PEAK CENTRE
FOR HUMAN PERFORMANCE

Running Threshold VO2 max Test Results

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PERSONAL INFORMATION

Name:	Kristin Marvin			**Weight:**	158.0 lbs
Date:	January 10, 2017	**Age:**	41	**Height:**	169.6 cm
Grade:	2%			**Sex:**	Female

The Threshold VO2 max test provides you with a lot of very valuable information to help you build your program and assess your fitness improvements. From this test we can:

1. Determine your individual training zones
2. Determine the number of calories and amount of carbohydrate you need for training and racing
3. Monitor your efficiency and changes in efficiency

YOUR RESULTS

Stage	Speed (km/h)	HR (bpm)	Lactate (mMol)	VO_2 (l/min)	VO2 (ml/kg/min)	RQ	Kcal/min	CHO (Kcal/min)	CHO (g/min)
1	6	105	1.21	1.57	21.8	0.82	7.4	3.1	0.77
2	7	123	0.67	2.07	28.8	0.86	10.0	5.5	1.39
3	8	132	1.60	2.20	30.6	0.89	10.7	7.1	1.76
4	9	144	1.82	2.50	34.9	0.90	12.3	8.5	2.14
5	10	156	2.39	2.68	37.4	0.95	13.2	11.5	2.87
6	11	163	3.65	2.88	40.1	0.97	14.3	13.4	3.36
7	12	172	4.72	3.16	43.9	1.01	15.9	15.9	3.98
8	13	175	8.49	3.16	44.0	1.06	16.0	16.0	4.00

VO2max: 44.0ml/kg/min
3.16L/min

Anaerobic Threshold: 11.4 km/h
Speed: 13.0 km/h

Aerobic Threshold: 9.3 km/h

The table above shows your results. The first column is the stage of the test, the second is the speed at which you were working. The third column is your heart rate and the fourth is the blood lactate level that was measured in the blood taken from your finger. Ideally we like to see the first 2-3 stages with lactate values under two as this is a sign of a good aerobic base. Lactate values above two in these stages suggests the need to do more aerobic base work. The fifth and sixth columns are your oxygen consumption scores. The highest value at the end of the test is your VO2 max, which is the maximum amount of oxygen you can take in and use. VO2 max is not necessarily an indicator of performance but is more of an indicator of performance potential. The next column, RQ, is a number that typically falls between 0.7 and 1.2 and represents the proportions of fat and carbohydrate that you are burning at each stage of the test. The next column is the number of calories per minute that you were burning at each stage. Beside that we have the number of calories from carbohydrate and the number of grams of carbohydrate in each stage.

TRAINING ZONES

Training zones allow you to target specific training intensities and adaptations. Training zones are built around three physiological points: aerobic threshold, anaerobic threshold and VO2 max. By graphing your results we can determine five different training zones:

