteoporosis among the adolescent female with a low SES. Furthermore, research has suggested that lifestyle practices tend to cluster together (Pate et al., 1996), particularly around physical activity, nutrition, and smoking. Given this, the present study not only evaluated each lifestyle practice or factor in isolation (e.g. physical activity, cigarette smoking, and nutrition), but also considered the linkage between these factors. Results from the study will be used to assist health educators in developing future programs promoting healthy lifestyle choices for the prevention of osteoporosis. The link between SES and knowledge, beliefs, and practices will also be better understood, and thus be helpful in designing osteoporosis interventions targeted towards high-risk groups.

1.4 STATEMENT OF THE PROBLEM

1.4.1 Purposes

The primary purpose of this study was to evaluate the knowledge, beliefs, and practices among adolescent females regarding lifestyle risk factors for osteoporosis. Descriptive statistics obtained from the study helped to address this purpose (i.e., to describe the knowledge, beliefs, and practices regarding osteoporosis lifestyle risk factors among the sample population). A second purpose was to determine whether knowledge, beliefs, and practices differ between adolescent females of varying socio-economic status. The third purpose was to assess whether lifestyle practices such as cigarette smoking, physical inactivity, and poor nutrition, would cluster in the adolescent female population.
1.4.2 Hypotheses

1. Adolescent females who have greater knowledge and subsequent beliefs regarding osteoporosis lifestyle risk factors (physical activity, nutrition, and cigarette smoking) will engage in more positive healthy lifestyle practices than those with less knowledge and subsequent beliefs.

2. Individuals with a higher SES will exhibit greater knowledge and beliefs, and healthier lifestyle practices (e.g. regular physical activity, higher calcium intake, and abstinence from smoking) compared to those individuals with a lower SES.

3. Physical activity, calcium intake, and smoking behaviors will cluster together.

1.5 ASSUMPTIONS

a) The subjects are representative of a typical adolescent female population aged 12 to 16 years.

b) The subjects’ responses to all questionnaires are accurate assessments to approximate their risk of developing osteoporosis.

c) The subjects’ responses to the questionnaire items are representative of the adolescent female population.

1.6 LIMITATIONS

a) The Osteoporosis Risk Factor Questionnaire may have limited scope in accurately measuring knowledge and beliefs among adolescent females.
b) The Food Frequency Questionnaire is self-reported, and therefore may not provide completely reliable reflections of nutritional practice.

c) The Physical Activity Questionnaire for Older Children (PAQ-C) is a self-reported, retrospective questionnaire that relies on the ability to recall and is subject to memory errors. The PAQ-C may also underestimate the physical activity of some very active individuals because it is insensitive in assessing the intensities of activities (Crocker et al., 1997). Thus, it may not assess the physical activity level of the subjects accurately and reliably; it may also have not provided two distinct groups (e.g. high versus low) for the purpose of t-test analyses in the present study.

d) In the present study, SES was identified by the Prince Albert school boards based upon educational achievement and household income. Those schools in neighbourhoods in which the majority of residents had obtained post-secondary education and had a high income were considered to be high SES, while those schools that were classified as having low SES were located in neighbourhoods in which the majority of residents had achieved less than grade twelve and a household income at or below the poverty line. This categorization of SES based on the area in which the participants attended school is a limitation of this study. In addition, the range of SES in Prince Albert, Saskatchewan may be considerably narrower than that compared to a larger, urban or rural setting in other places.

e) The number of consent forms that were distributed was not recorded and therefore the participation rate for each of the high and low socio-economic schools was not determined in the present study. This may be a limitation in that those girls who returned their consent forms may have been a bias sample.
1.7 DELIMITATIONS

The results of this research can be projected to adolescent females aged 12 – 16 in Prince Albert, Saskatchewan.
CHAPTER 2

METHODS

2.1 PARTICIPANTS

Two hundred twenty seven adolescent females (aged 12 through 16) from the Prince Albert public and separate school systems consented to participate in this study. This sample size was used to allow for greater statistical power since small to moderate overall effects were expected (Bateman, 1992). It was also expected that there would be some loss of data due to erroneous and/or incomplete questionnaires.

Participants were recruited from six different schools in the city of Prince Albert. Three schools within the Catholic board and three schools within the public board were chosen from various socio-economic areas of the city. Of the six schools, 2 were considered of a low socio-economic area, 3 were considered medium to high socio-economic area, and one was considered of a high socio-economic area. This identification was based upon parental educational achievement and household income status as identified by the Prince Albert school boards. Neighborhoods in which the majority of residents had an educational achievement of less than Grade 12 and a household income status at or below the poverty line were considered to be in a low socio-economic area. Hence, the schools within this area were classified as such. Those neighborhoods in which the majority of residents had obtained post-secondary education and had a household income status of $50,000/year or more were considered to be in a high socio-economic area, and hence schools within this area were classified
as such. Those schools who were classified as having “medium” SES were those
schools that fell somewhere in between the latter two categorizations (i.e., high and
low). Students from grades 7, 8 and 9 from each school took part in the study.
Approval of this project was obtained from the Human Experimental Behavioral
Sciences Ethical Review Committee of the University of Saskatchewan. Consent was
obtained from the Prince Albert separate and public school boards, and from the
participants and their parent/guardian prior to the study (Appendix A).

2.2 MEASURES

Four questionnaires were administered: 1) The Osteoporosis Risk Factor
Questionnaire (see Appendix B); 2) The Physical Activity Questionnaire for Older
Children (PAQ-C) (see Appendix C); 3) The Teenagers’ Nutrition Questionnaire (see
Appendix D); and 4) The Smoking Behaviour Questionnaire (see Appendix E).
Written instructions, which were included on the questionnaires, were read aloud for
the subjects by the researcher of the study. Questions regarding the study were also
answered at this time.

2.2.1 The Osteoporosis Risk Factor Questionnaire

The Osteoporosis Risk Factor Questionnaire was developed for this study to
assess knowledge and beliefs in the adolescent population. It consisted of two
sections: knowledge and beliefs. Each section consisted of questions developed by
the researcher of this study using existing questionnaires and related literature.
Validity is an important part of developing a questionnaire. It is defined as the degree
Two types of validity that were considered in the development of the Osteoporosis Risk Factor Questionnaire are content and construct. The first type, content, is defined as a condition that is claimed when a questionnaire or test adequately covers or samples what it is supposed to cover (Thomas & Nelson, 1996). In the present study, the questions included in the questionnaire were reviewed and approved by a panel of experts (Exercise Physiology, Pedagogy, Nutrition, Physical Therapy, and Growth and Development) to establish content validity of the Osteoporosis Risk Factor Questionnaire. Revisions were then made to address issues raised by the expert panel related to problems that were identified (language, test items, format, etc.). To establish construct validity, defined as the degree to which a test measures a hypothetical construct (Thomas & Nelson, 1996), the known difference method was considered. The known difference method is a technique that compares test scores or results of a group that should differ on a behavior, trait, or ability (Thomas & Nelson, 1996). However, for this study, the constructs, ‘knowledge’ and ‘belief’, were unable to be compared to another study, since there has not been a similar study assessing the knowledge and beliefs regarding osteoporosis among adolescent females to date. Moreover, criterion (concurrent) validity of the Osteoporosis Risk Factor Questionnaire was not assessed due to the lack of an absolute and established standard for comparison.

The revised Osteoporosis Risk Factor Questionnaire was also pre-tested on a volunteer sample of ten adolescents (females in grades 7 - 9) prior to data collection to assess questionnaire comprehension. Students were asked to help make the
questionnaire easier for other students to complete, and were asked to identify any items that they found unclear or confusing. Minor revisions regarding the wording of questions were then made to the questionnaire.

**Knowledge**

The knowledge section of the questionnaire consisted of 20 questions pertaining to knowledge regarding osteoporosis lifestyle risk factors: 1) physical activity 2) nutrition and 3) cigarette smoking. Of the 20 questions, 14 were true/false, while the remaining 6 were multiple-choice. An example of one of the true and false nutrition questions would read, ‘It is difficult to get the calcium you need from vegetables alone.’ Each correct true-false question was worth one mark, while zero marks were given for an incorrect or “unsure” response. Multiple-choice questions were worth a half mark each. The final knowledge score was used to test two of the hypotheses of this study.

**Beliefs**

The second section of the questionnaire assessed beliefs regarding lifestyle risk factors for osteoporosis (physical activity, cigarette smoking, and nutrition). Twenty statements assessed beliefs toward lifestyle practices associated with osteoporosis as well as behavioral modeling for each: physical activity (8 questions), nutrition (7 questions), and cigarette smoking (5 questions). Responses to the belief statements took the form of a 5 - point forced choice, Likert scale, ranging from “strongly agree” to “strongly disagree”. For example, one statement pertaining to beliefs about
physical activity read, ‘I believe that physical activity helps to build strong, healthy bones.’ Each statement was worth a maximum of five points, with an optimal response receiving five points. For example, a response of “strongly agree” to the statement, ‘I believe that drinking milk will reduce my risk of osteoporosis’ was considered optimal, and was therefore given five points. In contrast, the least optimal response (e.g. responding with “strongly disagree” to the above statement) was given one point. The total number of points attained was considered the participants’ percentage score out of 100. The total belief score was used to evaluate the first and second hypotheses.

Reliability is another important part of developing a questionnaire. For example, a reliable test is one in which the test results are consistent, indicating a low degree of measurement error. Developing a reliable test gives greater confidence that the test scores are accurate representations of the variable being measured (Gronlund, 1988b). Thus, before the Osteoporosis Risk Factor Questionnaire was administered, a pilot study was undertaken. Twenty-seven adolescent females, aged 12 – 16, from one randomly selected school that was in the current study, were asked to complete the Osteoporosis Risk Factor Questionnaire twice in order to evaluate test-retest reliability. For the knowledge section of the Osteoporosis Risk Factor Questionnaire, results revealed that the two values were significantly correlated. Test re-test reliability for the knowledge section was as follows for the two trials: physical activity knowledge ($r = .65, p < .01$); smoking knowledge ($r = .65, p < .01$); and nutrition knowledge ($r = .75, p < .01$). In terms of the belief section of the Osteoporosis Risk Factor Questionnaire, a Pearson Product Moment Correlation
showed a significant correlation for all twenty statements between the two trials ($r = .79, p < .01$). Given these findings, the Osteoporosis Risk Factor Questionnaire was considered reliable.

**Practice**

2.2.2 The Physical Activity Questionnaire for Older Children (PAQ-C)

Self-reports are the most widely used method to obtain physical activity data. They are relatively quick, easy to obtain, inexpensive, unobtrusive, and non-reactive (Baranowski, 1988). The Physical Activity Questionnaire for Older Children (PAQ-C) is a self-report method that is used to assess general levels of physical activity in children aged 9 through 15 years (Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997). It consists of an activity checklist and several questions regarding physical activity during segments of the day (e.g. lunch hour or after school), as well as physical activity on the weekend. The PAQ-C is a 9-item self-report 7-day activity recall scored on a 5-point scale, with higher numbers indicating higher physical activity levels. The first item is an activity checklist consisting of common sports, leisure activities, and games, with extra space to list other activities. Six items assess physical activity in physical education classes, lunch, recess, after school, in the evenings and on the weekend. The next item asks the individual, "which one of the following describes you best for the last 7 days?" The individual has a choice of five statements describing low to very high activity levels. The last item asks the individual the frequency of his/her physical activity. These nine items are then used to calculate a final summary activity score (Crocker et al., 1997), determined by
averaging the values of the nine items, ranging from 1 (low) to 5 (high). In addition, one item at the end of the questionnaire assesses whether sickness or anything else prevented them from being active in the last week.

The PAQ-C is a cost-effective and convenient method to assess students' physical activity (Crocker et al., 1997). It takes from 10 to 20 minutes to complete, making it appropriate for a large-scale study. Also, research indicates that the PAQ-C has acceptable test-retest reliability (r= .75 to .82) (Crocker et al., 1997) and validity (Kowalski, Crocker, & Faulkner, 1997). Convergent validity is supported in the PAQ-C since the PAQ-C is related to the PAR activity rating (r=.73), the PAR 7-day recall interview (r = .59), and the Leisure Time Exercise Questionnaire (r = .57) (Kowalski et al., 1997).

2.2.3 The Teenagers’ Nutrition Questionnaire

The nutritional practice of each subject was assessed using several self-reported surveys developed by Dr. Susan Barr (1994). The present study titled the nutritional assessment tool, ‘The Teenagers’ Nutrition Questionnaire’. The Teenagers’ Nutrition Questionnaire contains the following elements: one item concerning frequency of meals; a food frequency questionnaire (FFQ) to estimate calcium intake; an item regarding milk preference; and scales to reflect taste enjoyment of dairy products.

