Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XIII, ISSUE 2, 2013, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengace Learning, Cabell's Directories

Science, Movement and Health, Vol. XIII, ISSUE 2, 2013
June 2013, 13 (2), 73-77

Original Article

IMPROVE MAXIMAL AEROBIC SPEED IN HANDBALL SENIORS THROUGH INTERMITTENT EFFORT

CAZAN FLORIN[1], RIZESCU CONSTANTIN[1], GEORGESCU ADRIAN[1]

Abstract

Purpose: Working at high intensity intervals, the maximum aerobic speed aims central and peripheral qualities of maximum oxygen consumption. Through this experiment we want to improve its ability to repeat short explosive efforts and also to allow athlets more time to be quickly and strong more often.

Material and methods: Experimental strategy implementation period was 8 weeks during July and August 2010. The research was conducted on HCM Constanta senior team participating in the National Handball League 2010-2011 edition. The team is a group composed of 18 players, with a mean age of 26,94±3,78 years.

Study took place in Sports Hall of Constanta, the team conducted its official matches, with a field approved by the Romanian Handball Federation and the track Farul Stadium in Constanta.

We will include specific physical training program with a training schedule intermittent effort. We use such intermittent longer races more or less long, long intervals since the sequence of effort / rest 3-3 minutes, 2-2 minutes, then intermittent sprint 30 meters and passing through the more classical intermitent: 30"-30", 20"-20". These flights will be carried out at speeds close to maximum aerobic speed (VMA) using the 30-15 IFT (intermittent effort test) on intensity between 80 and 110% of flights will also be performed in line or commuting, or made way through periods of game activity effectively reduced for periods of 3 to 4 minutes. At the beginning and end of the training program, athletes were tested to determine VMA by 30-15 IFT.

Results: After applying the new program designed by intermittent effort, we managed to improve maximal aerobic speed, men handball team HCM Constanta from17.21 to 18.83 km / h.

Conclusions: After applying the training program with intermittent effort we managed to improve its ability to repeat short explosive efforts and also to allow athletes more time to be fast and powerful often.

Keywords: maximal aerobic speed, intermittent effort, handball, improve.

Introduction

Maximal aerobic speed (also called maximal oxygen consumption, maximal oxygen uptake, aerobic capacity, functional aerobic capacity, or simply VO2 max) is regarded as the criterion measure of cardiorespiratory fitness. Maximal aerobic speed is a useful physiological measurement, utilized by trainers to track progress with their athlets. It is the highest rate at which oxygen can be distributed, consumed during exercise or the maximal rate at which oxygen can be taken in, and used by the body during physical activity. VO2 max is usually expressed in relative (uptake relative to body weight) terms as milliliters of oxygen consumed per kilogram of body weight per minute (ml O2 /kg/min or ml/kg/min). The "V" in VO2 max represents the volume used per minute (in scientific notation, a dot (sometimes) appears over the V to indicate "per unit of time"). Significant factors that influence maximal oxygen consumption in healthy adults are gender, heredity, body composition, age, state of training and mode of exercise (http://www.ideafit.com/fitness-library/maximal-aerobic-power-and-functional-independence-in-older-adults).

For an athlete to compete successfully in an endurance event, a VO2max of at least 70 ml.kg-1.min-1 is a minimum requirement (Hawley et al., 1997 cited by Finn). While athletes employ a variety of training strategies to increase VO2max, recent research suggests that a form of interval training known as high-intensity intermittent training leads to rapid improvements in VO2max and endurance performance (Finn 2001). To attain an optimal stimulus (and forthcoming adaptations), athletes are generally required to spend a couple of minutes in their 'red zone,' which generally means hitting >90 – 95% of either VO2 max or maximal heart rate (HR) (Laursen and Jenkins, 2002).

Despite the growing interest in game- or skill-based conditioning (Buchheit et.al. 2011, Impellizzeri et.al. 2006, Sheppard and Borgeaud, 2009), running-based high-intensity interval training (HIIT) is still one of the most popular forms of exercise to improve cardiorespiratory fitness in athletes (Billat, 2001a, 2001b).

