3-2015

Human Performance Lab Newsletter, March 2015

St. Cloud State University

Human Performance Lab News & Views

Department of Kinesiology, Health and Physical Education

March 2015

Kelly's Corner

David Bacharach

Hello to everyone from the HPL. Although I thought last year was going to be my last Kelly's Corner, I was asked to write one truly final note. This year marks an even bigger milestone than our million dollar one from last year. It is perhaps as much a hurdle as it is a milestone; but, it is one we view with reflection and hope. With a serious budget shortfall, faculty positions will not be returned to the department and SCSU can no longer fund the HPL as it has in the past. Reflecting back on my time here, we enjoyed unparalleled support and success using a Division-I Research model for a Thesis only Master's program. That model does not fit well with SCSU's current role in higher education. That same model that brought us regional and national recognition is also disappearing at other schools around the country. Curriculums in Kinesiology programs have moved away from physical sciences. The trends are to have programs that train students in health advocacy. Programs in community health and wellness, along with personal training have flourished. Those programs are good; but, in a way it shifts the burden of knowledge for basic science to schools of medicine or psychology where the underlying principles that control the mind and body are still the focus. So, without the science focus, what niche is there for a HPL? What role might it play in the future? No one knows for certain but we are hopeful the HPL will be able to return some of its community programs via an avenue for in-service education of Biomedical and Kinesiology majors and minors. It could also be a vehicle for applied research in areas more commonly labeled Wellness. It is not unrealistic to foresee an undergraduate applied exercise and sports science major here at SCSU. Supervised exercise classes, personal training, wellness counseling could all be programs offered to the community through the department and the HPL. Where, how and when this might happen depends a lot on facilities and staffing. We continue to dialogue about Eastman renovation as the future home of the HPL. It appears promising, albeit too soon to really know. The "how" depends on replacing faculty positions for myself and Dr. Street. The "when" will be determined by the first two and of course the budgetary constraints of the institution. Until these changes come to pass, we can only serve others as we have always tried to do. To do that we, ourselves must remain healthy and models of good behavior. In this newsletter, you will find a list of HPL Adult Fitness participants. This list reflects what the HPL set out to do 45 years ago: take care of ourselves, watch out for the welfare of others, live the best we can and be thankful for all that we can do. Please mark May 16, 2015 on your calendar too. We will be hosting a picnic that day for all HPL alumni and friends.

HPL Celebration

Saturday, May 16, 2015

A Warm Invitation Goes Out To:

All Ex. Sci. MS students, their families and friends

and

All Adult Fitness Staff and Participants.

Come Celebrate with Jack, Glenn, Dave and former HPL staff.

On Saturday May 16th from 11-3 pm , right here on SCSU's campus in the Rec Center of Halenbeck Hall we will be hosting a picnic in celebration of the HPL. It's been 45 years since the lab first opened its doors. During that time an unbelievable number of students spent hours in the HPL bunker diligently working toward their future. An equally crazy number of AFP participants (See insert) were directed through a top level fitness assessment while a group of genuinely warm MD's helped support the entire endeavor. It's time to celebrate those successes so we can all share in the varied stories.

Please RSVP via email, phone or USPS to:

Email: HPL@stcloudstate.edu

320-308-3105

SCSU-HPL c/o Carol Shaw
111 Halenbeck Hall
720 4th Ave. South
St. Cloud, MN 56301

Maintaining a Healthy Weight in a Land of Plenty

Glenn Street

We in the United States are routinely bombarded with tantalizing images of mouthwatering food and drink. This crafty advertising is designed to arouse our appetites for the vast array of large portioned, flavor enhanced and calorie-dense (high-fat and sweetened) processed foods that are so pervasive in our society. While our unfettered access to this high calorie bounty may seem a blessing, it can also be a stumbling block as we strive to age healthfully. Overindulgence in these rich foodstuffs increases our risk of obesity, joint problems, diabetes and cardiovascular disease, which is still the leading cause of death in adults around the world (World Health Organization). However, the *real* and far more insidious enemy is our ultra-convenient and sedentary lifestyle. Rather than human powered locomotion to get around, we favor the automobile, elevator, escalator and moving walkway. Rather than integrating actual *work* in our daily routine, we employ every labor-sparing mechanism imaginable to reduce our effort. And rather than engage in hours of actual physical activities, we choose to spend those hours parked on a couch being entertained by our myriad of electronic devices.

