

# **The Importance of Exercise in Post-Menopausal Women**

## **By Koran Sherman and Graduate Student Mentor, Anna M. Welch**

### **Introduction**

Many factors play an important role in the energy metabolism of the human body, but one important factor that contributes to differences in metabolism are differences in sex. Men and women have many biological differences that affect a plethora of functions, such as the efficiency of metabolism and hormone regulation. These differences also impact exercise and how it can affect fat and muscle mass. Distinguishing the energy metabolism differences between men and women is important because it can allow for a better understanding how of female hormones can affect energy metabolism and the body's response to exercise. The Department of Health and Human Services recommend that women should be participating in at least 150 minutes of vigorous activity per week. Exercise is an important aspect of health, but many women are unaware of how exercise can directly impact hormones and energy metabolism in pre and postmenopausal women. The purpose of this article is to explain the major metabolic differences between men and women, and then highlight the effect that aerobic exercise has on female hormones and energy metabolism in pre-/post-menopausal women.

### **Why is Exercise Important?**

For the average person, exercise capacity and overall fitness level tends to decrease with age.<sup>[1]</sup> This can increase the risk of mortality and the development of chronic illness, but there is evidence that suggests that this decrease in fitness level can be slowed with consistent exercise and maintenance of a fitness plan.<sup>[1]</sup> One way to measure a person's aerobic fitness capacity and determine their fitness level is by measuring  $VO_2max$ . In a research study published by Sisson et al., (2009) the goal was to examine predictors of  $VO_2max$  in sedentary post-menopausal women following aerobic exercise training. To conduct this experiment, 464 sedentary post-menopausal between the ages of 45 and 75 years were assigned to three test groups of difference exercise volumes. The first group worked to burn 8kcal/kg per week, the second test group exercised at 50% above 8kcal/kg per week which was 12kcal/kg and finally the last group trained at 50% below 8kcal/kg which was 4 kcal/kg.<sup>[1]</sup> After six months of aerobic training, the researchers were able to conclude that older women that exercised more were just as capable as the younger women to increase their  $VO_2max$  and therefore improve their fitness. This research article gives

promising results and shows that although it is typical for fitness to decline with age, participating in regular exercise can help improve overall health and protect women from common chronic diseases, such as osteoporosis. We know that exercise is important for post-menopausal women, but how the body responds to that exercise is also just as important.

### **Changes to Metabolism in Post-Menopausal Women**

In post-menopausal women, energy metabolism changes and can become less efficient. Poor metabolic health has been shown to increase the risk of chronic degenerative diseases. Research shows that women going through menopause appear to have changes in about 74 metabolic biomarkers when compared to pre-menopausal women, which is not unexpected.<sup>[2]</sup> A research study by Wang et al., (2018) aimed to investigate if this change in metabolism is due to the change in hormones when a woman transitions into menopause or simply due to chronological aging. To investigate this relationship, the changes in metabolic biomarkers in 1492 women were assessed over the course of 2.5 years using quantitative nuclear magnetic resonance metabolomics.<sup>[2]</sup> The data collected during the research study showed there were significant changes in the metabolic biomarkers. This suggests that the change in these biomarkers can be contributed to menopause, rather than changes due to chronological aging. Specifically, menopause caused changes to the apolipoprotein-B-containing lipoprotein subclasses on these metabolic biomarkers.<sup>[2]</sup> The transition into menopause slowed the body's ability to breakdown lipoproteins like LDL cholesterol for example, which in turn increased inflammation.<sup>[2]</sup> This is concerning because it could mean a post-menopausal woman has a higher cardiometabolic risk than a pre-menopausal woman. The results of this study confirm the importance of keeping up with regular exercise, especially after the onset of menopause. These findings also lead us to question how regular exercise can impact fat metabolism in the body of a post-menopausal woman.