Material and methods

Experimental strategy implementation period was 8 weeks during July and August 2010. The research was conducted on HCM Constanta senior

[1]Faculty of Physical Education and Sport, University Ovidius Constanta, Romania
Email: cazan10florin@yahoo.com
Received 15.01.2013 / Accepted 19.05.2012

team participating in the National Handball League 2010-2011 edition. The team is a group composed of 18 players, with a mean age of 26, 94±3,78 years. At the beginning and end of the training program, athletes were tested to determine VMA by 30-15 IFT.

Study took place in Sports Hall of Constanta, the team conducted its official matches, with a field approved by the Romanian Handball Federation and the track Farul Stadium in Constanta.

We included a training program with intermittent effort schedule. We use such intermittent longer races more or less long, long intervals since the sequence of effort / rest 3-3 minutes, 2-2 minutes, then intermittent sprint 30 meters and passing through the more classical intermitent: 30"-30", 20"-20" as you can see in Tabel 1. These flights will be carried out at speeds close to maximum aerobic speed (VMA) using the 30-15 IFT (intermittent effort test) on intensity between 80 and 110% of flights will also be performed in line or commuting, or made way through periods of game activity effectively reduced for periods of 3 to 4 minutes (Cazan, 2010).

Tabel 1. Training program with intermittent effort schedule

Week	Day	Running time	Running intensity	Recovery duration	Recovery intensity	Series duration	Number of series	Recovery time between series
Week 1	Monday	5 min.	80-85%	-	-	-	5	3 min.
	Wednesday	4 min.	80-85%	-	-	-	5	3 min.
	Friday	3 min.	85-88%	-	-	-	5	3 min.
Week 2	Monday	3 min.	85-88%	-	-	-	6	3 min.
	Wednesday	2 min.	85-88%	-	-	-	6	3 min.
	Friday	2 min.	85-88%	-	-	-	6	3 min.
Week 3	Monday	1 min.	90%	30 sec.	Passive	12 min.	2	3 min.
	Wednesday	45 sec.	90%	15 sec.	Passive	7 min.	3	3 min.
	Friday	45 sec.	90%	15 sec.	Passive	8 min.	3	3 min.
Week 4	Monday	30 sec.	90%	15 sec.	Passive	7 min.	3	3 min.
	Wednesday	30 sec.	90%	30 sec.	40%	12 min.	2	3 min.
	Friday	30 sec.	93%	30 sec.	Passive	10 min.	3	3 min.
Week 5	Tuesday	20 sec.	95%	20 sec.	Passive	8 min.	2	6-7 min. active
	Thursday	20 sec.	90%	20 sec.	45%	8 min.	2	6-7 min. active
Week 6	Tuesday	15 sec.	100%	15 sec.	Passive	10 min	3	3 min.
	Thursday	15 sec.	95%	15 sec.	25%	7 min.	2	6-7 min. active
Week 7	Tuesday	15 sec.	95%	10 sec.	passive	7 min.	2	6-7 min. active
	Thursday	10 sec.	90%	10 sec.	passive	7 min	2	6-7 min. active
Week 8	Tuesday	10 sec.	100%	10 sec.	passive	6 min.	2	6-7 min. active

Thursday	10 sec.	110%	10 sec.	passive	6 min.	2	6-7 min. active

To overcome the inherent limitations of VO2 max for training prescription based on changes of direction, and intermittent supramaximal was developed 30-15 IFT (Buchheit, 2008, 2010). IFT 30-15 was designed to determine the maximum VO2 and HR, and anaerobic capacity, capacity inter-effort recovery, acceleration, deceleration, and abilities COD (Buchheit 2008a, 2008b). Final speed reached to test VIFT is therefore a compound velocity, which takes into account all physiological variables created when doing HIIT including COD. In other words, the IFT 30-15 is very specific, not for sport specific, but common training sessions conducted in intermittent sports. While other protocols such as Yo-Yo tests have somewhat similar physiological requirements, VIFT is only speed that can be used for exercise prescription (eg final performance measured at Yo-Yo, or the total distance covered, can not be directly used for training prescription because her relationship with VO2 max is based on speed) (Dupont et al. 2010) to demonstrate the validity of the test logic, VIFT proved to be better than VO2 max HIIT, COD to individualize the players inteam sports (Buchheit 2008). This was exemplified by a low heterogeneity between players cardiopulmonary system responses (Buchheit 2008). Finally, IFT 30 to 15 is also attractive because it was perceived to be less painful than continue running tests (Leger and Boucher, 1980 (Leger and Lambert, 1982) by 70% of players tested (Buchheit, 2005).