When an abundant food supply is combined with a sedentary lifestyle, as it is in America, the effects can be truly devastating. Perhaps the most poignant example of the destructive power of the modern American lifestyle is the story of the Pima Tribe of Arizona. The ancestors of these Native Americans (who were noted for their running prowess) hunted, gathered, and farmed the river valleys without mechanization to meet their caloric demands. Although their rugged and militaristic lifestyle increased the chances of meeting an untimely death, it certainly ensured a life free of obesity, diabetes, and cardiovascular disease. However, following WWII, as the Pimas assimilated into the slothful society around them, their activity plummeted while their fat consumption skyrocketed from 15% to 44%: making obesity and diabetes common place. Today, they have the world's highest known rate of diabetes: half of Pima adults over 35 are diabetic!

Lean Pima hunters and warriors (circa. 1800's).

Pima couple (circa. early 2000's).

Adding to the tragedy of the Pima's story is the contrast their Mexican cousins provide. Nearly a millennium earlier, a splinter group of Pimas retreated into the highlands of northern Mexico. These Pimas of Maycoba still live in this remote area, living as their ancestors did; gardening and raising livestock with no electricity or running water. Recently, a research team compared these two bands of genetically identical relatives and found (unsurprisingly) that the near-traditional lifestyle of the Mexican cousins has shielded them from the epidemic of obesity and diabetes that plagues their relatives in Arizona. While Westernization explains much of this contrast, there is little doubt that their genes also played a role. For hundreds or thousands of years genetic material was passed down through the generations from those who survived the frequent famines (droughts) because of their superior ability to store fat during times of plenty. While these caloric-thrifty genes continue to serve the Pima of Maycoba well in their traditional way of life, they are now a curse for the Pima of Arizona as their bodies perpetually stow away calories for a famine that never comes.

Though these genetic forces are undeniably at work in all cultures, blaming them or our environment for the fact that well over 1/3rd of Americans are classified as obese, and that this fatness has been increasing at an alarming rate (even extending its grip to our youth), would be to ignore the control we can choose to wield in maintaining a healthy weight. While we all face different challenges in maintaining our weights, the underlying principle of weight control remains universal and unwavering—we must match our caloric intake with our caloric expenditure. For guidance on putting this principle to practice, we need only turn to our Adult Fitness Program participants, many of whom are now in their 70's and 80's—yet fit as a fiddle. We are continually inspired by these individuals who have bucked the slothful and glutinous ways of modern America, and in the process have become models for us on how to maintain a healthy weight and stay fit. Our hats are off to you.

To read more about the Pima and a fascinating history of obesity research, we refer you to the following book by Robert Pool. Fat: Fighting the Obesity Epidemic. Oxford University Press, 2001.

Maintaining a Healthy Weight in a Land of Plenty

(Cont.)

Take Home Messages on Weight Control

The scientific literature makes it abundantly clear that preventing fatness in our children and grandchildren is of utmost importance. It is during these younger years that new fat cells can form if children are inactive and/or eating too many calories. Since the number of fat cells will generally stay with us for a lifetime, it is critical for parents and grandparents to set up an environment that will minimize fat cell formation. Otherwise our children will face a lifetime of struggles trying to maintain a healthy weight.

A similar message applies as we age. There is growing evidence that each time we gain fat weight, we tend to develop a new set point that makes it harder for us to lose the weight we gain. While we needn't obsess about our weight, we are always better off avoiding weight gain by reducing caloric intake and/or increasing calories burned by a combination of additional strength and aerobic exercise at the first sign of weight gain.

