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Stress: Origins and Management Techniques Used Among College Students

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ABSTRACT

This study replicates previous research in assessing perceived stress levels, primary sources of stress and coping mechanisms used among college students. Additional purposes are to determine how effective these preferred coping activities are in relieving stress and to determine if any differences exist among selected variables i.e., gender, year in school, race, and whether or not a student was involved in collegiate athletics. Three scales were used to determine these relationships. Women reported higher levels of perceived stress than did men also; a greater number of hassles in their everyday lives and were unsure of their future after college when compared to men. Black athletes had less perceived stress, were more socially active, and spent more time using functional methods to relieve than did all other subgroups. The most utilized functional methods for managing stress were social activities, napping, exercise, eating, sex, and watching television. Unfortunately, these methods have not been proven ways to directly and effectively manage stress.

Stress: Origins and Management Techniques Used Among College Students

INTRODUCTION

According to the National Mental Health Association (1996), 75-90% of visits to physicians are stress related (Donatelle & Davis, 1999). Job stress is a major health factor costing businesses an estimated $150 billion annually. Stress-related disorders are a major cause of rapidly increasing health care costs (Bradley, 1997).

These statistics are staggering and continue to escalate as schedules become more crammed, people's lives are busier, and chaos seems to reign. The impact of stress in our lives is overwhelming and perhaps, at times, underestimated. Americans appear to have become used to a high degree of stress every day. Many people may have difficulty discerning when stress has increased to dangerous levels, leading to a series of negative outcomes such as illness or a mental health disorder.

Stress is an inevitable yet essential part of life. All kinds of events, positive (buying a house, getting a new job, attending college, moving into the dormitory or renting an apartment for the first time) and negative (having a job you hate, getting a divorce, fighting with a spouse or boyfriend/girlfriend, preparing for an exam) bring out the specific response of the body we all know as stress.

Not all stress is bad. In fact, some can be good for us. A healthy amount can make life stimulating and exciting (Battison, 1997; Cunningham, 1997). It is necessary for us to concentrate, make decisions, and function in a positive manner. It can keep us on our toes and be

a real motivator for change. There is nothing like a little stress and fear to create a challenge, perhaps allowing us to reach places we never dared to venture before. You can probably relate this to feelings you experience as an important event draws near. Your body is designed to deal with the pressure, and after the event, you relax and your body slows down again. It is only when this pressure, or stress, becomes intense that you are unable to relax and you feel "distressed" (Battison, 1997). You feel out of control, you are no longer able to handle the demands made on you, and you begin to feel unwell.

Stressors usually do not come one by one. They travel in packs. It is the combination and culmination of them that cause most people to experience negative health outcomes.

Stress is the physical, emotional and mental response to various events or conditions (Cunningham, 1997). Feeling stressed is a state--like being happy, sad, excited or angry. It is a physiological, emotional and mental storm that occurs in the body when faced with anything uncertain, unpleasant, frightening or confusing. Being "stressed out" is when your body, mind and heart cannot comprehend handling or facing one more event or circumstance.

Where does our stress come from? What is stressful to one person may not be to another. When we look at where our stress originates, it is important to evaluate what caused great distress to us as children. Was it being left alone (abandonment), having strangers near us, speaking or having to perform in public, divorce of parents or early trauma of some kind?

These early experiences set the stage for what could be, and may cause, stress for us as adults (Cunningham, 1997). How one learned to manage stress and fear as a child may provide insight to coping techniques as adults.

REVIEW OF THE LITERATURE

In this section, the review of the literature has been divided into six sections: Definitions of stress and the body's response to stress; stress: its historical development; nutrition and stress; lifestyles related to stress & coping mechanisms; stress management among college students; and an overview of instruments selected for use in this study.

Definitions of Stress and the Body's Response to Stress

There's a common, yet mistaken, impression about stress: that it's always something bad. Not true. Stress has been defined as the response of the body-mind to any demand. So it is essential to life. Breathing is stress. A heartbeat is stress. Walking, sleeping, thinking, even intimate contact is stress. In other words, stress cannot be avoided. Without stress, life as we know it would not be possible.

Hans Selye, M.D., the father of stress research, defined stress as that which accelerates the rate of aging through the wear and tear of daily living (Selye, 1950, 1975, 1978). How you respond to or handle stress, he felt, is closely tied to your overall body-mind efficiency, including the effectiveness of your immune system.

One definition of stress, reduced to its simplest terms, "stress is a heightened state of bodily functioning triggered by the release of certain adrenal hormones, especially epinephrine and norepinephrine, which allows you to cope with or adapt to changing circumstances" (Chrousos & Gold, 1992). Stress is, therefore, adaptation energy. Stress is not good or bad in and of itself. How we perceive and control stress is of primary importance. Stress which you want and, for the most part, can control is perceived as powerless. It is perceived as bad, or negative, when our body-minds are overwhelmed with negative stress. It then becomes distress, which, if not altered, can lead to acute and chronic disease and, ultimately, to death.

Selye identified three stages the body-mind goes through in a stress reaction, a process he called the General Adaptation Syndrome (Selye, 1950).

Stage One (the Alarm Reaction)

This is our initial response-stage to stress. It is our body's call to action: the "fight or flight" response triggered by a perceived threat. Internal changes which occur during the alarm phase include increased sugar and fats being released into the bloodstream for immediate energy. Heightened muscle tone prepares the body for immediate action. Increased pituitary gland function stimulates increased production of adrenalin and glucagon. Blood is diverted from the digestive system to the brain, as attention and alertness increase.

Stage Two (the Resistance Stage)

If the stress continues, the body enters this stage in which you consciously, or unconsciously, perceive a threat. Your body-mind continues to stay in a heightened, state of physiological alertness, a "never-ending readiness for the worst." It is this adaptation process which is most responsible for stress-related illness, due to the constant arousal and the ultimate fatigue and resulting malfunction of specific organ systems.

Stage Three (Exhaustion of body function)

If this stress arousal continues, overall exhaustion occurs. Disease, illness and death could follow. Sometimes exhaustion of one weakened system will shift the resistance to a stronger body system, forcing that system into the adaptation process. For example, essential hypertension (high blood pressure) may not initially be life-threatening, inasmuch as the body can adapt to it by shifting the burden to the heart or kidneys, which can ultimately become exhausted, resulting in irreversible disease.

Various surveys (Giordano, et al, 1986; Irmie, et al, 1989) show that stress-related problems contribute to 80 percent of all major illnesses, including cardiovascular disease,

digestive disorders, mental illness, musculoskeletal disease, cancer, endocrine and metabolic disease and chronic infectious disease. One in three Americans surveyed suffered from job stress and burnout (Giordano, et al, 1986; Irmie, et al, 1989).

Since it is impossible to avoid all negative stressors, our best bet is to learn consciously to identify them and learn to deal with them. Following is a list of telltale stress signs. If you have seven or more, there's a good chance you're over stressed (Hoffmann, 1987):

- cold hands
- eyestrain
- frequent gritting of the teeth
- repeated headaches
- high blood pressure
- irregular and shallow breathing
- easy irritability
- nervous movement of the knees and hands
- sudden change of appetite
- loss of interest in sex
- inability to sleep or oversleeping
- upset stomach
- poor concentration
- difficulty in thinking
- non-stop anxiety and/or depression
- low self esteem
- excessive drinking or smoking
- turning to the use of recreational drugs

Under severe stress, proteins from the thymus or lymph glands are converted to sugar for instant energy. Within 24 hours, the thymus, the key gland in the immune system, can shrink to 50 percent of its normal size, effectively neutralizing a crucial portion of our immune systems and its B and T cells from functioning normally.

Continued and unrelenting stress makes the body draw frantically on all available raw metabolic materials to cope. The dynamics involved in the destructive process of continued stress include the runaway production of cell-destroying free radicals, which must be neutralized by an ever-diminishing supply of antioxidants, such as vitamins C and E, beta carotene and the mineral selenium.

Another consequence of severe chronic stress is the over-production of our bodies' natural tranquilizers and pain-killing endorphins. These, in large amounts, can become neuro-suppressive and prevent the cells in our nervous systems from firing properly. They are also immunosuppressive, thereby weakening our resistance to disease by destroying T4 helper cells, Natural Killer Cells and macrophages which comprise the core cells of our immune system. The over-production of endorphins can also upset the balance of our endocrine glands (Zucker, 2000).

Under extreme stress, the amount of protein used up in a day may equal that supplied by four quarts of milk (Zucker, 2000). By replacing the protein, we can often slow or stop the stress-related destruction of tissue.

By taking extra vitamin A, when under chronic stress, it is possible to support the adrenal (kidney) function to prevent the over-production of cortisone, which can destroy lymph cells, severely decreasing the effectiveness of the immune system (Langer, 1996).

Chronic stress may often result in a deficiency of pantothenic acid (vitamin B5) resulting in an inability of our adrenal glands to produce many essential hormones. If this vitamin deficiency is short-lived, adrenal gland changes can be reversed. However, long-term deprivation

of pantothenic acid may, in certain cases, bring on chronic adrenal problems. So, if you are under continuous stress, you would be well advised to support your diet with liberal amounts of supplementary pantothenic acid.

A daily supplement of a high-dose of vitamin C is also essential for proper adrenal functioning as well as for its detoxifying and antioxidant properties (Langer, 1996). Therefore, some physicians urge their patients to take between 1,500 and 3,000 mg/day of supplemental vitamin C and increase or decrease it to bowel tolerance, if they encounter severe and unrelenting stress.

Small deficiencies of linoleic acid can also depress adrenal function, so it is essential, when under stress, to supplement your diet with essential fatty acids.

Shortages of protein, vitamin B2 (riboflavin) and choline, also a B-vitamin substance, in chronic stress, can exhaust our pituitary gland, making it unable to synthesize the proper hormones to orchestrate the most effective endocrine response to chronic stress.

The best way to cope with stress, therefore, is through optimal nutrition and lifestyle changes, including adequate rest, pure air, plenty of aerobic exercise, quiet meditation and mental tranquility.

Stress: Its Historical Development

Living organisms survive by maintaining an immensely complex dynamic and harmonious equilibrium, or homeostasis, that is constantly challenged or outright threatened by intrinsic or extrinsic disturbing forces or stressors (Chrousos, G., et al, 1988). The steady state required for successful adaptation is maintained by counteracting/reestablishing forces, or adaptational responses, consisting of an extraordinary repertoire of physical or mental reactions that attempt to counteract the effects of the stressors in order to reestablish homeostasis. In this context, we define stress as a state of disharmony, or threatened homeostasis. The adaptive

responses can be specific to the stressor or can be generalized and nonspecific. The latter can be stereotypic and generally occur only if the magnitude of the threat to homeostasis exceeds a certain threshold. These contemporary concepts regarding stress have evolved over the past 2 ½ millennia (Chrousos, G., et al, 1988; Taylor, H., 1922; Singer, C., 1941; Medvei, V., 1982; Selye, H., 1950; Witzmann, R., 1981). In the beginning of the classic era, Heracleitus was the first to suggest that a static, unchanged state was not the natural condition, but rather that the capacity to undergo constant change was intrinsic to all things. Shortly afterward, Empedocles proposed the corollary idea that all matter consisted of elements and qualities in a dynamic opposition or alliance to one another, and that balance or harmony was a necessary condition for the survival of living organisms. One hundred years later, Hippocrates equated health to a harmonious balance of the elements and qualities of life and disease to a systematic disharmony of these elements. The terms "dyscrasia" and "idiosyncrasy" are derived from the Hippocratic concept of health and disease, meaning, respectively, a defective or peculiar mixing of the elements. Hippocrates also suggested that the disturbing forces that produced the disharmony of disease derived from natural rather than supernatural sources and that the counterbalancing or adaptive forces were of a natural origin as well. Thus, he introduced the concept that "Nature is the healer of disease," a notion later echoed by the Romans when they referred to the counterbalancing forces as Vis Medicatrix Naturae, or the "healing power of nature." Epicurus had, in the meantime, suggested that the mind could be among or influence these healing forces, and he wrote that ataraxia, or "imperturbability of mind," represented a particularly desirable state.

