

Assessment Feedback Sheet

Student No./Name: Lee Jamieson / 1702000

Module: Advanced Training Methods

Module Code: SHSS6089

Personal Evaluation – to support your academic progress please complete the section below <u>BEFORE</u> submitting your work.									
What do you consider to be the best aspects of this work?	Information given on the training method								
Which aspects do you consider could have been improved in this piece of work?	Research on other methods								
What have you found most satisfying whilst undertaking this submission?	The prescription of a training regime								
ASSESSMENT CRITERIA	Learning	GRADE							
		Poor 0-25%	Unsatisfactory 26-39%	Satisfactory 40 – 49%	Good 50 – 59%	Very Good 60 – 69%	Excellent 70 – 85%	Exceptional 86– 100%	%
Knowledge and understanding of established training methodologies	1								20
Knowledge and understanding of chosen advanced methodology	1								35
Critical evaluation using high quality research.	1								35
Academic writing and referencing									10
It is expected that students will present work that is proof read and follows the School Reference Guide and Assessment Checklist . Therefore a range of 0 – 10 marks will be deducted for non-completion of any of the points on the checklist below .									

TUTOR COMMENTS:

Submission date: 20/12/19

Return date: 24/01/20
(at least within 4 weeks)

Tutor: Geraint Forster

Mark:

Introduction

The basis of this report is to implement and evaluate the effectiveness of High Intensity Interval training on a client who has specific goals to achieve. Any technology used will be mentioned and the benefits of using it for training. A Tanita machine was used to gather information about the client's body composition which will be used to look at further improvements such as body fat percentage, Muscle mass and weight will be given an overview during the report.

There are a variety of methods and training styles in which people exercise their cardiovascular system. Incorporating these methods may help them to adhere to their training regime. However, as mentioned this report will identify the effectiveness of high intensity training for a participants VO2 max, VO2 max is measured by the stroke volume and maximum heart rate of an individual and will be more explained further on. Another goal of the client is a reduction in body fat. The reasons are the participant wanted to increase his cardiovascular performance for a half marathon competition. Additionally, this report will provide research and evidence as to why this method may be the most effective for increasing the cardiovascular system within a certain period. Details on why and how a vo2 max test will be conducted will be provided in the method section. There are other training methodologies available which are used for increasing a performers aerobic capacity. The success of these will depend on their current training, if any, as well as their genetics

The participant has an average of two years' experience in resistance training, they also jog twice a week and have taken part in football games in the past. However, the participant does not have much riding experience on a Wattbike which is the main apparatus for this chosen method and will be explained why in the method section. The participant does not have any previous problematic injuries that may have an effect on performance and no precautions will be required. To be able to measure how effective this method is, the participant will perform a vo2 max test before program. This will be repeated after five weeks to achieve valid results.

Other training methods

By carrying out endurance training, an individual is able to increase their maximal endurance capacity (VO2 max). This is able to be improved in different ways and there are many forms of endurance training that have been introduced throughout the years to performers wanting to achieve their highest (VO2 max). There are multiple benefits of aerobic training which consist of major cardiovascular modifications to the body some of which are an increased Heart size and rate, stroke volume, cardiac output, and also blood volume, pressure and flow (Kenney, Wilmore & Costill (2015).

Additional adaptations to aerobic training are an increased blood flow the to the working muscles and a lesser amount that are inactive or not as essential, also capillary to fiber ration is improved (Kenney, Wilmore & Costill 2015)

Continuous training

Continuous training involves running at a set rate for an extended duration at a chosen pace throughout the duration. The aims of this method is to improve cardiovascular factors such as aerobic fitness and also reduce risk factors within the cardiovascular system (Milanovic, 2015) however in a systematic view by Milanovic in 2015, it is noted that when compared to High Intensity Interval training the difference in VO2 max improvements are 6% higher with High intensity training. Also, another study comparing the two methods from Tabata et al 1996 had shown a similar result, stating that there were no significant changes in their controlled continuous group when compared to the high intensity group who found significant differences within the VO2 max. Another study from Baquet 2012 states in his findings of endurance training within young performers that exercise programmes having performers reach 80% or higher of their heart rate notice significant improvements compared to continuous training. However, it is possible that studies comparing high intensity to

continuous are not making the continuous programmes longer, this may help in achieving the same amount of work rate throughout the programmes chosen intensity.

Rationale and overview of prescribed programme

High intensity Interval (HIIT) training is a training method which involves repeated bouts of high-intensity exercise interspersed with recovery periods (Laursen, 2012) this method was chosen due to the time frame in which the client wanted to achieve the desired goals. The reason a bike is being used rather than running or another form of cardiovascular training, is because the participant carries out resistance training three times a week. This causes a focus on the lower region, causing the participants legs to be fatigued regularly. The participant enjoys jogging but not fast running the participant enjoys jogging but does not enjoying performing fast running which would have been an issue. Choosing a bike will help with the adherence to the programme and due to the preference, it may also help with the participants performance when it comes to training as it will be more enjoyable to perform then a sprinting run.