The FFQ was developed for a study investigating the calcium intake of adolescents (Barr, 1994). Unlike other food frequency questionnaires, this FFQ was designed to include foods such as milkshakes, which take into account the adolescent
population. Barr (1994) also included beverages low in calcium (e.g., soft drinks) in her FFQ in order to assess whether consumption of these beverages was negatively associated with calcium intake. For each food item, the subjects indicated the number of times per day, per week, or per month they consume something of stated size, or indicated that they do not eat the particular food.

Food frequencies are generally acknowledged as useful in assessing usual dietary intakes of large numbers of subjects (Angus, Sambrook, Pocock, & Eisman, 1989) and as providing a better approximation than a 24 hour dietary recall (Margetts, Cade, & Osmond, 1989). Although multiple dietary records are believed to provide the most accurate estimate of usual intakes, the number of records needed to characterize the individual’s usual intake is large (Basiotis, Welsh, Cronin, Kelsay, & Mertz, 1987) and would not be feasible for a study like the present one. Estimates of calcium intake from FFQs were found to correlate well with 4-day and 7-day weighed food records (Angus et al., 1989; Cummings, Block, McHenry, & Baron, 1987), and with dietary records kept daily for one year (Willett, Reynolds, Cottrell-Hochner, Sampson, & Browne, 1987). The FFQ was also validated using a group of 130 adolescents (Barr, 1994). Results showed that the FFQ quantified 81% of the mean calcium intake when compared to the one-day food record. The two values were highly correlated (r = .98; P< 0.001), and the slope of the regression was very close to unity (.96). Reliability of the FFQ was also assessed in a group of 18 students who completed the FFQ on two occasions approximately 3 months apart (Barr, 1994). The correlation between the two sets of data was r = .76. The Teenagers’ Nutrition Questionnaire used in this study was not assessed for reliability and validity since the questions were drawn from
the above survey instrument developed by Barr (1994) that has been shown to have acceptable validity and reliability.

In addition to the FFQ, the Teenagers’ Nutrition Questionnaire provides information on the frequency (times per week) that the individual eats breakfast, lunch, dinner, and between-meal snacks, and the number of these meals and snacks eaten out. Another item requests that participants identify one type of milk that they prefer to consume most. Likert type scales adapted from Lewis assessed taste enjoyment of eight dairy products including whole milk, low fat milk, skim milk, cottage cheese, hard cheese, plain yogurt, fruit flavored yogurt, and ice cream ranged from 1 point (given for the “not at all” response), to 5 points (given for the “very much” response).

2.2.4 The Smoking Behaviour Questionnaire

The Smoking Behaviour Questionnaire assessed self-reported cigarette smoking. The questionnaire consisted of five questions pertaining to cigarette use, with three of these questions regarding the use and frequency of cigarette smoking (Gritz & Crane, 1991). The other two questions inquired about the initiation of cigarette smoking and overall cigarette use. The second section of the Gritz & Crane (1991) questionnaire, assessing smoking as a means of weight control, was not applicable to this study, and therefore was not used.

The Smoking Behaviour Questionnaire was used to divide the subjects into two groups. These groups included: 1) non-smokers and 2) smokers (currently
smoking cigarettes). Of the smokers, participants were then assessed on smoking frequency/volume in the past thirty days.

2.3 PROCEDURES

The questionnaires were administered during the participants' physical education or health education class time, and took approximately 45 minutes in total to complete. The researcher of this project distributed the questionnaires and briefly explained the questionnaires before the participants began. The researcher remained in the room during completion of the questionnaires to answer questions. When the participants had completed the questionnaires, the researcher carefully checked to ensure that no questions had been left unanswered.

2.4 DATA ANALYSIS

After entering the data, the questionnaires were screened individually so that those with incomplete data (e.g. missing personal data such as body weight) or unusual responses (e.g., a response of ‘Martian’ for ethnic background) were eliminated from the analysis. When the data was ready for analysis, descriptive statistics and frequencies were run on the demographic variables - age, socio-economic status, race, height, weight, and menstrual history. A similar analysis was done on the dependent variables - knowledge, beliefs, and practices for each lifestyle risk factor (physical activity, calcium intake, and smoking). In addition to analyzing estimated daily calcium intake, descriptive statistics were run on the data obtained from the FFQ (i.e., milk preference, taste enjoyment, and meal frequency). Data
regarding milk allergy and vitamin usage was also analyzed. To examine cigarette smoking, descriptive statistics and frequencies were run on smoking status and volume, as well as the age at which the participants began to smoke.

T-tests were used to test the primary hypothesis, that adolescent females with greater knowledge and subsequent beliefs regarding osteoporosis lifestyle risk factors would be engaging in more positive, healthy, lifestyle practices than those with less knowledge and subsequent beliefs. Knowledge was categorized into two groups: 1) high knowledge, defined as one standard deviation above the mean knowledge score for the entire sample; and 2) low knowledge, defined as one standard deviation below the mean knowledge score for the entire sample. The t-tests used in this study determined whether any there was any difference in physical activity or nutritional practice between the two high and low knowledge groups. They also determined whether a difference in physical activity or nutrition practice existed between high and low belief groups. In order to reduce any chance of a Type I error due to multiple t-tests, the alpha rate was set to .05.

In addition to t-tests, chi-square tests were used in order to analyze the smoking data. The chi-square test was chosen in order to compare two sets of nominal data that were arranged into categories by frequency counts. The sets of data included were high and low smoking knowledge (using the same definition for high and low groups as above), high and low smoking belief groups, and smoking practice groups (current smoker versus non-smoker). Only two sets of data were compared per one chi-square test. These tests determined the simple relationships between knowledge, beliefs, and practices for cigarette smoking.
To test the second hypotheses, that individuals with a higher SES would exhibit greater knowledge and beliefs, and healthier lifestyle practices (e.g., physical activity, higher calcium intake, and non-smoking) compared to those individuals with a lower SES, t-tests were used. Results from the t-tests were used to compare the difference between the means of the two samples (i.e., high vs. low SES) with the difference expected if only chance was operating. This determined the effect of the independent variable, SES, on the dependent variables knowledge, beliefs, and practices for physical activity, nutrition, and smoking.

Like hypothesis one, chi-square tests were used in order to analyze the smoking data. The chi-square test was chosen in order to compare two sets of nominal data that were arranged into categories by frequency counts. The two sets of data included were from the socio-economic groups (i.e., high and low), and cigarette smoking groups (i.e., non-smoking and smoking). Before running these analyses, participants were categorized into low, middle, and high socio-economic status as identified by the Prince Albert public and separate school boards. However, only those participants with high (n = 41) and low SES (n = 32) (extreme group design) were used in the analysis. This extreme group design was used since the present study was exploratory, and thus required the best chance of finding a significant difference between the two SES groups.

To test the third hypotheses, that lifestyle practices (physical activity, nutrition, and cigarette smoking) would cluster together, descriptive statistics and frequencies were applied to the data to examine the simple relations.
CHAPTER 3

RESULTS

3.1 SUBJECT DESCRIPTIVES

The present study included 227 participants ranging from 12 – 16 years in age, with the exception of some analyses in which fewer subjects were used. This was due to incomplete or missing data, which will be identified throughout the text and tables. For example, frequency data available from 224 participants showed that most were 13 or 14 years of age, with the mean age of the sample being 13.5 ± 1.0 (SD) years.

Ethnic background/race was also obtained from the participants (n = 225). Results revealed that 61% of the participants in this study were Caucasian, while 36% were Native Canadian and Metis, respectively. The remaining 3% were Oriental or Black (see Table 3.1). Socio-economic status (SES) was identified by the Prince Albert separate and public school boards, based on parental education and income, as previously described. The majority of participants were classified as middle SES, while those with high SES and those with low SES, when combined, accounted for 32% of the sample. Socio-economic status of the participants is shown in Table 3.1.

Subject characteristics such as height, weight, and menstrual status also were obtained from the participants. Height ranged from 142 – 177 centimetres (cm), with the mean height for the group being 163 ± 5.76 cm (n = 214). Weight ranged from 28.6 to 99.1 kg, with a mean of 53.6 ± 11.1 (kg) (n = 212). Information regarding menstrual status was collected from 222 participants, and showed that 29% (n = 64) of
females in this study did not have a regular menstrual cycle, while 71% (n = 158) did have a regular monthly period. These descriptive findings indicate that the majority of the participants were in late adolescence.
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (n = 224*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 years</td>
<td>37</td>
<td>16.5</td>
</tr>
<tr>
<td>13 years</td>
<td>81</td>
<td>36.2</td>
</tr>
<tr>
<td>14 years</td>
<td>73</td>
<td>32.6</td>
</tr>
<tr>
<td>15 years</td>
<td>30</td>
<td>13.4</td>
</tr>
<tr>
<td>16 years</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>Race (n = 225*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>137</td>
<td>61.1</td>
</tr>
<tr>
<td>Native Canadian</td>
<td>47</td>
<td>21.0</td>
</tr>
<tr>
<td>Metis</td>
<td>33</td>
<td>15.0</td>
</tr>
<tr>
<td>Oriental</td>
<td>5</td>
<td>2.2</td>
</tr>
<tr>
<td>Black</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>SES (n = 227)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>41</td>
<td>18</td>
</tr>
<tr>
<td>Medium</td>
<td>154</td>
<td>68</td>
</tr>
<tr>
<td>Low</td>
<td>32</td>
<td>14</td>
</tr>
</tbody>
</table>

*Note: Subject numbers vary due to missing data
Descriptive statistics showed that knowledge and subsequent beliefs concerning osteoporosis were limited and unhealthy lifestyle practices (physical inactivity, low calcium intake, and cigarette smoking) were prevalent among the sample population. Further, results showed that general knowledge regarding these three risk factors was present, but specific knowledge regarding each risk factor was lacking. For example, although 81% (n = 184) of the adolescent females in this study knew that physical activity was good for their bones, 58% (n = 132) were unable to correctly identify what kinds of physical activity (e.g. swimming vs. soccer) were best for building strong bone. In terms of questions concerning physical activity and nutritional behaviours, 80% (n = 181) knew that physical activity must accompany dieting for safe, effective weight loss; 65% (n = 148) knew that physical activity helps to burn more calories at rest; 60% (n = 137) knew that physical activity could help to avoid muscle loss when dieting to lose weight; 63% (n = 143) were aware that regular physical activity helps the body use calcium more efficiently; and 58% (n = 132) were aware that irregular and or complete loss of the menstrual cycle is harmful to bone health. However, 39% (n = 88) indicated that excessive physical activity and severe dieting could speed up bone growth. When it came to nutrition knowledge, 67% (n = 153) identified that it is difficult to get enough calcium from vegetables alone and 77% (n = 176) knew that drinking too much pop or caffeine could be harmful to bone health, but only 45% (n = 102) recognized that adolescents need more calcium than a child aged six or seven. Participants also had difficulty in correctly distinguishing between calcium rich and non-calcium rich foods such as ice cream, pizza, oranges, kiwi, and grapefruit. In terms of cigarette smoking, although 86% (n = 195) of the
young women in this study seemed confident that cigarette smoking is harmful to health in general, knowledge regarding smoking and its link to osteoporosis was lacking (less than 43% reported that it could lead to osteoporosis).

Although knowledge was therefore considered to be limited among the participants, descriptive statistics showed that beliefs held towards physical activity, nutrition, and smoking were fairly high among the girls in this study. Belief scores for each of the osteoporosis lifestyle risk factors were as follows: 1) beliefs about physical activity – mean score 33.50 (maximum possible score 40.00); 2) beliefs about nutrition – mean score 29.56 (maximum possible score 35.00); and 3) beliefs about smoking – mean score 20.37 (maximum possible 25.00). This might suggest that although the participants did not have the knowledge to answer every physical activity, nutrition, and smoking question correctly, they did believe that these three lifestyle practices were important factors in osteoporosis prevention.

