Athletic Amenorrhea:
prevalence and awareness among female athletes

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INTRODUCTION

Conceptual Framework

While there is increasing recognition of women to participate in sports at all levels, there is also growing awareness that biological differences between the sexes may require different training rules and practices for men and women, especially for young female athletes. The environment of elite female athletes has been given little mention in the literature regarding health effects and the potentially fatal group of disorders called the "female athletic triad" (Skolnick 1993). This triad includes disordered eating, an energy deficit when the calories they expend exceeds their calorie intake, menstrual dysfunction, the absence of consecutive menstrual cycles, and decreased bone mineral density, premature bone loss and/or inadequate bone formation resulting in loss bone mass (Skolnick 1993). Women who participate in competitive sports are under enormous pressure to maintain an extremely low body weight through diet and exercise. While exercise is viewed as widely beneficial to women of all ages, the pressure to succeed in sports by achieving or maintaining an unrealistically low body weight through food restriction and high intensity training may lead some women to develop eating disorders, amenorrhea, and osteoporosis (Frederick and Hawkins 1992). If it is shown that female athletes have a higher rate of menstrual dysfunction and because more and more women are exercising regularly, and the long term affects of exercise disorders are not known, more research is needed in this area.
Statement of Problem

A normal menstrual cycle coupled with consistent exercise can create optimal bone health for women (Frederick and Hawkins 1992). Exercise, especially types of exercise in which the muscles work against gravity, is important for the development and maintenance of strong bones, and can reduce bone loss (Fredereck and Hawkins 1992). Intensive aerobic exercise, however, can adversely affect bone density indirectly by its effect on the hypothalamic-pituitary-gonadal axis, which leads to a fall in blood estrogen concentrations; the effects of which cause amenorrhea (Wolman 1994). Amenorrhea is regarded as a relatively benign condition and only a consequence of training and many in the medical community see it as a normal adaptation of female athletes. Thus, the loss of periods during athletic training is not seen as problematic, but amenorrhea is a symptom of something going wrong and could be a sign of a potentially serious clinical problem. Research suggests that no irreversible reproductive dysfunctions should occur as a result of menstrual dysfunction in athletes, but various disorders including luteal phase deficiency and hypoestrogenic amenorrhea are very common among athletes and can last a long time (Shanghold et al. 1990). There is also growing concern about the risk of osteoporosis in women athletes with amenorrhea and the resulting low estrogen levels (Shanghold et al. 1990).

The research I proposed here, is to undertake a four-month investigation of female athletes undergoing strenuous training. These athletes will all be 18 to 24 years of age and individuals who have participated throughout their teenaged years in competitive sports, the specifics of the participants will be discussed at length in a further section. The goal of this study is to determine if Division I athletes at Western Michigan
University are showing signs of menstrual dysfunction and whether or not they are being educated of the consequences. In addition, the information given to these female athletes in training, especially under the duress of weight reduction and the stress of competition, regarding the possibility of menstrual dysfunction and its consequences on bone density will be examined. To do this, the role of the menstrual cycle, what optimal bone health is, the effects of intense training on female biology, as well as the role of body image for these young adults will be explored through a review of the medical and anthropological literature. To conclude, a discussion of the proposed research project and its methodology along with the benefits of research such as this will be discussed. This study further emphasizes the problems associated with, but not often reported on, elite female athletes, and the lack of both medical study and information, if any, is being offered to women regarding long-term health.

LITERATURE REVIEW

Women who participate in sports are under enormous pressure to maintain an extremely low body weight through diet and exercise. While exercise is viewed as widely beneficial to women of all ages, the pressure to succeed in sports by achieving or maintaining an unrealistically low body weight through food restriction and high intensity training may lead some women to develop eating disorders, amenorrhea, and osteoporosis (Skolnick 1993). To properly contextualize this particular research topic, it is essential to review the literature regarding menstruation and women's health, how a normal menstrual cycle coupled with exercise can create optimal bone health, the female
athletic triad, athletic amenorrhea and its effect on bone density, and how female athletes view their body.