In the years of the Renaissance, Thomas Sydenham extended the Hippocratic concept of disease as a systematic disharmony brought about by disturbing forces, when he suggested that an individual's adaptive response to such forces could itself be capable of producing pathological

changes. Claude Bernard extended our notion of harmony or the steady state in the 19th century, when he introduced the concept of the milieu interieur, or the principle of a dynamic internal physiological equilibrium. Walter Cannon later coined the term "homeostasis" and extended the homeostatic concept to emotional as well as physical parameters. He also described the "fight or flight reaction" and linked the adaptive response to stress with catecholamine secretion and actions. In the 1930s, Hans Selye borrowed the term "stress" from physics and set it to mean the mutual actions of forces that take place across any section of the body. He hypothesized that a constellation of stereotypic psychological and physiological events occurring in seriously ill patients represented the consequences of a severe, prolonged application of adaptational responses. He referred to this state as the "General Adaptation or Stress Syndrome" and, in effect, redefined Sydenham's concept of diseases of adaptation.

Selye made it clear that not all states of stress, or threatened homeostasis, were noxious when he coined the terms "eustress" and "distress." Hence, he believed that mild, brief, and controllable states of challenged homeostasis could actually be perceived as pleasant or exciting and could be positive stimuli to emotional and intellectual growth and development. It was the more severe, protracted, and uncontrollable situations of psychological and physical distress that Selye believed led to frank disease states.

Nutrition and Stress

Nutrition

Nutrition is more than the food you eat. It's also how you digest, absorb and metabolize these nutrients. But assuming your body uses food well, there's ample evidence showing that what goes in your mouth has a good deal to do with your health and life expectancy.

Fiber or roughage, the undigested portion of plants, continually proves itself to be an invaluable part of a healthy menu. Upping your fiber intake, particularly with the water soluble

fiber found in dried beans and oat bran, is an inexpensive and safe way to lower blood cholesterol (Glore, et al, 1994). Dietary roughage also wards off constipation, improves diabetic symptoms, helps treat hypertension, decreases the risk of colon cancer and generally fills you up.

Decreasing the fatty foods you eat is an excellent way to battle heart disease, some cancers, high blood pressure and maintain a more slender waistline. Even immunity is compromised if you eat too much fat (Nirgiotis, et al, 1991). However, some fat is necessary to maintain health. Fish oils and essential fatty acids (EFA's), found in vegetable oils, are beneficial in the right amounts.

An example of how diet affects health is the ongoing 11 year old China-Cornell-Oxford project. Researchers discovered that Chinese who eat low-fat, high-fiber foods and exercise a lot have less cancer, obesity and heart disease (Anon, 1990; Ser Vass, 1990; Brody, 1990).

Food isn't something you probably associate with stress. But what and how you eat has a direct impact on how you feel (and stress often affects the foods you choose)(Glore et al, 1994; Nirigiotis, et al, 1991).

Irritability, sleeping troubles, indigestion, fatigue--all these symptoms can be due to stress. Diet is also a factor. So if you adjust your eating habits, chances are you'll feel better and be set to make other stress-reducing changes.

Your body likes routine. Like sleep, plan meals and snacks at regular times throughout the day. It would great if we could all just eat when we're hungry, the healthiest way to go. But busy lives don't allow this. Instead, we tend to put off eating when chores or stress intervene, or we eat out of frustration or fatigue.

A regular meal schedule allows you to relax before eating which aids digestion. Carry this leisurely attitude to the dinner table. Enjoy your meal, each taste and the texture of your food and

the people you're dining with. Notice when you're full and stop eating. Eating too fast or too much is stressful too (Glore, et al, 1994).

Busy times require planning. Besides setting up regular mealtimes, map out a week's worth of breakfasts, lunches and dinners. Include lots of fruits and vegetables (a minimum of five servings of both each day), lean toward whole grains like brown rice and whole wheat bread and pastas, and keep your protein at a good level with lean meats, skinless poultry, fish, beans and legumes, and even dairy.

Avoid sweet, fatty snacks during break time or late at night. Even though they taste good and seem to ease stress, too much sugar and fat do more harm than good. Although recent studies show that carbohydrates (of which sugar is one) calm most people down, long-term too many sweets add to your stress, not decrease it (Nirigiotis, et al, 1991).

Hypoglycemia, or low blood sugar, can mimic stress with irritability, shaking, and apprehension. For this reason refined sugar should also be avoided by anyone prone to anxiety or under a great deal of pressure.

Too much sugar or saturated fat increases your susceptibility to illness (Glore, et al, 1994; Nirgiotis, et al, 1991; Ser Vass, 1990). Excess fat can lead to constipation, increase your risk of heart disease, certain cancers, not to mention add weight; on the other hand, make sure you're getting enough of those essential fats found in nuts, seeds, fish and healthful oils like olive and canola. Salty foods deplete potassium, a mineral necessary for proper nerve functioning, so should be eaten sparingly.

The more your body has to handle, the more it relies on what you feed it. Stress ups nutritional needs. So poor food choices not only fail to meet your daily requirements, but can compound the problem. Elect, instead, to nourish your body with wholesome food, loving people, exercise, rest and plenty of TLC.

A low-stress diet is low in fats, refined sugar and starches. It is also relatively low in protein. The best low-stress diets consist of several small meals throughout the day, allowing you to maintain a continuous supply of energy (Zucker, 2000). Following a six-small-meals-a-day plan, consisting of breakfast, a mid-morning snack, lunch, a mid-afternoon snack, dinner and a mid-evening snack, will help maintain your energy supply. In addition, careful food selections at these mealtimes will help.

Some good choices to incorporate into a low-stress diet are: unsweetened fresh/dried fruits, unsalted nuts, raw vegetables, low-fat yogurt, cottage cheese and high-fiber breads. These foods are "preferable to the biscuits, cake, fruit loaf, chocolate and mayonnaise-laden sandwiches that usually comprise midmorning, afternoon and evening snacks," (Graham, 1998). Also, water and natural, unsweetened fruit juices help calm stressed-out nerves.

Stress-Triggers

Can some foods trigger or increase stress? Yes. These foods are called "pseudostressors" or "sympathomimetics," because they imitate stimulation of the sympathetic nervous system -- the part of the nervous system mostly involved in stress reactions (Zucker, 2000).

Caffeine

Anything containing caffeine, like coffee, tea and cola, is a potential pseudostressor. Theobromine and theophylline – both found in tea -- are also sympathomimetics. These chemicals produce a pseudostress response by accelerating metabolism and increasing alertness, and cause the release of stress hormones (such as adrenaline) -- which increase the heart rate and blood pressure. These chemicals also make the nervous system super-reactive, which means that it becomes more likely that stressors present in the body will produce a stress response. Habitual coffee-, tea- and cola-drinking is a factor in causing "many stress-related disorders and psychological disturbances, including anxiety states, depression and psychosis," (Graham, 1998).

These beverages are also all diuretics, things which increase the rate at which the body eliminates fluid. The diuretic effect, over time, causes dehydration and thickening of the blood, digestive disorders and metabolic imbalance.

Refined sugar and carbohydrates

Foods which have refined sugar and refined carbohydrates -- such as white flour, rice and high-fructose corn syrup -- are stressors, and a body under stress has an even harder time processing these carbohydrates (Zucker, 2000). In addition, taking in a lot of sugar in a short period of time (or missing meals and then consuming sugar) can result in hypoglycemia, which is marked by headache, dizziness, anxiety, trembling and irritability. A sugar-caused stress response and accompanying cortisol production raise blood glucose levels which, in turn, burden the pancreas. This heightened blood-sugar level leads to insulin resistance and can bring on fatigue, depression and emotional instability.

Fats

Consuming the wrong kinds of fat can cause "stress damage" to your body. The consumption of too much fat prevents your body from properly using carbohydrates, initiating the cascade of problems mentioned above.

Processed foods

Processed foods, such as junk foods and fast foods, contain synthetic additives -- preservatives, emulsifiers, thickeners, stabilizers and flavor-enhancers. Some of these, including Tartrazine and Sodium Yellow are thought to cause stress-related symptoms. These colorants are believed to excite the central nervous system, and have been implicated in stress-related conditions, such as childhood hypersensitivity, attention deficit disorder and certain allergies.

Alcohol

The diuretic and insulin resistance enhancing effects of alcohol add to the whole sugar-and-stress problems mentioned earlier.

In addition to maintaining a proper diet, exercise and plenty of rest are needed to reduce stress and maintain a good, healthy energy level (Zucker, 2000).

Lifestyles Related to Stress & Coping Mechanisms

Although we've come to know stress as an emotional or mental strain, it can also refer to an imbalance of any health habit: eating too much sugar or fat, exercising too much or too little, not getting enough rest. Or it can mean exposure to pollution, poisons or excessive noise. Whatever the cause, repeated stress can lead to sickness.

Although much of our knowledge about stress's affect on health is anecdotal, research continues to be done on the link between disease and stress. Herpes (Schmidt, et al, 1991), menstrual cramps (Sigmon & Nelson, 1988), the common cold (Cohen, et al, 1991), angina (chest pain) (Yeung, et al, 1991) and even cavities (Sutton, 1990) are aggravated or brought on in part by emotional or mental stress.

We can't control everything about our health. Genetics, accidents, age and pollution are out of our reach. But we can make decisions about some things like diet, exercise, rest, smoking and drinking. The best life is made up of healthy choices.

Is it really true that how we live affects health? The research certainly says so. More and more studies keep pointing to sensible eating, regular exercise, no smoking, minimal alcohol consumption and less stress as the best ways to control disease and enjoy a higher quality of life.

Rest and Relaxation

Because of stress-and as a way to deal with a busy, stressful schedule-many people skimp on sleep. This is a big mistake. Less sleep not only deprives your body of necessary down time, but it can exacerbate stress and compound other health problems.

