



A M Luebbers III

# Annual Training Patterns and Success in Ironman- Distance Triathletes

It's All About the Bike

VDM

Verlag  
Dr. Müller

A M Luebbers III

# Annual Training Patterns and Success in Ironman-Distance Triathletes

It's All About the Bike



VDM Verlag Dr. Müller

## **Impressum/Imprint (nur für Deutschland/ only for Germany)**

Bibliografische Information der Deutschen Nationalbibliothek: Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

Alle in diesem Buch genannten Marken und Produktnamen unterliegen warenzeichen-, marken- oder patentrechtlichem Schutz bzw. sind Warenzeichen oder eingetragene Warenzeichen der jeweiligen Inhaber. Die Wiedergabe von Marken, Produktnamen, Gebrauchsnamen, Handelsnamen, Warenbezeichnungen u.s.w. in diesem Werk berechtigt auch ohne besondere Kennzeichnung nicht zu der Annahme, dass solche Namen im Sinne der Warenzeichen- und Markenschutzgesetzgebung als frei zu betrachten wären und daher von jedermann benutzt werden dürften.

Coverbild: [www.ingimage.com](http://www.ingimage.com)

Verlag: VDM Verlag Dr. Müller Aktiengesellschaft & Co. KG  
Dudweiler Landstr. 99, 66123 Saarbrücken, Deutschland  
Telefon +49 681 9100-698, Telefax +49 681 9100-988  
Email: [info@vdm-verlag.de](mailto:info@vdm-verlag.de)

Herstellung in Deutschland:  
Schaltungsdienst Lange o.H.G., Berlin  
Books on Demand GmbH, Norderstedt  
Reha GmbH, Saarbrücken  
Amazon Distribution GmbH, Leipzig  
ISBN: 978-3-639-26019-9

## **Imprint (only for USA, GB)**

Bibliographic information published by the Deutsche Nationalbibliothek: The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at <http://dnb.d-nb.de>.

Any brand names and product names mentioned in this book are subject to trademark, brand or patent protection and are trademarks or registered trademarks of their respective holders. The use of brand names, product names, common names, trade names, product descriptions etc. even without a particular marking in this works is in no way to be construed to mean that such names may be regarded as unrestricted in respect of trademark and brand protection legislation and could thus be used by anyone.

Cover image: [www.ingimage.com](http://www.ingimage.com)

Publisher: VDM Verlag Dr. Müller Aktiengesellschaft & Co. KG  
Dudweiler Landstr. 99, 66123 Saarbrücken, Germany  
Phone +49 681 9100-698, Fax +49 681 9100-988  
Email: [info@vdm-publishing.com](mailto:info@vdm-publishing.com)

Printed in the U.S.A.  
Printed in the U.K. by (see last page)  
ISBN: 978-3-639-26019-9

Copyright © 2010 by the author and VDM Verlag Dr. Müller Aktiengesellschaft & Co. KG and licensors  
All rights reserved. Saarbrücken 2010

**A M Luebbers III**

**Annual Training Patterns and Success in Ironman-Distance  
Triathletes**

UNITED STATES SPORTS ACADEMY

CORRELATIONS BETWEEN ANNUAL TRAINING PATTERNS AND RACE  
PERFORMANCE IN MALE, NON-ELITE, IRONMAN-DISTANCE TRIATHLETES

January 2005

submitted for fulfillment of the requirements for the degree of  
Master of Sport Science  
in  
Sport Coaching

By  
A. Mathew Luebbers III  
Chair: Dr. Douglas Goar  
Okinawa, Japan

## Abstract

Male, English-speaking non-elite, ironman-distance triathletes were surveyed using an on-line questionnaire for descriptive characteristics, race history, and training history. Useable results from 39 individuals were then sorted into high, mid, or low success groups by their race time or their race place by age-group ( $n=39$ , age  $35.0\pm5.9$  y). Training patterns for a 12-month period, based on training distance or training hours in swimming, bicycling, and running, were generated for each group. There were observed differences between group patterns, the most outstanding being the high success group showing greater distances of bike training, which is consistent with other study's findings. A suggested annual training volume pattern for ironman-distance triathletes was proposed based on the common training volume pattern elements used by the high success group triathletes sampled in this study.