**Why is the menstrual cycle important in women’s health?**

A basic understanding of the normal menstrual cycle is the foundation for the recognition and treatment of menstrual dysfunction. Kingingham and colleagues in a 1996 article clearly examine the function and importance of a normal menstrual cycle in the female body. A normal menstrual cycle averages 28 days, with day one marking menstruation and day 14 marking the time of ovulation, however, cycles can vary in length from 22 to 45 days. The function of the menstrual cycle is to regulate the maturation of the ovum and prepare the uterus for implantation. The pituitary gland releases follicle stimulating hormones to start the development of the egg in the ovaries. The follicle that the egg grows in releases estrogen into the bloodstream to prepare the endometrium for potential pregnancy. As a result, the endometrium thickens and uterine secretions increase. At the same time, oestrogen acts as a feedback mechanism to stop any more eggs from maturing, and to stimulate the release of luteinising hormone (LH) form the pituitary. During ovulation, a sudden LH surge from the pituitary causes the release of the mature ovum. The follicle left behind develops into a structure called the corpus luteum and starts to thicken the endometrium further. The increasing levels of estrogen and progesterone inhibit the release of FHS and LH from the pituitary in another feedback mechanism. If conception does not take place after ovulation, all the ovarian hormones drop to their initial levels and menstruation begins (Small 1999).

Cyclic menstrual bleeding requires normally functioning ovaries, a uterus with a responsive endometrium, an unobstructed outflow tract, and an intact hypothalamic-
pituitary-ovarian axis (Kingham et al. 1996). Aside from pregnancy, the most common causes of amenorrhea involve disorders within the hypothalamic-pituitary-ovarian axis, in which hormonal signals, or an inappropriate response to these signals, leads to inadequate coordination of ovarian follicular development (Kingham et al. 1996).

A woman's monthly cycle does not just affect fertility. It influences mood, muscle mass, percent body fat, energy, metabolism and aerobic capacity—all important factors for elite athletes (Walsh 1996). As Walsh discusses, there are two main phases of the menstrual cycle, the number of days from the first day of your period to ovulation is the follicular phase, during which estrogen and progesterone are low, and the days after ovulation is the luteal phase, when both hormones are high. She also suggests the luteal phase is when many metabolic changes can occur that can alter athletic performance, although, research into this topic has not yet produced conclusive results.

The basis for the female hormonal cycle, as discussed by Wojtys et al. (1998) in the American Journal of Sports Medicine, is the endocrine coordination between the hypothalamus, the pituitary gland, and the ovaries. The coordination among these centers occurs through the circulatory system via hormones. Estrogen, progesterone and relaxin affect many tissues and systems other than the ovarian follicles. Estrogen affects soft tissue strength, muscle function, and the central nervous system. While progesterone can act as a central nervous system anesthetic and relaxin can drastically diminish collagen tension. These complex interactions of hormones may play a role in the susceptibility of women to serious injuries. Wojtys et al. designed a study to investigate the variation in anterior cruciate ligament injury rates during the female monthly cycle and found that there is an increased incidence of ACL injury during the ovulatory phase of the menstrual
cycle. This suggests that the epidemic of non-contact ACL tears in female athletes may be related to hormonal fluctuations.

**Optimal Bone Health**

A normal menstrual cycle, coupled with consistent exercise can create optimal bone health for women. Peak bone mass, the greatest amount of bone at any time of life, is typically obtained by the age of 30 years or earlier (Thrash and Anderson 2000). Before this age, bone modeling predominates, with skeletal growth of females usually completed by sixteen to eighteen years (Thrash and Anderson 2000). Bone remodeling is a complex process involving a number of cellular functions directed toward the coordinated resorption and formation of new bone, as action activity associated with osteoblasts and osteoclasts (Leslie and St. Pierre 1999).