Exercise in the Heat and Thermoregulation

Luke Weyrauch

We are homeotherms, meaning we keep a steady body temperature (98.6°F) even under extreme environmental conditions. Simply put, if we failed to keep our body temperature within a narrow range, we would perish. Maintaining this body temperature is achieved by balancing heat production with heat loss. Heat is produced when metabolic energy within the body is converted to mechanical energy. In a perfect system, 100% of this metabolic energy would get converted to mechanical energy. Yet, being imperfect, an estimated 30-70% of this metabolic energy is converted to heat. This is fortunate, as we rely on this non-stop heat source to maintain our core temperature.

Yet this non-stop furnace generally produces more heat than is needed to maintain our core temperature. As a result, under most conditions our skin must constantly release heat to prevent over-heating. The primary means of dissipation is heat transfer to the cooler environment. However, this transfer depends on a temperature gradient, meaning it must be cooler outside the body than inside the body for heat to easily pass from the body to the environment. When environmental temperatures surpass body temperature (98.6 °F), heat is not readily lost from the body to the environment. Under these conditions, evaporation of sweat becomes the primary method of heat loss. The conversion of liquid water to water vapor requires energy, and this energy comes from the heat produced by the body. Therefore, it is not so much the sweating itself that lowers body temperature, but the evaporation of this sweat.

During exercise, heat production increases markedly. Exercising muscles can increase their heat production several fold. As expected, the harder muscles work, the more heat production intensifies. Thus, during high intensity exercise, there is much more heat produced than during lower intensity exercise. Under temperate conditions, this excess heat production is compensated for by increasing heat loss to the environment. The body achieves this by increasing flow of warm blood to the skin where it relinquishes some of its heat and flows back to the core at a cooler temperature. Due to this heat dissipation, there is only a minimal increase in core temperature during exercise under temperate conditions. This increase in heat production, of course, depends on the duration and intensity of exercise, but relative to exercise in the heat, the increase in core temperature is modest.

During exercise in the heat when environmental temperature approaches or exceeds body temperature, the balance between heat production and heat loss is compromised. Heat loss mechanisms are impaired, and sweat evaporation becomes the primary means to dissipate the heat produced by the working muscles. If the rate of heat loss can't keep pace with heat production, core temperature can approach ~104°F. Once this temperature is reached, the brain usually stops the individual from continuing to exercise. The fact that the human body can exercise in a hot environment for any amount of time at all gives evidence to the remarkable thermoregulatory processes the body possesses. Should you elect to exercise in a hot humid environment, you can reduce the risk of thermal stress by making sure you are fully hydrated going into the exercise session so that your sweat production is unrestricted. To further enhance heat loss through sweat evaporation, wear as little clothing as possible and make sure the clothing worn breathes well.

Thesis Topics

Brian Traeger

I will be completing a research paper that looks at how the deterioration of muscle function affects walking economy in patients with Parkinson's. While this deterioration of muscle function is well documented in Parkinson's patients, I am curious whether this progressive loss of muscle function causes the metabolic cost of walking to increase; something that is thought to contribute to fatigue—a common nemesis of Parkinson's patients. Should I learn that they are related, the obvious question that will follow is whether there are rehabilitation exercises that can slow or reverse this loss of muscle function and reduce the metabolic cost of walking and fatigue. I hope to discover that such exercises have been shown to improve walking economy (reduce metabolic cost), diminish fatigue and elevate a person's quality of life.

Jeff Bohlman

For my thesis, I plan to test whether 20 yard sprint times can be improved by warming up (running) with a weighted vest compared to the same warm-up without the weighted vest. Some have suggested that warming up with a heavy load, such as a weighted vest, will increase muscle force after the warm-up ("post-activation potentiation") and improve sprint performance. According to Turner and colleagues, this muscle force potentiation is strongest up to four minutes following such a warm-up. Thus, in my study on two separate occasions, the same subjects will perform a few sprints immediately following a warm-up period. One warm-up will include the use of a weighted vest and the other will not. My hypothesis is that the weighted vest warm-up will improve sprint performance compared to the same warm-up without a weighted vest.

Ke Shi

My thesis is about the relationship between foot inclination and maximum vertical jump height. Most shoes have positive foot inclination because the manufacturers put additional shock absorption foam under the heel, which means the heel is slightly higher than the forefoot. The opposite design has been tried by manufacturers where the forefoot is slightly higher than the heel (negative inclination). It is possible that elevating the forefoot may improve one's maximum vertical jump height due to the following: 1) Ankle is higher at takeoff because of the elevated forefoot 2) Ankle range of motion may increase, giving the jumper more time to generate jumping forces and/or 3) More elastic energy may be stored and returned during the jump.

