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**Research and
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**THE EFFECTIVENESS OF HIGH INTENSITY
TRAINING IN RELATION TO HEALTH AND
FITNESS LEVELS**

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METHODOLOGY

This research report is based on qualitative desk research, using mainly secondary sources such as books and Dundalk Institute of Technology Library database, where journals and research reports were acquired. All data and information in this research report were obtained from credible sources.

INTRODUCTION

It is a well known fact that regular exercise reduces risk of various diseases. Physical inactivity is a huge risk factor in development of a range of chronic diseases such as cardiovascular diseases, diabetes, dementia and cancer. Many researches support this fact and also provide robust evidence that physical activity plays a major role in terms of almost all life-style related diseases prevention. (Hawley, Gibala 2009). Generally, the recommended amount of exercise is approximately 150 minutes a week. However, there were discoveries made, that the recommended amount can be significantly reduced by exercising in short, but more intensive spurts. (Wiley, Blackwell 2010). High Intensity Training (HIT) is a form of an intense exercise which was developed as a shorter alternative to conventional exercise, providing us with the same benefits.

The purpose of this article is to examine how HIT dramatically improves peoples' fitness and health levels. High intensity training is high interval training, consisting of short intervals of high intensity exercise followed by less intense periods of recovery. During the high-intense period a person is required to give it at least 80 to 95% percent of their best effort.

There are various ways of performing high intensity training and also the intervals vary with each exercise. The basic form of high intensity training, also called 'The Bare Minimum,' consists of a couple of minutes of gentle warm-up, then intense exercise for 20 seconds, followed by 90 seconds of recovery time. This is repeated three times. (Mosley, Bee, page 111). In total 'The Bare Minimum' takes less than 10 minutes per session and the high

intensity interval takes only 60 seconds altogether. On a weekly basis, excluding warm up and recovery intervals, the total time of high intensity exercise is 3 minutes. This is significantly lower than the widely recommended amount of 150 minutes of exercising a week. There is a widespread belief within the fitness industry, that the more time spent exercising the better. For example, celebrities like Jennifer Lopez or Madonna reportedly spend 90 to 120 minutes a day working out (Mosley, Bee 2013). This article will challenge the old beliefs about the amount of conventional exercise advised. The question is “how can we get more for less?”

SHORT HISTORY OF HIGH INTENSITY TRAINING

In recent years, High Intensity Training (HIT) is gaining popularity among fitness professional as well as attracting interest of the general public. Therefore it has been actively studied by many researches in order to understand the consistent positive results of HIT.

Evidence suggests that the principles of this form of exercise are not new. Some studies report that High Intensity Training existed among hunter-gatherers. A study on Hadza hunter gatherers describes how these people would do a mix of different activities. They alternated relatively low intensity activities like walking with brief rapid burst of movement such as active hunting. (Mosley, Bee 2013).

In the beginning of the 20th century a German running coach Woldemar Gerschler was one of the first people to study and use high intensity training. He would instruct an athlete to sprint up to 400 metres in order to increase their heart beat up to 180 beats per minute. Then the athlete would have to rest until his heart rate decreased to 120 minutes. By doing this, his athletes exhibited considerable improvements in their race times.

Similarly, in 1950's a young medical student Roger Banister was determined to run a sub four minute mile. Due to his busy schedule and lack of time he limited his workouts to ten cycles of one minute intense sprints followed by longer intervals of low intensity jog. In 1954

Roger Bannister broke the four minute mile record. Since then this approach to training became widely used among professional athletes (Mosley, Bee p. 59).

For many years, it was believed that High Intensity Training was a technique used to increase speed, not endurance. Despite this, athletes continued incorporating HIT in their training programmes, continuously exhibiting improved results. Later research confirmed that endurance athletes can definitely benefit from High Intensity Training. An extensive study of Paton and Hopkins (2005) showed that HIT in endurance athletes can considerably increase their performance. In addition, they also state that by adding HIT to athletes' training programme, which previously has not done so, would substantially improve their training results.

Initially, HIT has been studied to understand its effect on speed and endurance in athletes, but recent research revealed surprising results in relation to health improvements.