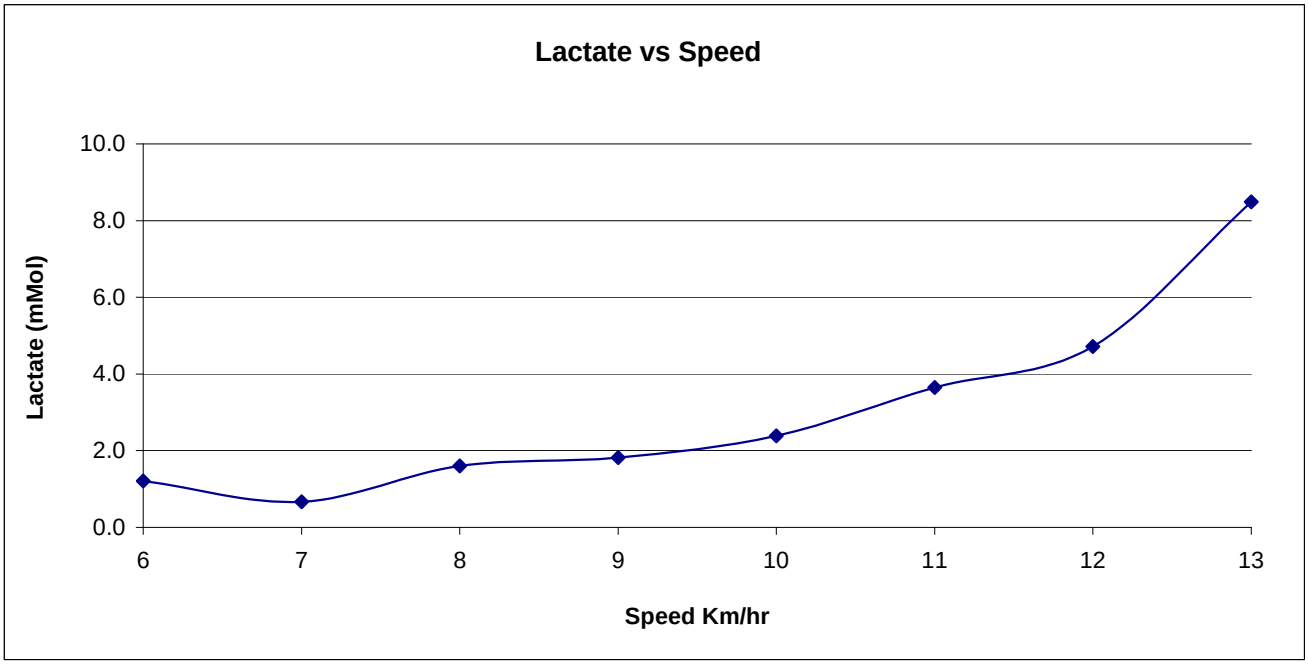
Zone 1: This is your aerobic base zone and race pace for events lasting 3 hours or more. It encompasses intensities up to aerobic threshold. In this zone you use predominantly slow twitch muscle fibres. In most endurance sports up to 80% of total training time is spent in Zone 1

Zone 2: This zone is race pace for events lasting from 40 minutes up to 3 hours. This zone is between aerobic and anaerobic threshold. Zone 2 is the most commonly used zone for people who are self selecting a pace but is of limited value in endurance sports. Only 5-10% of your training should be done in Zone 2.

Zone 3: This is the anaerobic threshold zone and represents race pace for events lasting 20-40 minutes in duration and possibly longer for elite athletes.

Zone 4: This zone is between anaerobic threshold and VO2 max. It is very important for events that have a lot of uneven terrain like cross country skiing, mountain biking, or cross country running.

Zone 5: This is the VO2 max zone. It is important for improving VO2 max and is race pace for event lasting 2-6 minutes in duration.



TRAINING ZONES

TRAINING ZONES								
ZONE	Heart Rate			Treadmill Speed kph			CHO (g/min)	
	Low		High	Low		High	Low	High
1	125	to	147	7.3	to	9.3	1.50	2.36
2	148	to	161	9.3	to	10.8	2.36	3.26
3	162	to	172	10.8	to	12.0	3.26	3.98
4	173	to	174	12	to	12.6	3.98	4.00
5	175	to	+	12.6	to	13	4.00	4.00