## TABLE OF CONTENTS

Abstract .....	ii
LIST OF TABLES .....	v
LIST OF FIGURES .....	vii
CHAPTER I	
INTRODUCTION .....	1
Statement of the Problem.....	4
Research Questions.....	5
Definition of Terms.....	5
Scope of the Study .....	10
Delimitations.....	10
Limitations .....	10
Assumptions.....	11
Significance of the Study .....	11
Summary .....	12
CHAPTER II	
REVIEW OF RELATED LITERATURE.....	13
Planning Ironman-distance Triathlon Training.....	13
Classic Periodization.....	13
Classic Periodization Applied to Ironman-distance Triathlon.....	18
Other Training Models.....	21
Reverse-Volume Periodization .....	21
Linear Undulating Progression .....	21
Emphasis Phased Training.....	22
Crash Training .....	23
General Training for Ironman-distance Triathlons .....	23
Endurance Training.....	24
Economy Training .....	25
Muscular Endurance Training.....	26
Other General Training .....	26
Specific Training for Ironman-distance Triathlons.....	27
Swim Training .....	27
Bike Training .....	28
Run Training .....	30
Long Single Sport Training Sessions.....	31
Mixed or Combination Training Sessions .....	31
Long Combination Training Sessions.....	32
Measuring Ironman-distance Triathlon Training.....	32
The Intensity of Training.....	32
Maximal Oxygen Consumption.....	32
Lactate Concentrations.....	33
Heart Rate .....	34
Ventilatory Threshold .....	35
Training Pace .....	35
Perceptual Methods.....	36
Power Levels in Cycling.....	38
Training Intensity Zones .....	38

The Quantity of Training .....	39
Comparing Different Modes of Training .....	41
Training Impulse or Training Units .....	41
Running Equivalents .....	42
Aerobic Points .....	43
Characteristics of Ironman-Distance Triathletes .....	44
Physical Characteristics .....	44
Competitor Achievement Levels .....	46
Competitor Locales and Nationalities .....	47
Non-parametric Data Testing Methods .....	48
Summary .....	49
CHAPTER III	
METHODS .....	50
Subjects .....	50
Instrumentation .....	52
Procedures .....	54
Design and Preparation for Data Analysis .....	55
Summary .....	56
CHAPTER IV	
RESULTS .....	57
Survey Respondent's Data .....	57
All Athletes .....	57
Athletes Grouped by Race Time .....	58
Athletes Grouped by Race Place within Age-group .....	75
Data Correlations .....	92
Summary .....	99
CHAPTER V	
DISCUSSION, SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS .....	100
Discussion .....	100
Race Performance Time, Triathletes, and Training .....	100
Race Finish Place, Triathletes, and Training .....	105
Correlations between Descriptive Characteristics, Training, and Race Performance .....	111
Correlations between Race Performance, Triathletes, and Monthly Training Patterns .....	113
Summary .....	115
Similarities in Training, Training Patterns, and Triathletes in General .....	115
Differences in Training, Training Patterns, and Triathletes Grouped by Performance .....	116
Training Patterns of Successful Triathletes .....	117
Conclusions .....	119
Annual Training Patterns of Successful Ironman-distance Triathletes .....	119
Suggested Training Patterns for Ironman-distance Triathletes .....	121
Recommendations for Future Study .....	124
REFERENCES .....	125
APPENDICES .....	136