BENEFITS OF HIGH INTENSITY TRAINING

Before the benefits of HIT are discussed, it is important to point out the dangers of physical inactivity also known as sedentary lifestyle. It has been proven that many non-communicable diseases are the result of inactive lifestyle. More precisely, it is estimated that being physically inactive causes 6 to 10 percent of diseases such as type 2 diabetes, colon and breast cancers and heart disease. Furthermore, this unhealthy lifestyle is the cause of 9% of premature mortality (Lee et al. 2012). This study also revealed that partial or full elimination of inactivity would substantially improve health in individuals.

INSULIN SENSITIVITY

One of the significant benefits of HIT is a rapid improvement in insulin sensitivity. Low insulin sensitivity is a sign that the body is having difficulties metabolising glucose, which could eventually lead to diabetes. Hawley and Gibala stated in their report, that the estimated number of people affected by type2 diabetes by 2025 will be approximately 300 million worldwide (Hawley, Gibala 2009). Lee at al. (Lee et al.2012) also reported that sedentary lifestyle is a significant factor contributing to type 2 diabetes development.

In the book *Fast exercise*, Michael Mosley (Mosley, Bee 2013), who is a medically trained journalist, discusses insulin sensitivity improvements as a result of High Intensity Training. As a borderline diabetic he was interested in what effect would HIT have on his insulin sensitivity. He took part in a High Intensity Training experiment for four weeks, exercising three times a week. The total intense exercise in the four week period was 12 minutes. At the end of the experiment, Michaels' insulin sensitivity improved by 25 percent. (Mosley, Bee p.81) This confirmed James Timmons' claim, who is a Professor of Systems Biology at Loughborough University, that HIT decreases diabetes risk factors. (Babraj, Timmons 2009).

Hawley & Gibala (Hawley, Gibala 2009) also researched insulin sensitivity response to HIT. However, instead of focusing purely on HIT, he compared various studies results of low intensity exercise and high intensity exercise over 12 months. The observed group was

doing low to moderate exercise such as walking for the first 6 months, followed by high intensity programme for the rest of the experiment. The group did not show any insulin sensitivity improvement after 6 months of low to moderate training programme. On the other hand, after 6 months of high intensity exercise the group's insulin sensitivity improved by 30 percent. His findings underpin the claims of Mosley and Timmons about the effectiveness of HIT in type 2 diabetes prevention.

CARDIOVASCULAR HEALTH

HIT has also a positive impact on cardiovascular disease risk. Ciolac Emmanuel Gomes (2012) published in *The American Journal of Cardiovascular Disease* that as we age, the stiffness in central arteries increases, and this can be accelerated by high blood pressure. In his study, young healthy subjects with familial predispositions to high blood pressure showed some arterial stiffness even before their blood pressure increased. However, after 16 weeks of HIT, the observed group showed significant arterial stiffness reduction. This was then compared to continuous moderate exercise, which showed no effects on arterial stiffness reduction. Similar findings were also present in the study of Nybo et al. He states that brief intense training has the capacity of reducing arterial blood pressure as well as it reduces the risk of high blood pressure development (Nybo et al. 2010).

CHOLESTEROL

Furthermore, HIT has been linked to reduction of bad cholesterol (LDL) as well as the increase of good cholesterol (HDL). Buchan (Buchan et al. 2013) published that significant bad cholesterol (LDL) reduction was observed in a control group doing HIT. However, he also raised a question whether the cholesterol reduction was the effect of HIT on the study participants, or if it was the result of increased physical activity in general. In this matter, his study is not conclusive and further research is required in this area. In relation to good cholesterol (HDL) increase, longer continuous periods of hit are required to improve HDL increase (Musa et al. 2009).