When you're doing laundry late at night because you're working all day or even getting up early to attend exercise class even though you're exhausted. Here are some common symptoms: (1) Tired people tend to be less civil and more irritable. (2) Productivity and mental clarity diminish (so you drink more coffee). (3) Sleepy children tend to get poor grades in school. (4) Traffic accidents are more likely. (5) Exhausted individuals are more apt to use alcohol and other drugs to compensate for fatigue (Streissguth, et al, 1991; Jenson & Pakkenberg, 1993). (6) The un-rested tend to get sick more often.

How can you tell if you're sleep deprived? Here are a couple of hints: Can you nap anytime, anywhere? Do you fall asleep as soon as your head hits the pillow? Do you need an alarm clock to wake up in the morning? If you answered yes to one or more of these questions, you're not getting enough sleep at night (Battison, 1997).

So what can you do? First make sleep a priority. Most people need at least eight hours a day. Also, develop a bedtime routine by getting ready an hour before sleep and always retire and awake the same time each day. Avoid alcohol, caffeine and heavy exercise several hours before bed.

Naps aren't just for babies. The afternoon siesta is an honored tradition around the world. If you hit a slump during the day (most of us feel a little sleepy after lunch)(Haus, et al, 1994,) catch a few winks. If you can't manage a nap, then relax. Bodies need both physical and mental breaks throughout the day. Instead of pushing through your fatigue, give your body what it needs, a rest. Don't work through your coffee break. Don't run errands while eating in your car during lunch. And if the housework needs doing, put your family to work so you can rest in the evening.

Caffeine

America's wake-up call, caffeine, is her downfall as well. This ubiquitous stimulant is found in coffee, black tea, chocolate, soft drinks and some medications such as cold remedies, diet formulas and wake-up pills.

It's easy to understand why caffeine ranks as the most popular drug in the world and the United States (about nine out of ten Americans consume caffeine) (Martin, 1991). Caffeine not only wakes you up, it also sharpens concentration and temporarily chases away the blues.

Unfortunately, most people use caffeine's stimulating qualities to prop themselves up during tense times. "In our society, the stress of day-to-day living has a tendency to 'wear out' our adrenal glands" (Feldman, 1995). Caffeine is an ideal way to squeeze more adrenalin and norepinephrine out of the adrenals for a boost of energy. This constant jolting is tiring for both you and your adrenals. The result is usually another cup of coffee, exhaustion and addiction.

Stress and caffeine build upon one another. You can't sleep at night because of stress; caffeine makes it worse. Stress sends you into mood swings; caffeine pushes you harder. Caffeinism, caffeine addiction, can't be turned off at will so sleepless nights and restless days take a toll on your already stressed-out body.

Besides adding to stress, caffeine causes "coffee nerves," that nervous, irritable, anxious feeling. Other complaints include insomnia, increased urination, headaches, irregular or fast heartbeat, stomach pain, breathing problems, excessive sweating, spots in front of your eyes, ringing in your ears and tingling in your fingers and toes (Lowinson, et al, 1997).

Give yourself a week to break the caffeine habit. Withdrawing from caffeine, even moderate usage, is difficult. Symptoms include headaches, fatigue, nausea, muscle pains, changeable mood and foggy thinking. To ease the pain of withdrawal, take extra vitamin C, drink calming teas like chamomile, peppermint and valerian and avoid other addictive substances like refined sugar and alcohol (Lowinson, et al, 1997).

Vitamins

Without vitamins we become very sick or die. Most vitamins come from our food; others are produced by our body. Vitamins K, B12, thiamin and folic acid are manufactured by micro-organisms in our intestine, while our skin uses sunshine to make vitamin D.

No one questions that vitamins are necessary for good health. However, scientists and doctors continue to debate the kind and amount of nutrients we need, and how vitamins really affect disease. In a perfect world food is the ideal source of vitamins. Unfortunately, cooking, storage, processing, refining, synthetic fertilizers, herbicides and nutrient-poor soil all steal some of food's nutrition. Stressful living conditions, pollution and inadequate eating habits demand that most of us supplement our diets with additional vitamins. In addition, your size, sex, age, health, physical activity, biochemical make-up and where you live all create individual vitamin requirements.

New research says that vitamins' effect on health is even more far reaching than we thought just a few years ago. Antioxidant vitamins, most notably C, E and beta-carotene, seem to protect against some cancers, heart disease and other illnesses. Vitamin B6 helps those with PMS, carpal tunnel syndrome and diabetes. Osteoporosis may be prevented with vitamin K. Most importantly, immunity, the body system that governs health in general, is affected by vitamins A, E and B6 (Machlin & Sauberlich, 1994).

Exercise

Washers, dryers and all the other labor-saving devices we've come to depend on have made life easier and getting exercise harder. Some have accepted this trend and lead sedentary lives. However, regular exercise, whether its aerobics class, walking or gardening, is essential for good health.

A very large study followed the exercise habits of more than 13,000 men and women for eight years. Less fit individuals died, mainly from heart disease and cancer (Blair, et al, 1989). In other research, exercise has been shown to help prevent osteoporosis (Nelson, et al, 1991) and some forms of diabetes (Manson, et al, 1991), treat high blood pressure (Somers, et al, 1991) and painful menstrual cramps (Golub, 1987), and control weight (Haus, et al, 1994).

Part of the problem, of course, is encouraging people to exercise. Some employers have taken it upon themselves to offer their workers fitness programs. The results are positive. Not only are employees more fit, but the company saves money with fewer on-the-job injuries, reduced absenteeism and lower health care costs (Gebhardt & Crump, 1990).

Besides controlling weight, regular physical activity lowers your risk for heart disease, hypertension, colon cancer and stroke. Exercise increases longevity and helps diabetics manage their condition better (Blair, et al, 1989). These facts alone should decrease stress.

Unfortunately, only one-tenth of Americans are exercising as much as they should (Healthy People 2000). This wouldn't be so bad except everyday tasks have become less taxing. This means occupational activity, the type of exercise you get from just doing your job or working around the house, contribute very little to physical fitness. Instead you have to squeeze "recreational" exercise into your already tight, stressful itinerary.

Before you get stressed out, let's look at why exercise should be part of your daily routine. First, it makes you feel better. Once you've been exercising for two months (make that a goal), you'll be hooked. Two, you'll look better. You'll smile easier, walk straighter, shed a few pounds and emanate a healthy glow. Lastly, stress will be much easier to handle-that project that usually takes two hours, may only require one and a half. There's your 30 minutes for physical activity. Not only does exercise remind tense muscles to relax, but you begin to breathe and forget about your worries, at least for a while.

Smoking

One way people try to control stress is by smoking. This short term solution, however, has many lifelong consequences, not only for you but your offspring as well.

Past studies have linked cigarette smoking during pregnancy to behavioral problems (Weitzman, et al,1992) and impaired intellectual development (Fogelman & Manor, 1988) in children. A 1994 investigation from the Universities of Kentucky and Wisconsin confirmed that it's not just smoking that harms unborn children but how long the mother smokes. Undoubtedly nonsmoking mothers deliver fewer low weight and premature babies than smoking women. However, women who quit during their first trimester, have healthy infants than women who smoked throughout pregnancy (Mainous & Hueston, 1994).

Adults who decide to smoke live shorter and sicker lives. Besides cancer, smoking increases your risk of heart disease, peptic ulcers, problems with pregnancy (Lowinson, et.al., 1992), decreases insulin effectiveness (Facchini, et al, 1992) and impairs immunity (Barton, et al, 1990). Those who elect not to smoke, but are exposed to second-hand smoke suffer almost as much.

Parents who smoke around their small children have been accused by some of child abuse. These kids suffer from more ear infections, colds, pneumonia and illness in general than their unexposed playmates (Fontelo, 1993).

In adults, passive smoking increases your chance of heart disease. Recently, researchers at the University of California in San Francisco offered one explanation for this. Scientists placed rats in a smoke-filled cage for six hours a day, five days a week. The longer the rats breathed in smoke, the larger were their myocardial infarcts, necrotic areas in the heart (Zhu, et al, 1994).

Alcohol

Alcohol is another substance we use to temporarily relieve stress. While research says that the occasional glass of wine decreases the incidence of coronary heart disease, in the larger scheme of things alcohol is anything but health promoting.

Almost 25 years ago, a group of New York investigators explored why alcoholics are more susceptible to sickness than the general population. One reason for this, they discovered, was diminished immunity (Brayton, et al, 1970). On top of this, alcohol tends to wash away nutrients, damage various organ systems such as the liver, cause some cancers, promote hypoglycemia (particularly in diabetics), and, ironically, hurt the heart when consumed in large quantities.

Early alcohol exposure, as in the womb, can result in fetal alcohol syndrome, a condition where a small brain, low IQ and poor judgment are evident. This disorder continues on into adulthood (Streissguth, et al, 1991).

People who drink as grownups also risk brain damage. A Danish study confirmed what we've always suspected: chronic alcoholism destroys white matter in the brain. This damage may be reversible in alcoholics who quit drinking (Jenson & Pakkenburg, 1993).

Many people use alcohol to relax. But this approach to stress reduction has far reaching effects. Short-term, drinking can cause hangovers, increased urination and thirst, and like caffeine, insomnia.

Habitual alcohol use can lead to abuse and serious health problems like cirrhosis of the liver, brain damage, gastritis, pancreatitis, peripheral neuropathy and lowered resistance to disease. While it's true that moderate drinkers have a lower incidence of coronary heart disease, this doesn't eliminate other health risks. Chronic drinking can, however, cause other heart problems like alcoholic cardiomyopathy.

Malnutrition is a risk when alcohol is your soother. Because alcohol is a high calorie drink, you eat less. Long-term or heavy drinking may cause inflammation of the intestine, stomach or pancreas thus disrupting digestion and nutrient absorption. When the liver is affected, so is vitamin activation (Jenson & Pakkenburg, 1993). Stress hikes your nutritional needs; alcohol reduces nutrient availability.

Stress Management Among College Students

The review of literature revealed no studies that had looked directly at methods that college students use, in general, to relax, unwind, cope, or reduce stress except for Dr. Michael Olpin's doctoral dissertation, which was conducted in 1996 at Southern Illinois University at Carbondale, Illinois. This present study is a repeat and follow-up of Olpin's research for his dissertation. While his research was conducted on the campus of Southern Illinois University, this research was conducted in a similar manner on the campus of Concord College in Athens, West Virginia.

Introduction

The instrument used for this study was developed by Dr. Michael Olpin (1996) and used by him during collection of data for his dissertation in 1995 and 1996 at Southern Illinois University at Carbondale, Illinois. The following section on methods of measuring stress is a duplication of information taken from Olpin's dissertation describing the methods of measuring stress that he used in the development of the instrument by himself and the human subjects' committee at the Southern Illinois University at Carbondale, Illinois. References to the literature in this section was made in his dissertation and not repeated in this study. This information was reprinted with permission from Dr. Michael Olpin, who now resides in Ogden, Utah, and is the Chair, Department of Health Promotion and Human Performance at Weber State University, Ogden, Utah.

Methods of Measuring Stress

Brannon and Feist (1992) mentioned that there are several approaches that have been used to measure stress, the most frequently used falling into three broad categories: performance tests, physiological measures, and self-reports, especially those that measure life events or daily hassles. Among health psychologists and health educators, self-report questionnaires are the most common approach to measure stress. For the purposes of this study, a self-report questionnaire was used.

