



# Endurance Athlete Training - Fat Burn Zone (FBZ)... DB#24

Becoming your own coach

Burn more fat & last longer in the Fat Burn Zone (FBZ)

## Zone 2 - Z2



# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

### Background:

As in any subject we might get interested in we research & at times devour all the data we can find so we might find a starting point and areas to experiment with along the way. My path of running to martial arts to motorsports to cycling has led me to an overview that might be a good starting point for you. My experience with endurance training spans 20+ years with a curiosity centering around increasing performance through competition within myself.

After 50+ books read ...



### *Becoming your own Coach - Why?*

- 1) Understand how your body reacts to 'damage' or stimulus.
- 2) Experiment with inputs & outputs of your training to find what works for you.
- 3) Breaking limitations that your past and your mind has to offer to progress.



# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

lessons and learning, use it and share it if you like.

I do not receive any compensation for any these products, yet in full Disclosure:

- I am not a doctor nor do I play one on the internet or anywhere else.
- Please be careful with 'interval' training, these are at a much higher heart rate & cause strain on the mind & body. At a minimum they damage your system at a faster rate needed more recovery time. I suggest at least two sleep cycles between 'intervals' and limiting to twice per week.
- Thank you!



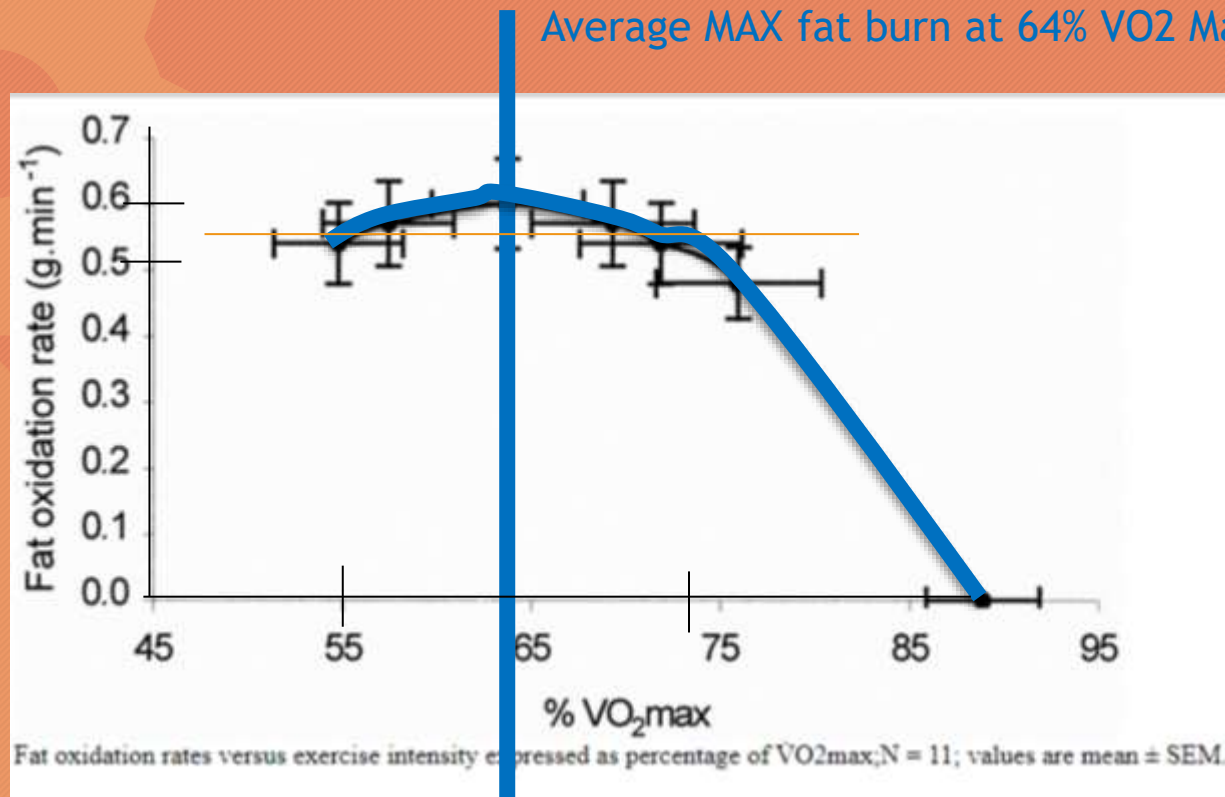
# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