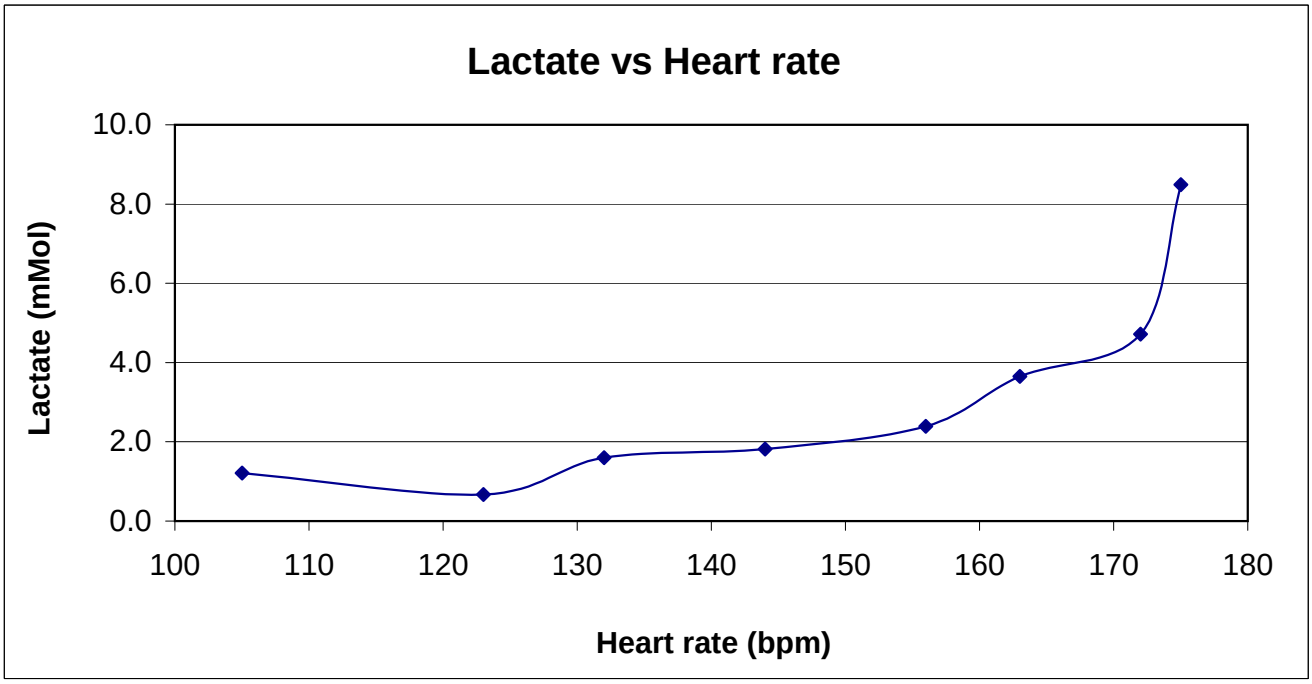
Even though we use a treadmill protocol that makes running on a treadmill biomechanically as close as possible to running outdoors, running on a treadmill is not exactly the same as running outdoors. Over the years we have done several studies to determine the differences between running outdoors and running on a treadmill. Below you will find your paces and speeds for outdoor running for each of the zones. Interestingly, even though the speeds may vary the CHO and Calories do not seem to change because the differences between treadmill and outdoor running seem to be linked more to efficiency.

Zone	Outdoor Speed kmh			Outdoor Pace		
	Low		High	Low		High
1	8.3	to	10.3	07:13	to	05:49
2	10.3	to	11.8	05:49	to	05:05
3	11.8	to	13.0	05:05	to	04:36
4	13.0	to	13.6	04:36	to	04:24
5	13.6	to	14.0	04:24	to	04:17

HEART RATE

As you see in the training zone table we have provided you with both heart rate and speed zones. We prefer to use speed zones because speed is more stable than heart rate and is a better representation of the muscle fibres that are being activated. Many external factors, like heat, stress, sleep, caffeine, various drugs and fatigue all affect the relationship between heart rate and lactate. For example if you were training on a hot day after 20-30 minutes you may notice that your heart rate is starting to climb even though your speed is the same. If you decrease your speed to keep your heart rate in the right range you are changing the muscle fibres that you are using and changing the training effect.

If you do not have a GPS, or other speed monitoring system and have to use heart rate wait until you have been running for about 10 minutes take a look at your heart rate and your speed this will give you a heart rate speed relationship for that day. If your heart rate starts to climb don't worry about it try to keep your speed constant.