There are several questionnaires that could have been used for this study. The one that was chosen was the Perceived Stress Scale (PSS) (Cohen, Karmarck, & Mermelstein , 1983). The Perceived Stress Scale (PSS) measures the degree to which situations in one's life are appraised as stressful (Cohen, Karmarck, & Mermelstein, 1983). It was designed to determine how unpredictable, uncontrollable, and overloading subjects find their lives (Cohen, Tyrrell, & Smith, 1993). In one study, the Perceived Stress Scale proved to be a very strong predictor of burnout and stress induced consequences (Hills & Norvell, 1991). The PSS adequately measures the degree to which situations in one's life are appraised as stressful with substantial reliability and validity.

Other scales that could have been selected for this study included the widely used Social Readjustment Rating Scale (SRRS) developed by Holmes and Rahe (1967). It measures the amount of change, using Life Change Units, a person is required to adapt to in the previous year. It was designed to predict the likelihood of disease and illness following exposure to stressful life events. Richard Lazarus followed this line of reasoning but speculated that it was the little annoyances or "hassles" that, over time, lead to ill health. He and his colleagues developed a Hassles Scale (Kanner, Coyne, Schaefer, & Lazarus, 1981; Delongis, Coyne, Dakof, Folkman, & Lazarus, 1982; Lazarus & Folkman, 1984) to assess the small yet potentially stressful events and

their affect on health. The Ways of Coping Inventory (Folkman & Lazarus, 1980) is another tool that assesses the appraisal of stressors and possible coping styles.

The Hassles Scale created by Kanner and his colleagues (1981) was assessed by Kohn, Lafreniere, and Gurevich (1990) who said it is "contaminated by items and a format which imply distressed physical and mental responses to stress as well as exposure to daily hassles." They went on to develop The Inventory of College Students' Recent Life Experiences (ICSRLE). The ICSRLE was designed to identify individual exposure to sources of stress or hassles and allow for an identification of the extent to which those stressors are experienced over the past month. It was developed uniquely for college students, as the sources of stress in a university environment are reported to be different from other settings (Burks & Martin, 1983; Sarason, Johnson, & Siegal, 1978). The ICSRLE was found to have a .59 correlation ($p < .0005$) against the PSS with an alpha reliability of .88. For the purpose of this study, the ICSRLE was used primarily to assess sources of stress among college students (Olpin, M., 1995).

IMPORTANCE OF THIS STUDY

This study had several purposes just as Olpin's 1996 study had. The first purpose was to assess perceived levels of stress experienced by college students. A second purpose was to detect the primary sources of perceived stress among college students. A third purpose was to determine the activities students routinely participate in to reduce stress, relax, unwind or cope with individual pressures and how often they participate in these types of activities. A fourth purpose was to determine how effectively these preferred relaxing, stress managing, coping activities reduce perceived stress. A final purpose was to determine if any differences exist among selected variables (gender, year in school, race, and age) for perceived stress levels, sources of stress, and methods for managing stress. In addition to the above final purpose, I added two more selected variables to the final purpose, which was not included in Olpin's 1996 study: Commuter versus

non-commuter and athlete versus non-athlete.

RESEARCH QUESTIONS

The research questions posed for this study, with the addition of questions six and seven, were the same as they were for Olpin's study which included:

1. What do college students perceive to be the major source(s) of stress?
2. Is there a relationship between the major sources of stress and the levels of perceived stress among college students?
3. What methods do college students actively participate in to reduce stress?
4. Is there a relationship between the amount of stress perceived by college students and the amount of time they spend involved in stress reducing or relaxing activities?
5. What differences exist by gender, by age, by race, and by year in school, for perceived levels of stress, sources of stress and for methods of managing stress?
6. What differences, if any, exist between commuter and non-commuter for perceived levels of stress, sources of stress and for methods of managing stress?
7. What differences, if any, exist between athletes and non-athletes for perceived levels of stress, sources of stress and for methods of managing stress?

DATA COLLECTION

Results were obtained from a survey of 357 students enrolled in two sections of SOC 101, Introduction to Sociology; two sections of PSY 101, Introduction to Psychology; one section each of PSY 220, Life-Span Development, PSY 222, Child Psychology, and PSY 300, Basic Learning; one section each of HED 303, Principles of Mental and Emotional Health, HED 304, Principles of Nutrition and Weight Management, and HED 415, Community Health and Health Promotion during the spring, 1999 semester at Concord College in Athens, West Virginia. The

subjects for this study were predominantly white and black (88.5% and 5.9% respectively) males and females (39.2% and 60.8% respectively) between the ages of 18-23 (92.1%) (Tables 1, 2 & 3). The representation of sophomores, juniors, and seniors was fairly even (18.5%, 16.8%, and 13.8% respectively) with the largest proportion of subjects being freshmen (50.9%) (Table 4). Commuters totaled 43.7% of the population while students who live on campus made up the majority with 56.3% (Table 5). Athletes represented a mere 15.4% while non-athletes represented 84.6% of the group surveyed (Table 6). Survey packets were distributed to all sections during normal class hours and with the preapproval of the professor. Students were asked to voluntarily complete the survey instrument after reading a one-page cover sheet describing the instructions for completing the survey. Participants were asked to read opening instructions and responses thoroughly before marking their responses. Provided to participants was a pre-sharpened number two pencil (to relieve the stress of not having one) and a Scantron Answer Sheet, which was used for their responses.

The Survey Packet (Appendix A) consisted of The Perceived Stress Scale (PSS), The Inventory of College Students' Recent Life Experiences (ICSRLE), The Relaxation Frequency Inventory (RFI) and a demographic questionnaire consisting of 86 questions taking most students less than 20 minutes to complete. The Perceived Stress Scale was meant to assess an individual's stress and provide a numerical index to represent current stress levels (Olpin, 1996). The Inventory of College Students' Recent Life Experiences measured the frequency and intensity of hassles known to be stressful on college campuses. The Relaxation Frequency Inventory listed common methods that people use to relax or manage stress. It was designed to assess the frequencies that people participate in those activities. The demographic questionnaire was designed to gather descriptive characteristics of the subjects.

TABLE 1. RACE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1=white not of Hispanic origin	301	84.3	88.5	88.5
	2=black not of Hispanic origin	20	5.6	5.9	94.4
	3=Hispanic	2	.6	.6	95.0
	4=Asian or pacific islander	10	2.8	2.9	97.9
	5=other	7	2.0	2.1	100.0
	Total	340	95.2	100.0	
Missing	9.00	17	4.8		
Total		357	100.0		

TABLE 2. GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1=male	134	37.5	39.2	39.2
	2=female	208	58.3	60.8	100.0
	Total	342	95.8	100.0	
Missing	9.00	15	4.2		
Total		357	100.0		

TABLE 3. AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1=18-19	191	53.5	56.0	56.0
	2=20-21	87	24.4	25.5	81.5
	3=22-23	36	10.1	10.6	92.1
	4=24-25	5	1.4	1.5	93.5
	5=26 or above	22	6.2	6.5	100.0
	Total	341	95.5	100.0	
Missing	9.00	16	4.5		
Total		357	100.0		

TABLE 4. RANK IN COLLEGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1=freshman	173	48.5	50.9	50.9
	2=sophomore	63	17.6	18.5	69.4
	3=junior	57	16.0	16.8	86.2
	4=senior	47	13.2	13.8	100.0
	Total	340	95.2	100.0	
Missing	9.00	17	4.8		
Total		357	100.0		

TABLE 5. STATUS - COMMUTER OR RESIDES ON CAMPUS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1=commuter	153	42.9	43.7	43.7
	2=live on campus	197	55.2	56.3	100.0
	Total	350	98.0	100.0	
Missing	9.00	7	2.0		
Total		357	100.0		

TABLE 6. ATHLETE VERSUS NON-ATHLETE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1=athlete	55	15.4	15.4	15.4
	2=not an athlete	302	84.6	84.6	100.0
Total		357	100.0	100.0	

METHOD OF ANALYSIS

The survey instrument contained four sections. The first, The Perceived Stress Scale, consisted of ten questions. Each question's response variable ranged from one to five (actually

from a to e on the survey) and were entered for analysis in nominal scale. The second section, The Inventory of College Students' Recent Life Experiences, consisted of forty-eight questions. Each question from this section response variable ranged from one to four (actually from a to d on the survey) and were entered for analysis in nominal scale. The third section, The Relaxation Frequency Inventory, consisted of nineteen questions. Each question's response variable ranged from one to five (actually from a to e on the survey) and were entered for analysis in ordinal scale. The final section, the demographics section, consisted of seven questions with response variables ranging from one to two up to one to five and was entered for analysis some nominal and some ordinal which were dependent on the form of answers required. The missing variable used during data analysis was "nine." The five selected variables (gender, year in school, race, commuter versus non-commuter, and athlete versus non-athlete) were classified as the dependent variables and cross-tabulated against each question answered from the independent variables (PSS, RFI, and the ICSRLE) to determine measures of association. Frequencies were calculated for each of the five selected variables and also for each response of the survey and then cross-tabulated again to determine measures of association. After considering this, totals for the entire population were considered. Means and ranges were calculated for each question from the three inventories (PSS, RFI, and the ICSRLE) which made up the survey. Percentages were calculated for each subgroup within the five selected variables (demographic section of the survey) and for each question within each of the three independent variables (PSS, RFI, and the ICSRLE). Pearson Chi-Square values less than .05 were not considered significant. Direct correlations between questions and groups were not used in this study due to the nature of the responses being in the ordinal or nominal scales. This type of analysis would not have produced a reliable outcome and would have been a waste of valuable time. Comparisons among the five selected dependent variables and the three inventories were not calculated at this time due to the

limitations of this study and to time constraints, but are being considered for future study in order to fully answer research questions two and four. Age groups were also not considered but may be at a later time. Data analysis was conducted using the SPSS Graduate Pack Version 10.0 computer application.

LIMITATIONS OF THIS STUDY

There were several weakness and considerations worthy of notation to this study, not only as the data was entered, but also while the surveys were being conducted and during analyzing and tabulation of the data. Some of these include the fact that students in morning sections seemed to be more responsible and concerned in answering the questions accurately than did the students in sections during the afternoon. Several response sheets (38) were not considered for analysis due to the fact that some responses were marked hurriedly and inaccurately by using the same response variable. Some response sheets were answered all "a." Others were turned in without a single response marked with only a name at the top. Students were plainly advised not to place their names on the response sheet. It was obvious who had responded accurately and who had not. This leads me to fear whether or not my data had been skewed one way or the other. One must also wonder if students had read and understood the directions for each section before proceeding to answer the questions. One possible reason for this conduct was that professors in two sections surveyed advised students that when they had finished with the survey they were excused from class for the day, although it was mandatory they complete the survey before leaving. This may have caused students to be less thorough and precise with reading instructions and when responding to answers. The fact also remains that some of the individuals surveyed may have rated their stress levels differently on the day surveyed rather than as their life as a whole. Stress levels and factors relating to stress may have been exaggerated while some

may have not been considered at all. Some subjects may perceive preparing for an examination highly stressful, others may perceive a dispute with a boyfriend or girlfriend just part of everyday life and not something which leads to stress. Another limitation of the study was that students had to recall, while sitting in a classroom, stress levels, hassles, and use of stress managing activities. The student's' recollection of these may not have been entirely accurate (Olpin, 1996). Although much time and effort went into research for the review of the literature for this study, time was limited for the preparation for data collection, entry, and analysis, which could have been detrimental to the outcome of the study. Also, money was limited for the funding of such a monumental project.