Scores for both the belief and knowledge variables were divided according to one standard deviation above and below the mean so that low, moderate, and high group frequencies could be calculated. The number of participants in each group was as follows: physical activity knowledge – low (n = 48) and high (n = 57); nutrition knowledge – low (n = 39) and high (n = 38); smoking knowledge – low (n = 37) and high (n = 74); physical activity beliefs – low (n = 33) and high (n = 35); nutrition beliefs – low (n = 48) and high (n = 28); and smoking beliefs – low (n = 44) and high (n = 45). Results for the descriptive statistics for knowledge and beliefs are displayed in Table 3.2.
Table 3.2. Descriptive Statistics – Knowledge and Beliefs (n = 227)

<table>
<thead>
<tr>
<th>Type of Knowledge</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity</td>
<td>5.10</td>
<td>1.80</td>
<td>.00</td>
<td>8.00</td>
</tr>
<tr>
<td>Nutrition</td>
<td>3.82</td>
<td>1.04</td>
<td>.50</td>
<td>6.00</td>
</tr>
<tr>
<td>Smoking</td>
<td>2.15</td>
<td>.70</td>
<td>.00</td>
<td>3.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Beliefs About</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity</td>
<td>33.50</td>
<td>3.71</td>
<td>23.00</td>
<td>40.00</td>
</tr>
<tr>
<td>Nutrition</td>
<td>29.56</td>
<td>3.63</td>
<td>17.00</td>
<td>35.00</td>
</tr>
<tr>
<td>Smoking</td>
<td>20.37</td>
<td>3.19</td>
<td>11.00</td>
<td>25.00</td>
</tr>
</tbody>
</table>
In terms of lifestyle practices, physical activity data from the self-reported Physical Activity Questionnaire for Older Children (PAQ-C) ranged from 1.43 to 4.38 (scored 1 - “low” to 5 - “high” physical activity level). The mean physical activity score for the group (n = 227) was 2.94 ±1.4. Frequencies for the physical activity data showed that 8% (n = 18) scored between 1.4 and 1.9; 44% (n = 100) scored between 2.0 and 2.9; 43% (n = 99) scored between 3.0 and 3.9; and only 4% (n = 10) scored greater than 4.0 on the Physical Activity Questionnaire. Thus, the majority of participants in this study would be considered to have a physical activity level somewhere in between high (PAQ-C score of 5) and low (PAQ-C score of 1).
### Table 3.3. Mean Physical Activity and Calcium Intake Scores for High vs. Low Knowledge and Belief Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Physical Activity Score</th>
<th>Calcium Intake (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low (n = 48)</td>
<td>High (n = 57)</td>
</tr>
<tr>
<td>Physical activity knowledge</td>
<td>3.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Physical activity beliefs</td>
<td>3.09 (n = 33)</td>
<td>2.90 (n = 35)</td>
</tr>
<tr>
<td>Nutrition knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutrition beliefs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Nutrition data (i.e., estimated daily calcium intake) was collected via the self-reported Teenagers’ Nutrition Questionnaire. Although the Teenagers’ Nutrition Questionnaire was administered to all 227 participants, only 93% (n = 212) of the participants had complete data available and appropriate for analysis. Data were considered unfit for analysis if more than two food items were missing, or if participants reported extreme (i.e., impossible) consumption of calcium rich foods. For example, two subjects reported consuming ten servings of calcium in ice cream and yogurt products alone in one day, while a few other subjects reported extremely high consumption of fluid intake (e.g. 13 servings per day). Calcium intake data from the 212 self-reported food frequency questionnaires also underwent testing for normality to determine whether the data was normally distributed. Descriptive statistics showed that the calcium data was normally distributed, as Z scores for skewness (Z = .83) and kurtosis (Z = .48) were both within the normal range (-2 ≤ Z ≤ 2). Estimated daily calcium intake from the 212 participants ranged considerably, from 50 to 3358 milligrams per day. According to the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes (1997), females aged 9 through 18 years are recommended an adequate intake (AI) of 1300 mg of calcium every day. The mean estimated calcium intake in this study was found to be 1235 ± 700 mg/day (SD). Frequency tables for daily calcium intake showed that 59% (n = 124) of the participants were not consuming adequate calcium intake for their age (i.e. less than 1300 mg per day). When the data was analyzed further, 25.5% (n = 54) reported a daily estimated calcium intake of less than 650 mg/day; 33% (n = 70) reported a daily
intake between 650 mg and 1300 mg; 27.8% (n = 59) reported a daily intake between 1301 mg and 1950 mg, and 13.7% (n = 29) reported a daily calcium intake of greater than 1950 mg/day.

Although the present findings show a wide range of estimated daily calcium intakes, with the mean intake (e.g. 1235 mg/day) greater than that found in many other studies, over half of the participants did not attain the daily-recommended adequate intake for calcium. In 1997, Neumark-Sztainer et al. suggested that there are several correlates of inadequate calcium consumption. These correlates included being female, nonwhite, and of low socio-economic status. In the current study, the mean intake for calcium for Caucasians was 1287 mg/day, while the mean calcium intake for Metis and Native Canadian participants was 1192 mg/day. A t-test showed no significant difference between the mean calcium intakes for these two groups (t (203) = .90, p > .05). In addition, results from a t-test between low and high SES groups found that the mean calcium intake for the low group was 1307 mg/day, and the mean calcium intake for the high group was 1318 mg/day. This difference was not significant (t (71) = -.08, p > .05). Thus, neither SES nor ethnic background was associated with inadequate calcium intake in the current study.

Scales for taste enjoyment of eight dairy products were assessed in the Food Frequency Questionnaire to help explain the calcium intake of the participants in this study. The mean score for taste enjoyment for eight dairy products was 24.93 ± 0.37 (SE), where the maximum amount of 40 points indicated the greatest taste enjoyment score for dairy products. Like the current study, Barr (1994) reported that, for adolescent males and females in her study, the mean taste enjoyment score was 25.0 ±
0.3 (SE). The current study found that results regarding taste enjoyment of various dairy products, which were reverse scored, were as follows (mean score is in brackets): whole milk (mean = 4.12); low fat (2% or 1%) milk (mean = 2.42); skim milk (mean = 3.93); fruit-flavored yogurt (mean = 1.76); plain yogurt (mean = 3.69); cottage cheese (mean = 3.39); hard cheddar cheese (mean = 2.28); and ice cream (mean = 1.38), where scores 1 = “enjoy very much”, and 5 = “do not enjoy at all”. These findings suggesting that taste enjoyment for milk is relatively low among the participants may explain why calcium intake was below the recommended adequate intake of 1300 mg/day for over half of the participants in this study.

In addition to the above questions regarding taste enjoyment for milk and other dairy products, the present study included an item that inquired about milk preference. It has been suggested in the literature that milk consumption should account for most of the calcium intake in one day, as the Canadian Food Guide recommends 4 glasses of milk per day (Whiting et al., 2001). Results showed that the most of the females in this study do drink milk provided it is of their preference (e.g. 2% vs. skim); only 5.7% (n = 14) indicated that they do not drink milk at all (see Table 3.4 for results). Furthermore, data showed that the above number of girls who do not drink milk (n = 14) is comparable to those who are allergic to milk or dairy products (n = 15). Given these findings, it is quite possible that the adolescent girls in this study are drinking milk, but are not drinking enough of it (i.e., less than the recommended four glasses of milk per day), and therefore are lower in calcium.

An item assessing meal frequency was also incorporated into the Teenagers’ Nutrition Questionnaire to assess meal frequency and the prevalence of unhealthy
Table 3.4. Grouped Frequency of Nutrition – Milk Preference (n = 215*)

<table>
<thead>
<tr>
<th>Type of Milk Preferred</th>
<th>Frequency</th>
<th>Percent</th>
<th>Percent (Barr, 1994)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Milk</td>
<td>16</td>
<td>7.4</td>
<td>23.7</td>
</tr>
<tr>
<td>2% Milk</td>
<td>97</td>
<td>45.1</td>
<td>48.1</td>
</tr>
<tr>
<td>1% Milk</td>
<td>56</td>
<td>26</td>
<td>8.8</td>
</tr>
<tr>
<td>Skim Milk</td>
<td>12</td>
<td>5.6</td>
<td>6.5</td>
</tr>
<tr>
<td>Chocolate Milk</td>
<td>20</td>
<td>9.3</td>
<td>7.2</td>
</tr>
<tr>
<td>Do NOT drink milk</td>
<td>14</td>
<td>6.5</td>
<td>5.7</td>
</tr>
</tbody>
</table>

*Note: Subject numbers vary due to missing data
nutritional behaviors such as skipping meals. Frequencies from the available data (n = 217) showed that 12% (n = 26) never eat breakfast, and only 34.6% (n = 75) of girls eat breakfast every day. Further, 32.3% (n = 70) do not eat lunch every day. However, 83.4% (n = 181) of participants in this study reported that they do eat dinner every day. These results suggest that unhealthy nutritional practices such as the skipping of meals are occurring among the adolescent females in this study. Data regarding meal frequencies are displayed in Table 3.5.
<table>
<thead>
<tr>
<th>Meal - Breakfast</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never eats</td>
<td>26</td>
<td>12.0</td>
</tr>
<tr>
<td>Eats 1x/week</td>
<td>13</td>
<td>6.0</td>
</tr>
<tr>
<td>Eats 2x/week</td>
<td>17</td>
<td>7.8</td>
</tr>
<tr>
<td>Eats 3x/week</td>
<td>18</td>
<td>8.3</td>
</tr>
<tr>
<td>Eats 4x/week</td>
<td>18</td>
<td>8.3</td>
</tr>
<tr>
<td>Eats 5x/week</td>
<td>34</td>
<td>15.7</td>
</tr>
<tr>
<td>Eats 6x/week</td>
<td>16</td>
<td>7.4</td>
</tr>
<tr>
<td>Eats breakfast every day</td>
<td>75</td>
<td>34.6</td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never eats</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>Eats 1x/week</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>Eats 2x/week</td>
<td>6</td>
<td>2.8</td>
</tr>
<tr>
<td>Eats 3x/week</td>
<td>8</td>
<td>3.7</td>
</tr>
<tr>
<td>Eats 4x/week</td>
<td>9</td>
<td>4.1</td>
</tr>
<tr>
<td>Eats 5x/week</td>
<td>30</td>
<td>13.8</td>
</tr>
<tr>
<td>Eats 6x/week</td>
<td>11</td>
<td>5.1</td>
</tr>
<tr>
<td>Eats lunch every day</td>
<td>147</td>
<td>67.7</td>
</tr>
<tr>
<td>Dinner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never eats dinner</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Eats 1x/week</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Eats 2x/week</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Eats 3x/week</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>Eats 4x/week</td>
<td>5</td>
<td>2.3</td>
</tr>
<tr>
<td>Eats 5x/week</td>
<td>18</td>
<td>8.3</td>
</tr>
<tr>
<td>Eats 6x/week</td>
<td>8</td>
<td>3.7</td>
</tr>
<tr>
<td>Eats dinner every day</td>
<td>181</td>
<td>83.4</td>
</tr>
</tbody>
</table>
Of the 227 participants, 225 had complete data from the Smoking Behaviour Questionnaire. Results showed that 42% had smoked more than once, while 58% had never smoked. The mean age at which participants had first smoked cigarettes was 11 ± 2 years. Of those who smoked, nearly 10% had first smoked before the age of nine, 11% first smoked at age nine, 12% had smoked by age ten, 14% had smoked by age eleven, and 42% had first smoked at age twelve or thirteen. Only 10% of participants reported that they first smoked at age fourteen. Thus, the age at which the most of the adolescent females first started to smoke cigarettes was in the early stages of adolescence (as 48% of smokers had smoked before the age of eleven). Of those who reported that they had smoked, nearly 25% (n = 54) were considered to be current smokers (i.e., they had smoked in the past thirty days). In comparison, a study done on 641 adolescent females found that 29% were current smokers, with 25% of the sample having smoked 100 or more cigarettes in their lifetime (Forrester, 2001).