AEROBIC FITNESS

Additional improvements were also observed in aerobic fitness. Aerobic fitness refers to the lung and heart capacity to distribute oxygen to our working muscles as well as the muscles' capacity to use the oxygen efficiently. Scientists use aerobic fitness as a measure to predict a person's future health. It is done in a form of VO₂max measurement, which is used to assess how efficiently oxygen is distributed into and around a body. Low aerobic fitness can enhance the risk of heart disease, diabetes, cancer or dementia (Mosley, Bee p.37). High intensity training is proven to notably increase our oxygen uptake (VO₂max). Emmanuel Gomez Ciolac (2012) reported in his pilot study that the oxygen consumption in subjects increased by 35 percent after HIT. Regular exercise increased oxygen uptake by 16 percent, which is a significantly lower value compared to HIT. Similarly, Hawley & Gibala (Hawley, Gibala 2009) published that up to 30 percent VO₂ max increase was observed in subjects.

In contrast, Michael Mosley (Mosley, Bee 2013) as an active participant in a HIT experiment did not exhibit any aerobic improvement. This, rather unfair result for Michael, was explained by Professor James Timmons. He said that: *"What we've known for some time now, is that there's a huge variation in how people respond to an exercise regime and there is actually no guarantee that following any particular recipe will produce favourable results"* (James Timmons, cited in Mosley, Bee 2013). James Timmons and his team developed a DNA test to predict whether an individual will respond to exercise by increasing their fitness. This is done using the gene code of just 11 genes. Approximately 20 percent of the population do not respond to exercise in the form of aerobic fitness increase (motleyhealth). Michael Mosley is one of the 'non responders' as his DNA test showed only a small number of genes responsible for oxygen uptake (VO₂max) (Mosley, Bee 2013). However, other discussed benefits of HIT were present.

FAT LOSS AND APPETITE REDUCTION

According to Schoenfeld & Dawes (Schoenfeld, Dawes 2009), HIT is superior to conventional exercise in relation to weight loss. In his research article, he refers to a study of Tremblay et al., observing 2 groups of participants divided into endurance training group and HIT group. There were significant differences in fat loss between the groups. HIT group exhibited 9 fold greater fat reduction when measuring skinfold thickness at the end of the study. This finding is backed up by Shiraev & Barclay (Shiraev, Barclay 2012) claiming that HIT has been shown to reduce fat significantly, particularly abdominal fat, as well as total body mass.

Moreover, HIT is found to control our appetites. Michael Mosley (Mosley, Bee 2013) refers to a study published in the International Journal of Obesity that young men consumed fewer calories after HIT than they did after moderate exercise. Michael also observed this fact on himself after doing HIT. This is in line with the findings of Schoenfeld & Dawes (Schoenfeld, Dawes 2009) who claims that intensive exercise significantly decreases hunger. In contrast, De Feo (De Feo 2013) does not agree with these findings due to other reports claiming that HIT can increase appetite in studied subjects due to higher calorie expenditure. However, these reports were based on studying obese people with the tendency to eat more regardless.

HOW DOES HIT WORK

Scientists are still trying to come up with the full answer to how HIT can be so efficient in such a short time. Partial explanation of HIT efficiency lies in the fact that HIT makes the muscles to produce new mitochondria, also known as the body's 'power plants'. These are responsible for fat and sugar conversion into energy. Michael Mosley (Mosley, Bee 2013) researched the connection between HIT and mitochondria production. He found that the more intense exercise, the higher number of mitochondria is produced in the muscles. Therefore HIT is extremely effective in new mitochondria production as the exercise intensity is extremely high during intense intervals. This results in increased conversion of fat and sugar into energy, not only in skeletal muscles but also in the heart muscle. Therefore, fat and sugar are not stored within the body. Hawley & Gibala (Hawley, Gibala 2009) also reported increases in mitochondrial capacity markers after HIT and consecutive insulin sensitivity and fat reduction in observed groups. In addition, mitochondria burns fat and sugar not only during exercise but also some time after exercise as muscles recover.

As previously mentioned, HIT is superior to conventional exercise in relation to fat reduction, particularly in the abdominal area. Mosley (Mosley, Bee 2013) believes that HIT is a shock to the body and this leads to rapid release of catecholamine, which is a fat cell burning hormone.