Exercise affects the skeleton in several ways. The direct effects of stress loading can be to increase bone mineral density, now a strategy for preventing osteoporosis (Wolman 1994). There are a variety of factors that increase bone density. Weight bearing activities are associated with increase in bone density but are less pronounced if the exercise does not incorporate gravity stimulation (Wolman 1994). Thus, swimming, being a weight-supported activity, produces only a limited effect on the skeleton, compared with some weight bearing activities such as running. The skeletal response to exercise is greatest at the site of maximum stress (Wolman 1994). For example, this effect is seen in professional tennis players, whose playing arm can be up to 30% more dense than the non-playing arm, runners have increased density in the calcaneous, femoral shaft, and spine, and rowers, who perform intensive upper body exercise, display
even more spinal bone density (Wolman 1994). Any exercise activity that produces repetitious stress loading to a part of the skeleton will tend to increase bone density at that site (Wolman 1994). The prescription of exercise programs such as running, tennis, rowing, or volleyball, can lead to appreciable increases in bone density after several months of training and for older people, exercise may reduce the risk of osteoporosis (Wolman 1994).

Some of the factors that contribute to the onset of osteoporosis have their antecedents early in life in the form of modifiable behaviors or lifestyles. Leslie and St. Pierre (1999) examined risk factors for osteoporosis that are especially relevant to the college health setting and found that among 20 to 29-year-old females, strenuous exercise for hours a day over many months can lower estrogen levels, especially if significant weight loss accompanies such programs. The authors concluded that the loss of estrogen during this period can negatively influence the opportunity to build peak bone mass.

The susceptibility of bone to sex hormone deprivation was recognized more than fifty years ago with a noticeable association between osteoporosis and menopause (Rizzoli and Bonjour 1997). Since then, the concept of a causal link between estrogen deficiency and accelerated bone loss has been supported by observations in various states of premature oestrogen deficiency, such as anorexia, secondary amenorrhea due to strenuous exercise, and the use of gonadotropin inhibitors (Rizzoli and Bonjour 1997). Rizzoli and Bonjour (1997) also examine the importance of estrogen on the affect on metabolism and the structural integrity of bone. Observations made by the authors in disorders associated with low estrogen production or inadequate estrogen action suggest that sex hormones are a key factor in acquisition of bone mass. Some might object that in
exercise related amenorrhea, eating disorders are a likely factor in the low bone mass, but these researchers observed that marathon runners’ bone loss was essentially attributable to estrogen deficiency rather than alterations in calorie, calcium, or protein intake.

Female Athletic Triad

Athletics provide an environment that places bodies and physical appearance at the forefront, even above performance, particularly for women. As Greenleaf (2002) discusses, the cultural ideals and norms of beauty and physicality are engrained at an early age. Furthermore, one of the challenges related to body image unique to female athletes is the pressure to meet cultural body ideals while also possessing qualities beneficial to successfully completing physically demanding tasks of their sport. The athletic environment provides a setting that allows women to demonstrate strength, power, and coordination that may be deemed inappropriate in the larger context of femininity. While dissatisfaction with one’s body in Western culture has become the norm, it is not without consequence among elite athletes, and can develop into the female athletic triad.