Findings from the present study showed that 34% (n = 32) had smoked more than 100 cigarettes in their lifetime, and that approximately 58% (n = 54) smoked one or more cigarettes daily. The volume of cigarettes smoked by current regular smokers in this study ranged from those who smoked less than one cigarette per day (21.3% (n = 20)) to those who smoked 2 or more packs per day 1.1% (n = 1). Upon closer examination of the data, results revealed that of those who were current smokers, 22% smoked between 1-5 cigarettes per day, over 14% smoked half a pack per day, and that just over 3% smoked one pack or more of cigarettes per day. These findings are higher than those reported for adolescent females by Forrester (2001) where 11.7% smoked less than one cigarette per day and 0.2% smoked 2+ packs per day (see Table 3.6).
Table 3.6. Frequency and Volume of Cigarette Smoking (n = 225*)

<table>
<thead>
<tr>
<th>Smoking Status</th>
<th>Frequency</th>
<th>Percent (Current study)</th>
<th>Percent (Forrester 2001)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-smoker</td>
<td>171</td>
<td>75.0</td>
<td>71.0</td>
</tr>
<tr>
<td>Regular Smoker</td>
<td>54</td>
<td>24.0</td>
<td>29.0</td>
</tr>
<tr>
<td>Smoking Volume (last 30 days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>40</td>
<td>42.6</td>
<td>71.4</td>
</tr>
<tr>
<td>&lt; 1 cigarette/day</td>
<td>20</td>
<td>21.3</td>
<td>11.7</td>
</tr>
<tr>
<td>1-5 cigarettes/day</td>
<td>21</td>
<td>22.3</td>
<td>10.6</td>
</tr>
<tr>
<td>½ pack per day</td>
<td>10</td>
<td>10.6</td>
<td>4.7</td>
</tr>
<tr>
<td>1 pack per day</td>
<td>1</td>
<td>1.1</td>
<td>1.4</td>
</tr>
<tr>
<td>1 ½ packs per day</td>
<td>1</td>
<td>1.1</td>
<td>0.0</td>
</tr>
<tr>
<td>2+ packs per day</td>
<td>1</td>
<td>1.1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

*Note: Subject numbers vary due to missing data
3.2 TESTS OF HYPOTHESES

3.2.1 Hypothesis One

It was hypothesized that adolescent females who had greater knowledge regarding osteoporosis lifestyle risk factors would be engaging in more positive, healthy lifestyle practices than those adolescent females with less knowledge. This relationship was tested using t-tests. Results revealed that there was no significant relationship between either physical activity knowledge and physical activity practice or between nutrition knowledge and nutritional practice (i.e., calcium intake).

It was also hypothesized that adolescent females with greater subsequent beliefs about osteoporosis lifestyle risk factors would be engaging in healthier lifestyle practices. T-tests between the high and low belief groups showed that like knowledge, there was no association between physical activity beliefs and physical activity practices, or between nutrition beliefs and nutrition practices (i.e., calcium intake).

A chi-square test was applied to the nominal data for smoking to determine whether a relationship exists between smoking knowledge (i.e., high vs. low) and smoking practice (i.e., non-smoking vs. smoking), or between smoking beliefs (i.e., high vs. low) and smoking practice (i.e., non-smoking vs. smoking). Results from the chi-square distribution showed that the amount of knowledge did differ between the smokers and the non-smokers (p < 0.01) and that the intensity of beliefs were also different between the smoking and non-smoking groups (p < 0.01).

The above findings suggest that physical activity and nutritional practices (i.e. calcium intake) did not reflect knowledge regarding osteoporosis lifestyle risk factors. However, while knowledge and subsequent beliefs did not predict practice for some
factors (i.e., physical activity and calcium intake), a relationship did exist for other factors (i.e., cigarette smoking) (see Table 3.7 – 3.8).
### Table 3.7. Effect of High vs. Low Knowledge on Practice

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>t-value</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Those with low physical activity knowledge</td>
<td>3.00</td>
<td>.64</td>
<td>-.05</td>
<td>103</td>
<td>.96</td>
</tr>
<tr>
<td>Those with high physical activity knowledge</td>
<td>3.00</td>
<td>.56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Those with low nutrition knowledge</td>
<td>1123</td>
<td>656</td>
<td>-1.50</td>
<td>71</td>
<td>.14</td>
</tr>
<tr>
<td>Those with high nutrition knowledge</td>
<td>1368</td>
<td>736</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3.8. Effect of High vs. Low Beliefs on Practice

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>t-value</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Those with low physical activity beliefs</td>
<td>3.09</td>
<td>.64</td>
<td>1.42</td>
<td>66</td>
<td>.16</td>
</tr>
<tr>
<td>Those with high physical activity beliefs</td>
<td>2.90</td>
<td>.49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Those with low beliefs about nutrition</td>
<td>1333</td>
<td>714</td>
<td>-.54</td>
<td>66</td>
<td>.59</td>
</tr>
<tr>
<td>Those with high beliefs about nutrition</td>
<td>1440</td>
<td>883</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2.2 Hypothesis Two

To test the second hypothesis, that participants with a higher SES would exhibit greater knowledge, beliefs, and positive, healthy lifestyle practices (e.g. regular physical activity, higher calcium intake, and refrain from cigarette smoking) compared to participants with a lower SES, who would exhibit less knowledge, beliefs, and unhealthy practices, t-tests (for physical activity and calcium intake) and chi-square tests (for cigarette smoking) were applied. Before running these analyses for each of physical activity, nutrition, and smoking knowledge beliefs, and practices, participants were categorized into low (n = 41) and high (n = 32) SES groups. Independent sample t-tests showed that, for knowledge, there was no significant difference between the two SES groups for nutrition (p > .10), but that there were significant differences between the high and low SES groups for knowledge regarding physical activity (p < .05) and smoking (p < .01).

In terms of beliefs, t-tests indicated that there was no significant difference between high and low SES groups for beliefs about nutrition (p > .10) or about smoking (p > .10). However, there was a significant difference found between the high and low SES groups for beliefs regarding physical activity (p < .05).

In terms of lifestyle practices, t-tests showed that there were no differences between the high and low SES groups for physical activity (p > .10), or for nutrition (i.e., calcium intake) (p > .10). However, for the cigarette smoking data, a chi-square test revealed that there were differences between the low and high socio-economic groups for smoking practice (p< 0.1) (see Tables 3.9 – 3.16). These findings suggest that socio-economic factors such as education and income are related to knowledge,
beliefs, and practice for a few of the osteoporosis lifestyle factors among the adolescent females in this study.
Table 3.9. Effect of High and Low SES on Knowledge regarding Physical Activity

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>t-value</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low SES</td>
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<td>-2.78</td>
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<td>.01</td>
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<tr>
<td>High SES</td>
<td>5.30</td>
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Table 3.10. Effect of High and Low SES on Knowledge regarding Nutrition

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<tr>
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<td>-0.59</td>
<td>73</td>
<td>.56</td>
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<tr>
<td>High SES</td>
<td>3.83</td>
<td>1.10</td>
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Table 3.11. Effect of High and Low SES on Knowledge regarding Smoking

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</thead>
<tbody>
<tr>
<td>Low SES</td>
<td>1.88</td>
<td>.64</td>
<td>-3.0</td>
<td>73</td>
<td>.004</td>
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<tr>
<td>High SES</td>
<td>2.32</td>
<td>.61</td>
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**Table 3.12.** Effect of High and Low SES on Beliefs about Physical Activity

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<td>2.60</td>
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<td>High SES</td>
<td>34.56</td>
<td>3.28</td>
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</table>

**Table 3.13.** Effect of High and Low SES on Beliefs about Nutrition

<table>
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<th>SD</th>
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<tbody>
<tr>
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<td>3.53</td>
<td>1.57</td>
<td>73</td>
<td>.12</td>
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<tr>
<td>High SES</td>
<td>28.70</td>
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**Table 3.14.** Effect of High and Low SES on Beliefs about Cigarette Smoking

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<th>Group</th>
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<tr>
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<td>High SES</td>
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**Table 3.15.** Effect of High and Low SES on Physical Activity Practice

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<th>SD</th>
<th>t-value</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2.77</td>
<td>.60</td>
<td>-1.46</td>
<td>73</td>
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<tr>
<td>High SES</td>
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</table>

**Table 3.16.** Effect of High and Low SES on Nutritional Practice

<table>
<thead>
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<th>Mean</th>
<th>SD</th>
<th>t-value</th>
<th>df</th>
<th>p</th>
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<tbody>
<tr>
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<td>564.00</td>
<td>-.08</td>
<td>73</td>
<td>.93</td>
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<tr>
<td>High SES</td>
<td>1318</td>
<td>640.71</td>
<td></td>
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</tr>
</tbody>
</table>
3.2.4 Hypothesis Three

It was hypothesized that physical activity, calcium intake, and cigarette smoking would cluster together. To test this hypothesis, descriptive statistics (frequencies) were applied to the data. Results showed that an inverse relation existed between cigarette smoking and physical activity, since 91% of adolescent females with a high physical activity level (defined as one standard deviation above the mean for the entire sample; n = 35) did not smoke. On the flip side, frequencies revealed that of those with a low physical activity level (defined as one standard deviation below the mean for the entire sample; n=36), only 64% did not smoke. The relationship between cigarette smoking and calcium intake, however, showed no association. Data showed that of the non-smokers (n=162), 59% had calcium intakes less than the adequate intake (<1300 mg) for an adolescent female (Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, 1997). On the other hand, of the smokers (n=50), 56% had calcium intakes less than the adequate intake (< 1300 mg) for an adolescent female (Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, 1997). Thus, the difference between the two smoking and non-smoking groups was minimal. This finding was not unlike the finding regarding the relationship between calcium intake and physical activity. When physical activity scores were divided into high and low groups according to one standard deviation above and below the mean for the entire sample, frequencies showed that there was only a weak association between calcium intake and physical activity. For example, of those participants who had low physical activity levels (n=36), 64% had calcium intakes less than the adequate intake (< 1300 mg) (Standing

Similarly, of those participants who had high physical activity levels (n=30), 57% had calcium intakes less than the adequate intake (< 1300 mg) for an adolescent female (Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, 1997). Thus, there seemed to be an association between physical activity and cigarette smoking, although the link between physical activity and calcium intake, and calcium intake and smoking among adolescent females in this study was unclear.
CHAPTER 4
DISCUSSION

Since the adolescent years can be viewed as a window of opportunity to influence life-long bone health, the current study examined lifestyle practices (physical activity, calcium intake, and cigarette smoking), which have been shown to be controllable risk factors for osteoporosis. In addition, knowledge and beliefs regarding the above osteoporosis lifestyle risk factors were assessed, as no study to date has examined these variables among the adolescent female population. Thus, knowledge, beliefs, and practices regarding osteoporosis lifestyle risk factors among young women were the focus of this cross-sectional study.

It was expected that if knowledge and subsequent beliefs regarding osteoporosis lifestyle risk factors were high, that this would transfer to healthy lifestyle practices among the adolescent females in this study. Moreover, it was hypothesized that this trend towards high knowledge (subsequent beliefs) and healthy lifestyle practices would be most evident among those participants with high compared to those participants with low socio-economic status (SES). Finally, it was predicted that physical activity, nutrition, and smoking practices would cluster together in the present study.

Findings showed that although the participants believed healthy lifestyle practices were important in preventing osteoporosis, their lifestyle practices did not
reflect these beliefs. Physical inactivity, cigarette smoking, and inadequate calcium
intakes were prevalent among the young females in this study. While cigarette
smoking and physical inactivity tended to cluster together and vary according to SES,
calcium intake was generally less than the adequate intake value necessary for
adolescent women (Standing Committee on the Scientific Evaluation of Dietary
Reference Intakes, 1997), regardless of other lifestyle practices or SES. Specific
knowledge regarding physical activity, nutrition, and smoking was also lacking.
These results suggest that despite positive beliefs about osteoporosis lifestyle risk
factors, the majority of adolescent females in the current study, particularly those with
low SES, lack the knowledge to make appropriate decisions (concerning osteo-
protective lifestyle practices) and are at increased risk.

4.1 DESCRIPTIVE STATISTICS

To be able to design the right preventive strategies for osteoporosis, health care
professionals need to determine the existing degree of knowledge of, as well as beliefs
toward osteoporosis in the target population (Magnus et al., 1996). The current study
was conducted to gain information on the knowledge and subsequent beliefs regarding
osteoporosis lifestyle risk factors among adolescents. Results showed that there were
gaps in knowledge concerning osteoporosis among the sample population. As
explained in the results section, most of the participants could not correctly identify
what types of physical activity were best for building and protecting strong healthy
bones; several had trouble differentiating between calcium rich and non-calcium rich
foods and were unable to correctly recognize the number of daily servings of dairy
products recommended for someone their age; and the majority were unsure about the relationship between smoking and osteoporosis. In terms of beliefs, findings showed that unlike knowledge, beliefs about osteoporosis were positive, as the majority of the participants scored high on the belief section. This suggests that although the young women lacked specific knowledge regarding osteoporosis lifestyle risk factors, they did believe that healthy lifestyle choices would reduce the risk of chronic diseases such as osteoporosis.