## LIST OF TABLES

1.	Comparison of Endurance Training Periodization Terminology.....	20
2.	Selected Endurance Training Methods .....	25
3.	RPE and CR10 Scales of Perceived Exertion .....	37
4.	Average Weekly Training Volume .....	40
5.	Summary of Ironman-distance Athlete Data .....	45
6.	2003 Ironman World Championships Male Competitor Classification Summary .....	46
7.	2003 Ironman World Championships Male Competitor Race Results.....	47
8.	Male Non-elite Athletes by Region Reported in 2003 Kona and IBT Results.....	48
9.	Subject Grouping and Sub-groupings.....	52
10.	Survey Descriptive Personal Data to be Gathered.....	52
11.	Survey Race-related Data to be Gathered.....	53
12.	Survey Training Characteristic Data to be Gathered .....	53
13.	Survey Training-related Data to be Gathered .....	54
14.	AS Descriptive Data .....	57
15.	TS Descriptive Data.....	58
16.	TS Country of Birth and Country of Current Residence .....	59
17.	TS Non-ironman-distance Race Data .....	60
18.	TS Non-Kona Ironman-distance Race Data .....	61
19.	TS Kona Ironman Race Data .....	62
20.	TS Annual Training Data.....	63
21.	TS Swim Training Hours by Months Prior to Ironman-distance Race.....	64
22.	TS Swim Training Distance by Months Prior to Ironman-distance Race .....	65
23.	TS Bike Training Hours by Months Prior to Ironman-distance Race .....	66
24.	TS Bike Training Distance by Months Prior to Ironman-distance Race .....	67
25.	TS Run Training Hours by Months Prior to Ironman-distance Race .....	68
26.	TS Run Training Distance by Months Prior to Ironman-distance Race .....	69
27.	TS Number of Annual Combined Training Sessions. ....	73
28.	TS Training Influences by Groups as percentages of that Group (n=39).....	73
29.	TS Training Influences by Groups as percentages of that Influence (n=39) .....	74
30.	TS Initial Regular Sport Activity as Percent of Members of that Performance Group ....	74
31.	TS Initial Regular Sport Activity as Percent of Members of that Sport Activity .....	75
32.	PS Descriptive Data .....	76
33.	PS Country of Birth and Country of Current Residence.....	76
34.	PS Non-ironman-distance Race Data.....	77
35.	PS Non-Kona Ironman-distance Race Data.....	78
36.	PS Kona Ironman Race Data .....	79
37.	PS Annual Training Data.....	80
38.	PS Swim Training Hours by Months Prior to Ironman-distance Race.....	81
39.	PS Swim Training Distance (km) by Months Prior to Ironman-distance Race .....	82
40.	PS Bike Training Hours by Months Prior to Ironman-distance Race.....	83
41.	PS Bike Training Distance by Months Prior to Ironman-distance Race .....	84
42.	PS Run Training Hours by Months Prior to Ironman-distance Race.....	85
43.	PS Run Training Distance by Months Prior to Ironman-distance Race .....	86
44.	PS Number of Annual Combined Training Sessions.....	90
45.	PS Training Influences by Groups as percentages of that Group .....	90

46.	PS Training Influences by Groups as percentages of that Influence .....	91
47.	PS Initial Regular Sport Activity as Percent of Members of that Performance Group ....	91
48.	PS Initial Regular Sport Activity as Percent of Members of that Sport Activity .....	92
49.	Summary of Selected Descriptive, Performance, Training, and Experience Variables that Show Significant Spearman's Rho Correlations .....	93
50.	Spearman's Rho Correlation of Finish Place and Monthly Training .....	94
51.	Spearman's Rho Correlation of Race Time and Monthly Training .....	95
52.	Spearman's Rho Correlation of Age and Monthly Training .....	96
53.	Spearman's Rho Correlation of Race Swim Time and Monthly Training Hours .....	97
54.	Spearman's Rho Correlation of Race Bike Time and Monthly Training Hours .....	97
55.	Spearman's Rho Correlation of Race Run Time and Monthly Training Hours .....	98
56.	Spearman's Rho Correlation of Race Segment Times and Monthly Training Distances .	98
57.	Selected Descriptive, Performance, Training, and Experience Variables' Relationships to Higher Race Finish or Faster Race Time .....	113
58.	Percent of Total Annual Training Distance or Training Time by Month as Performed by High-success-level Triathletes .....	122
59.	Male Non-elite Athletes by Country (A-G) from 2003 Kona and IBT Results .....	137
60.	Male Non-elite Athletes by Country (F-R) from 2003 Kona and IBT Results .....	138
61.	Male Non-elite Athletes by Country (S-Z) from 2003 Kona and IBT Results .....	139
62.	Training Intensity Levels .....	155
63.	Spearman's Rho Correlation Matrix of Selected Variables .....	161