### **Metabolism in Exercise Trained Women**

A popular topic in the media today is discussion based on the locations where women store fat and the efficiency of fat metabolism, but how does this change in women that participate in resistance training? There is extensive research showing how resistance exercise (RE) affects fat metabolism in male subjects, but research is limited on the impact in females.<sup>[3]</sup> In a research article published by Allman et al., (2019) the purpose was to bridge this gap and determine how RE can change fat oxidation and lipolysis in pre-menopausal women. The

subjects used for this study were 13 healthy, resistance trained women between the ages of 18 and 35.<sup>[3]</sup> Body composition, maximal strength testing, resting energy expenditure and blood tests were collected for each subject over the course of five laboratory visits. The participants were also asked to refrain from taking additional supplements and keep a diary to keep track on their food intake. The results showed that, similar to men, women that participated in RE 6 times a week had a significant increase in overall fat metabolism. An interesting finding from this research was that women had a higher lipolytic rate at mid-RE and post-RE compared to men.<sup>[3]</sup> Overall, the women that participated in the study had improvements in body composition, resting metabolism and fat oxidation. Although this study focused on the fat metabolism in pre-menopausal women, we can still use the results from this study to further explain why regular exercise is important for older women, especially post-menopausal women.

### **Decreasing the Risk of Osteoporosis**

Another factor that consistent exercise can affect is bone mineral density. Sedentary post-menopausal women are at a high risk for developing bone density conditions, such as osteoporosis. Exercise is the most commonly known way to prevent osteoporosis and it is especially important for older women due to hormonal changes, which will be discussed later in this article. Gonzalo-Encabo et al., (2019) aimed to determine the effects of a 12-month exercise intervention on bone mineral density in post-menopausal women. To collect data, 400 post-menopausal women were put into two aerobic exercise groups. Group 1 exercised for 150 minute per week and group 2 exercised 300 minute per week.<sup>[4]</sup> For each subject, total bone mineral density of each subject was assessed at 3 time points using a whole-body dual-energy X-ray absorptiometry. Data was collected at the beginning of the study, at 12 months (after exercise intervention) and 24 months.<sup>[4]</sup> After the 12-months intervention, participants in both the moderate exercise group and the vigorous exercise group had an increase in bone mineral density. Although both test groups achieved promising results, the participants in group 1, with the higher dose exercise did display a greater increase in bone mineral density ( $p < 0.05$ ).<sup>[4]</sup> The takeaway from this research study is that any amount of exercise will help maintain total bone mineral density, but higher amounts of aerobic exercise will significantly decrease the amount of bone density lost as women transition into menopause.

### **The Effect of Estrogen in Women**

To fully understand the importance of exercise for post-menopausal women, it is also important to understand how female hormones affects the exercise and various bodily processes, such as energy metabolism. Estrogen is a hormone that is known to maintain and develop the reproductive system and female sex characteristics,<sup>[5]</sup> but in order to understand its role in the health of post-menopausal women, we need to know how estrogen affects other parts of the body. As discussed in the International Journal of Molecular Sciences, estrogen tends to decline as a result of menopause, which has various health implications on women.<sup>[5]</sup> Due to this decrease in estrogen, post-menopausal women are typically more at risk for metabolic changes and cardiovascular changes. According to this study, estrogen has also been linked to immune function.<sup>[5]</sup> From this research, it is obvious how important estrogen is to the female body and it forces us to ask the question of how can women combat this decrease in estrogen levels after menopause? Nutrition and exercise are all important pieces of this puzzle and research is still being conducted to answer this question. Trenti and authors (2018) noted that pharmacological intervention has also been a topic of conversation for protecting women from increased risk caused by post-menopausal hormonal changes. Overall, understanding the impacts of estrogen in the female body can help health professionals better aid women to stay healthy especially after the transition into menopause.

Another important function of estrogen is the absorption of iron in the bloodstream. A decrease in estrogen leads to less iron being metabolized which leads to iron accumulating in the body and damaging the cells. Research shows that this buildup of iron that typically occurs in post-menopausal women can also lead to an increased risk of osteoporosis.<sup>[6]</sup> Researchers used animal model research to investigate how estrogen impacts iron metabolism, but similarities can be drawn to make conclusions about human subjects. As a woman goes through menopause, estrogen level decreases by about 90% which drastically impacts the efficiency of iron metabolism in the body.<sup>[6]</sup> There is also additional research that has been conducted to compare the sexes and their risk of conditions due to inefficient iron metabolism.