It is difficult to evaluate whether the above findings are typical among the adolescent female population. Like knowledge, the literature concerning beliefs towards osteoporosis lifestyle risk factors among young adolescent women is almost non-existent. However, some studies have been done on college age women. A recent study by Wallace (2001) examined osteoporosis knowledge in college women (mean age 24.8 years) and found that, on average, the women were able to correctly answer 65% of the questions assessing general osteoporosis knowledge such as risk factors and preventative measures. Similarly, a study done on the knowledge, beliefs, and behaviours concerning osteoporosis among college women (mean age = 19.6 years) showed that the large majority of participants were able to identify the general risk factors low calcium intake and lack of exercise, but that only 36% were able to correctly identify all of the specific risk factors (Kasper et al., 1994). The above results concerning the knowledge regarding osteoporosis risk factors among college women match the findings from the current study. For example, on average, the participants in the present study scored 11 out of a maximum of 17 points on the knowledge section of the questionnaire, which means that most of the adolescent girls
were able to correctly answer 65% of the questions. A much smaller percentage was able to correctly identify all the specific risk factors. For example, only 9% of participants were able to answer all six nutrition questions correctly, 33% were able to answer all three smoking questions correctly, and just 6% answered all eight physical activity questions correctly. These similar findings to the above studies are somewhat surprising since the present study focused on adolescents (mean age = 13.5 years), while the above studies targeted college women (mean age = greater than 19.6 years). In addition, nearly all of the participants in the comparable studies were Caucasian, while in the present study, only 61% were Caucasian, 36% were Aboriginal/Metis, and the remaining 3% were of other ethnic backgrounds. These results suggest that regardless of age or ethnic background, important knowledge regarding specific preventative lifestyle behaviours for osteoporosis is lacking among young women.

One other study in the literature that assessed knowledge regarding osteoporosis in females examined Norwegian females. This same study reported that knowledge of osteoporosis among Norwegians aged 16 – 79, was generally high. (Magnus, Joakimsen, Bernsten, Tollan & Sogaard, 1996). Magnus et al. (1996) also reported that younger women (aged 16 - 59) knew more than older women (aged 60 and over). However, this Norwegian study (Magnus et al., 1996) focused more on older women and their knowledge concerning pharmacological methods to prevent osteoporosis, such as hormone replacement therapy, than the present study did. Thus, it is not comparable to the current study. It would be interesting, however, to track knowledge, beliefs, and practices regarding osteoporosis lifestyle risk factors through
different phases of a female’s lifespan (i.e., adolescence, young adulthood, and post-menopause).

In addition to knowledge and beliefs, planning and development of preventive strategies for osteoporosis must also take into account existing lifestyle practices among the adolescent female population. One of the purposes for the descriptive statistics in this study was to identify whether unhealthy lifestyle practices such as physical inactivity, cigarette smoking, and low calcium intake were among the population of study. Results for physical activity, nutrition, and smoking practices are discussed below.

One of the key determinants of adult bone health is physical activity. In a review on large population based studies it was suggested that, on average, only one quarter of adolescent females participate in moderate to vigorous physical activity for twenty or more minutes per week (Pate et al.; 1994). Results from the current study showed that a large percentage of the participants in this study were considered to have low to moderate levels of activity, as the mean physical activity score (scored 1-5) was 2.94. In 2001, Forrester, who also used the Physical Activity Questionnaire as a measurement tool, found that among 641 adolescent females in rural and urban Saskatchewan, the mean physical activity score was 2.40. This finding was somewhat similar to levels reported in previous research with adolescent females in Saskatchewan (mean physical activity score = 2.20) (Crocker & Faulkner, 1999). While this low to moderate level of physical activity reported in the above studies may be adequate for some health benefits, research suggests that vigorous weight bearing or high intensity bone loading activity (e.g., running) is more important in developing
bone health than low to moderate intensity non-weight bearing or bone loading activity (e.g. swimming) (Gutin & Kasper, 1992). Because the present study did not assess bone loading, one cannot conclude that this type of activity was not being done. However, since a substantial number of adolescent females in this study were not engaging in high levels of physical activity, it is likely that a significant portion would not be receiving an adequate amount of the weight bearing physical activity necessary for building strong, healthy bones. This suggestion is comparable to that of Kasper et al. (1994) who assessed bone loading, frequency, and intensity of exercise among college women, and found that a substantial amount (59.8%) were not getting adequate osteo-protective exercise.

A second reason for concern regarding the low to moderate level of physical activity found in the present study is that the majority of research shows that physical activity tends to decline with age (Pate et al., 1994). In 2000, Telama and Yang reported that participants from the Cardiovascular Risk in Young Finns Study had a significant decline in the frequency of physical activity and sports participation after age 12, and data from the Amsterdam Growth and Health study also showed a significant decline in habitual physical activity from age 13 – 27 (Van Mechelen et al., 2000). Mixed longitudinal data from the Pediatric Bone Mineral Accrual Study in Saskatchewan (1996) found that there was a significant decline in physical activity level from elementary to high school, and that this decline was more pronounced in females than in males. In the U.S., results from the National Health Survey showed that physical activity eroded from ages 15 – 18 (Caspersen et al., 2000). Thus, given the above findings and the young ages of the participants in this study (mean age =
13.5 years), one might expect that the present physical activity levels would decrease with age and lifestyle transitions (i.e., entry into high school, attainment of a drivers' license, etc.). In addition to a decline in activity level with age, the literature suggests that physical inactivity in childhood tracks into adolescence (Kelder et al., 1994; Pate et al., 1999) and from adolescence into adulthood (Dennison, Straus, Mellitus, & Charney, 1988; Raitakari et al., 1994; Trudeau, Laurencelle, Tremblay, & Shephard, 1999). Hence, physical activity habits formed early may predict physical activity levels in later life, and prevent the degree of decline seen in physical activity with age, thus reducing the degree of risk for developing osteoporosis.

In addition to the above concerns for the low to moderate physical activity level reported among most adolescent females in this study, Pate et al. (1994) suggested that self-reported surveys tend to overestimate true physical activity. Therefore, the actual physical activity levels of the adolescent females in this study may be even lower than the level that was reported, placing the participants in this study at increased risk of less than optimal peak bone mass development. As a result of the above concerns regarding physical activity levels in the present study, early and continued interventions educating young females on the effects of weight bearing physical activity are necessary to prevent the development of early osteoporosis. Researchers also must continue to examine the determinants of physical activity among adolescent females, in order to effectively address the problem of inactivity.

As established in the literature review, the adolescent years are a window of opportunity to influence lifelong bone health (Weaver, Peacock, & Johnston, 1999). Approximately 90% of peak bone mass in girls is accumulated in this short stage of
the life cycle (Matkovic, Jelic, Wardlaw, Illick, Goel, Wright, Andon, Smith, & Heaney, 1994). Bone acquisition is accelerated within the genetic potential by lifestyle choices, including diet. The skeleton serves as a structural function and also a reservoir for calcium to maintain calcium levels within normal range during periods of inadequacy (Weaver et al., 1999). In addition to poor skeletal health, studies have reported other health risk correlates of inadequate calcium (Neumark-Sztainer et al., 1997). These include diseases such as colon cancer and hypertension. Thus, there are multiple benefits in consuming adequate amounts of calcium.

Results from the present study found that estimated mean calcium intake was 1235 mg/day. The recommended adequate intake of 1300 mg per day for adolescent girls (Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, 1997), which means that 60% of girls in the present study were not getting the recommended adequate intake of 1300 mg per day. Similarly, Barr (1994) found that, among a mixed sample of Caucasian/Asian adolescents in a metropolitan setting, more than half had calcium intakes below the recommended intake. This was especially true for females, who had a mean calcium intake of 815 ± 26 mg/day (SD) (Barr, 1994). Although the above two studies used the same food frequency questionnaire to assess calcium intake and found mean intakes that were below the recommended intake, Barr (1994) reported a value much lower than the mean calcium intake in the present study. This difference in calcium intake was likely due to the different ethnic backgrounds (e.g., Caucasian & Asian vs. Caucasian & Aboriginal/Metis) and different locations (e.g., metropolitan vs. small, agriculture-based community) that the two studies used. For instance, Barr (1994) reported that Asian students in her study
had significantly lower scores for calcium intake than the Caucasian students and those of mixed ethnicity. In 1997, Neumark-Sztainer et al. also found that there were large ethnic/racial differences in consumption patterns among adolescents, with Asian Americans most likely to report low dairy food consumption, and Caucasians least likely to have inadequate intake. In contrast, the present study did not include Asian females, and in fact, found no significant difference between the two main ethnic groups (i.e., Caucasian vs. Aboriginal & Metis).

Several other studies also have found that the vast majority of young women are engaging in calcium intake behaviors that are inadequate for building healthy bone. Kasper et al. (1994) reported that mean calcium intake among young college women was 773 ± 626 mg/day. Likewise, an American National Survey reported extremely low intake of dairy products among 14.1% of the females in the grade 7–12 girls in their Minnesota study, making it unlikely for them to reach full genetic potential for bone mass development (Neumark-Sztainer et al., 1997). Inadequate calcium consumption among young women has been reported in many other studies, which show that during adolescence, girls appear to be decreasing their calcium intake rather than increasing it to meet their high calcium needs (Eck, Hackett-Renner, 1992; Johnson, Johnson, Wang, Smicklas-Wright, & Guthrie, 1994; Fleming & Heimbach, 1994).

Despite the high daily mean calcium intake (i.e. 1235 mg per day) in the current study compared to other studies, many of the participants in the present study did not reach their adequate intake of 1300 mg of calcium per day. To better understand the inadequate consumption of calcium in adolescent females, several
studies have examined whether an inverse relationship exists between calcium and age. In 1997, Albertson, Tobelmann, and Marquart found that 14-day food records showed that over 90% of adolescent females in their study consumed less than 100% of the RDA for calcium, and that the percentage who consumed less than 2/3 of the RDA increased with age (Albertson et al., 1997). In addition, Neumark-Sztainer et al. (1997) reported a higher percentage of older adolescent females having inadequate consumption of dairy foods compared to younger adolescents. Similarly, there was a 7-12% decline in fluid milk consumption from the 11–12 year olds and the 15–18 year olds in the Albertson et al. study (1997). Although it was thought that the findings from the present study would support this inverse relationship between calcium and age, the current study showed no association between the two variables. One possible explanation for this difference in results might be that the age range in the present study was too narrow (i.e. most participants were between 13–14 years of age) to detect a difference in calcium intakes.

Research has tried to explain why the adolescent female in particular is not consuming adequate calcium. It has been suggested that this inadequate consumption of calcium might be because some females do not drink enough milk, when it is recommended that adolescent females consume four glasses of milk per day (Whiting et al., 2001). This lack of milk intake may be due to three factors. The first is that adolescents are replacing low nutrient dense beverages such as soda pop or fruit flavored drinks with milk (Whiting et al., 2001). This is supported by Iuliano-Burns et al. (1999) who reported that during adolescence, a number of girls were replacing consumption of milk with consumption of diet and/or regular soft drinks. Weaver et
al. (1999) found that the low intake of calcium by adolescent girls could be at least partially attributed to the trend of replacing milk as the beverage of choice with soft drinks. Likewise, a study by Guenther (1986) also suggested that soft drink use was negatively associated with both milk intake and calcium intake in the diets of American teenagers. The present study, however, did not assess the intake of soda pop in relation to milk, and thus cannot be used for comparison.

The second reason for the inadequate calcium intake in adolescent females may be that they do not like the taste of milk. The present study inquired about consumption, preference, and taste enjoyment of common dairy products. Scales of taste enjoyment for milk were low to moderate, as most of the participants in the study regarded milk as "just so-so" or "do not enjoy very much". It was also thought that lactose intolerance and allergies to dairy products or to milk could be a possible reason accounting for the low intake of calcium, as 6.5% of girls in this study reported that they did not drink milk. This may indeed be true, as 7% of girls in this study indicated that they were lactose intolerant or allergic to milk or dairy products.

A third reason for the low calcium intake prevalent in adolescents may be the irregularity or the skipping of proper meals. This concern, as well as the increased consumption of soda pop detailed above, could be due to a number of factors: high prevalence of dieting/concern about body image, lack of time, and/or peer pressure among the adolescent female population. As a result of these factors, young females may not be consuming milk products such as milk, yogurt and cheese on a daily basis (Neumark-Sztainer et al., 1997). The current study assessed meal frequency and found that only 34.6% of girls ate breakfast every day, with 12% always skipping
breakfast. Furthermore, only one-third of the girls in this study ate lunch on a daily basis. Thus, these results may suggest that some girls in the present study were skipping meals and therefore, might have been missing an opportunity to consume foods high in calcium. Moreover, the above results regarding meal frequencies among the adolescent females in this study could be used as important information when developing intervention strategies aimed at enhancing healthy nutritional behaviors.