To ensure that athletes reach the intensity required, there are several ways to control and individualize running speeds. While the simplest method involves the athlete's perception of effort (eg. I run as hard as I can, knowing that x reps be done (Celine et al. 2011), or HR retrospective analysis (Helgerud et al 2007), where once the session is over, players help dictate a reaction changes in future sessions running distances) using ground running tests is a method more objective (Bill and Koralsztein 1996), accurate and practical (it is not necessary to monitor HR), and rather effective. For a long time, velocity associated with VO2 max (vVO2 max) was the speed. Reference favorite running HIIT program (Bill, 2001a, 2001b). However, since the speed of VO2 max is determined only by the athlete and the energy cost of jogging (Di Prampero et.al. 1986) its use is limited to single supramaximal intermittent jogging (ie,> vVO2 max) including changes in direction (COD) as predominantly implemented in team (Dupont et al, 2004) or tennis (Fernandez-Fernandez et al, 2011). For example, athletes with similar max vVO2 can present different profiles anaerobic recovery or COD. Programming based on vVO2 max for HIIT these athletes can lead to different levels of encouragement aerobic and anaerobic (Bill, 2008). this prevents standardization of training, and limited ability to target specific physiological adaptations.

Protocol of IFT 30-15

The 30-15 IFT consists of 30 s shuttle runs interspersed with 15 s passive recovery periods (Buchheit 2008). Velocity is set at 8 km.h-1 for the first 30 s run, and speed is increased by 0.5 km/h every 30 s stage thereafter (well-trained players can start the test at 10 or even 12 km/h to save time). Players are required to run back and forth between two lines set 40 m apart (Fig. 1) at a pace governed by a prerecorded beep. This prerecorded beep allows the players to adjust their running speed when they enter a 3 m zone placed in the middle and at each end of the field. During the 15 s recovery period, players walk in a forward direction toward the closest line at either the middle or end of the running area, depending on where their previous run stopped. This line is where they will start the next run stage from. Players are instructed to complete as many stages as possible and the test ends when they can no longer maintain the required running speed or when they are unable to reach a 3-m zone in time with the audio signal for three consecutive times. The velocity attained during the last completed stage is noted as the player's VIFT (Buchheit 2008).

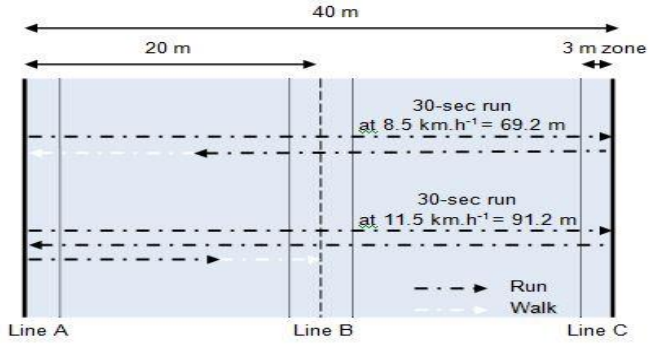

Fig. 1. Area prepared for the 30-15 IFT and example of two intermittent runs. For the run at 8.5 km.h-1 (about 69.2 m in 30 s), subjects start at line A, run to line C crossing line B, and then return. After crossing line B again, they stop after 8.5 m and walk to line A during the 15s recovery to be ready for the next stage. For the run at 11.5 km.h-1 (about 91.2 m in 30 s), subjects start at line A, make one complete round trip and stop after 9.5 m when going towards line B, then walk to line B during the 15 s of recovery for the next start. Note that calculation of targeted distances take into account the time needed for direction changes (Buchheit 2008).