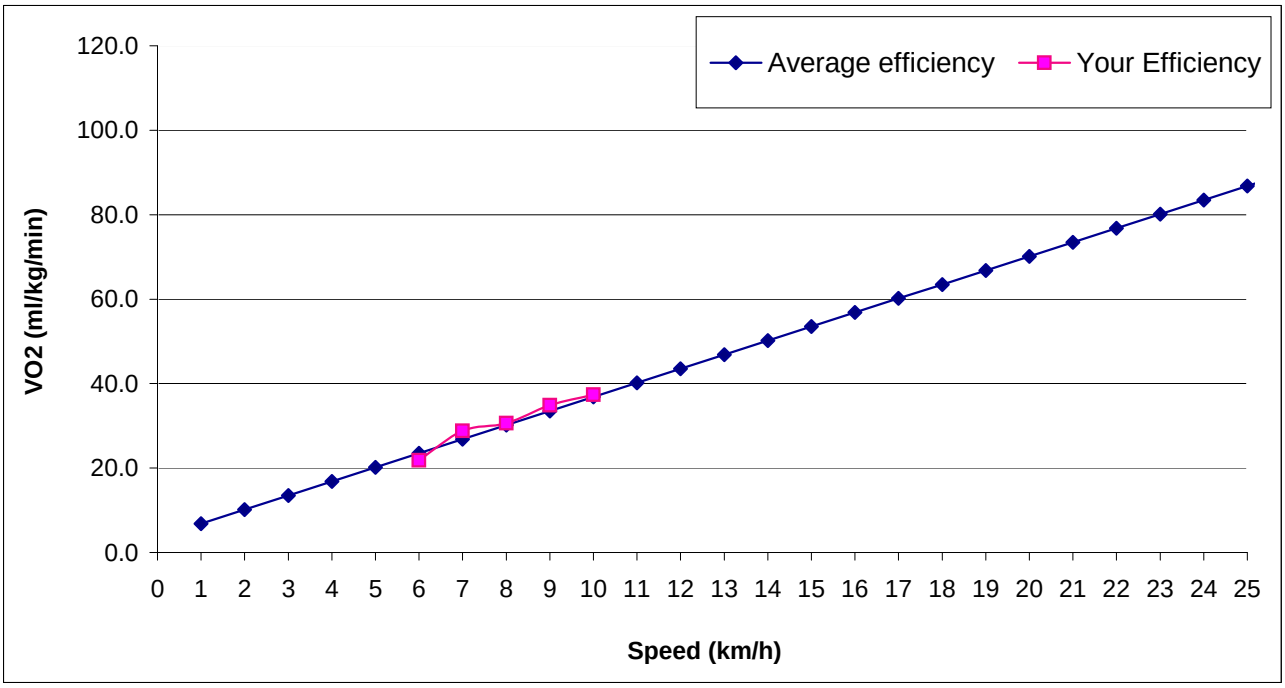


Efficiency

Efficiency is a measure of how effectively you transfer the energy your body is producing to running speed. It is expressed in terms of Oxygen consumption graphed against speed. The graph below shows your efficiency compared to average running efficiency. If your graph is to the left of the average line you are less efficient than average if it is to the right you are more efficient than average

Good efficiency allows you to get more speed from your fitness. There are many elite runner who have relatively low VO2 max scores but very high efficiency, allowing them to compete and win against runner who are fitter than they are.

A variety of factors can improve your efficiency: altitude training, improved running technique, and strength and power training.



Fueling and Refueling

Fueling During Training

Proper fueling during training can make the difference between a good workout and a bad workout. In longer training sessions taking in adequate energy will determine whether you get through the session or not.

Carbohydrates are the limiting energy source during long races or training sessions. When you become carbohydrate depleted your body goes into a catabolic state where it starts to break down muscle tissue for energy. The reliance on protein as an energy source can have several negative side effects for the competitive athlete. Glutamine and alanine are two of the amino acids readily converted to energy. Glutamine is also an important fuel for white blood cells, so reductions in blood glutamine concentration following intense exercise may contribute to immune suppression in overtrained athletes. Another group of amino acids that are used for energy are the Branched chain amino acids (BCAA). The availability of BCAA during exercise contributes to fatigue.