Regardless of the reasons for low calcium intake, the weight of the available evidence suggests that calcium during adolescence is associated with good bone health (Peacock, 1991). One particular study in rats demonstrated a non-reversible deleterious effect on peak bone mass due to calcium restriction throughout adolescence. After rats were restricted in calcium from weaning to 20 weeks (adolescent years) and then restored to recommended levels of calcium until 37 weeks of age, their adult tibia bone volume remained lower than that in the control group and was similar to that in rats kept on the calcium-deficient diet throughout (Peterson, Eurell, & Erdman, 1995). This deficient diet contained half the calcium requirements of rats, which is an extreme deficiency, but comparable to the mean calcium intakes of American female adolescents. Although the participants in the present study had a mean calcium intake higher than 50% of the adequate intake, there were a substantial number of girls who reported significantly less than the adequate intake for someone of their age.

It was also suggested in the review of literature that among young women, cigarette smoking was on the rise. Results from the Smoking Behaviour Questionnaire suggested that nearly one in four girls in this study were smokers, and
that of those who smoked, over half had smoked more than 100 cigarettes in their lifetime and currently smoked at least one cigarette per day. These statistics are comparable to a study by Aaron et al. (1995), who suggested that for a mostly Caucasian mixed socio-economic sample of American female adolescents, 22% of 14 year olds and 34% of 15 – 16 year olds regularly smoked. The findings from the present study are also comparable to a similar study by Forrester (2001), which showed that 29% of adolescent females from urban and rural settings in Saskatchewan were regular smokers. The small difference in the percentage of smokers in these studies may be due to age as the majority of participants in the present study were younger (mean age = 13.5 years), while those in the Aaron et al. (1995) study and in the study by Forrester (2001) were aged 15 – 16 years. These results indicate that in spite of tough legislation in Canada preventing the sale of cigarettes to individuals under the age of eighteen, young Canadians still seem to have access to cigarettes.

While it is difficult to determine the exact reasons for cigarette smoking among adolescent females, it is clear that smoking cigarettes is associated with decreased bone mineral density (Brot et al., 1997). Moreover, adolescents who adopt smoking behaviour early in life are at high risk of becoming regular smokers as adults, thus placing adolescent females who smoke at higher risk of developing osteoporosis (Chassen et al., 1990). This suggests that the adolescent female population needs to be targeted for smoking cessation programs to prevent smoking from becoming a more seriously entrenched lifestyle choice.
4.2. HYPOTHESIS ONE

The primary hypothesis of this study hypothesized that adolescent females who had greater knowledge and subsequent beliefs regarding osteoporosis lifestyle risk factors would engage in more positive healthy lifestyle practices than those with less knowledge and subsequent beliefs. As detailed in the results chapter, t-tests and chi-square tests were applied to assess the above-predicted relationships. Findings showed that there was no significant relationship between physical activity knowledge and practice or between nutrition knowledge and calcium intake. These results suggesting that there is no link between knowledge and practice for physical activity and nutrition are supported by the work of Harris (1984) who suggested that knowledge alone does not necessarily influence behaviour, and that it is unlikely that short-term changes in knowledge will predict behaviors in the long term. In addition, in 1994, Barr reported that it is often the peer group rather than knowledge that has an influence on behaviours, especially in teens. It is unclear, however, if the present study confirms that there is no relationship between knowledge and practice, as a chi-square test revealed a significant association between knowledge and practice for cigarette smoking.

One explanation for these contradictory results concerning the relationship between knowledge and practice is that the group of adolescent females evaluated in the present study seemed to be quite homogenous in nature, particularly for physical activity. For example, the physical activity data showed that the majority of girls in this study had physical activity scores that clustered around the mean (e.g. around 3.0). This clustering of scores might have reduced the chance of finding a significant
association between physical activity knowledge and practice. A second explanation for these different results might be that the PAQ-C may have underestimated the physical activity of the very active individuals in the present study because it may not be sensitive enough to assess the intensity levels of the activities (Crocker et al., 1997). The instrument may not have allowed a distinct categorization of the extreme groups (e.g. high versus low) for the purpose of a t-test analysis in the present study. Thus, the homogeneity of the sample for physical activity and the limitations of the PAQ-C may have reduced the chance of finding a significant difference between the two high and low knowledge groups for physical activity in the current study.

A further explanation for the finding that knowledge was not significantly associated with practice may be that in the absence of an immediate threat to their health, young people are not concerned about their future health. For instance, although research has shown that there is a willingness of the population to prevent disease (Magnus et al., 1996), it may be difficult for adolescents to relate their present lifestyle practices to their future adult health status. Studies on adult women have supported this idea. Findings from a study on college women (mean age = 19.6 years) showed that they believed that osteoporosis was unlikely to develop in them and that they were more concerned about heart disease, breast cancer, and Alzheimer’s Disease (Kasper et al. 1994). This same study showed that college women believed that they were less responsible for osteoporosis development relative to other diseases, and that osteoporosis was less serious than other common causes of morbidity and mortality in women (Kasper et al, 1994). A study on older women (40 – 95 years) found that the majority believed that osteoporosis was a serious condition, but that only 29%
perceived a personal susceptibility (Hsieh, Novielli, Diamond, and Cheruva, 2001). Hsieh et al. (2001) also reported that women were less concerned about osteoporosis compared to cancer, cardiovascular disease, and neurological disorders, and that only 40% of these older women were taking active measures to prevent osteoporosis. Given that the above studies show that older women do not believe that they are susceptible to osteoporosis, it is quite possible that the adolescent females in this study were also not concerned about osteoporosis in the absence of a threat to their immediate health.

Two models that address susceptibility and intention to change lifestyle behaviors or practices are the Health Belief Model (Becker & Maiman, 1975) and the Protection Motivation Theory (Rogers, 1983). The first model, the Health Belief Model, is an organizing framework that was developed to explain the likelihood of taking preventive health measures (Becker & Maiman, 1975). It suggests that the likelihood of adopting behaviors appropriate to the prevention or control of some disease depends on the individual’s perception of a threat to personal health and a conviction that the recommended action will reduce this threat (Godin, 1994). Moreover, the Health Belief Model suggests that the perception of a health threat is determined by the strength of two underlying beliefs: personal susceptibility to a given disease and the potential severity of its impact on the individual’s life. The second model, the Protection Motivation Theory (Rogers, 1975; Rogers, 1983), is similar to the Health Belief Model (Floyd, Donna, Prentice-Dunn, & Rogers, 2000), as it is a centered around disease prevention and health promotion. The Protection Motivation Theory proposes that the intention to protect oneself depends upon four
factors: 1) perceived severity of a threat; 2) perceived vulnerability to a threat; 3) perceived response efficacy; and 4) perceived self-efficacy. Thus, the above two social-cognitive models suggest that other variables such as belief in susceptibility, seriousness, benefits of and barriers to preventive behavior, cues to action, and health motivation exist between knowledge and preventive practices.

Given the above findings suggesting that other variables such as susceptibility and intention to change are important when considering lifestyle practices, it is possible that knowledge alone does not directly lead to practice. That is, knowledge regarding health may be quite distal from the variable preventative practice. A recent study integrated the Health Belief Model to investigate whether beliefs and perceptions regarding osteoporosis influenced peri-menopausal women’s decisions to engage in preventive actions (Hisley, 1998). Results from this same study showed that there was a significant relationship between perceived osteoporosis seriousness and susceptibility, as well as overall perception of osteoporosis risk. In addition, there was a significant relationship between perception of osteoporosis risk and the practice of dietary calcium and regular exercise. These findings may explain why no relationship was established between knowledge and practice for both physical activity and nutrition in the present study. Therefore, future research with adolescent females should consider models such as the Health Belief Model and the Protection Motivation Theory, which suggest that there are other variables involved in the relationship between health knowledge and practice.

Another possible reason to explain why knowledge did not transfer into practice for all of the factors in this study might be one of our measurement tools, the
Osteoporosis Risk Factor Questionnaire. The questions in the knowledge section of this questionnaire included questions that addressed more general physical activity knowledge (e.g. true or false, physical activity helps to burn more calories at rest?), while others were specific to knowledge concerning bone loading and prevention of osteoporosis (e.g. true or false, soccer is a good activity for building strong bones?). Perhaps if the questionnaire had included only specific bone loading osteoporosis-type questions, a significant relationship between knowledge and practice for physical activity would have been found. Thus, if the data was re-analyzed using only those knowledge questions specific to osteoporosis, a relationship between physical activity knowledge and practice may be revealed.

Similar to the above explanation concerning measurement is the possibility that the lack of an association between knowledge and practice for some of the factors could have been due to the difficulty in measuring physical activity and calcium intake. For example, cigarette smoking, a relatively easy dependent variable to accurately measure, established a significant relationship for most of the variables. That is, since it is easy to determine whether one is a smoker or a non-smoker, it might have been less difficult to find a relationship between knowledge and practice for smoking. On the other hand, both calcium intake and physical activity were much more difficult to measure. This difficulty in measurement of these variables was due to their complexity (i.e. the subject’s perception of what physical activity is) and to the limitations of the questionnaire (i.e. memory recall errors, etc.). Thus, these two dependent variables may have not been completely accurate and the chance to find a
significant link statistically between knowledge and practice for calcium and activity may have been reduced.

4.3 HYPOTHESIS TWO

A second purpose of the current study was to determine whether socio-economic status had any influence on the knowledge, beliefs, and practices of the participants. It was hypothesized that girls with a higher SES would have greater knowledge (and subsequent beliefs) regarding osteoporosis and would exhibit healthier lifestyle practices compared to girls with a lower SES. The results from t-tests showed that the high SES group had greater knowledge regarding physical activity and held more positive beliefs about physical activity than the low SES group, yet there was no significant difference between the two groups for physical activity practice as indicated by the PAQ-C scores. T-tests also showed that there was no significant difference between the high and low SES groups for any of the nutrition variables – knowledge, beliefs, or practices. For the cigarette smoking data, however, a chi-square test showed that there was a significant difference between the means for knowledge and practice, but that there was no significant difference for beliefs about smoking between the high and low SES groups. These findings suggest that participants in the present study with a higher SES had greater knowledge and more positive beliefs regarding physical activity, greater knowledge and healthier practices regarding cigarette smoking, but did not have different nutrition knowledge, beliefs, or practices than those with a lower SES. SES also did not seem to influence physical activity behavior or smoking beliefs among adolescent females in the present study.
The above findings regarding SES and the knowledge, belief, and practice variables for physical activity, smoking and nutrition are difficult to explain. Since several studies suggest that low physical activity is more prevalent in adolescents with low SES (Bergstrom et al., 1996, Lowry, Kann, Collins, & Kolbe, 1996; and Zakarian, Hovell, Hofstetter, Sallis, & Keating, 1994), it is quite probable that the limitations of the present study may have masked the data, preventing it from revealing a significant association. For example, it is possible that the method of defining socio-economic status for the purposes of this study (i.e. based on the P.A. school board’s definition of high and low SES) did not accurately reflect the participants SES. Another limitation of the present study that could account for the above findings regarding SES and physical activity may be the lack of variance within the physical activity scores among the participants (i.e., that the sample of girls assessed in the present study were homogeneous when it came to physical activity). It is also possible that the questionnaire assessing physical activity in the present study may have underestimated the physical activity of some very active individuals and therefore would not have clearly divided those with high and low physical activity levels (Crocker et al., 1997). The literature supports this suggestion as it has been noted that a limitation of the Physical Activity Questionnaire for Older Children is that it is insensitive in assessing the intensities of activities (i.e., it does not discriminate between moderate and vigorous activities), as it simply provides a summary activity score (Crocker et al., 1997). Thus, since the literature supports the idea that physical activity behavior does vary according to SES, the method to define SES, the PAQ-C measurement tool, or
the sample population in the present study, may offer some explanation for the lack of an association between physical activity and socio-economic status.

The current study also found that SES was not associated with nutrition knowledge, beliefs, or practices (i.e. calcium intake). This finding is in contrast to that of Neumark-Sztainer et al. (1997), who found that nearly twice as many adolescents from low SES backgrounds had low intakes of dairy food than those from high SES backgrounds. As explained previously, this lack of an association between calcium intake and SES may be due to the homogeneous nature of the sample or that the methods to define SES were not completely accurate. In addition, Barr (1994) suggested that it is likely that other factors apart from SES, such as peer influence, affect the nutritional behaviors of adolescents, which may explain the above finding in the present study.