In a research article published by the American Heart Association (AHA), it suggests that due to high levels of estrogen present in pre-menopausal women, males are more likely than females to be at risk of iron-overload cardiomyopathy.<sup>[7]</sup> To investigate this further, research was conducted on male and female mice. The mice were injected and fed a diet high in iron in order to induce iron-overload. Female mice had no underlying illness in response to the induced iron-

overload, showing that the high levels of estrogen actually protected them from developing cardiomyopathy.<sup>[7]</sup> Male mice on the other hand did develop cardiomyopathy in response to the added iron and showed high levels of diastolic dysfunction.<sup>[7]</sup> Although this research was done on mice, again this research can be used to draw conclusions about the effect's estrogen has on various pathways in the body. This research also shows how post-menopausal women are more at risk for developing these diseases as a result of decreased estrogen levels.

### **Musculoskeletal Performance and Risk of Injury**

Continuing on with the importance of estrogen in the body, estrogen can also affect musculoskeletal performance and risk of injury. According to a research review published by *Frontiers in Physiology*, estrogen directly has an impact on the structure and function of the musculoskeletal system.<sup>[8]</sup> More specifically, estrogen improves the function of muscles and bones and decreases the stiffness in ligaments and tendons, which can increase the risk of injury. The main purpose of this research study was to determine how high estrogen levels can decrease power and performance in women and also make them more injury prone.<sup>[8]</sup> Research shows that women are more likely to suffer from an anterior cruciate ligament (ACL) tear than men. The reason for this increased likelihood of ACL injury is due to the high estrogen levels found in pre-menopausal women.<sup>[8]</sup> Unlike previous studies that focused on the association of high estrogen levels and increased bone density, a study by Chidi-Ogbolu & Baar (2018) also highlighted the negative impacts of estrogen on the musculoskeletal system. The authors suggested that women with high estrogen levels (pre-menopausal) to participate in more anabolic exercise like cycling. Cycling is often recommended because it can increase musculoskeletal health and performance, while also decreasing the risk of injury that can come from aerobic exercise like running for example.<sup>[8]</sup> The authors argue that anabolic exercise can improve muscle repair and in term help women to develop stronger bones, muscles and tendons, which overall will decrease injury rates.<sup>[8]</sup> In the study there was no information about how these suggestions could be applied to pre- or post-menopausal women that compete in competitive competitions. Using the information given about the role of estrogen in musculoskeletal performance and other parts of the body, we can come to the conclusion that although the decreased estrogen levels that results from menopause should theoretically decrease a middle-aged woman's risk of a ligament tear, there would still be an increase in issues with bone density, which was mentioned previously.

### **Aerobic v. Anaerobic Exercise: Which is Better?**

To wrap up this discussion on the importance of estrogen, we will analyze the effect of aerobic and anaerobic exercise in post-menopausal women. As mentioned throughout this paper, menopause causes a lot of physiological changes in the body and regular exercise can help minimize some of these changes, but how? In a research article published by the International Journal of Health Sciences, 94 post-menopausal women with osteoporosis were randomly divided into aerobic and anaerobic exercise groups to determine how these difference types of exercise impacted estrogen levels.<sup>[9]</sup> All subjects participated in aerobic or anaerobic exercise for 12 weeks and were tested for estrogen levels, fat mass and muscle mass before and after the exercise intervention. The results of the experiment showed that both types of exercise resulted in a significant improvement in estrogen level and decreased overall fat mass.<sup>[9]</sup> Both types of exercise were beneficial, anaerobic exercise produced more increased estrogen levels and lean muscle mass compared to aerobic exercise. Although the research from this study showed increased results with the use of anaerobic exercise like resistance training, both aerobic and anaerobic exercises showed positive results. This research further pushed the importance of regular exercise, especially in post-menopausal women.