**The Curve -**  
Taken from 2002  
paper:

Determination  
of the exercise  
intensity that  
elicits maximal  
fat oxidation

by  
ACHTEN, JUUL;  
GLEESON,  
MICHAEL;  
JEUKENDRUP,  
ASKER E



(This number is best gotten through a lab and therefore less helpful)

SIMPLIFIED  
DATA ON  
NEXT SLIDE





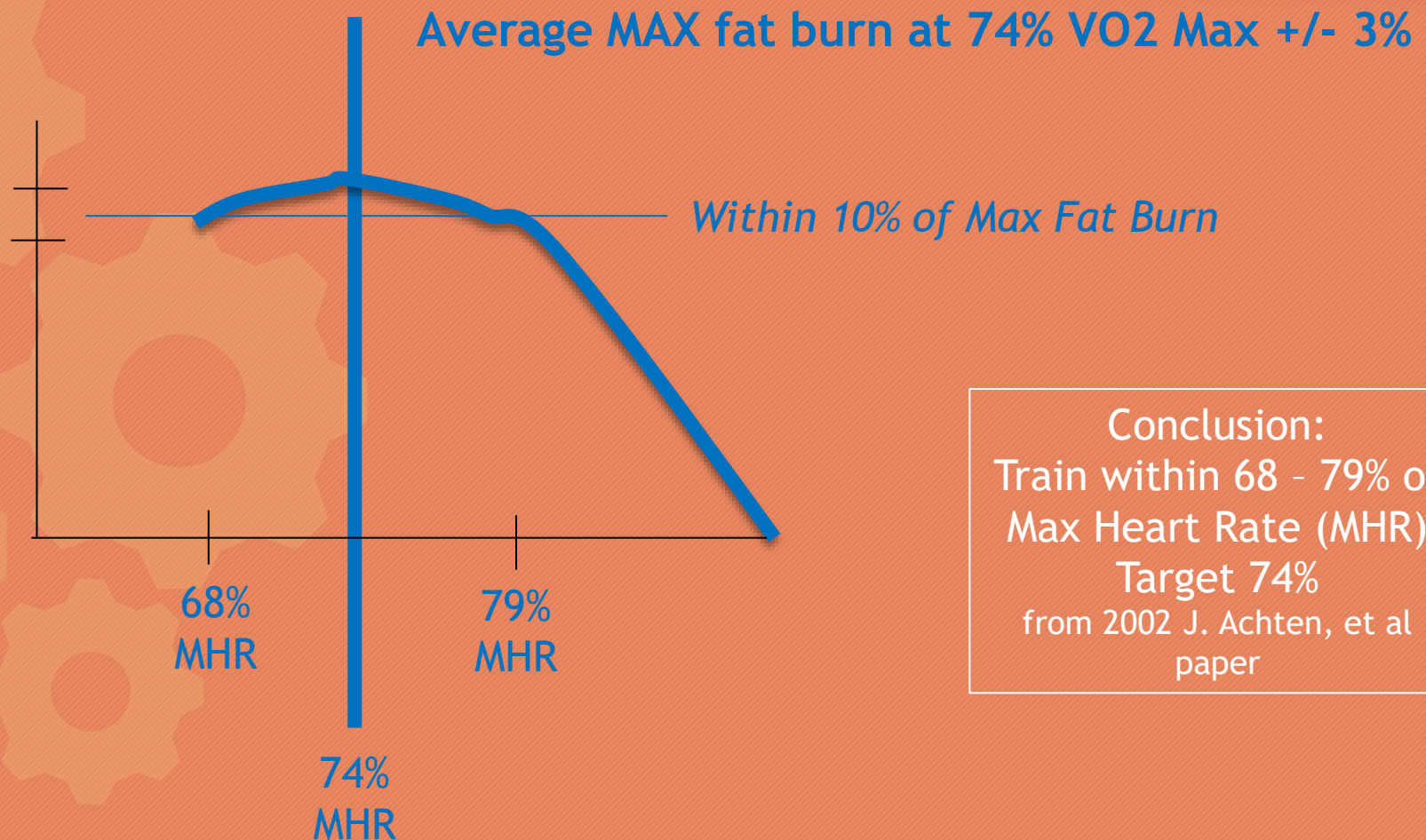
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Conclusion:  
Train within 68 - 79% of  
Max Heart Rate (MHR)  
Target 74%  
from 2002 J. Achten, et al  
paper