The results from the chi-square tests showing a relationship between SES and smoking knowledge and an inverse relationships between SES and smoking behavior are comparable to other studies. A study done on adolescents aged 12 – 17 showed that among girls, as family income increased, girls were less likely to smoke (Lowry, Kann, Collins, & Kolbe, 1996). Similarly, Pomerleau et al. (1997) suggested that low SES is often associated with cigarette smoking. These findings suggest that knowledge and practice for cigarette smoking vary according to SES.

4.4 HYPOTHESIS THREE

The third hypothesis predicted that there would be a clustering between physical activity, cigarette smoking, and nutrition. Therefore, it was expected that
those individuals who smoked would have calcium intakes less than the adequate intake for an adolescent female (i.e. < 1300 mg) and would tend to exhibit lower levels of physical activity. On the other hand, it was thought that those individuals who were highly physically active would have calcium intakes above that of the adequate intake for an adolescent female (i.e. > 1300mg), and would be non-smokers. Research on both adults and adolescents support this hypothesis (Blair et al., 1985; Kelder et al., 1994; Pate et al., 1996). Results from the present study found that an inverse relationship did exist between physical activity and cigarette smoking, but that there was no association between calcium and physical activity, or between calcium intake and cigarette smoking. Like the present study, results from Canadian and American studies have shown an inverse relationship exists between physical activity and cigarette smoking among adolescents (Aaron et al., 1995; Sport Nova Scotia, 1997). Similarly, a study in Finland found that physical activity was related to less smoking in both sexes among Finnish adolescents (Raitakari, Porkka, Taimela, Telama, Rasanen, & Viikari; 1994). Furthermore, the findings regarding physical activity and nutrition practices in the current study are comparable to a study on adults by Neumark-Sztainer et. al. (1997), which showed only modest associations between inadequate consumption of calcium and other health compromising behaviors such as physical inactivity or cigarette smoking. Thus, the present findings are not unlike previous findings that have reported that calcium intake does not tend to cluster with other lifestyle practices, but that physical activity is linked to other lifestyle practices such as smoking.
4.5 SUMMARY AND CONCLUSIONS

It has been suggested that failing to maximize peak bone mass in the growing years (due to unhealthy lifestyle practices) rather than excessive loss of bone in the post-menopausal years may a more important contributor to osteoporosis (Chan, 1991). One unhealthy lifestyle practice that plays a role in development of peak bone mass and which has been stated as one of the most probable reasons for the increased prevalence of osteoporosis in the western world is physical inactivity (Riggs & Melton, 1986). The present study found that most of the participants were engaging in low to moderate levels of physical activity, with very few participating in high levels. It is possible that since few of the participants were engaging in a high level of physical activity, they may not have been performing the types of activity shown to maximize peak bone mass and decrease the risk of osteoporosis (i.e. high impact, bone loading activity). However, this cannot be concluded given the limitations of the physical activity questionnaire used in the present study. Findings also indicated that calcium intake for adolescents in this study fell short of the adequate intake according the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes (1997). In addition to physical activity and nutrition, it was also found that 25% of the participants in this study were regular smokers, thereby also putting this population at increased risk. Due to the importance of these healthy lifestyle practices in the attainment of an optimal peak bone mass, efforts to increase calcium consumption, increase regular vigorous weight bearing physical activity, and reduce the prevalence of cigarette smoking among adolescent females appears critical.
Findings from the present study show that the participants believed in a healthy lifestyle to prevent osteoporosis, but lacked the specific knowledge necessary to make informed lifestyle decisions concerning osteo-protective practices. Further, the study showed that while cigarette smoking and physical inactivity tended to cluster together and vary according to SES (for some of the variables), calcium intake did not tend to cluster with other lifestyle practices and was not associated with SES. Thus, the results of this study and those of previous research (Kasper et al., 1994) suggest that health care professionals have either missed the opportunity to disseminate osteoporosis information to young women or such information has not yet been received and retained by them. Similarly, schools may not have seen it as their role to educate students about this particular health concern. Wallace (2001) concluded that regardless of the reason(s) for the absence of this type of knowledge, a need exists to increase awareness of osteoporosis risk factors and encourage healthy lifestyle practices in young women. The existing knowledge gaps that were identified in the target population in the present study can now be used to develop interventional programs concerning healthy lifestyle practices for osteoporosis. These programs should be developed for both pre-adolescent and adolescent girls of varying ethnic backgrounds and SES. The programs could be incorporated into the school curriculum and could include physical activity necessary for maximizing peak bone mass (e.g. fun weight bearing exercises like skipping, hop scotch, jumping jacks, push-ups, or plyometric-type activities), as well as theoretical components (e.g., educational resources designed to increase specific knowledge regarding the type, frequency, and intensity of physical activity, the minimum number of servings of dairy
products needed per day, and the reasons why other healthy lifestyle practices such as non-smoking are necessary) to help this population protect themselves against osteoporosis.

Future research should aim to identify factors that may motivate youth to consume a healthy diet, refrain from smoking, and participate in regular, bone loading physical activity. Because lifestyle practices and habits are formed early in life and may be carried into adulthood, prevention programs that encourage healthy lifestyle behaviors targeted toward young people need to be developed and tested. Future studies should also aim to develop methods to measure bone loading physical activity and to define socio-economic status. In sum, the effects of physical activity, nutrition, and smoking on bone health need to be addressed among the adolescent female population.
REFERENCES


Saskatoon In Motion Survey (2000). Saskatoon, SK.

Saskatoon Population Census. (1996). Saskatoon, SK.


healthy adolescents: Evidence for a marked reduction after 16 years of age at the levels of lumbar spine and femoral neck in female subjects. *Journal of Clinical Endocrinology and Metabolism, 75,* 1060 – 1065.


APPENDIX A

Consent Form for Students and Parents
Consent Form

Students and Parents

Title: The Knowledge, Beliefs, and Practices Among Adolescent Females regarding Osteoporosis Lifestyle Risk Factors

Kristal Anderson
Master of Science student
College of Kinesiology
University of Saskatchewan
Saskatoon, Saskatchewan

We would like to ask for your daughter’s assistance with a study that is being carried out in the College of Kinesiology. The purpose of the study is to evaluate knowledge, beliefs, and practices among adolescent females concerning lifestyle risk factors for osteoporosis. The findings from this project will provide valuable information to assist health educators in developing future programs for the prevention of osteoporosis.

If your daughter decides to volunteer, her role as a participant is to complete four questionnaires totaling approximately 40 minutes in length. The questionnaires will be completed during school hours in your daughter’s physical education class. Female students from the ages of 12 through 14 in your daughter’s school and five other schools will be participating in this study and will also complete the same questionnaire. It is hoped that all of the females in the class will agree to complete a questionnaire. The questionnaires have been designed to assess the knowledge, beliefs and practices regarding lifestyle risk factors for osteoporosis (i.e. physical activity, nutrition, and cigarette smoking). The data collected from the results of the questionnaires will be the basis for my thesis project.

The decision to participate or not to participate will not affect the grade that your daughter receives in any of her classes. Results are completely anonymous and only group results will be published. All the information provided to me through the questionnaires will be confidential and stored in a locked office when not in use. Upon request, you and your daughter will be given a copy of the questionnaire to peruse. If your daughter wishes, she may withdraw from the study at any time. Withdrawal from the study will not affect her grade in any way.

With your permission and your daughter’s permission, the questionnaires will be used to help us assess knowledge, beliefs, and practices among adolescent females. It is our hope that the information your daughter provides will assist health educators to develop future programs related to osteoporosis prevention and the promotion of healthy lifestyle choices.

If you and your daughter decide that she would like to be a part of this study, please complete the attached form. Also, please ask your daughter to read this letter and
indicate her consent as well. If you or your daughter has any questions or concerns about this study, please do not hesitate to contact either Kristal Anderson (966-2688 Graduate student) or Dr. Karen Chad (966-6511 - Associate Professor and Advisor) at any time.

PARENTS/GUARDIANS PLEASE READ and SIGN YOUR CONSENT

I have read and understand the purpose of this study and my daughter’s involvement in this study. I am aware that my daughter will remain anonymous throughout the study and in any written results of the data collection through participation in this project. I am aware that my daughter has the right to withdraw from the study at any time. I acknowledge that I have received a copy of the consent letter for my records. If I have any questions or concerns I can contact Kristal Anderson (306-966-2688) or her research advisor, Dr. Karen Chad (966-6511). If I wish to clarify the rights of my daughter as a research participant, I may call the Office of Research Services (966-4053).

I, ___________________________ give permission to allow ______________________

to participate in the study conducted by Kristal Anderson.

Signature ___________________________________________ Date ____________

-----------------------------------------------

Students Please Read and Sign Your Consent

I have discussed this study and consent with Kristal Anderson, and my parents/guardians. I understand the purpose of the study and my involvement. I understand that I have the right to withdraw at any time from the project, or ask to have any of the information that I have given eliminated from the final document.

Signature ___________________________________________ Date ____________
APPENDIX B

The Osteoporosis Risk Factor Questionnaire
The Osteoporosis Risk Factor Questionnaire

School: _____________________________________________________________

Your participation in this questionnaire will be of great assistance in obtaining the information that is needed for this study. Your name will not be put on the questionnaire, so your opinions will be completely confidential. Thank you!

I. True or False
Please circle true or false. Circle unsure if you don’t know the answer.

A. Physical Activity Knowledge

1. Bones are living tissues that need physical activity to be healthy and strong. T F Unsure

2. High impact physical activity such as soccer is best for your bones. T F Unsure

3. Regular physical activity helps your body use calcium more efficiently. T F Unsure

4. Physical activity helps you to burn more calories at rest. T F Unsure

5. Physical activity can help keep you from losing muscle when you’re dieting to lose weight. T F Unsure

6. Excessive physical activity combined with severe dieting can speed up bone growth. T F Unsure

7. Irregular and/or complete loss of your periods due to excessive exercise can be good for your bones. T F Unsure

8. For weight loss, dieting alone is better than dieting combined with physical activity. T F Unsure

B. Smoking Knowledge

9. Smoking a cigarette now and then will not harm your health. T F Unsure

10. Cigarette smoking increases bone growth. T F Unsure

11. Cigarette smoking can lead to osteoporosis. T F Unsure
C. Nutrition Knowledge

12. It is difficult to get the calcium you need from vegetables alone.  
   T  F  Unsure

13. Adolescents need more calcium than children age 6 or 7.  
   T  F  Unsure

14. Drinking too much pop or caffeine can be harmful to your bones.  
   T  F  Unsure

II. Multiple Choice

Which of the following foods are high in calcium?
Please check all that apply.

1.  [ ] Cherry yogurt
2.  [ ] Ham and Pineapple Pizza
3.  [ ] Butterscotch ice cream
4.  [ ] Hamburgers & hotdogs
5.  [ ] Chocolate milk (skim, 1% or 2%)
6.  [ ] Fruits such as oranges, kiwi, and grapefruit
II. Beliefs

Below are some statements asking how you feel about physical activity, nutrition, and smoking. For each statement, please indicate which word or phrase best describes how much you agree or disagree with the statement. Please answer each question.

EXAMPLE: Jennifer does not enjoy walking in the rain.

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Unsure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy walking in the rain.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PHYSICAL ACTIVITY**

1. I believe that physical activity helps to build strong, healthy bones. 
   | Strongly Agree | Agree | Unsure | Disagree | Strongly Disagree |
   | | | | | |

2. Being physically active makes me feel part of a special group of people.
   | Strongly Agree | Agree | Unsure | Disagree | Strongly Disagree |
   | | | | | |

3. I believe regular physical activity is important at any age.
   | Strongly Agree | Agree | Unsure | Disagree | Strongly Disagree |
   | | | | | |

4. The ads I see promoting physical activity make me want to be physically active.
   | Strongly Agree | Agree | Unsure | Disagree | Strongly Disagree |
   | | | | | |

5. I think that being physically active is an important part of being healthy.
   | Strongly Agree | Agree | Unsure | Disagree | Strongly Disagree |
   | | | | | |

6. My friends think that physical activity is important.
   | Strongly Agree | Agree | Unsure | Disagree | Strongly Disagree |
   | | | | | |

7. I think that physical activity is for everybody, not just for young children.
   | Strongly Agree | Agree | Unsure | Disagree | Strongly Disagree |
   | | | | | |

8. I believe that physical activity is important for preventing osteoporosis.
   | Strongly Agree | Agree | Unsure | Disagree | Strongly Disagree |
   | | | | | |
## NUTRITION

<table>
<thead>
<tr>
<th>9. I believe that calcium is good for me.</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Unsure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. A meal for me usually includes milk rather than a soft drink.</td>
<td></td>
<td></td>
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<tr>
<td>11. The advertisements I see for milk make me want to drink it.</td>
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<tr>
<td>12. I believe that drinking milk helps to build strong healthy bones.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Getting enough calcium is important at any age.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. I think that milk should be drunk by everyone, not just by young children.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. I believe that drinking milk will reduce my risk of osteoporosis.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## SMOKING

<table>
<thead>
<tr>
<th>16. Smoking cigarettes makes me feel part of a special group of people.</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Unsure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. I believe that smoking cigarettes can lead to osteoporosis.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. The ads I see for cigarettes make me want to smoke.</td>
<td></td>
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<tr>
<td>19. I think that smoking is a bad habit, especially for teens.</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>20. I believe that quitting smoking can help reduce the risk of osteoporosis.</td>
<td></td>
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</tbody>
</table>
APPENDIX C
The Physical Activity Questionnaire for Older Children
Physical Activity Questionnaire

Name: ___________________________  Height: _______
Weight: _______

We are trying to find out about your level of physical activity from the last 7 days (in the last week). This includes sports or dance that make you sweat or make your legs feel tired, or games that make you breathe hard, like skipping, running, or climbing.