RESULTS

Some interesting findings resulted from the students who responded to this survey. A few were the same as for Olpin's study, but some were very different. The chief stressors according to the Inventory of College Students' Recent Life Experiences were academic related and their life away from home. These stressors included a lot of responsibilities, struggling to meet their own academic's standards, not enough leisure time, dissatisfaction with school, not enough time to meet obligations, and worries about making important decisions about their future career. The majority stated that they were dissatisfied with school and that there was not enough time for leisure nor time to meet obligations in their life (87.7% and 87.2% respectively). This was an interesting finding because there was very little relationship between those who commute and those who live on campus. Freshmen appeared in the majority (54%) of subjects that did not have control over their time with seniors appearing to have more of a handle on things. Freshmen also stated that they were more unsure about their future than were the other subgroups. Athletes had the highest percentages of those surveyed who did not express anger and who were the most satisfied with their surroundings. Their levels of perceived stress were among the lowest of the

totals with the exception of their dissatisfaction with their athletic skills. This could stem from the fact that most athletes are receiving some sort of athletic scholarship which would account for their perceived stress levels and stressful life experiences to be low. Olpin's research (1996) revealed additionally that students were under other sources of stress such as financial burdens, lower grades than you hoped for, struggling to meet your own academic standards, and too many things to do at once, which was not the result of this study. There still seems to be a direct correlation between the number and intensity of stressors and the levels of individual stress.

Students of this survey use social activities (95.5%) to manage stress but amazingly 50.4% of those surveyed did not partake in the consumption of alcoholic beverages. National statistics (1995) showed that the majority of motor vehicles accidents caused by an intoxicated driver were under the age of 18 but that number is rapidly falling. The falling numbers could account for increased community awareness programs, DARE programs in public school systems, and an increase in self-responsibility from teenagers. Activities such as eating, watching television, taking short naps, and sex ranked among the highest activities used for managing stress. Pearson Chi-Square value of freshmen and sex as a method of relieving stress was .446. Just as interesting as the statistic on alcohol consumption, were the facts that 67.4% of those surveyed did not use tobacco products at all, 83.1% did not use drugs to manage stress, and 63.6% stated that they were exercising at least between two to four hours or greater per week. These are interesting findings based on the national averages. Based on findings found from the analysis from the Perceived Stress Scale, the effectiveness of these common methods students use to manage stress are not shown to be effective at doing so.

Women reported higher levels of perceived stress than men and also reported higher levels of hassles than did men. Olpin's study (1996) showed a difference of women not reporting higher scores than men on the ICSRLE and that men were under more hassles of everyday life

than were women. Body relaxation techniques, meditation, mental activities, and sex ranked among the highest of all the coping mechanisms women used to relieve stress with Pearson Chi-Square values of .334, .148, .435, .361 respectively. Other demographic variables showed very little, if any, difference between stress levels, perceived stress and unwinding techniques used. Freshmen did shown higher intensities of perceived stress and hassles than did any other rank and commuters displayed somewhat fewer hassles than did students living on campus probably do to the fact that they can leave campus when they wish to return to the comforts of home and under the shelter of their parents. More recent modifications made by Olpin to the instrument used in this study, from that which was used in his original study, may account for variations in the findings. Comparisons between groups as well as additional tables will be added as a follow-up study using the SPSS statistical software as I work toward completion of my dissertation.

It was very interesting that Olpin's work suggested that as stress levels go up, so do the number and intensity of hassles, or the more likely conclusion is that as the number and intensity of sources of stress goes up, so does the perceived level of stress. Similar analogies can be made from the analysis of the data produced from this study.

Although athletes revealed the highest exercise rates, women ranked higher than men overall when it comes to physical activity of more than three to four hours per week. It can be assumed that athletes most likely included regularly scheduled practices and other sport related activities required of their sport while in season rather than consider other extracurricular high intensity activities when not in season. Most lower division collegiate athletes perform very little high intensity activities when not in season. Athletes spent more than four hours per week napping, probably, again, being considered only during in season activity. It was interesting to see that athletes participated in a high level of social activities but refrained from sex (which was high among the whole population), and from alcohol, drugs, and tobacco. The latter was not

surprising due to the high degree of physical fitness that is required of a collegiate athlete but refraining from sexual activity was a little unexpected. Athletes have a need to rank high up on the social ladder and with popularity come persuasion and peer pressure from the opposite gender. The favorite overall past time athletes used as a means to relieve stress was watching television with a Pearson Chi-Square value of .246. This could suggest to a high degree that athletes spend a great deal of time watching sports related activities on television but also, may have considered watching game films for the justification for their answers.

The most utilized functional methods for managing stress were social activities, napping, exercise, eating, sex, and watching television. Interestingly, these higher-ranking methods are not directly related to reducing stress such as those used less frequently like biofeedback, body relaxation techniques, meditation, massage and mental activities (Olpin, 1996). Stress reduction is only perceived by students in these other dysfunctional stress managing activities. This could be why stress levels only continue to stay high when students feel they are doing everything they can do to relieve tension and stressful conditions. They are only fooling themselves and in reality only adding to the intensity of the hassles.

Olpin's study (1996) referenced a study by Endres (1992), which I was not able to find information on, that among the population surveyed in his 1996 study, students used talking with friends, going to the movies, sleeping, and sports, exercise and recreation as their primary methods in managing stress. Talking with other students in the class was used far more than any of the other methods in his study. This study displayed close comparisons in that social activities were among the highest of all coping methods used by students at Concord College.

Another study Olpin (1996) referenced was Prendergrast (1994) whose study said that among college students nationally, apart from alcohol use, 21 percent reported using drugs in the past month. This number included marijuana use. The instrument used in my study combined

marijuana with tobacco and place them into one category: smoking. The results from this study reported monthly drug use to be only 7 percent with 83 percent of the sample having never partaken in the use of drugs. This could be due to more comprehensive health education and drug awareness programs stemming up all over the United States.

The last group I looked at was race. According to Olpin's study (1996), blacks spent more time using functional methods of managing stress the whites. In this study, blacks, based on percentages and frequencies, had less perceived stress, was more socially and physically active, but displayed very little difference in hassles when compared to whites. Blacks did spend more time using functional methods to relieve stress than did whites, primarily talking with family and friends, and in time management activities. Black athletes were also among the lowest with perceived stress levels and a higher degree of self-satisfaction and confidence in themselves as students and as athletes. Many years ago these results would have been much different, but in today's athletic society black athletes, with the assistance of the media, have truly set the performance levels for all other athletes to reach for. Due to the low number of black athletes who completed the survey, this evidence is not generalized in my study.

No other differences varied enough, without further analysis, among any of the other selected variables that are worthy of reporting at this time.

DISCUSSION AND CONCLUSIONS

Based on the results of this study, it can be concluded that college freshmen rank among the highest with perceived stress out of the four subgroups. They also had the highest scores when it came to actively participating in social activities, which also included other nonfunctional activities such as drinking, smoking, and a slightly higher percentage in the use of drugs as coping mechanisms to relieve stress, or at least this seemed to be their favorite past times. Taking into consideration that freshmen are out from under "the wings" and watchful eyes

of their parents for the first time could account for higher percentages in these areas. Concord College admission's statistics (1999) revealed that freshmen returning for the start of their sophomore year were only 72%, not including those being placed on academic probation or suspension, as compared to the other three class ranks of more than 90%. Freshmen seemed to be the most irresponsible and unsure of their future as compared to the other subgroups. I was a freshman once, many years ago, and I can remember that all I wanted to do was "sow my wild oats" willing to try anything for the first time. As I grew older, I realized how foolish and wasteful these activities were and after twenty years decided to come back and give it one more try with a much more successful outcome. With this in mind, a comparison between non-traditional students and traditional students' college success would probably reveal some interesting facts.

Women displayed higher stress levels than men and seemed to increase with college rank. This could be related to women having thoughts of graduating college and then having to go out into the world to make it on their own. Men seem to be more confident when it comes to confronting the job world.

It was interesting to find that athletes were more confident in their personal abilities and that they had some of the lowest scores both on the PSS and the ICSRLE. Possible reasons could include that athletes spend a great deal of time preparing for game situations and sharpening their personal skills and abilities. Coaches also spend a great amount of time praising their athletes which help to build confidence and personal satisfaction. These attributes can be carried over into everyday life situations which could lead to less perceived stress and hassles of daily life. Spending time with peers and camaraderie between other athletes also give them a "way out" and a shoulder to cry on, so to speak. Because of this, athletes seem to spend less time alone, therefore, less time to ponder on perils of the day and life in general. Social activities such as

watching sporting events on television are also spent most of the time with other athletes and coaches. Overall, athletes are a part of a family away from home which seems to be a ruling factor in their lives. This cannot be observed in most of the other subgroups. One has to wonder if students who are members of fraternities or sororities would have the same or similar results.

It can be concluded that overall, as the frequency and intensity of stressors increase, levels of perceived stress also increase. Considering all of the methods of stress management used in the RFI, subjects of this study and Olpin's 1996 study predominantly do not participate generally in those activities that are directly designed to reduce stress as much as activities that reduce stress as a byproduct during participation. On average, subjects of this study participated in dysfunctional methods of managing stress more often than the functional methods of managing stress. Functional methods used by students to manage stress did not effectively reduce stress; also, the dysfunctional methods resulted in higher levels of perceived stress.

Based on the results of this study and the results of other research in this area, Colleges across the nation should be concerned with students perceived stress levels and management techniques they are using to cope with stressors upon arrival at their institutions. They may be, but are they doing anything about it? Not that I have seen. My recommendation would be to employ someone knowledgeable in these areas to provide stress management workshops for students as well as faculty, and to provide a means for students to increase their awareness levels of alternative and more functional methods of managing stress.

Recommendations for further research

Several approaches could be taken to improve on this research project:

1. A limitation of the study was that students had to recall, while sitting in a classroom, stress levels, hassles, and use of stress managing activities. The student's' recollection of these may not have been entirely accurate. A more accurate survey may be a daily

inventory similar to daily diet inventories. Recalling and marking at the end of the day, the answers to the questions may provide more rich data. Rather than recall over the past month, a daily inventory taken for a month's time would be more accurate (Olpin, 1996).