# Endurance Athlete Training Overview

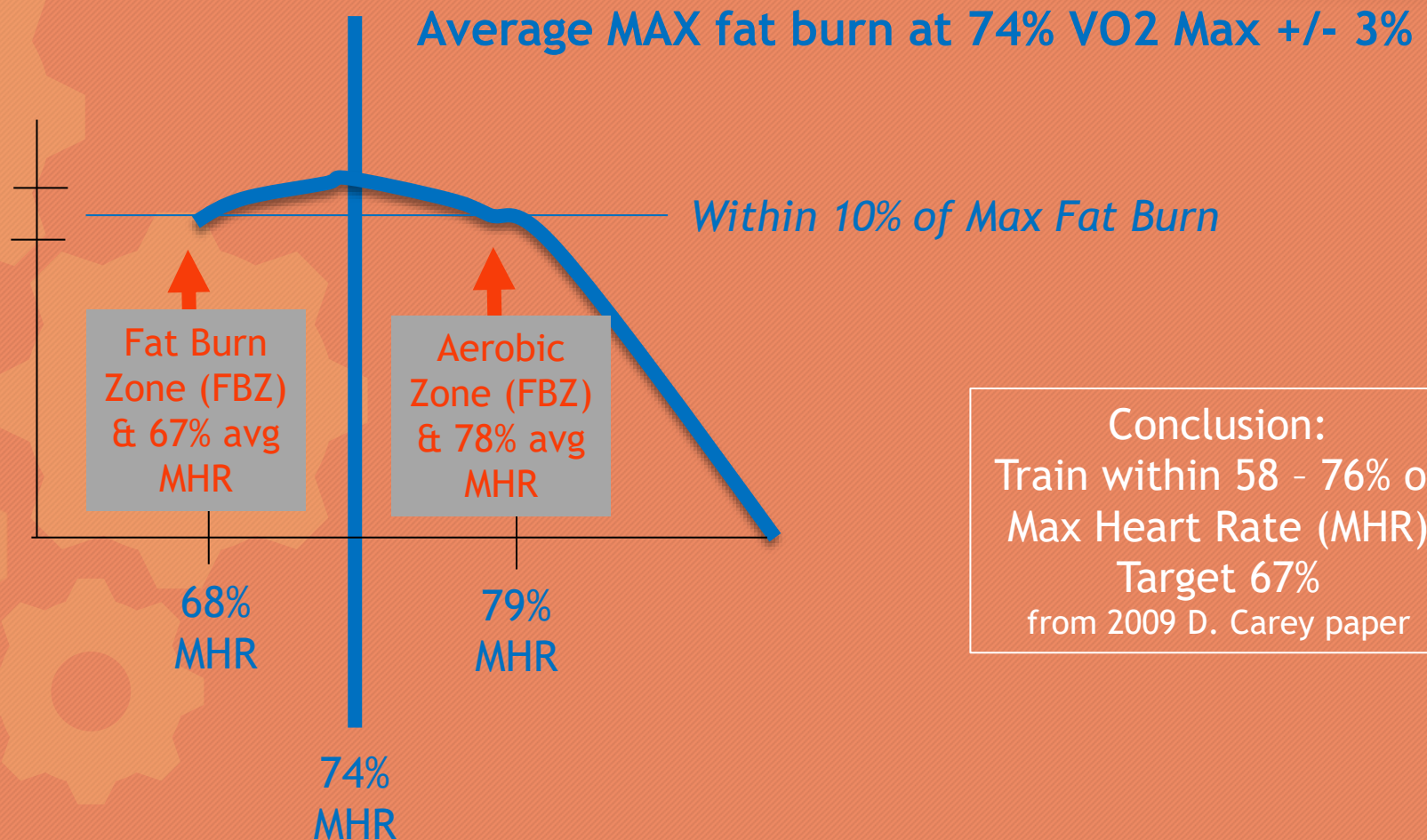
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ACHTEN, JUUL;  
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JEUKENDRUP, ASKER E

