Musculoskeletal Importance of Obesity:

Weight management in the realm of physical therapy

By Kelsey Crim

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An Honors Thesis

By

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Abstract

According to the Center of Disease Control, obesity rates have been on the rise in recent years. This condition has been proven to have direct effects on the cardiopulmonary system; obese individuals are considered at high risk for diabetes, cardiopulmonary disease, hypertension, and dyslipidemia among other issues. While these potentially fatal issues are well-documented and the general population has a plethora of resources on the effects of excessive weight on the cardiopulmonary system, often the musculoskeletal system is overlooked. The research I conducted on the joint load relations to obesity was intended to help health care providers, specifically physical therapists. After completing 540 hours of interning in an orthopedic outpatient clinic, I found many patients asking for more information on weight management. Therefore, in conjunction with my research, I have developed an informational pamphlet to be filled out and explained by the physical therapist and given to patients.

Acknowledgements

- I would like to thank Dr. Jeff Clark for offering advice and encouragement throughout my tenure at Ball State, without which I may never have ended up in California with an internship that inspired this project.

- I also want to thank Tonya Skalon for her patience and understanding as my advisor for this project.

Musculoskeletal Importance of Obesity: weight management in the realm of physical therapy

According to the Center of Disease Control, the United States has experienced a dramatic rise in obesity rates over recent years[1]. This same institute and other health-related studies have found the various detriments of excessive weight include but are not limited to an increased risk of diabetes, COPD, stroke, sleep apnea, cancers, hypertension, and dyslipidemia. These potentially fatal issues affect more Americans every year; however, while the effects of being overweight or obese are commonly applied to the cardiopulmonary system, the health of the musculoskeletal system is often overlooked. In the following, I will explain how and why joints are afflicted to the point of injury, as well as the impact excessive weight has on the rehabilitation of those injuries. Finally I will offer suggestions for physical therapy clinics as to how to assess and approach patients on the topic of obesity as it relates to recovery.

In order to assess the validity of reports on the correlation between obesity and joint load, one must understand the context of body mass index (BMI) as a measure of obesity. The BMI is a measure of the ratio between weight in kilograms and height in centimeters squared. The BMI has often been critiqued for its failure to accurately assess health risk of individuals because of its inability to differentiate between mass, and unhealthy mass. The BMI measures body weight in proportion to height and in this process does not assess body composition. It does not distinguish fat mass from fat-free mass. A muscular individual with larger amounts of fat-free mass would have a

[1] http://www.cdc.gov/nccdphp/dnpa/obesity/trend/maps/

high BMI but would not have the same cardiopulmonary risks of an individual with the same BMI consisting of higher fat mass.

This critique of the BMI has implications on its ability to assess cardiopulmonary risk. However, for the purpose of analyzing the consequences of an increased load on the joints, the BMI ratio is still sufficient. When considering the problem of weight-load on joints, the particular composition of the aggregate mass becomes irrelevant. Consider the same scenario in automotive engineering. The permitted weight load on the tires of a truck does not change by the type of weight. The result of a blown tire, from an overload is the same whether the weight is from steel or feathers. The same principle holds true when considering the affects of body mass on the body's joints. The BMI as a tool is sufficient to calculate these affects.

Considering that mass effects the body's joints, it follows that an individual with excessive weight distributes a larger load on the back, hip, knee, and ankle joints than is experienced by an individual with an average BMI. Weight-bearing joints such as the knee undergo an estimated load of three to six times the body weight[2]. Thus, each additional five pounds a person weight increases the load on the knee by 15 to 30 pounds. This increased load causes additional stress to the cartilage and bone. This additional stress causes wear that exacerbates degenerative diseases such as osteoarthritis and patellar tendonitis. Thus, there is a direct correlation between increased load on the joints from excess weight and degenerative joint diseases. This can affect the ankle, hips, and knee, but an abnormally high BMI can also affect mechanics of the spine, especially if the extra weight distributes around the midsection.

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[2] Felson DT: Weight and osteoarthritis. *J.Rheumatol.* 43:7-9. 1995.

This load causes anterior bending force and compressive forces on the spinal column, thus leading to back pain and disc pathology[3].

Logically losing weight should result in the reduction of the load on the joints, and a large quantity of data supports this hypothesis; as aforementioned, the range of three to six times the body weight is a founded ratio. Studies by Messier and colleagues show a four-fold relationship at the knee. In other words, for every pound lost, the joint experiences a load four pounds lighter[4]. Though the exact ratio of body weight and joint load is unknown, the benefits of maintaining a healthy weight correlate to the musculoskeletal system.