Remember:
A. There are no right and wrong answers — this is not a test!
B. Please answer all the questions as honestly and accurately as you can — this is very important.

1. Physical activity in your spare time: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Mark only one circle per row.)

<table>
<thead>
<tr>
<th>Activity</th>
<th>No</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>Or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skipping</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Rowing/canoeing</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>In-line skating</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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</tr>
<tr>
<td>Rugby</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Walking for exercise</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Bicycling</td>
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<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Jogging or running</td>
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<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Aerobics</td>
<td>□</td>
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<td>□</td>
</tr>
<tr>
<td>Swimming</td>
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<td>□</td>
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</tr>
<tr>
<td>Baseball, softball</td>
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<td>□</td>
<td>□</td>
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<tr>
<td>Dance</td>
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<td>□</td>
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<tr>
<td>Wrestling</td>
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</tr>
<tr>
<td>Badminton</td>
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</tr>
<tr>
<td>Gymnastics</td>
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<tr>
<td>Soccer</td>
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<tr>
<td>Street hockey</td>
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<td>Floor hockey</td>
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<tr>
<td>Basketball</td>
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<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Track and field</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Weight training</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Martial arts</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Ice skating</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Ice hockey/ringette</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Other:</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>
2. In the last 7 days, during your physical education (PE) classes, how often were you very active (playing hard, running, jumping, throwing)? (Check one only.)

   I don’t do PE .............................................  ○
Hardly ever ..................................................  ○
Sometimes ...................................................  ○
Quite often .................................................  ○
Always ........................................................  ○

3. In the last 7 days, what did you normally do at lunch (besides eating lunch)? (Check one only.)

   Sat down (talking, reading, doing schoolwork)................  ○
Stood around or walked around ................................  ○
Ran or played a little bit ....................................  ○
Ran around and played quite a bit .............................  ○
Ran and played hard most of the time .......................  ○

4. In the last 7 days, what did you normally do at recess? (Check one only.)

   Sat down (talking, reading, doing schoolwork)................  ○
Stood around or walked around ................................  ○
Ran or played a little bit ....................................  ○
Ran around and played quite a bit .............................  ○
Ran and played hard most of the time .......................  ○

5. In the last 7 days, on how many days right after school, did you do sports, dance, or play games in which you were very active? (Check one only.)

   None ........................................................  ○
1 time last week .............................................  ○
2 or 3 times last week .....................................  ○
4 times last week ............................................  ○
5 times last week .............................................  ○

6. In the last 7 days, on how many evenings did you do sports, dance, or play games in which you were very active? (Check one only.)

   None ........................................................  ○
1 time last week .............................................  ○
2 or 3 times last week .....................................  ○
4 or 5 times last week .....................................  ○
6 or 7 times last week .....................................  ○
7. *On the last weekend,* how many times did you do sports, dance, or play games in which you were very active? (Check one only.)

- None ................................................................. ○
- 1 time .............................................................. ○
- 2 — 3 times ........................................................ ○
- 4 — 5 times ........................................................ ○
- 6 or more times ................................................... ○

8. Which *one* of the following describes you best for the last 7 days? Read all five statements before deciding on the *one* answer that describes you.

A. All or most of my free time was spent doing things that involve little physical effort ................................................................. ○
B. I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics) .............. ○
C. I often (3 — 4 times last week) did physical things in my free time ................. ○
D. I quite often (5 — 6 times last week) did physical things in my free time .......... ○
E. I very often (7 or more times last week) did physical things in my free time ......... ○

8. Mark how often you did physical activity (like playing sports, games, doing dance, or any other physical activity) for each day last week.

<table>
<thead>
<tr>
<th>Day</th>
<th>None</th>
<th>Little bit</th>
<th>Medium</th>
<th>Often</th>
<th>Very often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Tuesday</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Wednesday</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Thursday</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Friday</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Saturday</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sunday</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

10. Were you sick last week, or did anything prevent you from doing your normal physical activities? (Check one.)

- Yes ................................................................. ○
- No ................................................................. ○

If Yes, what prevented you?  

________________________________________________________________________

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APPENDIX D

The Teenagers’ Nutrition Questionnaire
The Teenagers’ Nutrition Questionnaire: What teens eat and how they feel about it

Everyone knows that the teen years are important for building good nutrition habits to last a lifetime. However, it is not known what teens think about their food and nutrition, or how their busy lives affect what they eat. There are no right or wrong answers to the questions that follow – we simply want to know what your opinions are. Your name will not appear on the questionnaire, so no one will know your opinions.

I. WHAT YOU EAT

For each meal or snack listed below, please fill in how many times you eat the meal or snack per week. In the second column, fill in how many times per week you eat that meal or snack “out” (at a restaurant or fast food place).

Example: Eric eats breakfast on weekdays, but not on weekends. He never eats “out” for breakfast. He eats dinner every day, and eats this meal out with friends or family about twice per week.

<table>
<thead>
<tr>
<th>Meal</th>
<th>Times eaten / week</th>
<th>Times eaten out / week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dinner</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

YOUR MEALS AND SNACKS

<table>
<thead>
<tr>
<th>Meal</th>
<th>Times eaten / week</th>
<th>Times eaten out / week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning snack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afternoon snack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dinner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening snack</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

II. FOOD FREQUENCY QUESTIONNAIRE

Next we’d like to know about some of the foods you eat. For each food listed below, please fill in how often you usually eat a portion of the size stated. If you eat the food:
- every day or more than once per day, fill in how many times you have it per day
- less than once per day, but more than once per week, fill in number of times per week
- less than once a week, but more than once a month, fill in the times per month
- less than once a month, or never eat it, put an “X” under “do not eat”
Example: Susan has a glass of orange juice every morning, along with two slices of white toast. She usually has two sandwiches on brown bread at lunch, and eats french fries about three times per week. She almost never eats cauliflower.

<table>
<thead>
<tr>
<th>Food Description</th>
<th>Per day</th>
<th>Per week</th>
<th>Per month</th>
<th>Don’t eat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange juice, 1 cup</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>French fries, regular serving</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cauliflower, ½ cup (125 ml)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bread or toast, 1 slice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NUMBER OF TIMES I EAT THE FOOD**

<table>
<thead>
<tr>
<th>Food Description</th>
<th>Per day</th>
<th>Per week</th>
<th>Per month</th>
<th>Don’t eat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread or toast, 1 slice/roll</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muffin, 1 large</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pizza, 1 medium slice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheeseburger</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheese (plain or in sandwich)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 slice processed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 piece hard cheese</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broccoli, ½ cup (125 ml)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ice Cream (large scoop)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frozen yogurt (large scoop)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fast food milkshake</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cottage cheese, ½ cup</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yogurt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small carton (175 ml)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canned Salmon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>½ small can</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft drink (1 can or glass)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffee or tea, 1 cup</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tofu, 2 oz. (60 gm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk on cereal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange juice, 1 cup</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk/vico (any type, 1 cup)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macaroni and Cheese, 1 cup</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I usually drink (choose one only):
- Whole (homo) milk
- 2% milk
- 1% milk
- Skim milk
- Chocolate milk
- No milk

### III. HOW MILK AND DAIRY PRODUCTS TASTE

We are interested in how milk and dairy products taste to you. Please circle the phrase that best describes how you feel about the taste of each of the foods listed below. If you have never tasted the food, circle “DON’T KNOW”.

1. How much do you enjoy the taste of whole (homo) milk?
   - **VERY**
   - **IT'S**
   - **JUST**
   - **NOT VERY**
   - **MUCH**
   - **SO-SO**
   - **AT ALL**
   - **DON'T KNOW**

2. How much do you enjoy the taste of low fat (2% or 1%) milk?
   - **VERY**
   - **IT'S**
   - **JUST**
   - **NOT VERY**
   - **MUCH**
   - **SO-SO**
   - **AT ALL**
   - **DON'T KNOW**

3. How much do you enjoy the taste of skim milk?
   - **VERY**
   - **IT'S**
   - **JUST**
   - **NOT VERY**
   - **MUCH**
   - **SO-SO**
   - **AT ALL**
   - **DON'T KNOW**

4. How much do you enjoy the taste of fruit flavored yogurt?
   - **VERY**
   - **IT'S**
   - **JUST**
   - **NOT VERY**
   - **MUCH**
   - **SO-SO**
   - **AT ALL**
   - **DON'T KNOW**

5. How much do you enjoy the taste of plain yogurt?
   - **VERY**
   - **IT'S**
   - **JUST**
   - **NOT VERY**
   - **MUCH**
   - **SO-SO**
   - **AT ALL**
   - **DON'T KNOW**

6. How much do you enjoy the taste of cottage cheese?
   - **VERY**
   - **IT'S**
   - **JUST**
   - **NOT VERY**
   - **MUCH**
   - **SO-SO**
   - **AT ALL**
   - **DON'T KNOW**

7. How much do you enjoy the taste of hard cheese (such as cheddar)?
   - **VERY**
   - **IT'S**
   - **JUST**
   - **NOT VERY**
   - **MUCH**
   - **SO-SO**
   - **AT ALL**
   - **DON'T KNOW**

8. How much do you enjoy the taste of ice cream?
   - **VERY**
   - **IT'S**
   - **JUST**
   - **NOT VERY**
   - **MUCH**
   - **SO-SO**
   - **AT ALL**
   - **DON'T KNOW**
APPENDIX E
The Smoking Behaviour Questionnaire
The Smoking Behaviour Questionnaire

The following section measures your everyday practices. There are no right or wrong answers, so please be as honest and accurate as possible when answering the following questions. Results are completely confidential.

1. Have you ever smoked cigarettes? 
   Yes [ ] No [x]

If NO, you are done this questionnaire. Please move on to the next page.

2. If yes, at what age did you start smoking? Age ______

3. If yes, have you smoked 100 cigarettes or more in your lifetime?
   Yes [ ] No [x]

4. How frequently have you smoked cigarettes during the past 30 days?
   [ ] Not at all
   [ ] Less than one cigarette daily
   [ ] 1 to 5 cigarettes daily
   [ ] About ½ pack a day
   [ ] About 1 pack per day
   [ ] About 1½ packs per day
   [ ] 2 or more packs per day

5. I smoke the majority of cigarettes on:
   Weekends [ ] Weekdays [ ] Equally weekends and weekdays [ ]
INFORMATION ABOUT YOU

Please fill in the following information about yourself.

1. Age
   ______ Years

2. Height
   ______ ft ______ inches OR ______ cm

3. Weight
   ______ pounds OR ______ kg

4. Racial Origin: (check one or two)
   ______ Caucasian (white)
   ______ Oriental
   ______ East Indian
   ______ Black
   ______ Native Canadian (Indian)
   ______ Other (please specify: ______)

5. Are you allergic to milk or dairy products?
   ______ Yes OR ______ No

6. Do you have a regular period?
   ______ Yes OR ______ No

7. Do you work at a paying job?
   ______ No
   ______ Yes (If so, where do you work?) How many hours per week? ______
         Fast food place/restaurant
         Retail store (i.e. Walmart)
         Paper Route or Babysitting
         Other (please specify: ____________________________)

8. What is your mother’s job?

9. What is your father’s job?

10. Do you regularly take any vitamin/mineral pills? ______ Yes OR ______ No
    If yes, check all that you use every day:
        ______ multi-vitamin/mineral pill
        ______ vitamin C pill
        ______ iron pill
        ______ calcium pill
        ______ other (please specify: ____________________________)