### **Conclusion**

It is no secret that regular exercise is important and through this research review has provided ample evidence of the benefits of exercise, especially for post-menopausal women. Lack of exercise in this population can put women at an increased risk of developing chronic diseases such as cardiomyopathy, osteoporosis and many more.<sup>[7]</sup> Daily exercise can have a positive impact on energy and cell metabolism, estrogen levels, fat mass and muscle mass. A simple 30 minutes of aerobic exercise can greatly decrease some of the negative effects that women experience after transitioning into menopause.<sup>[1]</sup> Given the science behind why exercise is so important to hormonal regulation and metabolism, more women might be more inclined to participate in more consistent exercise. Aging cannot be controlled, but what can be controlled is exercise frequency and how we respond to aging.

### **Apply it**

- This article provides information on how post-menopausal women can benefit from regular exercise can help the health and fitness professional educate women in this population on how to improve their overall health.
- Knowledge on the risks of intense exercise can and post-menopausal women.

- Help health and fitness professionals appropriately prescribe exercise to their post-menopausal clients.

### **Bridging the gap**

The purpose of this article is to identify the risks and benefits of regular exercise in post-menopausal women. It is known that exercise has many benefits for overall health, but this article specifically shows the research on how various bodily processes, like metabolism and hormone production are impacted by exercise in women that have gone through menopause. Research has been conducted in order to determine which types of exercise (aerobic or anaerobic) are best for women that fall into this age category.

### **Summary statement**

A review of the various reasons why exercise is essential for post-menopausal women. Menopause causes changes in hormones, metabolism and risk for injury, but with regular exercise these negative effects can be minimized and controlled.

### **Pulled text**

Men and women have many biological differences that affect a plethora of functions, such as the efficiency of metabolism and hormone regulation. These differences also impact exercise and how it can affect fat and muscle mass. Distinguishing the energy metabolism differences between men and women is important because it can allow for a better understanding how of female hormones can affect energy metabolism and the body's response to exercise.

### **Bio**

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### **References**

1. Sisson, S. B., Katzmarzyk, P. T., Earnest, C. P., Bouchard, C., Blair, S. N., & Church, T. S. (2009). Volume of exercise and fitness non-response in sedentary, post-menopausal women. *Medicine and science in sports and exercise*, 41(3), 539.

2. Wang, Q., Ferreira, D. L. S., Nelson, S. M., Sattar, N., Ala-Korpela, M., & Lawlor, D. A. (2018). Metabolic characterization of menopause: cross-sectional and longitudinal evidence. *BMC medicine*, *16*(1), 1-12.
3. Allman, B. R., Morrissey, M. C., Kim, J. S., Panton, L. B., Contreras, R. J., Hickner, R. C., & Ormsbee, M. J. (2019). Fat metabolism and acute resistance exercise in trained women. *Journal of applied physiology (Bethesda, Md. : 1985)*, *126*(3), 739–745.
4. Gonzalo-Encabo, P., McNeil, J., Boyne, D. J., Courneya, K. S., & Friedenreich, C. M. (2019). Dose-response effects of exercise on bone mineral density and content in postmenopausal women. *Scandinavian journal of medicine & science in sports*, *29*(8), 1121-1129.
5. Trenti, A., Tedesco, S., Boscaro, C., Trevisi, L., Bolego, C., & Cignarella, A. (2018). Estrogen, Angiogenesis, Immunity and Cell Metabolism: Solving the Puzzle. *International journal of molecular sciences*, *19*(3), 859.
6. Yang, X., Xu, M. M., Wang, J., & Xie, J. X. (2016). Effect of estrogen on iron metabolism in mammals. *Sheng li xue bao : [Acta physiologica Sinica]*, *68*(5), 637–643.
7. Das, S. K., Patel, V. B., Basu, R., Wang, W., DesAulniers, J., Kassiri, Z., & Oudit, G. Y. (2017). Females are protected from iron-overload cardiomyopathy independent of iron metabolism: key role of oxidative stress. *Journal of the American Heart Association*, *6*(1), e003456.
8. Chidi-Ogbolu, N., & Baar, K. (2019). Effect of Estrogen on Musculoskeletal Performance and Injury Risk. *Frontiers in physiology*, *9*, 1834.
9. Razzak, Z. A., Khan, A. A., & Farooqui, S. I. (2019). Effect of aerobic and anaerobic exercise on estrogen level, fat mass, and muscle mass among postmenopausal osteoporotic females. *International journal of health sciences*, *13*(4), 10–16.