### Add to the Curve

- Taken from 2009 paper:  
Quantifying Differences in the "Fat Burning" Zone and the Aerobic Zone:  
Implications For Training  
by  
Carey, Daniel G



**Conclusion:**  
Train within 58 - 76% of  
Max Heart Rate (MHR)  
Target 67%  
from 2009 D. Carey paper

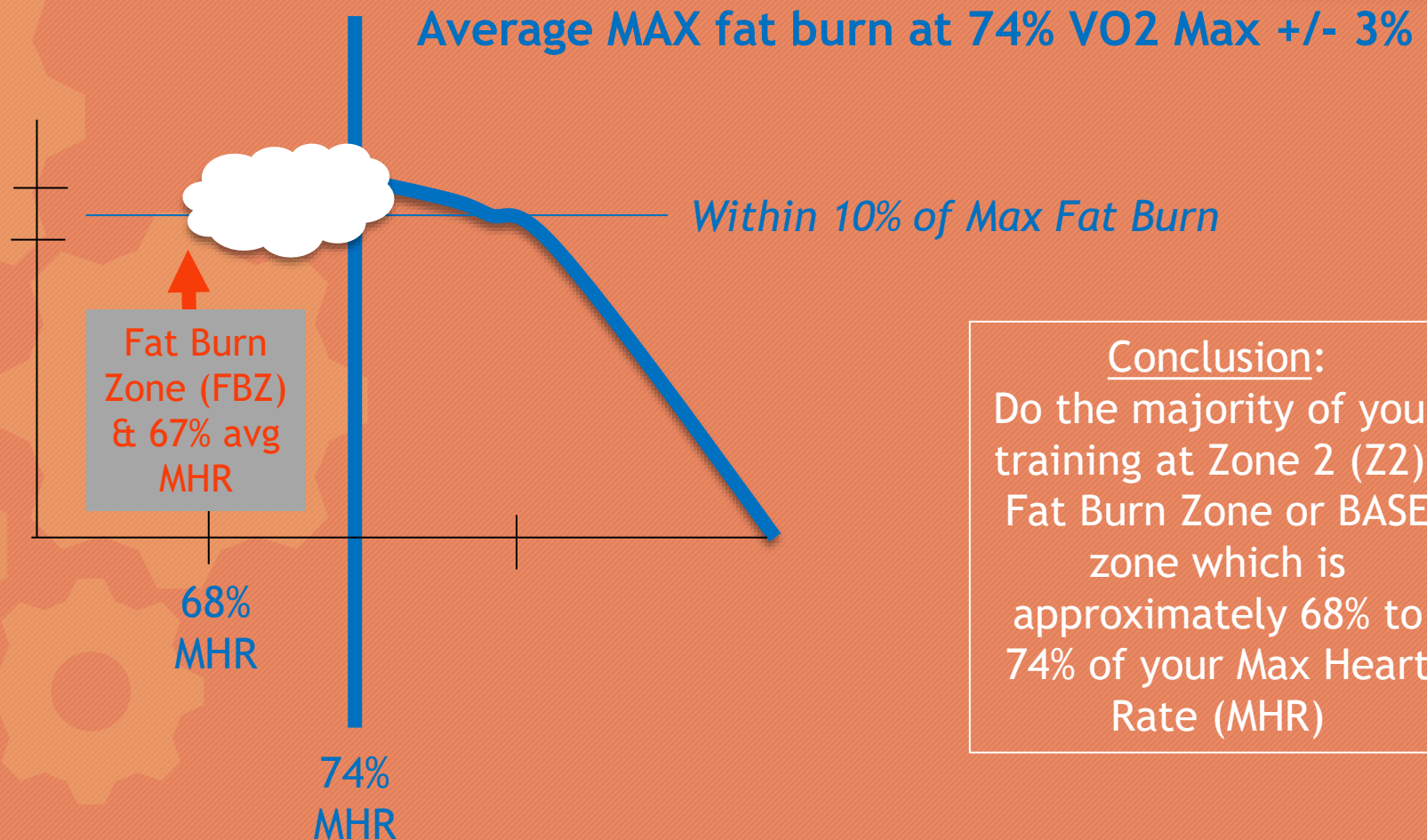


# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

### What to do?

1. Estimate Max Heart Rate (MHR) - See Deeper Blog DB#23 to estimate
2. Start training
3. Consider getting tested once you have some conditioning to refine these estimated numbers



Conclusion:  
Do the majority of your training at Zone 2 (Z2), Fat Burn Zone or BASE zone which is approximately 68% to 74% of your Max Heart Rate (MHR)



# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

So what does this mean for you?