The female athletic triad, which consists of disordered eating behaviors, amenorrhea, and osteopenia/osteoporosis, is an area of concern for women who otherwise consider themselves to be in superior physical condition (Thrash and Anderson 2000). Problems associated with this triad include development of an energy deficit, when the energy, or calories, they expend exceeds their energy intake. This deficit may be unintentional, resulting from inadequate replenishment of the caloric demands of training, or it may be intentional—a conscious attempt to lose weight or body fat in the interest of
improved appearance or athletic performance (Dummer et al. 1987). Dummer et al. (1987) studied young elite swimmers and revealed that 60.5% of average-weight females and 17.9% of underweight females were trying to lose weight by decreasing their food intake, however, 12.7% were bulimic, 2.5% were using laxatives, and 1.5% were using diuretics. Disordered eating can be seen in athletes participating in all sports. However, just as many studies have come to opposite conclusions. Hausenblas and Mack (1997) presented a study which examined self-presentational concerns related to the physique and eating disorder correlates among female divers. Female divers in this study reported significantly less social physique anxiety than an athletic and nonathletic control group. Even though these competitive divers compete and train in revealing attire and are evaluated subjectively by judges, they did not report heighten social physique anxiety, present eating disorders as well as body image issues. Thus, involvement in activities that emphasize physical self-presentation does not necessarily place females at a higher risk for developing eating disorders.

The advantage in athletic performance of maintaining a healthy minimal level of body fat and the strong negative connotation of overfatness in our society combined creates strong pressures for thinness (Rust 2002). Some researchers (Katz 1986 and Wiita et al. 1995) have speculated that society’s emphasis on physical fitness and leanness may promote preoccupation with low or extremely low body weight and may develop into eating disorders. In addition, Katz (1986) has suggested that extreme exercise, such as long-distance running, can trigger anorexia in persons who are at risk psychologically and biologically for developing an eating disorder.
Amenorrhea

Up until the early 1980s, most regarded amenorrhea as a relatively benign condition and only a consequence of training (Skolnick 1993). Many in the medical community still think that amenorrhea is a normal adaptation of female athletes and it is normal for them not to have periods during athletic training, but amenorrhea is a symptom of something going wrong and could be a sign of a potentially serious clinical problem (Skolnick 1993). There are two types of menstrual dysfunction, primary and secondary amenorrhea. Primary amenorrhea is defined as the absence of menses by age sixteen and secondary amenorrhea is typically defined as the absence of at least three to six consecutive menstrual cycles in a female who has begun menstruating (Skolnick 1993 & Drinkwater et al. 1996). According to Skolnick (1993), the prevalence of secondary amenorrhea in adult athletes ranges from 3.4% to 66%, depending on the sport studied or criteria used to define amenorrhea, compared to 2% to 5% of women in the general population.

Some athletic women experience altered menstrual cycles as discussed above, but this is rarely a result of sporting activity alone. Athletes who have inadequate diets for their activity level, such as runners, dancers, and gymnasts, are usually prone to "athletic amenorrhea," a form of hypothalamic amenorrhea (Carbon 1994). As Rust (2002) discusses, hypothalamic amenorrhea is characterized by a reduction in the secretion of a hormone, called gonadotropin releasing hormone (GnRH), from the brain’s hypothalamus. The function of GnRH is to stimulate the pituitary gland, which in turn sends signals to the ovaries. A reduction of GnRH and luteinizing hormone (LH) is found in amenorrhea. The lack of LH stimulation causes suppression of the ovary, which
then fails to produce estrogen and progesterone. In turn, no ovulation occurs and there is no cyclic menstrual bleeding. It is speculated that this type of amenorrhea is not the result of low body weight or body fat but, rather, energy drain. Energy drain is a combination of excessive psychological and physical training combined with an inadequate caloric intake.

Over the past decade, the reduction and disturbance in menses in young athletes, or amenorrhea, is starting to be seen as a disorder with great consequence with side effects creating a loss in bone mineral density. Drinkwater, Breumner, and Chestnut (1990) raise the question of whether extended periods of menstrual irregularity may exert a prolonged effect on bone mineral density. Specifically, the study was designed to examine more closely the relationship between present bone mineral density and menstrual history and current menstrual status of active young women. Ninety seven athletes, ages 18 to 38 years, participated in the study and were examined using single and double absorptiometry to determine mineralization for different parts of the skeleton and the resulting data was compared to menstrual patterns. Drinkwater et al. (1990) concluded that the loss of bone mass correlated with abnormal menstruation, with the women experiencing the greatest irregularity having the greatest reduction in vertebral mass. The authors also stated that body weight had a beneficial effect, and heavier women experienced less mineral loss than their lighter peers.