It is important to note that a high BMI does increase the risk for degenerative joint diseases that lead to injury and/or surgery requiring physical therapy. Physicians regularly assess a person's BMI, as a contributing factor to these joint problems. Often, physicians overlook the affect of a person's BMI on recovery from these joint problems or surgery. Henceforth, I will validate the need for a normalized body weight in order to experience an efficient, effective, and less painful rehabilitation of these injuries.

Joints are more likely to experience an increased load because of a high BMI, and because of this increased load, they are more likely to experience degeneration leading to an injury or surgery. When joint degeneration calls for orthopedic surgery, the joint requires rehabilitation as administered by a physical therapist. Research shows a strong positive correlation between pain experienced while bearing weight on the knee and BMI; BMI also has a significant impact on rehabilitation outcome.

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[3] Makk SP. Obesity's effects on bones and joints. Kentuckiana Healthy Woman. 2(2): 25. 2007

[4] Messier SP, Gutekunst DJ, Davis C, DeVita P. Weight loss reduces knee-joint loads in overweight and obese older adults with knee osteopathy. Arthritis Rheum. 2(7): 2026-32. 2005

Overweight and obese populations experience more pain and slower or less effective rehabilitation than those that are of a healthy weight[5]. Thus, rehabilitation is less painful, faster, and more effective with an average BMI.

A high BMI can also negatively affect the outcome of physical therapy. When an obese patient completes the therapy necessary to reach functional goals, he or she continues to exert unnecessary force on the joint of the original injury. Hip and knee replacements exhibit wear in all patients, but obese patients' replaced joints tend to degenerate more quickly. This wear and tear can result in the need for additional surgeries or injury to other ligaments that must compensate for the deficient strength of the original injury[6].

In order to offer the most efficient, enjoyable, and successful care, physical therapists should make normalizing body weight as measured by BMI a priority in the prevention and rehabilitation of degenerative changes in the joints. It is the responsibility of the primary physicians and physical therapists to educate their patients on the consequences of weight on the cardiopulmonary and musculoskeletal systems. Physicians should prudently assess patients BMI and implement a plan of care as necessary.

Because the studies of musculoskeletal health cited rely on BMI as a measure of body weight, the primary assessment of orthopedic physical therapy patients should focus on the BMI. This can be done by manually converting the patients' weight to

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[4] Jasiak-Tyrkalska B, Franczuk B, Jaworek J, Mosurska D. The Body Mass Index (BMI) and Rehabilitation outcome in patients with degenerative changed of the knee joint. Ortop Traumatol Rehabil. 6(4): 467-71 2004

[6] Makk SP. Obesity's effects on bones and joints. Kentuckiana Healthy Woman. 2(2): 25. 2007

kilograms and dividing that number by height in meters squared, or practitioners can use one of the many online calculators at reputable websites such as the National Institute of Health.

BMI measurements are sufficient in assessing the risk of degenerative effects on the joints and therefore sufficient for the practical application to physical therapy. However, as aforementioned, BMI does not take into account the composition of body weight. Since it is the Hippocratic responsibility of every health care provider to accurately educate patients of their health, physical therapists have an obligation to further inform the patient on the importance of a healthy BMI, its shortcomings as a measure of cardiopulmonary health, as well as methodology to change one's BMI. All of this can be found in the pamphlet included titled "Understanding Your BMI: A guide to weight management for cardiopulmonary and musculoskeletal health and wellness".

Justification and Explanation of the Supplemental Pamphlet "Understanding Your BMI"

I created a brochure entitled "Understanding Your BMI: A guide to weight management for cardiopulmonary and musculoskeletal health" that can be used as a tool for physical therapists as they educate their patients on Body Mass Index (BMI) in terms of its definition, calculation, and correlation to risk of cardiopulmonary diseases as well as joint load. The brochure is a prototype also offers information on how to alter one's BMI by knowing the importance of Basal Metabolic Rate (BMR) when used in conjunction with the Harris Benedict Formula.

My information is limited to a single page pamphlet because if the material was too lengthy, patients would be less likely to actually get through the material. One page of commonly asked questions sparks interest and keeps information straight and to the point. Also, anything larger would require the physical therapists spend more of the rehabilitation time explaining or going over the material. Though the topic of excess weight is important, I have spent 540 hours interning at a clinic and I have seen health care providers strain to ensure that every moment the insurance companies fund be spent on the most beneficial activities. Manual manipulations and therapeutic exercises take precedence over a tiresome lecture on diet and weight loss because of their direct and objective effectiveness.