The source of BCAAs for energy metabolism during exercise is the blood BCAA pool, which is replenished through the breakdown of whole body proteins during endurance exercise. However, the use of BCAAs in the muscle during prolonged exercise may be greater than capacity to provide BCAAs. This means that the plasma BCAA concentration may decline during prolonged endurance exercise. The decline in plasma BCAAs during endurance exercise can result in an increase in the ratio of free tryptophan to BCAAs.

Free tryptophan and BCAAs compete for entry into the brain via the same amino-acid carrier. Therefore, a decrease in BCAAs in the blood allows entry of tryptophan into the brain. The decrease in plasma BCAAs and increase in free tryptophan during prolonged endurance exercise alters the ratio of free tryptophan to BCAAs and increases the entry of tryptophan into the brain. An increased concentration of tryptophan in the brain promotes the formation of the neurotransmitter 5-hydroxytryptamine (5-HT). 5-HT has been shown to induce sleep, depress motor neuron excitability, influence hormone function, and suppress appetite. It has also been suggested that chronic elevations in 5-HT concentration, which may occur in athletes maintaining high-volume training, explains some of the reported signs and symptoms of the overtraining syndrome: anemia, amenorrhea, immunosuppression, appetite suppression, weight loss, depression, and decreased performance.

The use of whole body proteins to supply energy will tend to decrease muscle mass. Decreases in muscle mass will ultimately lead to decreased strength and power production thereby decreasing performance.

Carbohydrates
The amount of carbohydrate required during exercise depends on the intensity and duration of the activity, the fitness level of the participant and their metabolic predisposition to carbohydrate oxidation. Rates of carbohydrate use can be individually determined using a metabolic cart. While for many years the endurance community has focused on CHO intake during exercise more recent evidence suggest that a combination of carbs and protein may be even better for endurance athletes.

Carbohydrate- Protein Mixes

While carbohydrate ingestion during exercise can enhance performance recent research suggests that the addition of protein to a carbohydrate drink during exercise enhances performance even further. Athletes consuming a mix of carbohydrates and protein (CHO-PRO) in their exercise drink have improved their endurance capacity by 29% over consuming just a carbohydrate drink when exercise at moderate intensity. At higher intensity the effect is even greater, the consumption of a CHO-PRO drink improves endurance capacity by 40% compared to carbohydrate alone.

During periods of higher volume training the use of a CHO-PRO mix can make the difference between good quality training and going through the motions in the second workout of the day. In a study of multiple training sessions in one day researchers from the University of Texas found that athletes consuming a carbohydrate drink improved their endurance in the second workout by 55% compared to a placebo while the athletes consuming CHO-PRO increased their endurance by 112% compared to the placebo. The best results seem to occur when the concentration of CHO is 4-8 g/100ml of drink and is high glycemic index like sucrose or glucose. The protein concentration should be 1.5-2.2 g/100ml of drink and be made up of a complete fast acting protein like whey protein. If you have an allergy to milk proteins soy protein, although not ideal, can be an acceptable alternative to whey.

Based on your test results the table below shows the amount of carbohydrate you are burning for different durations of training in each of the zones.

Zone	30 min	60 min	90 min	120 min	150 min	180 min
1	57.9	115.8	173.7	231.5	289.4	347.3
2	84.3	168.6	252.9	337.2	421.5	505.8
3	108.6	217.2	325.8	434.4	543.0	651.6
4	119.7	239.4	359.1	478.8	598.5	718.2
5	120.0	240.0	360.0	480.0	600.0	720.0

We recommend that you try to replace 50-60% of the carbohydrate that you burn while you are training. Normally it is best to use liquids or gels during training as they tend to cause fewer GI problems than solid food. However, if you are doing sessions that are longer than 180 minutes you may need a little solid food. Experiment with various combinations to find what works best for you.