Luke Weyrauch

For my thesis, I am investigating whether an elevated core/muscle temperature increases muscle damage relative to a normal core/muscle temperature. Participants will perform two trials, once with a normal core temperature and another with an elevated core temperature. In each trial they will perform an identical eccentric reverse arm curl exercise protocol. Following this exercise that has been shown to induce muscle damage, indicators of that damage will be collected and compared between the two trials to determine if an elevated core temperature increases muscle damage during the same exercise.

CONGRATULATIONS!!

The faculty and staff of the Human Performance Laboratory would like to acknowledge and congratulate the following students who completed their master's degrees in 2015:

Kasara Mahlmeister
Eric Wright

Exercise and the Mind

Jeff Bohlman

The *physiological* benefits of regular exercise are well established because of having been studied in great depth for decades. However, the same can't be said of research on the *psychological* benefits of exercise. Not only is this research sparse, but its outcomes are more subjective and poorly understood because of the brain's intricate architecture and complex internal interactions—a very challenging organ to study. Despite the limitations in this line of research, exercise disciples consider the psychological benefits of physical activity to be so self-evident that, to them, questioning this link is naive. Lending credence to such fervency is growing evidence of exercise benefiting the physical and chemical characteristics of the mood center of the brain—the region targeted by most anti-depressant medications. Regardless of whether these organic alterations explain the psychological benefits of exercise espoused by fit individuals, behavioral scientists are now delving into the important practical work of trying to confirm the observations of these fitness advocates. For example, there is growing evidence that exercise improves sleep habits, enhances mood and creates a calming effect when handling stressful situations. A recent fascinating study on small mice substantiates the third of these benefits; inducing a calming effect to stressful situations. Since small mice are known to be vulnerable to social stress, as are humans, the responses of two groups of these small critters were compared when bullied by large alpha mice. Prior to introduction of the bullies, for three weeks one group of small mice was housed in a living space that did not incentivize physical activity ("spartan cages"), while the other group had access to exploratory tunnels and running wheels—which amazingly, the mice in this group spun of their own free-will close to six miles daily. Upon introduction of the large alpha mice, the inactive group became withdrawn and exhibited symptoms of depression and anxiety, whereas the physically active group seemed impervious to the bullying; showing no signs of depression or anxiety. While the field of exercise psychology is clearly still in its infancy, the existing evidence indisputably points to physical activity having real positive effects on one's mental well-being—so, exercise away, your brain will thank you.

This article relies heavily on an article titled "The Exercise Effect" by Kirsten Weir found in the December 2011 American Psychological Association cover story (accessed March 2015, https://www.apa.org/monitor/2011/12/exercise.aspx).

Parkinson's Disease

Brian Traeger

I have a personal interest in Parkinson's disease because it runs in my family. This, along with physical activity being known as an effective treatment for the disease, prompted me to study the effects of exercise on Parkinson's as part of my graduate program in the Human Performance Lab. I thought I would share some of this information with you.

Parkinson's disease is considered an age-related illness. It affects approximately 1% of people in their 60's; a rate that can climb as high as ~4% in the eldest. Since the baby boomers—the 79 million Americans born between 1946 and 1964—are entering these advanced ages, the National Parkinson Foundation estimates that hundreds of thousands of new cases will be diagnosed over the next several decades.

Parkinson's disease is a neurological disorder caused when certain neurons die. When healthy, these neurons produce the brain chemical dopamine, which is responsible for transmitting signals to produce smooth and coordinated muscle activity. Thus, as these neurons die and no longer produce dopamine, Parkinson's patients often struggle to control movements and experience motor symptoms, including but not limited to tremor, rigidity (stiffness), and freezing (the temporary, involuntary inability to move). Ultimately, the patients' motor symptoms lead to impaired mobility and restricted independence. In addition, their loss of balance and muscle control commonly leads to falls, which sometimes cause serious injury.