(HIIT) was chosen as the goals of this client were the outcomes provided by (HIIT) as research from Buchheit 2013 suggests that the targets of (HIIT) are aimed at increasing aerobic and anaerobic performance. The submaximal heart rate of an individual is reported to reduce with training at moderate intensity exercises, but also noticeably more recognised at higher intensity exercise which will be beneficial for extended periods of exercise. however, there is no change in maximal age-related heart rate (Buchheit 2013). Stroke volume is the number of litres which is able to be pumped out by the hearts ventricles which is improved allows for blood to be transported to the working muscles faster and more effectively (Kenney, Wilmore & Costill, 2015). This method is chosen also as higher intensity training can increase a performers lactate threshold which will serve in improving both lactate clearance and reduce the production (Hebisz 2019). This is a very beneficial improvement for a marathon, this will translate into being able to perform at higher intensities without a higher accumulation of lactic acid which will be even more of a bonus if the performer were looking to achieve a specific time of completion during the event. Another benefit of high intensity training is that is known to be at minimum of the same effectiveness of other methods such as continuous training, possibly more beneficial (Kenney, Wilmore & Costill (2015)

The chosen programme will involve using a stationary Wattbike along with a heart rate monitor. The heart rate monitor will show progression of intensity of the workout by changing the rate of beats per minute each time the workout intensity is increased or decreased. The expected heart rate during the sprints are expected to reach over 90% of max heart rate due to the sprints being maximal effort and aims of the programme.

Training would consist of two sessions per week for 5 weeks. The training approach was focused on High Intensity Interval Training, this was achieved by the performer cycling on a Watt bike which had intervals of 3 minutes moderate intensity which acted as an active recovery. Each 3 minutes had gone; the performer would cycle at maximal effort for 20 seconds. 6 sprints would be carried out throughout a thirty-minute session. After 2 weeks, the number of sprints would increase by 2, and then after a further 2 totalling in 10 sprints within thirty minutes for the final week of training. After each sprint during the thirty minutes during the training session, data would be collected which involved the Power and average power, Heart Rate (HR), and Rate of perceived exertion (RPE). These measurements would give a way of tracking the progression throughout the sessions, and each measurement was expected to improve throughout the 5 weeks to the final VO2 max test.

The Tanita machine helped to gain information such as body fat, total muscle mass, visceral fat and more. Initially a second test would be carried out after the 5 weeks of training and compared. However due to unforeseen circumstances as mentioned, a second test could not be performed to measure the differences after the training.

A maximal Vo2 test was carried out to gather data and a final figure for the participant and was carried out on a Watt bike. The performer cycled for 10 minutes at a set Revs per minute (RPM) and would have to maintain this throughout the duration, each minute the resistance was increased by 1. If, however the participant cycled for longer than ten minutes, the total (RPM) would be increased by 5 and the cyclist would. During this, Douglas bags were used to hold the performers oxygen which would be measured by a Servomex which measured the O₂ and CO₂. The same machine also has another purpose which vacuums the amount of oxygen and would give a figure in millilitres. A collection time of thirty seconds each minute is carried out, during the thirty seconds of collection, data that is collected was the Heart rate (HR), average power in Watts (W), and Rated of perceived exertion (RPE). These measurements would help to track progress if the performer were to carry out the test again and also to get a rough idea of the status of the individual. The aim for the (RPE) scale was

also used to help during the training sessions to come as the participant should be achieving maximal effort, giving a score of 10 on the scale.

The heart rate monitor would aid in showing the participants heart rate (HR) and was expected to achieve maximal beats per minute during each session, this also supports that the performer was able to achieve maximal effort which is the aim of the training programme.

The maximal heart rate measurement to find the performers possible max (HR) was a sum:

$$220 - \text{Age} = \text{Max (HR)}$$

The performer was 20 years old meaning the expected heart rate would be 200, and this was shown to the performer to introduce another aim of the training sessions.

Effectiveness of chosen intervention

The client achieved a VO2 max score of 62.1 ml/per kg in the first test and achieved a maximal heart rate of 201, throughout the training sessions the performer was able to achieve the desired goal of exercising to max heart rate or within 10%. If the performer were more experienced on a Wattbike it is believed that the performers economy would have allowed for max heart rate each sprint as it is clear from the tables in the appendices that the client gets closer each training session. It was also believed to be the best approach for the client in terms of adherence as mentioned the client does not enjoy flat out sprinting and also is well trained in that area already. Implications such as not being able to measure body composition nor VO2 max again disallows for a clear statement on whether this was effective in reaching the goals of the client.