Results

Table 2. 30-15 IFT test results obtained from initial testing and final testing

	INITIAL TEST		FINAL TEST	
	n=18		n=18	
Variables	M±DS	CV (%)	M±DS	CV (%)
VMA km/h	17.21 ± 0.81	4.59	18.83 ± 0.38	2.04

Established significance level at p<0.05.
M, average; DS, standard deviation; CV, variability coefficient; n, number of subjects.

Discussion

Applying the training program designed by us for senior handball team HCM Constanta, we managed an improvement of VMA, from 17.21 to 18.83, a significant improvement at p <0.05. We had an increase in VMA by 9.5%.

Researchers at McMaster University in Canada have investigated the effects exerted training VO2 max (MacDougall et al, 1998). Training was carried out on a stationary bike ERGOMETAL 3 days a week. The program began with four intervals of 30 seconds separated by a rest period of 4 minutes. In spatamani 7 Number ranges increased to 10, while rest intervals were gradually reduced 2.5 minutes. VO2 max increased by 9%, demonstrating that significant gains can be obtained in VO2 max of relatively short duration exercises. In the first week of the program, each workout session it took 14 minutes. In Week 7, the duration of each session increased to 30 minutes.

Besides its effect on VO2 max, high-intensity intermittent training may improve athletic performance.

Lindsay et al. (1996) reported that 4 weeks of interval training can improve 40-km time trial performance of competitive cyclists. The cyclists replaced approximately 15% of moderate intensity endurance training with high-intensity intermittent training, completing six interval sessions during the course of the study. Each interval session consisted of six to eight 5-min work bouts at 80% of peak power, separated by 60 s of recovery. The authors found significant improvements in 40-km time trial performance (54.4 ± 3.2 vs 56.4 ± 3.6 min) and time to fatigue at 150% of peak power (72.5 ± 7.6 vs 60.5 ± 9.3 s) (Finn 2001).

Studies considered in these articles have used high-intensity intermittent efforts as a form of intervention on exercise capacity. However the application forms were widely different. Some working range takes between 15 to 30 seconds while resting periods covering 10 seconds to 4.5 minutes. Conclusion would be that are needed more research to determine the most effective form of training, interval and effort needed break to improve endurance performance.

Conclusion

After applying the new program designed by intermittent effort, we managed to improve maximal aerobic speed, men handball team HCM Constanta from17.21 to 18.83 km / h. After 8 weeks training program with intermittent effort we managed to improve its ability to repeat short explosive efforts and also to allow athletes more time to be fast and powerful often.

In conclusion, choosing training program for 8 weeks with intermittent exercise, the programming intervals intermittent exercise room is important to ask certain physiological systems, and instead to take into account certain adaptations. Speed reached at the end of the IFT 30-15 (VIFT) is a complex structure that takes into account all physiological variables obtained when performing intermittent intervals including changes steering effort (eg, anaerobic capacity, capacity inter-effort recovery, acceleration, deceleration and change of direction skills). VIFT speed is therefore of major importance and precision speed to bring players with different levels of physiological profiles to similar metabolic requirements, thus standardizing training content.

References

Billat, L.V., 2001a, Interval training for performance: a scientific and empirical practice. Special recommendations for middle- and long-distance running. Part I: aerobic interval training. Sports Med. . 1: 13-31.

Billat, L.V., 2001b, Interval training for performance: a scientific and empirical practice. Special recommendations for middle- and long-distance running. Part II: anaerobic interval training. Sports Med. 31: 75-90.

Billat, L.V., and Koralsztein, J.P., 1996, Significance of the velocity at VO2max and time to exhaustion at this velocity. Sports Med. 22: 90-108.

Buchheit, M., 2005, The 30-15 Intermittent Fitness Test: a new intermittent running field test for intermittent sport players - Part 1]. Approches du Handball. 87: 27-34.

Buchheit, M., 2008a, 30-15 Intermittent Fitness Test and repeated sprint ability. Science & Sports. 23: 26-28.

Buchheit, M., 2008b, The 30-15 Intermittent Fitness Test: accuracy for individualizing interval training of young intermittent sport players. J Strength Cond Res. 22: 365-374.