There are higher numbers of catecholamine receptors around the abdomen, thus the fat loss is greater in this area. It is essential to control excess abdominal, or visceral, fat as it is regarded to be more dangerous than fat in other areas. Visceral fat could not be physically reached as it lies within our bodies, in the abdominal cavity. It fills the spaces between our internal organs. Excess visceral fat could lead to cardiovascular problems, increased risk of type2 diabetes and many metabolic irregularities (Harvard medical school).

SAFETY OF HIT

Firstly, any form of exercise can result in injuries if not performed correctly. It is advised to have a medical check up prior to any exercise regime. This applies particularly to people who are either sedentary or extremely unfit. With regard to HIT, its safety has been researched a numerous times and it is considered to be safe and effective alternative to conventional exercise. Guiraud (Guiraud et el. 2012) wrote a review paper 'High intensity training in cardiac rehabilitation' where many studies on HIT safety were examined. HIT has proven to be not only safe but also more effective than conventional exercise in improvements in heart function as well as quality of life in cardiac patients.

Another recent review paper 'High intensity aerobic exercise in chronic heart failure' (Meyer et. El 2012) similarly concluded that HIT is safe and more effective than traditional training for exercise capacity improvement in patients with heart failure.

As previously mentioned, HIT increases mitochondrial capacity in the heart muscle. Therefore HIT is also linked to bigger and stronger heart (Mosley, Bee 2013).

In contrast, due to the intense nature of HIT, there is a risk of potential overtraining, especially if combined with other forms of exercise. From a medical point of view, it is important to take into consideration the physical abilities of a trainee before HIT is incorporated into their training regime (Schoenfeld, Dawes 2009). This applies mainly to people with medical conditions. For healthy individuals it is recommended to rather ease into HIT, slowly building up the intervals duration (Mosley, Bee 2009).

HIT INCORPORATION INTO PEOPLES' LIVES

Michael Mosley believes that HIT can be incorporated into peoples' lives with ease. Due to its short duration (less than 10 minutes per session), HIT can be performed practically anytime and anywhere. It can be done for example at home, at work place, or when outside. As already mentioned, HIT comes in many forms, the most common being cycling, running, stair-running, swimming or skipping. The only requirement to get HIT is to change the standard intensity of exercise to high intensity intervals followed by short recovery periods. An example of a short HIT workout would be running at moderate pace for approximately 3 minutes to warm up. Then sprint for 20 seconds followed by 90 seconds of low intensity jog to recover. Repeat 3 times. Of note, the amount of 20 seconds can be increased to 60 seconds, depending on the individual's fitness level. Then, the recovery intervals have to be also extended.

LIMITATIONS

So far, HIT has been studied mainly in laboratories and other control environments. The subjects would be tested prior to experiments and closely observed in relation to their safety. There is more research needed to establish the general amount of HIT that would be suitable for the general public. On the other hand, many studies agree, that HIT performed 3 times a week is safe for everyone. However, if performed more, the risk of overtraining may occur (Schoenfeld, Dawes 2009).

ADHERENCE TO HIT

Although HIT model is time-efficient, it requires high levels of participant motivation.

During experiments, the participants are verbally encouraged during the high intensity intervals. Nancy J. Selfridge (Selfridge 2012) suggested that this could lead to artificially increased motivation in subjects. Yet, Hawley & Gibala's research indicated that because of HIT's short duration, participants tend to adhere more to this model than to lengthy conventional exercise due to the reduced time commitment (Hawley and Gibala 2012).

CONCLUSION

In conclusion, there is a valid reason why HIT is gaining popularity in recent years. This exercise allows subjects to reduce the risk of type2 diabetes, decrease cholesterol, reduce fat and increase aerobic fitness in as little as few minutes a week. Research confirmed that HIT may be an attractive alternative to traditional time consuming traditional exercise. With regard to safety of HIT, there is more research needed on the application of HIT to general public. Nonetheless to say, that the health benefits of HIT has been mainly studied in people with cardiovascular disease and diabetes. All subjects showed some form of improvement in their health markers. There is no doubt, that HIT is also beneficial for generally healthy people. This is encouraging to anyone who wishes to undertake HIT as a new, shorter exercise regime. The benefits outweigh the risks. (3052 words).

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