2. Include in the demographics section a choice for marital status and working status and analyze the differences that may exist with this variable (Olpin, 1996).
3. The survey did not sufficiently address environmental conditions such as work setting, dorm or apartment, out of doors, or church (Olpin, 1996).
4. The survey did not address the amount of sleep that subjects get per night as a factor in stress management (Olpin, 1996).
5. Having students respond to the questionnaire at different times during the school year may yield different results. Stress levels may be different closer to final exam time, or at the very beginning of a calendar school year (Olpin, 1996).
6. Ask professors of sections surveyed to remind students that class will remain in session after the survey has been completed.
7. Include in the demographics section a choice for whether students are enrolled full-time, part-time, or non-traditional.
8. Include in the demographics section a choice as to whether student's' college expenses were being paid through financial aid, assistance from parents/guardians, or it they were having to work their way through college on their own.
9. A question could also be added in the demographics section to determine if students came from a single-parent dwelling
10. The survey did not address other issues such as STD's, eating disorders and other health related issues as factors in stress management.
11. Taking into consideration that students are more relaxed and sharper in the morning hours

of the day, the survey could be conducted in morning sections and possibly compared with a survey conducted in afternoon sections.

12. On the demographics section, have a response as to whether students are a member of a fraternity or sorority.

13. The population of black athletes and blacks in general should be larger in order to attain more accurate information to include in data analysis.

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APPENDIX A

Please Read this page before going on to the next page.

Dear Student:

This survey is part of a study being conducted by Gilbert O. Catron, a McNair Scholar at Concord College, Athens, West Virginia. The purpose of this survey is to determine various pieces of information with respect to stress as it occurs in your life and what you do to handle stress. There are no right or wrong answers. Your responses may help in the development of stress management activities, services, and programs for college students.

The survey will take less than 15 minutes to complete. Participation in this study is voluntary. You should feel confident about answering these questions because:

- You do not give your name anywhere on the papers. No attempt will be made to identify you in the results.
- Results of this study will be reported only in terms of group scores.
- This project has been reviewed and approved by the SIUC Human Subjects Committee during a previous dissertation study by Michael N. Olpin at the University of Illinois at Carbondale, Illinois in 1996. The committee believes that the research procedures adequately safe guard the subjects' privacy, welfare, civil liberties, and rights. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson. Office of Research Development and Administration, Southern Illinois University, Carbondale, IL 62901-4709. Phone: (618) 453-4543.

If you choose to participate, please complete the survey packet as truthfully and completely as you can. You may direct all questions concerning this research to Dr. Michael N. Olpin, Department of Physical Education & Health, Concord College, Athens, WV.

Please mark <u>all</u> of your responses on the accompanying scantron.

<u>Do not</u> answer any question directly on this Survey Packet.

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the number of times you felt a particular way; rather indicate the alternative that seems like a reasonable estimate.

For each question choose from the following alternatives:

a. never
b. almost never
c. sometimes
d. fairly often
e. very often

1. In the last month, how often have you been upset because of something that happened unexpectedly?
2. In the last month, how often have you felt that you were unable to control the important things in your life?
3. In the last month, how often have you felt nervous and "stressed"?
4. In the last month, how often have you felt confident about your ability to handle your personal problems?
5. In the last month, how often have you felt that things were going your way?
6. In the last month, how often have you found that you could not cope with all the things that you had to do?
7. In the last month, how often have you been able to control irritations in your life?
8. In the last month, how often have you felt that you were on top of things?
9. In the last month, how often have you been angered because of things that happened that were outside of your control?
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Please go on to the next page

The following is a list of experiences which many students have some time or other. Please indicate for each experience how much it has been a part of your life over the past month. Mark your answers according to the following guide:

Intensity of Experience over the Past Month
a = not at all part of my life
b = only slightly part of my life
c = distinctly part of my life
d = very much part of my life

11. Conflicts with boyfriend's/girlfriend's/spouse's family
12. Being let down or disappointed by friends
13. Conflict with professor(s)
14. Social rejection
15. Too many things to do at once
16. Being taken for granted
17. Financial conflicts with family members
18. Having your trust betrayed by a friend
19. Separation from people you care about
20. Having your contributions overlooked
21. Struggling to meet your own academic standards
22. Being taken advantage of
23. Not enough leisure time
24. Struggling to meet the academic standards of others
25. A lot of responsibilities
26. Dissatisfaction with school
27. Decisions about intimate relationship(s)
28. Not enough time to meet your obligations
29. Dissatisfaction with your mathematical ability
30. Important decisions about your future career
31. Financial burdens
32. Dissatisfaction with your reading ability

Please go on to the next page

33. Important decisions about your education
34. Loneliness
35. Lower grades than you hoped for
36. Conflict with teaching assistant(s)
37. Not enough time for sleep
38. Conflicts with your family
39. Heavy demands from extracurricular activities
40. Finding courses too demanding
41. Conflicts with friends
42. Hard effort to get ahead
43. Poor health of a friend
44. Disliking your studies
45. Getting "ripped off" or cheated in the purchase of services
46. Social conflicts over smoking
47. Difficulties with transportation
48. Disliking fellow student(s)
49. Conflicts with boyfriend/girlfriend/spouse
50. Dissatisfaction with your ability at written expression
51. Interruptions of your school work
52. Social isolation
53. Long waits to get service (e.g., at banks, stores, etc.)
54. Being ignored
55. Dissatisfaction with your physical appearance
56. Finding course(s) uninteresting
57. Gossip concerning someone you care about
58. Failing to get expected job
59. Dissatisfaction with your athletic skills

Please go on to the next page

The following is a list of categories that people use to relax, unwind, or cope with stress while going to school. Please indicate the frequency that you have participated in each of the following activities, over the past month.

Mark your answers according to the following guide:

Amount of time spent participating in stress managing activity:

a. not at all
b. less than 1 hour per week
c. 1-2 hours per week
d. 3-4 hours per week
e. more than 4 hours per week

60. **Biofeedback:** Using a Biofeedback machine with monitors that you observe while sitting; consciously creating greater levels of relaxation in parts of the body that you wouldn't normally be able to relax.
61. **Body Relaxation Exercises:** *autogenics*-while lying down or sitting in a chair with eyes closed, repeating phrases designed to make portions of the body feel warm and heavy; *progressive relaxation*-briefly tensing and then releasing each portion of the body successively from head to foot; *body awareness*-briefly putting your passive attention on each part of the body in succession from feet to head
62. **Drinking:** drinking alcohol for coping, relaxing, unwinding, or escaping pressures of college life.
63. **Eating:** eating food to just to help you cope with pressures and stresses of being in school
64. **Exercise:** includes aerobic activity such as running, jogging, bicycling, walking, roller blading, swimming, or other types of exercise such as tennis, basketball, racquetball, volleyball, skiing, weight lifting, stretching, hatha yoga, or tai chi, etc.
65. **Hobbies or Leisure activities:** Doing things you *truly love* to do; doing things you find highly enjoyable; may include such things as listening to music, art, fishing, etc.
66. **Massage, Acupressure or Shiatsu:** Using the hands (yours or someone else's) to rub, stroke, press, or touch portions of your body for therapeutic/relaxing purposes.

Please go on to the next page

67. **Meditation:** includes *transcendental meditation*-repeating a mantra silently for a period of time; *mindfulness meditation*-consciously focusing on the present moment; periods of *contemplation*; *breathing exercises*-consciously focusing on the rhythmic in-and-out movement of the breath for an extended period of time.
68. **Mental activities:** *guided imagery* or *creative visualization*-visualizing relaxing images, colors, or scenarios in your imagination; *self-hypnosis*-while in a relaxed state, listening to or repeating affirmations designed to help you relax even further.
69. **Naps:** taking short naps, during the day.
70. **Sex:** Using sexual intercourse or masturbation as a way to relax or unwind.
71. **Shopping/Spending money:** spending money *just to help you feel better.*
72. **Smoking**: trying to make yourself feel better by smoking tobacco or marijuana.
73. **Social Activities:** Spending time with friends away from stressful environments, including parties, dates, eating out with a friend, etc.

Please go on to the next page

Amount of time spent participating in relaxing, unwinding, coping, or stress managing activity:

a. not at all
b. less than 1 hour per week
c. 1-2 hours per week
d. 3-4 hours per week
e. more than 4 hours per week

74. **Spiritual or Religious Development**: reading uplifting literature; taking walks through nature; attending church; periods of solitude; prayer; journal writing.
75. **Talking with family, friends, or other supportive people:** Communicating with others so that you feel listened to and supported in what you say and how you feel.
76. **Time management: activities:** planning ahead, scheduling future activities, taking time to evaluate personal effectiveness or control over your life.
77. **Watching television:** viewing TV as a means to help you to unwind, relax, or escape daily pressures.

For Numbers 78 & 79, mark your answers using the following guide:

a. Never
b. About once per month
c. About 2-3 times per month
c. About 2-3 times per week
d. Daily

78. **Over-the-counter or prescription drugs:** using OTC's or prescription drugs to help you feel better, reduce pain, reduce discomfort, or calm you down
79. **Recreational drugs:** using chemicals to help you cope with stress, pressures, or pain

Please go on to the next page

Please respond to each of the following by marking on the scantron the most appropriate answer.

80. My gender is:
a. Male
b. Female

81. My age is:
a. 18-19
b. 20-21
c. 22-23
d. 24-25
e. 26 or above

82. My race is:
a. White, not of Hispanic origin
b. Black, not of Hispanic origin
c. Hispanic
d. Asian or Pacific Islander
e. Other

83. My current year in school is:
a. freshman
b. sophomore
c. junior
d. senior

84. School I am currently attending:
a. Weber State University
b. Northern Colorado University
c. Concord College
d. Southern Illinois University

85. Status:
a. commuter
b. live on campus

86. I am an athlete:
a. yes
b. no

Thank you for volunteering to fill out this survey. Please take a moment to check the scantron and make certain you have put a mark for each question. After you have done this, please put the survey packet and the white sheet of paper on top of the scantron. Once everyone has finished, you will be instructed to place the scantron in an envelope and pass in the survey packets.

Please go on to the next page

A Spectrochemical Series of Pyridine and Substituted Pyridines with Cr(III)

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A Spectrochemical Series of Pyridine and Substituted Pyridines with Cr(III)

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Introduction

The interest regarding substituent effects on pyridine and its attraction to chromium has been ongoing. Studies of pyridines combined with different transition metals such as vanadium(II), chromium(III), cobalt(II), molybdenum(III) and nickel(II) have been carried out.[1,2] Such experiments range from examining transition metal perchlorates and tetrafluoroborates bonded with pyridine ligands[3,4] to studying substituent effects in aromatic ligands.[5] The photophysics of many complexes containing pyridine or substituted pyridines have been studied.[6,7] Experimental studies have also been made on the spectra of chromium(III) complexes in the region of the pyridine absorption band.[8]

Basicity of pyridines can be calculated from literature values of pKa and then translated into pKb values. The higher the pKa values of their conjugate acid forms, the stronger the base, and the lower the pKa values, the weaker the base.[9] The understanding of these pKb values allows for assumptions on how well the specific pyridine will attract the chromium. Although substituents on a benzene ring have little affect on the basicity of a compound, substituents on pyridines do affect its basicity.[9] The substituent effects appear to correlate with the Hammett-sigma constants on formation constants of complex series.[10]

A general spectrochemical series has been made, but not one including different substituted pyridines: $I^- < Br^- < S^{2-} < SCN^- < Cl^- < N_3^- < F^-$ < urea, OH^- < ox, $O^{2-} < H_2O < NCS^- <$ py, $NH_3 <$ en < bpy, phen < $NO_2^- < CH_3^-$, $C_6H_5^- < CN^-$ < CO.[11] This study

attempts to expand this series by investigating the interaction of Cr(III) with pyridine and several substituted pyridine ligands.