## LIST OF FIGURES

1.	Training hours per month by discipline for High-TS. ....	69
2.	Training hours per month by discipline for Mid-TS.....	70
3.	Training hours per month by discipline for Low-TS.....	70
4.	Training distances per month by discipline for High-TS.....	70
5.	Training distances per month by discipline for Mid-TS.....	71
6.	Training distances per month by discipline for Low-TS. ....	71
7.	TS Swim training distances per month by group.....	71
8.	TS Bike training distances per month by group.....	72
9.	TS Run training distances per month by group. ....	72
10.	Training hours per month by discipline for High-PS.....	87
11.	Training hours per month by discipline for Mid-PS.....	87
12.	Training hours per month by discipline for Low-PS. ....	87
13.	Training distances per month by discipline for High-PS.....	88
14.	Training distances per month by discipline for Mid-PS. ....	88
15.	Training distances per month by discipline for Low-PS. ....	88
16.	PS Swim training distances per month by group.....	89
17.	PS Bike training distances per month by group.....	89
18.	PS Run training distances per month by group.....	89
19.	High-success-level triathlete training pattern for hours by month.....	119
20.	High-success-level triathlete training pattern for swim hours and distance by month...	120
21.	High-success-level triathlete training pattern for bike hours and distance by month.....	121
22.	High-success-level triathlete training pattern for run hours and distance by month. ....	121
23.	Annual training hours pattern, by percent of training each month, for high-success-level triathletes.....	123
24.	Annual training distance pattern, by percent of training each month, for high-success-level triathletes. ....	123

## CHAPTER I

### INTRODUCTION

Endurance sports encompass a variety of activities and athletes. Swimming, bicycling, and running are three separate activities that can be contested at distances long enough to make each of them endurance events. Athletes have taken swimming, cycling, and running, combined them into one competitive event, and named that event a triathlon (International Triathlon Union, 2003a; Johnstone, n.d.). Triathlons are held all over the world, at all levels of competition, including the Summer Olympic Games (International Triathlon Union, 2003a, 2003b).

There are different race distances contested within a triathlon, from short, sprint-distance triathlons, through very long, multiple-day ultra-endurance stage races. There are at least three widely accepted, commonly used triathlon events with standard distances of swim, bike, and run segments. An Olympic-distance race is comprised of distances of 1.5 km of swimming, 40 km of cycling, and 10 km of running (International Triathlon Union, 2003b). A one-half ironman-distance race has a 1.9 km swim, a 90 km bike, and a 21.1 km run (Ironmanlive 2003a). The full ironman-distance race is a 3.8 km swim, a 180.2 km bike, and a 42.2 km run (Mione, 2004).

Of these three, the ironman-distance triathlon, due to the length of each of its race segments, may require a high level of endurance-based fitness. Also of note are other long-distance triathlons, held all over the world, that are slightly shorter or slightly longer than official ironman-distance triathlons. The International Triathlon Federation (2003c) rules state that the minimum distances for a long-distance triathlon are a 3.8 km swim, a 120 km bike, and a 30 km run. These races are so close in distance to the official ironman-distances that they are sometimes considered equivalent races, often termed iron-distance races (Trifind, 2004).