Let's go back to our 45 year old, 150 lb.  
*Male from 'Deeper Blog DB#22'*

### Review:

Sally Edward's Max Heart Rate (MHR)

$MHR = 210 - (0.5) \times (AGE) - (0.05) \times (WEIGHT) + 4$  (for male)

$MHR = 210 - (0.5) \times (150) - (0.05) \times (150) + 4 = 184$

If we apply studies average MHR

2002 Study, Fat Burn Zone =  $MHR \times 0.74 = 184 \times 0.74 = 136$

2009 Study, Fat Burn Zone =  $MHR \times 0.66 = 184 \times 0.67 = 123$

From Dr. Philip Maffentone/David Allen, MAF method =  $180 - AGE = 180 - 45 = 135$

Most of the people who ask are moderately trained at best, so I ask them what Heart rate they exercise/train at and they say some high number in Zone 3.

To keep it as simple a possible I say:

You will burn more fat calories and last longer if you simply train at

# 180 - AGE





# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

Now let's get to the good stuff!

CALORIES - Carbohydrate/Sugar & Fat Burn

Taken from 2009 paper:  
Quantifying Differences in the "Fat Burning" Zone and the Aerobic Zone: Implications For Training  
by  
Carey, Daniel G

### Simplified Table

Total = Women & Men

<b>Aerobic Zone</b>	AVG	Min	Max	<b>Fat Burn Zone</b>	AVG	Min	Max
%MHR	<b>78</b>	68	87	<b>67</b>	58	76	
Fat cal/min	<b>2.4</b>	3.1	1.7	<b>3.3</b>	3.11	3.45	
% Fat/Total	<b>21%</b>	34%	12%	<b>36%</b>	46%	30%	
Total cal/min	<b>12</b>	9.2	14.2	<b>9</b>	6.7	11.5	

Total Men & Women: Aerobic zone = 21% (about 1/5) and FatBurn Zone = 36% (about 1/3)

Total Men & Women: Total calories burned - Aerobic zone = 12, FatBurn zone = 9

Total Men & Women: Total Fat calories burned - Aerobic zone 2.4, FatBurn zone = 3.3 cal/min

Total Men & Women: This happens at - Aerobic zone 78% MHR, Fat Burn zone = 67% MHR



# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

Let's take that 45-year old, 150 lb. athlete & have him bicycle a 100-mile English Entry.

He trains and does two events one in the Aerobic Zone & one in the Fat Burn Zone.

He like most people has 1500 - 2000 glucose or sugar calories in his body (liver & muscles).

To keep it simple we will assume he has the high side at 2000 calories.

He is an 'average joe' he will average 15 mph, so it is going to take him ~ 6 2/3 hours to finish.

In this first case, we will assume he does NOT take on any nutrition only electrolytes with water.

'Bonk' for this is defined when an athlete is out of 'stored glucose/sugar' calories & the real pain begins; he is now burning protein.

Total Calories burned (most) calculators						
Hours	Aerobic Zone			Fat Burn Zone		
	AVG	Min	Max	AVG	Min	Max
3	2102	1647	2556	1642	1213	2070
4	2802	2196	3408	2189	1618	2760
5	3503	2745	4260	2736	2022	3450
6	4203	3294	5112	3283	2426	4140
7	4904	3843	5964	3830	2831	4830
8	5604	4392	6816	4378	3235	5520

Poor 'average joe'

If his is in the **Aerobic zone** on average  
(=  $180 \times 0.78 = 140$  bpm)

**He lasts just under 3 hours Bonk!**

If he is in the **Fat Burn Zone** on average  
(=  $180 \times 0.67 = 121$  bpm)

**He lasts just under 4 hours Bonk!**

For 'joe' the pain begins. He Stops or Feeds & a long rest or starts to burn protein/muscle



# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

Same 'average joe', same 100 miles and he would like to finish well.