In 1992, Baer and Taper assessed the dietary intake and exercise training of amenorrheic and eumenorrheic athletes. They claim that strenuous training combined with a low-energy diet are the main causes of amenorrhea in adolescent runners. In this study, six amenorrheic and six eumenorrheic runners were assessed for their dietary
training status. Each girl completed a seven day diet record and was examined for body composition. The purpose was to determine what aspects of the amenorrheic runners' training had caused them to stop menstruating. The results of this study showed that adolescent athletes who train vigorously and consume a low-energy diet exhibit secondary amenorrhea and reduced estradiol levels. The authors advise trainers of teenage athletes to emphasize the need to consume an appropriate energy intake in order to control amenorrhea.

It should be noted that some cases of menstrual dysfunction in athletes result from pathological conditions that are unrelated to exercise. For example, according to Shanghold et al. (1990), athletes are no less susceptible than the general population to pituitary tumors, thyroid dysfunction, polycystic ovary disease, and premature ovarian failure. Any of these disorders can cause menstrual dysfunction and hormonal abnormalities. Because of this, it is important to determine whether the cause of athletic amenorrhea is due to lack of energy intake or one of the previous pathological conditions.

Exercise and bones

The ability of the female athlete to push her body to the physiological limit has produced extensive knowledge about how various physiologic systems respond to exercise (Carbon 1994). For female athletes, menstrual dysfunction may lead to decreased bone mineral density, a concern for young athletes since the average woman gains 40% to 50% of her skeletal mass during adolescence (Lloyd et al. 2000). Hypoestrogenism associated with amenorrhea may predispose athletes to osteoporosis (Carbon 1994). Osteoporosis is defined as a systemic skeletal disease characterized by
low bone mass and microarchitectural deterioration with increased bone fragility and fractures (Deblinger 2001). Osteoporosis results when the dynamic, constant process of bone remodeling becomes unbalanced, with more being resorbed than is being replaced, leading to a porous bone structure (Deblinger 2001). Bone is made up of both cortical and trabecular bone. Cortical bone constitutes 85% of the skeleton, yet trabecular is metabolically more active and prominent at sites where osteoporotic fractures most commonly occur (Carbon 1994). Despite high levels of exercise, women with athletic amenorrhea are likely to have decreased trabecular bone density as a result of low gonadal steroid concentrations (Carbon 1994). Cortical bone density, which is increased by weight bearing activities discussed earlier, remains normal (Carbon 1994). There seems to be a conflict between the acquisition of bone by skeletal modeling and remodeling in response to the imposed exercise demands, and the bone mineral losses associated with energy deficits and amenorrhea (Burrows et al. 2003).

Lloyd et al. (2000) examined how cumulative teenage sports histories and average teenage calcium intake are related to total bone mineral gains between ages 12 and 18 years. They compared this data to proximal femur bone mineral density at 18 years and concluded the amount of physical activity that distinguished a primarily sedentary teenager from one who engages in some form of exercise on a daily basis is related to peak bone mineral density. Moreover, another study suggests low bone mineral density of the lumbar spine is as common among oligomenorrheic athletes, those with irregular menses, as among amenorrheic athletes, and both have lower bone mineral density than similar athletes with regular menses (Micklesfield et al. 1995).
Athletic Body Image

The advantage in athletic performance of maintaining a healthy minimal level of body fat and the strong Western ideals of "fat" in our society combine to create strong pressures for thinness among female athletes (Rust 2002). Although a majority of girls and women achieve positive health benefits from regular physical activity, an interrelated combination of disorders can occur in girls and women who are physically active. Athletic body images, in terms of how athletes perceive and value their bodies as athletes, and factors impacting athletic body image have received little attention in the literature. There may be unique factors within the athletic context that contribute to athletic body image, such as uniforms, and coach and parent pressure. The results of which, may lead to negative physiological, emotional, and behavioral problems (Rust 2002), but little has been done to examine the impact of these pressures.