Despite the extensive research on Parkinson's disease, there currently is no cure and treatments are found wanting. Current treatment primarily consists of medications that help alleviate the motor and non-motor symptoms experienced by patients. Although the medications initially suppress symptoms, as the disease progresses the medications become less effective and long term use leads to debilitating side effects.

Even though current treatment is limited, there is increasing evidence to show that regular exercise can provide additional benefits to people with Parkinson's disease. Although research on this subject is ongoing, it appears that exercise programs should include rhythmic aerobic activities; exercises that change tempo, activity, or direction; and exercises that require balance and preparatory adjustment of the body. Some exercise options that seem to work effectively are dancing, boxing, cycling, treadmill walking, and Tai chi. These exercises have been shown to reduce stiffness, and improve mobility, posture, motor coordination, balance, and gait in patients with Parkinson's disease. If you or someone you know has Parkinson's disease, incorporate these types of exercises that are found enjoyable into the routine, so that, in addition to relieving the symptoms of Parkinson's, the patient can have fun and live a more normal life for as long as he or she possibly can.

Heel Height and Pain in the Lower Back

Ke Shi

Back pain remains our most prevalent musculoskeletal ailment. Pain in our upper and lower back can invariably be traced to muscle spasms (unrelenting contractions). Most often this is triggered by asking neck and/or back muscles, particularly those that are weak or fatigued, to either generate unduly large albeit brief forces or more commonly, manageable forces for extended periods of time. While it may seem trivial to ask these muscles to perform their normal function of keeping the trunk in an upright posture, nothing could be further from the truth. Well over half our body weight comes from our head, neck, arms and trunk. Since back extensor muscles are mechanically disadvantaged by being in close proximity to the flexible backbone (axes), they often have to tug on the trunk with forces as large as a few hundred pounds when we are standing or sitting. If we tilt our head forward and lean our trunk forward these forces increase even more. Is it any wonder so many of us struggle with chronic neck or back pain when sitting or standing for extended periods with less than ideal posture?

Curiously, there is unsubstantiated chatter in the media contending that heel height of one's shoes can cause back pain. The puzzling aspect of this chatter is that there is little reason to expect that we would ignore our ingrained postural cues and suddenly change our posture simply because of different heel heights. A review of the scientific literature bears out the falsehood of this chatter. The preponderance of studies unmistakably show no measureable change in posture (that might lead to back pain) when donning the spectrum of heel heights found in the shoe market, even when we include those with precariously high heels (pumps). Thus, rather than look for alternative footwear to relieve back pain, the best advice remains keeping our back muscles fit and refreshed by staying physically active and limber, and avoiding poor (forward lean) posture.

"Earth Shoe"

"Flat"

"Typical Walking Shoe"

"Pump"

Human Performance Laboratory
111 Halenbeck Hall
St. Cloud State University
720 Fourth Avenue South
St. Cloud, MN 56301-4498

Non Profit Org.
U.S. Postage
PAID
Permit no. 460
St Cloud, MN 56301

Please contact Carol Shaw if your address has changed.

Phone: 320-308-3105

Thank you, Thank you, Thank you!!!!

The staff and students at the HPL greatly appreciate the financial support so many of you have provided over the years. We are always so gratified to know that you believe in our work enough to personally invest in it. We thank the following people who made contributions to the Adult Fitness Program in 2014.

Anonymous
Dave and Nancy Bacharach
Curtis and Betty Ghylin
Janice Engebretson
Robert W. Gregory
Randall Jensen
Rick and Carol Jones
Ken and Sally Kelsey
Colonel Nel Nemec
Harry Olson
John Pike
Phil and Val Rogosheske
Gerald M. Sales
Glenn and Nancy Street
Steve and Elaine Thrune
Talliev and Karen Vollen
John and Sue Weitz

HPL Staff (L to R): Glenn Street, Carol Shaw, David Bacharach

Should you be in a position to make a contribution to the HPL, please make checks payable to:

SCSU Foundation-Adult Fitness
St. Cloud State University
Alumni & Foundation Center
720 Fourth Ave. S.
St. Cloud, MN 56301-4498