He talks to some people & does some research & decided to take on ~ 225 carb calories/hour.

He again being an experimenter trials two target heart rates, one in the Aerobic Zone & one in the Fat Burn Zone.

Aerobic zone All numbers are calories, except as marked.				
Hour	2000	Spent - avg	take in	total
1	2000	701	225	1525
2	1525	701	225	1049
3	1049	701	225	574
4	574	701	225	98
5	98	701	225	-378

**Bonk!**

Aerobic zone on average  
 (= 180 X 0.78 = 140 bpm)  
 He lasts just over 4 hours

Fat Burn Zone All numbers are calories, except as marked.				
Hour	2000	Spent - avg	take in	total
1	2000	547	225	1678
2	1678	547	225	1356
3	1356	547	225	1033
4	1033	547	225	711
5	711	547	225	389
6	389	547	225	67
7	67	547	225	-255

**Bonk!**

Fat Burn Zone on average  
 (= 180 X 0.67 = 121 bpm)  
 He lasts just under 6 hours

OK 'average joe' is very close if he keeps his average HR lower & stays in the Fat Burn Zone!

With no or small changes & he can finish the 100 miles well.



# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

Truth be told there is a lot of variation in the numbers presented.

The point is to be like 'average joe' & experiment during your training & on your events.

I have shared 'all of the math', so you can calculate a starting point for yourself.

Once you have a starting point you can experiment.

So, some suggestions on what to experiment with:

- Target average heart rate (this deeper blog)
- Amount of calories intake per hour (see deeper blog DB#19)
- Type of caloric intake - solid or liquid (“”)
- Amount of Electrolytes intake per hour (“”)

EXPERIMENT & note changes in your journal





# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

### My direct experience:

I completed a metric century (~62 miles) in my 30's with an average heart rate of ~190 bpm. This is absolutely crazy & I would not recommend this to anyone. My lack of knowledge then is one reason why I write this now.

At age 54 now I train most of my time ~ 80% - 90% at 130 - 135 bpm.

$180 - 54 = 126 + 5$  for training frequency for years  $+ 5$  for age (see Mark Allen) = 136 bpm.

This is an average heart rate target. I will climb a mountain at a higher average heart rate ~ 155 bpm. (see Zone 4 Intervals in deeper blog DB#22). I will back out of a pack of riders, if my heart rate is above the above average heart rate for longer than I have trained with the Zone 4 intervals.

This are very hard & painful lessons that I have learned multiple times. Yes, I have 'bonked' many times. You are probably not a pro athlete if you are reading this, stay in your zone, experiment, become the best you can be & have a great ride!





# Endurance Athlete Training Overview

## Fat Burn Zone (FBZ) - Z2

### Some additional notes:

The numbers presented are simplified. For example: You burn a split of fat & glucose/sugar calories, you can only replace the glucose/sugar portion during the event. There is no digestion rate from consumption to blood stream. The averages are used and not the ranges.

See references in a future deeper blog and/or the attached spreadsheet, if you want to understand more of the math.

**The point is to start, now, if this interests you.**

As your body transforms into an endurance athlete your ability to do work per given heart rate will increase, you will get faster.

As you spend more time in the Fat Burn Zone your Fat Burning engine will increase allowing you to ride harder & longer.

**If you are obese**, the good news is you will see a faster rate of improvement than 'joe average' because your starting point will be lower.

Your Fat Burn Zone will be LOWER than what is presented here.

Fat Burn Zone for 'obese' 'joe average' might be **60 - 100 bpm** which is much lower. It is likely better to start out walking regularly.

It is very important that if you are 'obese' that you target a lower heart rate, work with a doctor & the latest research.

(using & assumption Sally Edward's Max Heart Rate calculation, 0.74% of Max Heart Rate = 0.64% VO2 max, 'obese' fat burn zone is lower at 24% to 46% of VO2 max, and 'obese' is defined as a BMI of >30)

EXPERIMENT & note changes in your journal