To better understand the relationships among body image, eating, and exercise in female athletes, a feminist cultural studies framework is employed here. Krane et al. (2001) engaged in focus group interviews regarding female athletes' ideal body image, eating and exercise patterns, and feelings associated with eating and exercise. Results of this study revealed that most of the women desired unrealistically ideal bodies: a toned body with minimal fat. Also, the athletes' ideal body was dependent upon the social context, such that their body satisfaction and concomitant mental states and self-presentation varied depending upon whether the athletes were considering their bodies as athletes or as culturally female. Additionally, the perceived influence of past competitive experiences on current body image was explored by Greenleaf (2002). In her study, in-depth interviews were conducted with six former competitive collegiate athletes to
explore how past competitive experiences influence current body image. It was found that female participants still recognized conflict between their athletic body and social ideals. This study stresses the effects of athletic body image even later on in life for females and how thoughts about their bodies were based on their former competitive athletic bodies. This research shows that athletic body image may be a problem not only for current competitive athletes but also for former competitive athletes living within current social constructions of female body image.

Contemporary social constructions of femininity are changing to include a body that is stronger, more toned, and fit through physical activity. Throughout the twentieth century, female athleticism and femininity have been at odds, and a change might be perceived as a step in the right direction for the inclusion of women athletes into the realm of femininity (Daniels 2000). The research above proves that women in sports are under pressure to maintain a low body weight to succeed in sports. The research lacks the confictions female athletes have between athletic body image and Western ideals of femininity and the resulting health affects.

METHODOLOGY

Project Description:
I propose to undertake a four-month investigation of female athletes undergoing strenuous training to determine the incidence of menstrual dysfunction and the level of awareness among female athletes, such as terminology, cause, and the effects of amenorrhea.
The study group will consist of females who are elite collegiate athletes between the ages of 18 and 26. Subjects must already be engaged in exercise an average of eight hours per week (2-24) for a minimum of four years to be considered elite. As a part of the study, subjects will complete a questionnaire to assess training, health, diet, menstrual status, and awareness (appendix 1). Specifically, such factors as age, age at onset of training, years of training, time off from training, age at menses, cycles per year, cycle flow, and the use of oral contraceptives will be assessed, all in accordance with the privacy standards discussed under the privacy of subjects section. Subjects determined to be amenorrheic (0-3 menstrual cycles per year) will constitute study group number 1, and subjects determined to be eumenorrheic (greater than 9 menstrual cycles per year) will constitute study group number 2. The control group will consist of athletes performing at the same level who are oligomenorrheic, or those who have an average of 10 to 13 menstrual cycles per year. Each group will consist of at least 30 individuals, each of which will be given a questionnaire.

Method of Analysis

Analysis will include the assessment of completed questionnaires (appendix 1) to assess training, health, diet, menstrual status, and level of awareness. Also, short interviews with the study subjects will gain insight of how these athletes perceive their bodies and the culture of femininity that influences these perceptions. In addition, conversations may take place during the questionnaire process. Data collected from the questionnaires will aid in the assessment of the percentage of female athletes who are experiencing menstrual dysfunction and the level of knowledge subjects possess.
regarding the effects of which. This data will then be discussed within the larger medical and anthropological contexts in which the image of body and health for women is currently being discussed. Along with the completion of this study and research paper, my efforts will be directed at bringing this information back to women in college athletics.

Benefits of Research

For elite athletes, amenorrhea is often regarded as a relatively benign condition and only a consequence of training. Many in the medical community still think that amenorrhea is a normal adaptation of female athletes and it is normal for them not to have periods during athletic training, but amenorrhea is a symptom of something going wrong and could be a sign of a potentially serious clinical problem, or result in a future of ill health for the individual.