Though body fat measurements are more comprehensive than BMI in terms of cardiopulmonary health, it is impractical to have physical therapists measuring patients' body fat composition. Not every clinic will have the instruments or education to measure percent body fat, and it is certainly more time intensive than BMI. The

pamphlet references other websites and recommends that patients discuss weight management with nutritionists and physicians to gain a greater understanding of the issue.

With the additional knowledge obtained from physical therapists, patients that have become more sedentary due to an injury will recognize that they have the potential to gain weight and therefore inhibit their recovery. Patients that carried excessive weight even before the injury will realize that it is necessary to make a lifestyle change to move toward ideal musculoskeletal and cardiopulmonary health. No health care provider with the patients' best interest at heart can deny the value of a lifestyle change with so many implications on the body.

Bibliography

http://www.cdc.gov/nccdphp/dnpa/obesity/trend/maps/

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Title of Honors Project: Musculoskeletal Importance of Obesity: weight management in the realm of physical therapy.

1. In addition to an internship in Anaheim, California in an inpatient setting, I will be completing my honors thesis to further my knowledge of rehabilitation and its effects on the obese population. In so doing, I will be expanding my understanding of the field I intend to pursue after graduation. I want to complete this project to tie together my undergraduate studies of exercise science and health assessment with the internship and my future endeavors in the realm of physical therapy. The correlation between musculoskeletal health and body composition is interesting but is often overlooked in my major especially; cardiopulmonary health tends to take the limelight when stressing the importance of exercise.
2. The proposed equivalent of HONRS499 is EXSCI479 for the spring semester of 2008.
3. The outcome of this project will be a combination research paper and creative project. The research paper will analyze what, if any, relation there is to one's body mass index and joint health and why this is important. The creative project will be a pamphlet designed as a tool for physical therapists to provide to their patients that will inform the reader of body mass index and its importance.
4. According to the Center of Disease Control, the United States has experienced a dramatic rise in obesity rates over recent years[1]. This same institute and other health-related studies have found the various detriments of excessive weight include but are not limited to an increased risk of diabetes, COPD, stroke, sleep apnea, cancers, hypertension, and dyslipidemia. These potentially fatal issues affect more Americans every year; however, while the effects of being overweight or obese are commonly applied to the cardiopulmonary systems, the health of the musculoskeletal

[1] http://www.cdc.gov/nccdphp/dnpa/obesity/trend/maps/

system is often overlooked. The research paper itself is targeted at health care providers, specifically physical therapists. The brochure's audience is the general population, namely those involved in rehabilitation.

5. I will assess articles currently published on the topic of obesity as it relates to the musculoskeletal system and rehabilitation. I will explain how and why joints are afflicted to the point of injury, as well as the impact excessive weight has on the rehabilitation of those injuries. I will offer suggestions for physical therapy clinics as to how to assess and approach patients on the topic of obesity as it relates to recovery. This information will then be filtered and simplified into the form of a pamphlet that physical therapists can use as a tool to educate their patients on the subject of the body mass index (BMI) and its importance.

   The brochure will include the definition of BMI, the patient's individual score, and classifications of body mass index. In addition, the basal metabolic rate (BMR) will be calculated by the physical therapist and provided in the pamphlet along with its definition. This number will then be used to calculate the average number of calories the patient should consume in one day to maintain weight – ingesting more or burning less calories than this number will tend to result in a gain of weight, and ingesting less or burning more calories than this number will tend to result in a loss of weight. Patients will be advised to seek the assistance of registered dieticians and physicians for a healthy weight loss goal should such action be beneficial.
6. I expect to learn that obesity does in fact result in degeneration of the joint, and that rehabilitation is less successful with obese patients. Because obesity is becoming a national epidemic, I expect to see an increase in the number of osteoarthritis patients in the United States, as well as an increase in the number of joint replacements, specifically of the knee and other load-bearing joints. If people come to understand the importance of healthy diet and exercise as it relates to both the musculoskeletal and cardiopulmonary systems, my goal is that being informed will make them attempt to maintain a healthy weight.

5/20/08

Student's Signature Date

5/20/08

Project Advisor's Signature* Date

Honors College Approval Date

*Your signature indicates that you have read and approved this proposal.