All athletes, including those that take part in ironman-distance and equivalent races, have a variety of life and race experiences. The 2003 Ironman World Championship in Kailua-Kona,

Hawaii on 18 October included over 1,600 triathletes, from 18 to 80 years old, from almost 50 different nations (Ironmanlive, 2003b, 2003c; Mione, 2004). These racers qualified for the championship from among a larger group of 54,000 ironman-distance triathletes (Mione, 2004). These athletes took part in at least one of over 20 races held in 15 different countries (Ironmanlive, 2004a) or qualified through a lottery system or special invitation (2004b).

According to Mione (2004), the ironman-distance triathlete trains an average of 18 to 24 hr each week. This training breaks down to about 11.3 km of swimming, 373.3 km of bicycling, and 77.2 km of running (Mione, 2004). Triathletes might also perform supplemental training, like weight lifting, yoga, or stretching, as part of their workout regimen (Mione, 2004).

Triathletes could perform a variety of training to prepare for competing in a triathlon. Some of the elements of ironman-distance training (Ash & Warren, 2004; Bernhardt, 2000; Evans, 2003; Fitzgerald, 2003; Friel, 1998; Friel & Byrn, 2003; Hobson, Campbell, & Vickers, 2001; Jonas, 1999; Price, 2003; Ross, 2003; Sleamaker & Browning, 1996; St. John, 2001; Strauss, n.d., 2004a, 2004b; Svensson, 1998; Town & Kearney, 1994) include:

1. Endurance training work to increase the duration that a velocity can be sustained at a given physiological exertion level; to includes cardiovascular and muscular endurance training.

2. Strength training work to increase ability to deliver force at a given physiological exertion level; this allows an increase in the ability to increase speed, an increase in injury resistance, and aids in fatigue resistance.

3. Speed training work to increase the velocity at a given physiological exertion level and to increase economy at a given velocity level.

These elements could be practiced or developed in any or all of the three disciplines used in a triathlon (swimming, cycling, or running), or in combination workouts that include multiple disciplines within the same workout (swimming and cycling, cycling and running, etc.) (Ash &

Warren, 2004; Bernhardt, 2000; Evans, 2003; Fitzgerald, 2003; Friel, 1998; Friel & Byrn, 2003; Hobson, Campbell, & Vickers, 2001; Jonas, 1999; Price, 2003; Ross, 2003; Sleamaker & Browning, 1996; St. John, 2001; Svensson, 1998; Town & Kearney, 1994).

Athletes preparing for an ironman-distance event make training choices. Those choices include the type, duration, intensity, and frequency of their workouts. Individual ironman-distance triathletes could use dissimilar training and still be competitive with each other. Conversely, they might reach different levels of success or achievement even though they perform similar training. There could be many reasons why dissimilar training produces equally successful or unsuccessful results, why the same training could produce differing levels of success for different athletes, or why different athletes make training choices.

Factors that could influence an athlete's training, or the results of that training, include general and specific items. The triathlete could have limitations such as a missing or deformed limb, being confined to a wheelchair, or having other anatomical challenges. Their ability may be hindered due to a high body mass, an injury (current or past), or an illness. Medical conditions such as asthma, hypertension, or a predisposition for heat illnesses could affect training choices and performance results. Some additional characteristics that might play a part in an athlete's race performance could include general muscle composition, bone and muscle anatomical structure, height, physiological age, chronological age, training age, and current level of fitness.

There could be psychological or lifestyle elements that also affect training and results. Factors such as motivation, social influences, income, and available training time could all play a part in an athlete's ability to train. The athlete's experiences or personal history could also influence the training process; an athlete's level of success with past training choices could impact on future training decisions. If his or her background includes participation as a

swimmer, runner, or cyclist, they may have different learned skills, behaviors, or training patterns than someone without that same background. Similarly, if they have experiences with long duration races, they may have developed different notions or abilities than an athlete lacking those experiences. A particular ironman-distance triathlete's peer group could also be an influence on training choices.