Experimental

To prepare the solutions of about 0.02M Cr(III), weigh out 0.2g of $Cr(NO_3)_3 \bullet 9H_2O$ to get 0.0005 mol of Cr(III). To 1 mL of 2,2'-dimethoxypropane, DMP, and 23 mL of methanol in an Erlenmeyer flask was added the 0.2g of $Cr(NO_3)_3 \bullet 9H_2O$. The solution was mixed with a magnetic stirrer and allowed to stand for one week. The next week, a six-fold excess of the pyridine or substituted pyridine was added and the resultant solution was stirred for 10 minutes. The spectrum of each solution was obtained vs. methanol from 900nm to 200nm using a Varian DMS 100S UV spectrophotometer. λ_{max} values were obtained for each of two absorbance peaks in the visible portion of the spectrum and converted to wavenumbers, $\bar{\nu}_1$, and $\bar{\nu}_2$. Dq values were obtained from the $\bar{\nu}_1$ values. The B values were determined using a graph made by plotting $\bar{\nu}_2/\ \bar{\nu}_1$ vs. Dq/B.[12]

Results and Discussion

The substituents on the pyridines did have an affect on the Dq values exhibited by the various pyridine ligands. The following spectrochemical series was determined: 4-cyanopyridine < 2-chloropyridine < 2-methylpyridine < 3,5 dimethylpyridine < 3-methylpyridine < 4-methylpyridine < pyridine < 2-ethylpyridine < 3-ethylpyridine < 4-ethylpyridne. The Dq data are summarized in Table 1.

Table 2 shows the nephelauxetic series of these same ten ligands.

Table 3 summarizes the Dq and B values of the complex ions, and in addition, shows that there appears to be some correlation between the ligand position on the

spectrochemical series and its strength as a base as indicated by its pKb value. The ligands lowest on the spectrochemical series have the highest pKb values and are approximately 20 cm^{-1} separated from the ligands higher on the spectrochemical series whose pKb values are lower.

Attempts made to obtain solution spectra of complexes involving 2-aminopyridine and 2,6-dimethylpyridine were unsuccessful.

Acknowledgments

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Table 1

Spectrochemical Series

Ligand	Dq, cm^{-1}
4-cyanopyridine	1702
2-chloropyridine	1704
2-methylpyridine	1724
3,5-dimethylpyridine	1729
3-methylpyridine	1731
4-methylpyridine	1734
pyridine	1736
2-ethylpyridine	1740
3-ethylpyridine	1744
4-ethylpyridine	1746

Table 2

Nephelauxetic Series

Ligand	B, cm^{-1}
3,5-dimethylpyridine	602
4-methylpyridine	608
3-methylpyridine	615
pyridine	620
4-cyanopyridine	637
2-chloropyridine	640
4-ethylpyridine	648
2-methylpyridine	676
3-ethylpyridine	770
2-ethylpyridine	791

Table 3

Ligand	Dq, cm^{-1}	pKb[13]	B, cm^{-1}
4-cyanopyridine	1702	12.10	637
2-chloropyridine	1704	13.51	640
2-methylpyridine	1724	8.04	676
3,5-dimethylpyridine	1729	7.91	602
3-methylpyridine	1731	8.32	615
4-methylpyridine	1734	8.00	608
pyridine	1736	8.83	620
2-ethylpyridine	1740	8.11	791
3-ethylpyridine	1744	8.20	770
4-ethylpyridine	1746	8.13	648

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BIRD POPULATIONS ACROSS HETEROGENOUS LANDSCAPES IN SOUTHERN WEST VIRGINIA

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12 December 2000

[1] McNair Scholar

ABSTRACT

We report on a one year preliminary study investigating the determinants of avian species richness at banding stations across southern West Virginia. We tested whether species richness varied across sites that differ in macrohabitat, plant biodiversity, elevation, and scales of suburban sprawl. Data were collected at Athens, Bluefield, Lilly Mountain, Pipestem, and Sandstone, West Virginia. The number of species captured across the sites was normally distributed and did not differ significantly (Kolmorogov-Smirnov $Z = 0.51$, $p > 0.957$). The number of species captured across the five localities averaged 68 ± 16.54. We captured 44 species at Lilly Mountain, 65 at Pipestem, 66 in Bluefield, 76 at Sandstone, and 89 at Athens. Analysis of covariance disclosed that the number of birds captured per species were significantly determined by covariates of body mass, wing chord, and date of capture, while age, sex, fat, locality were significant main effect variables. Stepwise multiple regression determined that age was the most significant predictor of species captured. A stepwise multiple regression model with age, wing, date, locality, body mass and fat was the best fit model for predicting species abundance, since it had the highest R^2 value and mean square. The magnitude of the regression coefficients (beta), indicate that the two most significant predictors of avian species diversity were age and wing ($\beta_{age} = -0.331$ and $\beta_{wing} = 0.536$). Additional multiple regression analyses disclosed that locality, elevation, and plant biodiversity were not significant predictors of species caught ($R^2 = 0.224$, $F = 0.10$, $p > 0.952$). Macrohabitat and housing density adjacent to the banding sites were also found to not be significant predictors of species captured ($R^2 = 0.819$, $F = 4.52$, $p > 0.181$). Likewise, proximity to urbanization and housing density of the city closest to the banding site were not important predictors of species diversity ($R^2 = 0.303$, $F = 0.43$, $p > 0.697$). Avian species richness was not correlated with locality, elevation, plant richness, macrohabitat, housing density, and proximity to the nearest major city. Guild analysis by

similarity of habitat showed that guild composition varied across banding locations ($F = 21.51$, $p < 0.001$). Age and type of birds and locality were significant predictors of guild composition. Localities with less urbanization and higher amount of forested land cover supported larger guilds.

INTRODUCTION

Ecologists often test problems and hypotheses by comparing pristine and anthropogenic-altered habitats. Although we have a fairly good knowledge of community and ecosystem structure of climax and pristine habitats, relatively little is known about urban ecology. While land is becoming increasingly urbanized and pristine environments are decreasing, studies have still been very limited in addressing the effects of urbanization on an ecosystem, its communities, species and populations (Cairns 1988). McDonnell et al. (1993) acknowledge that only recently have ecologists considered studying the diverse factors associated with urban areas. Sophisticated techniques, such as urban gradient analysis, model the impacts of urbanization (Blair 1996). This technique, however, has only been marginally considered in evaluating the effects of urbanization on bird communities (Blair 1996). Thus, there are relatively few studies that evaluate the impacts of suburban sprawl on bird communities. For example, little is known on how suburban sprawl is affecting bird populations during the critical times of migration and breeding (Blair 1996).

It is commonly known that many bird populations (e.g., Neotropical migrants) are constrained by the deforestation of tropical rain forest, where these birds winter. Because many long-distance Neotropical migrant landbirds are declining, studies are critically needed to identify key areas along migration routes and preserve then before they are consumed by suburban sprawl. Therefore, research on urbanization has followed two major paradigms, which have been limited

in scope (Blair 1996). These paradigms include comparisons between pre- and post-development of urbanization on bird communities and comparisons between bird communities at two sites with different degrees of urbanization.

Blair (1996) summarized some recent literature on the impacts of suburban sprawl on bird populations, which has indicated the following general patterns: (1) species composition changes in an area as urbanization increases; (2) most studies indicate that the species diversity decreases as an area increases in urbanization; and (3) that bird density increases with urbanization.

Moderate levels of urban development create significant areas with ornamental (and non-native) vegetation and edge habitats, as well as areas with altered water sources and primary productivity. The amount of edge and fragmented habitats increases with extreme development, which can drastically alter bird populations (Whitney and Adams 1980, Godron and Forman 1983, Mooney and Gulmmon 1983, Rudnicky and McDonnell 1989, Sisk 1991). Blair (1996) states that urbanization changes should be detected in the individual bird species and in the bird community as a whole. He further categorizes birds in these urbanized areas as (1) the "urban exploiters," which should be adept at exploiting the changes and should reach higher densities in these urbanized sites; (2) the "urban avoiders," which are sensitive to human-induced changes to the landscape and these birds should reach higher densities in natural sites; and (3) the "suburban adaptables" that are able to exploit novel or modified resources, such as nesting in ornamental vegetation, created during moderate levels of urbanization.

One inherent feature of avian urban ecology studies is that suburban sprawl changes native vegetation to non-native, exotic plants. In this paper, we compare bird populations across a gradient of urban scales in southern West Virginia. Our goals were two-fold: first, to build prediction models that would estimate avian guild structure (e.g., urban exploiters, urban avoiders, and suburban adaptables) across these heterogeneous landscapes and, second, to

compare avian demography (species diversity, age classes, and population size) across habitat types.

METHODS

Data were collected in conjunction with the MAPS program at a riparian habitat at Sandstone Falls in Summers County, West Virginia (see Stover et al. 1999, Hayes and Canterbury 2000) and a ridgetop habitat at Lilly Mountain in Raleigh County, West Virginia (see Canterbury 1990). The MAPS protocol (see DeSante et al., 1993, 1996) was also used at urbanized and non-urbanized sites in the town of Athens, West Virginia. Data was also collected in an urbanized site in Bluefield, West Virginia along with rural areas in Bluestone and Pipestem State Parks.

Six to ten black, nylon mist nets were used to capture birds at each site. The nets used were 12-m, 30-mm in size. The nets were opened from 0600-1200 and from 1500-1700 h. Captured birds were banded with uniquely numbered bands from the USFWS. Various mensural measurements (e.g., body mass and wing chord) were recorded on each bird captured (see DeSante and Burton 1993). Each bird was aged according to degree of skull pneumatization and sexed according to plumage, presence or absence of a cloacal protuberance or brood patch (see Pyle et al. 1987, DeSante and Burton 1993). Amount of body fat was also assessed (see DeSante and Burton 1993). The date, time, and net number were recorded for each individual captured. These measurements allow an estimation of important demographic parameters, such as relative abundance, species richness, recruitment, age class, habitat guild, and survivorship. These demographic data provided by the MAPS program (e.g, productivity, survivorship, immigration, and emigration estimates) help to shed information as to what stage(s) of the species life cycle control(s) the population declines (Canterbury 1999).