By comparing the average power with that data tables in the appendices, a difference of the mean average power produced by the performer throughout the sprint durations increased from 163.8 to 180.5, this gave an increase of sustained power by 10.2%. However, it is fairer to judge the first six sprints in each session as this allows to measure the difference fairly between all of the session due to from the week 3 onwards, a total of 8 sprints were carried out rather than six. When comparing all of the first six sprints in each session, the power average increased by 11.9%. This is a noticeable difference in improvement in performance, especially as the performer is training for a marathon which requires a sustained work rate. Also, the VO2 max test carried out before the training started showed the mean for average power being 143.5 (Table 11), however the time of this performance was only 10 minutes

compared a thirty minute timeframe but gives indications of how the performance on the final VO2 test could have been.

When comparing the first Peak Power (PP) in watts to the final cycle, the difference is quite a considerable and from the training it is showing that the increase of (PP) was 35.5%, this is quite a significant increase, especially within the time available for training. If a VO2 test were able to be carried out again, judging by the percentage increases in both average power and peak power, the performer is already showing signs of important improvements for his desired goals. By analysing the given results, it is also noticeable that the performer when performing the sprints, was able to achieve the desired goal of maximal training and getting within at minimum of 191 Beats per minute which is short of 4.7% of his maximal heart rate each sprint. As mentioned, due to unforeseen circumstances the final testing was not able to be carried out which would have shown the key differences that the intervention had been able to improve for the performer. However as stated the differences in percentage in both peak power and average power show significant improvements throughout the training and can give security for the performer that this training may have been more ideal especially with the time frame given for training when compared to continuous.

As previously mentioned in this report, research studied has suggested that (HIIT) is more effective in gaining an increased VO2 max when compared to continuous training methods and by looking at the data gained it can be backed up. From research it is known that (HIIT) is a method which used a set % of a chosen variable, often being Heart rate. The variables which are used are to measure level of intensity at any given time as is a means to fulfil the training goals (Buchheit, 2013) Though Heart rate monitors are able to track the individuals heart rate, there is sometimes a delay in the detection which can cause an inaccurate reading which possibly will cause implications during training or on the athletes performance. This method is also known to be a time effective way of improving the desired cardiovascular goals that are gained with endurance training in a shorter period, as mentioned studies compare both continuous and (HIIT) within the same time frame which is a possible reason for more studies finding (HIIT) more effective. Possible improvements can be to extend the duration of data collection for continuous training approaches. VO2 max is possibly able to increase faster due to an increase in capillary density and cardiac output which is a body adaptation to aerobic training (Kenney, Wilmore & Costill, 2015) Though a comparison of both from a same study would be the best to find which is more effective, (HIIT) or continuous, Milanovic states that “In studies where HIT and endurance were directly

compared, there was a small beneficial effect for HIT” which is to be further discussed in further studies.

Conclusion

In conclusion, the effectiveness of this training method has not been able to be fully supported in improving VO2 max due to changing circumstances and not being able to carry out the final test. However, it is evident that an increase in Peak power and sustained average power has been improved through this training method and will be beneficial to the performer’s competition. Though no goals were able to be identified it they have been achieved such as a reduction of body fat but can be expected as a result from the training but can not be concluded due to the implications that occurred, also a statement on whether this training method was the most effective out of the discussed methods will not be drawn as there is no sufficient evidence in this report to back it up.

References:

Baquet, G., Van Praagh, E. & Berthoin, S. (2003) ‘Endurance Training and Aerobic Fitness in Young People.’ *Sports Med* 33, 1127–1143. <https://doi.org/10.2165/00007256-200333150-00004> (Accessed 24 March 2020)

Buchheit M, Laursen PB. (2013) ‘High-intensity interval training, solutions to the programming puzzle: Part I: cardiopulmonary emphasis.’ *Sports Med*;*43*(5):313–338. doi:10.1007/s40279-013-0029-x (Accessed 20 March 2020)

Hebisz, Rafal & Hebisz, et al. (2018). ‘Effects of concomitant high-intensity interval training and sprint interval training on exercise capacity and response to exercise- induced muscle damage in mountain bike cyclists with different training backgrounds.’ *Isokinetics and Exercise Science*. 27. 1-9. Doi:10.3233/IES-183170. (Accessed 19 March 2020)

Kenney, W.L., Wilmore, J.H. and Costill, D.L., 2015. *Physiology of sport and exercise*. Human kinetics. (Accessed 19 March 2020)