Buchheit, M., Laursen, P.B., Kuhnle, J., Ruch, D., Renaud, C., and Ahmaidi, S., 2009 Game-based training in young elite handball players. Int J Sports Med. 30: 251-8.

Buchheit, M., 2010, The 30-15 Intermittent Fitness Test : 10 year review. Myorobie Journal 1: http://www.martin-buchheit.net.

Cazan, F., 2010, Specific physical preparation optimization for performance handball players, (doctoral dissertation), University of Pitesti.

Celine, C.G., Monnier-Benoit, P., Groslambert, A., Tordi, N., Perrey, S., and Rouillon, J.D., 2011, The perceived exertion to regulate a training program in young women. J Strength Cond Res. 25: 220-4,

Di Prampero, P.E., Atchou, G., Bruckner, J.C., and Moia, C., 1986, The energetics of endurance running. Eur J Appl Physiol Occup Physiol. 55: 259-66,

Dupont, G., Akakpo, K., and Berthoin, S., 2004, The effect of in-season, high-intensity interval training in soccer players. J Strength Cond Res. 18: 584-9.

Dupont, G., Defontaine, M., Bosquet, L., Blondel, N., Moalla, W., and Berthoin, S., 2010, Yo-Yo intermittent recovery test versus the Universite de Montreal Track Test: relation with a high-intensity intermittent exercise. J Sci Med Sport. 13: 146-50,

Fernandez-Fernandez, J., Zimek, R., Wiewelhove, T., and Ferrauti, A., 2011, High-Intensity Interval Training vs. Repeated-Sprint Training in Tennis. J Strength Cond Res,

Finn, Christian, 2001, Effects of High-Intensity Intermittent Training on Endurance Performance, Sportscience 5 (1), sportsci.org/jour/0101/cf.html,

Hawley J.A., Myburgh K.H., Noakes T.D., Dennis, S.C., 1997, Training techniques to improve fatigue resistance and enhance endurance performance. Journal of Sports Sciences, 15, 325-333

Helgerud, J., Hoydal, K., Wang, E., Karlsen, T., Berg, P., Bjerkaas, M., Simonsen, T., Helgesen, C., Hjorth, N., Bach, R., and Hoff, J., 2007, Aerobic high-intensity intervals improve VO2max more than moderate training. Med Sci Sports Exerc. 39: 665-71,

Impellizzeri, F.M., Marcora, S.M., Castagna, C., Reilly, T., Sassi, A., Iaia, F.M., and Rampinini, E., 2006, Physiological and performance effects of generic versus specific aerobic training in soccer players. Int J Sports Med. 27: 483-92,

Laursen, P.B., and Jenkins, D.G., 2002, The scientific basis for high-intensity interval training: optimising training programmes and maximising performance in highly trained endurance athletes. Sports Med. 32: 53-73,

Leger, L.A., and Boucher, R., 1980, An indirect continuous running multistage field test: the Universite de Montreal track test. Can J Appl Sport Sci. 5: 77-84.

Leger, L.A., and Lambert, J., 1982, A maximal multistage 20-m shuttle run test to predict VO2 max. Eur J Appl Physiol Occup Physiol. 49: 1-12.

Lindsay, F.H., Hawley, J.A., Myburgh, K.H., Schomer, H.H., Noakes, T.D., Dennis, S.C., 1996. Improved athletic performance in highly trained cyclists after interval training. Medicine and Science in Sports and Exercise, 28, 1427-1434

MacDougall, J.D,, Hicks, A.L., MacDonald J.R., McKelvie, R.S., Green, H.J., Smith, K.M., 1998, Muscle performance and enzymatic adaptations to sprint interval training. Journal of Applied Physiology, 84, 2138-2142

Sheppard, J.M., and Borgeaud, R., 2009, Skill Based Conditioning: A Perspective From Elite Volleyball. NSCA Hot Topic Series. December:

www.nsca-lift.org download 12.02.2013

http://www.ideafit.com/fitness-library/maximal-aerobic-power-and-functional-independence-in-older-adults, download 12.02.2013