In examining the serious effect of menstrual dysfunction on bone health, this research contributes to the contemporary understanding of women’s long-term health. Furthermore, while exercise is viewed as widely beneficial to women of all ages, the pressure to succeed in sports by achieving or maintaining an unrealistically low body weight through food restriction and high intensity training may lead some women to develop eating disorders, amenorrhea, and osteoporosis. Thus, this research may also benefit the quality of life for elite athletes by informing them of the effects of high intensity stress loading on their skeletons, while also making these concerns available to a wider audience to illuminate the potential difficulties college athletes may have after their athletic careers.
Subject Selection

To draw together a sample for my research, I will operate using the following criteria: First, female subjects must be at an elite level. This does not mean they are professional athletes but, rather, have been highly competitive for at least four years. Subjects, including the control group, will be Division I athletes from Western Michigan University who are actively competing. Second, participants must be able to accurately assess menstrual status. This will be determined through the use of a questionnaire and based solely on recall. Menstrual status will be described as one of the following: amenorrheic, 0-3 cycles per year, oligomenorrheic, 4-9 cycles per year, and eumenorrheic, ten or more cycles per year. Lastly, subjects must not be on any oral contraceptives due to the effects of estrogen on bone production.

Risk to Subjects

I anticipate no risk to those who act as my subjects during the four months that I conduct my research. All participants will have full disclosure as to who I am, what I am studying, and the step taken to protect their identity. Each individual will assigned a pseudonym that will be used at all times in my field notes and on questionnaires. All subjects will be participating on a voluntary basis, with the freedom to cease participation at any time, without prejudice.
Protection for Subjects:

All participation on the part of subjects will be strictly voluntary, as noted above, in addition, participants will be assigned pseudonyms for their confidentiality. I will be the only one aware of the true identities behind these names. Exemption will be requested from the Human Subjects Institutional Review Board due to the fact that no medical procedures will be performed on the subjects.

As participation is voluntary, withdrawal from the investigation, for whatever reason, will be accepted at face value. Upon request, all information regarding the withdrawing subject will be removed from my files and destroyed.

Confidentiality of Data

All data will be collected through the use of questionnaires and informal interviews. I do not intend to use a tape recorder, video camera, or any other type of recording device. Data will consist only of words, written on the questionnaires. All of these documents, as well as any other related documentation, will be kept in a locked file drawer in the office of my principle advisor, Dr. Pamela Stone, for a period of at least 3 years.

Informed Consent Process

Informed consent will be achieved through a form in which subjects sign to agree to participate in the study. The written consent discloses the right to voluntarily withdraw at any time.
Schedule

As stated, research in this project will be conducted for a four month length of time beginning in September, 2003 and will extend until December, 2003 to ensure that a maximal amount of subjects are obtained from a range of sports including gymnastics, skating, cross-country running, and track. This length of time will help promote trust in the researcher by the participants and allow for more data collection opportunities. Research and analysis will be completed by February, 2004 and the writing, and all revisions will be completed by August of that year.

Summary and Conclusion

This research and further study into athletic amenorrhea and its effect on bone density is extended to and beneficial for women’s health. The notion of menstrual regularity and health is part of an ideology in which the cultural construction of femininity can be viewed. The text above has demonstrated the ideals about menstrual regulation in athletes, but I believe it is pivotal in understanding women’s health. While there is increasing recognition of women participating is sports at all levels, there is also growing awareness that biological differences between the sexes may require different training rules and practices for men and women, especially young female athletes. Bringing the awareness of the ill effects of menstrual irregularity to female elite athletes will hopefully contribute to the evaluation and management of menstrual dysfunction and the long term effects of exercise related disorders.
Outline of thesis

I. Purpose
   A. Conceptual framework
   B. Review of the literature

II. Methods
   A. Setting
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   D. Data collection
   E. Questions
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III. Findings
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IV. Conclusions
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