The impact of housing density on bird populations was assessed with spatial or Geographic Information Systems (GIS) models (topological models) that relate housing density, season, and vegetation to avian demographic parameters, e.g., productivity (ArcInfo for PC). Geographic Information Systems is capable of assembling, storing, manipulating, and displaying geographically referenced information. It interprets data based on locations. A vegetation analysis of all of the banding sites was collected via the James and Shugart (1970) circular-plot method. Analysis of topograpical maps and GIS data were used to quantify the amount of urbanization per site. Data obtained from GIS and vegetation analyses included housing density within a 25 mile radius of the banding site, elevation, macrohabitat type, and plant species (shrubs and trees) diversity. Data from each site were entered into a SPSS spreadsheet and analyzed according to Sokal and Rolff (1982). Data were logarithmic transformed (to the base 10) to make variation constant across levels of the scales of measurement. Data were analyzed for mean differences in number of birds and species captured at each site. Data were analyzed in three ways. First, we used stepwise multiple regression analysis to predict which independent variable or covariate, such as site, mass, wing, date of capture or season, age, sex, and fat. Second, we performed analysis of variance (ANOVA) to identify significant relationships or how much of the variation in number and species captured were due to these aforementioned independent variables.

Finally, species were assigned to habitat guilds (Ehrlich et al. 1988) and changes in guild types across localities were analyzed with multiple regression analysis, one-way ANOVA, and Pearson product-moment correlation analysis. Habitat guilds included cities and towns (1), woodland edges (2), orchards and parks (3), wet areas such as swamps and marshes (4), open woods (5), mixed deciduous forest canopy (6), old fields (7), dry hillsides (8), grasslands (9), and mixed deciduous forest understory (10). Duncan's post hoc multiple comparisons test was used to test

for mean differences of guilds across sites. During data analysis we split large data files into smaller subsets, because datasets were too large to handle on our PC. This potentially created additional type II error, since multiple tests were performed. Type II error was minimized by robust selection of appropriate test statistics, large sample sizes, and elimination of confounding variation.

RESULTS

The number of species captured across the sites was normally distributed and did not differ significantly (Kolmorogov-Smirnov $Z = 0.51$, $p > 0.957$). The number of species captured across the five localities averaged 68 ± 16.54. We captured 44 species at Lilly Mountain, 65 at Pipestem, 66 in Bluefield, 76 at Sandstone, and 89 at Athens. The number of birds captured per species varied with body mass, wing chord, and date, as well as age, sex, and banding locality (Table 1). Age was determined to be the most significant predictor of species captured by using a stepwise multiple regression test that produced six models (Table 2). Model 6 in Table 2 disclosed the best prediction of avian species diversity, since it had the highest coefficient of determination (R^2). This model disclosed that age, wing, date, site, body mass, and body fat determined significant amount of variation in the number of species captured (Table 2). The magnitude of the regression coefficients (beta), indicate that the two most significant predictors of avian species diversity were age and wing ($\beta_{age} = -0.331$ and $\beta_{wing} = 0.536$, see Table 2). In a different multiple regression analysis, site locality, elevation, and plant biodiversity were not significant predictors of species caught ($R^2 = 0.224$, $F = 0.10$, $p > 0.952$, Table 3). Macrohabitat and housing density adjacent to the banding sites were also found not to be significant predictors of species captured ($R^2 = 0.819$, $F = 4.52$, $p > 0.181$, Table 3). Likewise, proximity to urbanization and housing density of the city closest to the banding

site were not important predictors of species diversity ($R^2 = 0.303$, $F = 0.43$, $p > 0.697$, Table 3). Avian species richness was not correlated with site locality, elevation, plant richness, macrohabitat, housing density, and proximity to the nearest major city (Table 4). Guild analysis by similarity of habitat showed that guild composition varied across banding locations ($F = 21.51$, $p < 0.001$). Age and type of birds (species) and locality were significant predictors of guild composition ($R^2 = 0.596$, $F = 771.84$, $p < 0.001$, Table 5). There was a significant negative association between guild and species composition (see Table 6), indicating some guilds had fewer number of species. Guild composition was also associated with age of birds and banding locality (Table 6). Localities with less urbanization and higher amount of forested land cover supported larger guilds (Table 7). For example, the most remote site (Lilly Mountain) had a mean guild number of 6.43, while the most urbanized site (Bluefield) averaged 5.51 (Table 7).

DISCUSSION

Urbanization erodes native bird populations in many ways. These include (1) avian reproductive failure in patchy, fragmented landscapes dominated by non-native vegetation, (2) competitive exclusion by aggressive, pre-adapted non-native bird species, and

Blair (1996) defined several levels of urbanization and noted that urbanization affects bird diversity in two ways. First, moderate urbanization can increase overall avian diversity by replacement of native species with non-native species. Second, severe urbanization decreases both total avian and native species diversity.

Urbanization causes the introduction of ornamental plants and alters the native vegetation structure (Beissinger and Osborne 1982, Rudnicky and McDonnell 1989). Precisely how birds respond to these changes in land and vegetation structure remains unclear. Researchers have suggested that urbanization erodes bird populations, not only through the loss of breeding habitat,

but also by increased reproductive failure of native birds nesting in ornamental plants and fragmented landscapes. These sites essentially become reproductive "sinks" where mortality is greater than reproductive success. Nest sites are lost to aggressive non-native species, such as the European Starling and House Sparrow. Eggs and nestlings are also depredated at higher rates in ornamental, non-native vegetation structured in an urbanized, fragmented landscape.

Lower level urbanization, however, may increase the habitat structural diversity (i.e., buildings and vegetation) and provide more areas for bird activities, such as perching (Emlen 1974, Beissinger and Osborne 1982). Moderate urbanization may increase edge habitat, but this habitat will decrease with the increase in severe development (Blair 1996). Intensely developed areas can decrease the resources available to birds (Whitney and Adams 1980). The result is that native habitats and species are eliminated in favor of a few exotic species (Godron and Forman 1983, Sisk 1991). However, birds species respond differently to degrees of urbanization. Some species, such as the Golden-winged Warbler, are considered habitat-specialists and area-sensitive and do not do well even with small scale fragmentation and development (Canterbury unpubl. data). Others, such as the Baltimore Oriole, can nest successfully in highly fragmented residential landscapes if a few large trees are left.

As expected, Blair (1996) concluded that the most avian diversity occurred in natural areas when compared with disturbed sites. Urbanization causes dominant species of a climax community to lose behavioral dominance, which allows species that are less competitive to co-exist (Blair 1996). Species that are good competitors will dominate the area if the disturbance is infrequent (Blair 1996). Severe disturbance eliminates many species, except those that have high dispersal rates and/or those that mature earlier in life (Blair 1996). Therefore, Blair's (1996) findings indicate that if pre-development levels of biodiversity want to be maintained, then plans for development should be concentrated spatially. To maximize the native biodiversity,

development of business endeavors should be concentrated in as little of an area as possible to limit the amount of land being developed (Blair 1996).

In the present study, multiple regression analyses indicated that avian species richness was not determined by locality, macrohabitat type, elevation, housing density, and proximity to urbanization. The magnitude of the regression coefficients indicated, however, that some of these variables may be significant with larger sample sizes. Therefore, larger sample sizes are needed before we can positively identify which variables or factors influence species richness across habitat types in southern West Virginia. We used a number of different types of multiple regression analyses, which may have increased making type I error. However, the SPSS file could not handle the large dataset we analyzed, so we minimized type I error by the types of variables used in the analyses and questions examined. For instance, factors related to urbanization (e.g., housing density near the banding site and proximity to the nearest major city) were analyzed as a single dataset. Additional spatial and statistical analyses are warranted for future studies.

We found that the number of birds captured per species varied with body mass, wing chord, date of capture, age, sex, body fat, and locality. The number of species captured varied from 44 to 89 across the five sites. In conclusion, additional years and sites must be incorporated into our regression models to increase prediction of avian species richness across sites in southern West Virginia. These latter analyses coupled with spatial models and principal component and factorial analyses may be necessary before we can understand the impacts of light and moderate development on bird populations in southern West Virginia. Future population and developmental pressures will also warrant sophisticated urban gradient and spatial analyses. Finally, future studies must also employ guild structure analysis.

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Table 1. ANOVA results of number of species captured by covariates and main effect variables. All independent variables were significant ($p < 0.001$) except sex ($p > 0.09$).

Variable	F
Covariates	
Mass	20.16
Wing	159.46
Date	130.18
Main Effects	
Age	65.41
Sex	2.40
Fat	11.34
Locality	71.96

Table 2. Stepwise multiple regression analysis that predicts species variation from site, date of capture, body mass, age, sex, wing chord, and fat of captured birds. All p-values are less than 0.001, except for fat in model 6 ($p < 0.026$).

Model	Variable	Standardized Coefficient	t	R^2
1	Age	-0.331	-22.44	0.110
2	Age	-0.309	-21.97	0.195
	Wing	0.293	20.83	
3	Age	-0.287	-21.06	0.251
	Wing	0.311	22.88	
	Date	0.239	17.55	
4	Age	-0.283	-21.18	0.279
	Wing	0.295	21.97	
	Date	0.290	20.74	
	Site	0.175	12.51	
5	Age	-0.264	-19.64	0.292
	Wing	0.532	17.46	
	Date	0.318	22.34	
	Site	0.177	12.75	
	Mass	-0.262	-8.66	
6	Age	-0.265	-19.70	0.293
	Wing	0.536	17.56	
	Date	0.316	22.20	
	Site	0.179	12.88	
	Mass	-0.267	-8.79	
	Fat	0.030	2.23	

Table 3. Multiple regression analysis of GIS data on species diversity.

Variable	Standardized Coefficients	t	p
Site	0.254	0.248	0.845
Elevation	-0.533	-0.464	0.723
Plant richness	-0.003	-0.003	0.998
Macrohabitat	-0.668	-2.217	0.157
Housing density[1]	0.592	1.968	0.188
Housing density[2]	-0.658	-0.906	0.461
Proximity[3]	0.253	0.349	0.761

[1] = in vicinity of banding site, [2] = nearest major city, [3] = in miles to nearest major city.

Table 4. Pearson product-moment correlations of log species diversity with independent variables (log transformed).

Variable	r
Site	0.012
Elevation	-0.416
Plant richness	0.238
Macrohabitat	-0.684
Housing density[1]	0.611
Housing density[2]	-0.510
Proximity to nearest city	-0.131

[1] = in vicinity of banding site, [2] = nearest major city, [3] = in miles to nearest major city.

Table 5. Multiple regression analysis of guild structure on species, bird age, and location of capture (station).

Variable	Standardized coefficients	t *
Species	- 0.464	-35.76
Age	0.138	11.05
Station	0.266	20.67

* all p values < 0.001.

Table 6. Pearson product-moment correlations among guild structure (habitat similarity), species, locality, and age of birds.

	Species	Locality	Age
Guild	-0.516**	0.081**	0.391**
Locality	0.129**		0.001
Age	-0.269**	0.001	

** $p < 0.01$.

Table 7. Duncan's post hoc test for differences in guilds across banding localities

		Subset for alpha = 0.05		
Station	**N**	**1**	**2**	**3**
Bluestone	160	4.90		
Athens-Town	2250	5.21	5.21	
Bluefield	39		5.51	
Athens-Lake	749		5.62	
Sandstone	368		5.69	
Pipestem	547			6.28
Lilly Mountain	111			6.43