The resources available could also influence an ironman-distance triathlete's training decisions. The athlete may have access to coaches, training facilities, or natural training sites (such as a lake or an ocean); they may live in an area that has year-round moderate weather conditions, allowing them to train outdoors almost anytime; or they could live in an area that has drastic seasonal changes, limiting their training opportunities.

This paper seeks to determine relationships among ironman-distance triathletes' training volume patterns and race results. It will try to answer the questions of what training volume pattern is followed by athletes when preparing for an ironman-distance race, and are there any similar or dissimilar trends in those patterns when athletes are grouped by their level of ironman-distance race success, with success measured by race finish time or race finish place.

#### Statement of the Problem

How can ironman-distance triathletes determine or plan an annual training volume pattern that will increase their chance of success at an ironman-distance triathlon? One way could be to make training plan choices based on those that tended to produce favorable results, as measured by level of success, in other athletes.

This research intends to define ironman-distance triathletes' training volume patterns in terms of time and distance, then look for trends between levels of success and training volume patterns. It intends to categorize training volume patterns by the athletes' level of success, identify training volume patterns used by athletes with high-success results in ironman-distance

events and, from a review of that grouped data, describe training volume patterns that might be used by ironman-distance triathletes to be more successful.

#### Research Questions

This paper seeks to answer the following questions:

1. Are there general training volume patterns that are similar among male non-elite ironman-distance triathletes?
2. Are these training volume patterns different when categorized by the athlete's achievement level?
3. What, if any, common training volume patterns do successful ironman-distance triathletes use?

#### Definition of Terms

The following definitions will be used in this paper:

Triathlon is a type of sport that includes three different disciplines within the same race, swimming, bicycling, and running. There are a variety of distances and orders of disciplines contested, but for this paper the order is swimming, then cycling, then running.

Triathlete is an athlete that takes part in triathlons. They may participate in other sports, but their main training and racing focus is triathlons.

Coach will be used to describe someone that assists an athlete in preparation for an event. The coach might be a full-time professional coach that designs and controls all aspects of the athlete's training plan, they might be a resource that assists with only part of a plan, or they might fall at any level of assistance in between. Any data gathered from coaches will be noted as such, and will be for background and reference use only. Coaches will also be take part in the early review process of the research instrument.



Ironman-distance is a specific type of triathlon with set lengths for each discipline of a 3.9 km swim, a 180.2 km bike, and a 42.2 km run. The term “Ironman” (capitalized, sometimes referred to as Ironman-branded) is a trademark of the World Triathlon Corporation and refers to specific races that have a licensing agreement with the World Triathlon Corporation. The term ironman-distance (lower case) refers to the distances to be performed in a specific triathlon of a 3.8 km swim, a 180.2 km bike, and a 42.2 km run.

Ironman-distance triathlete is a triathlete that is training for, or competes in, ironman-distance triathlons. They may also compete in other distances and other sports, but their primary training and racing focus is ironman-distance races.

Elite refers to an athlete that is registered as a professional or elite athlete with the sport's governing body, placing them in a different competitor category in ironman-distance events. This must be declared annually, and once declared the remaining race finishes for that calendar year are categorized among the elite field (USAT, 2003).

Age-group refers to an athlete that is not registered as a professional, placing them into competitor categories based on their age on the day of the race, usually divided into groups of 5-year increments, such as 18-24 years old, 25-29 years old, 30-34 years old, etc.

World championship-level describes an athlete that has qualified for the ironman-distance world championship race held each October in Kailua-Kona, Hawaii (also known as Ironman Hawaii or Kona Ironman). The athlete may or not actually compete in that world championship race. There are a small group of athletes that take part in the ironman-distance world championship race even though they have not qualified in a race during the current season. These athletes could be celebrity invitees, lottery entries, or other special entry cases. Also in the group of athletes that could compete in a particular year's world championship race is any past world championship overall winner, the previous year's champion in each age-group category,