Laursen, P.B., Jenkins, D.G. (2002). 'The Scientific Basis for High-Intensity Interval Training.' Sports Med 32, 53–73. <https://doi.org/10.2165/00007256-200232010-00003>
(Accessed 20 March 2020)

Tabata, I., Nishimura, K., Kouzaki, et al (1996). 'Effects of moderate-intensity endurance and high-intensity intermittent training on anaerobic capacity and VO₂max.' Medicine & Science in Sports & Exercise, 28(10), pp.1327-1330. (Accessed 19 March 2020)

Appendices

Week 1 table 1

Sprint	Peak Power (W)	Power Average (W)	Heart Rate	RPE
1	721	154	191	8
2	669	164	195	9
3	634	173	195	9
4	629	169	194	9
5	618	170	196	10
6	578	153	199	10

Power average Mean 163.8

Table 2

Sprint	Peak Power (W)	Power Average (W)	Heart Rate	RPE
1	770	159	193	8
2	704	168	191	9
3	698	170	193	9
4	629	169	195	10
5	611	170	197	10
6	601	172	196	10

Power average mean 168

Week 2 Table 3

Sprint	Peak Power (W)	Power Average (W)	Heart Rate	RPE
1	776	160	192	8
2	721	169	190	9
3	701	175	194	9
4	693	174	194	10
5	676	170	195	10
6	671	169	198	10

Power average Mean 169.5

Table 4

Sprint	Peak Power (W)	Power Average (W)	Heart Rate	RPE
1	795	160	192	8
2	721	169	192	9
3	701	175	194	9
4	693	174	194	10
5	676	170	196	10
6	662	173	197	10

Power average 170.1

Week 3 Table 5

Sprint	Peak Power (W)	Power Average (W)	Heart Rate	RPE
1	839	170	193	8
2	801	170	192	9
3	761	175	194	9
4	703	174	194	10
5	676	170	196	10
6	662	173	199	10
7	645	175	200	10
8	634	173	200	10

Power average mean 171.1, First six sprints mean 172

Table 6

Sprint	Peak Power (W)	Power Average (W)	Heart Rate	RPE
1	865	170	192	9
2	820	169	190	9
3	776	175	194	10
4	693	174	194	10
5	676	175	196	10
6	667	175	197	10
7	655	177	200	10
8	639	175	198	10

Power average mean 172.5, First six sprints mean 173

Week 4 Table 7

Sprint	Peak Power (W)	Power Average (W)	Heart Rate	RPE
1	876	182	192	10
2	834	180	190	10
3	797	178	194	10
4	693	174	194	10
5	676	170	196	10
6	662	173	197	10
7	645	174	200	10
8	634	172	200	10
9	629	172	199	10
10	622	173	200	10

Power average mean 174.8, First six sprints mean 176.1

Table 8

Sprint	Peak Power (W)	Power Average (W)	Heart Rate	RPE
1	889	176	194	9
2	820	174	194	9
3	776	175	195	10
4	693	175	194	10
5	677	173	196	10
6	662	173	197	10

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7	653	174	200	10
8	649	173	199	10
9	630	174	198	10
10	620	173	200	10

Power average mean 174, First six sprints mean 174.3

Week 5 Table 9

Sprint	Peak Power (W)	Power Average (W)	Heart Rate	RPE
1	901	178	195	9
2	823	176	193	9
3	776	175	194	10
4	721	176	193	10
5	699	174	197	10
6	676	173	196	10
7	645	174	200	10
8	634	174	200	10
9	629	173	199	10
10	622	173	200	10

Power average mean 174.6, First 6 sprints mean 175.3

Table 10

Sprint	Peak Power (W)	Power Average (W)	Heart Rate	RPE
1	977	185	194	10
2	963	185	196	10
3	901	185	198	10
4	898	183	198	10
5	779	181	196	10
6	770	181	197	10
7	734	179	200	10
8	712	180	200	10
9	698	180	199	10
10	679	179	200	10

Power average mean 180.5, First six sprints 183.3

Par-Q form

Given consent form

Please comment below if you have any further information regarding your health, physical or otherwise, that has not been covered by the above questions (i.e past or present injuries) :

Declaration, Terms & Conditions

I have read, understood and completed this questionnaire to the best of my knowledge and can confirm that the information I have provided is correct.

I understand that I am expected to participate in physical activity and exercise as this is a necessary element of this degree. This may include exercise to exhaustion and maximal efforts. I am aware that participation in these activities involves the risk of injury.

I agree to work with in the guidelines of the laboratory and the parameters of any test protocol when present in the laboratory.

I understand that unacceptable or dangerous behaviour may result in my removal from the facilities.

I agree to inform a member of staff in the event of any change to either my personal or medical details.

Signature: *J.Price* **Date:** *17/02/2020*

Jason Price

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