Training Planning – with special view on Balance and Strength Training

- Olympic Distance Triathlon -

Sergej Schäfer

GYMNASTIK- OCH IDROTTSHÖGSKOLAN
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Handledare: Alexander Ovendal

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1 Introduction

This report is part of the course Träningslära III (7.5 Credit Points) within the Trainer program at Gymnastik- och Idrottshögskolan in Stockholm. That report focuses on the planning of training for Olympic Distance Triathletes. As a basis, the previous report about Performance Demands is used and, furthermore, the focus lies on a specialized capacity: strength, in particular core stability and strength in combination with lower extremity stability. While there is a great variety in Triathlon referring to the distances this report is subject to Sprint and Olympic Distance.

2 Background

Mostly, Triathlon is seen in a very wrong way that it is a sport which is assembled of three different sports. But, as in all sports, it is much more complex. Triathlon is one sport that contains three disciplines: swimming, cycling and running. It needs different training methods than just to adopt the training of each individual sport, and a combined training of all disciplines which is highly complex in its demands. Additionally, the shorter the distance in the competition is, the more important become the transitions from swimming to cycling as well as from cycling to running. All disciplines are performed in the above mentioned order, with the transitions in between and no rest. The winner is the one who crosses the finish line first at the end of the running part.

2.1 Competition Format

Until 2008, a World Cup was held throughout the season including several competitions with the winner being the athlete with the most points at the end. One additional competition, for each, World and European Championships were organized. In 2009, the format has been changed and a World Championship Series was introduced. It is a similar format like the former World Cup but with the winner being the World Champion at the end of the season. Only European Championships and Olympic Games are held additionally in form of one competition, as major events. Since the year 2000 Triathlon has been part of the Olympic Games.

2.2 History

The beginning of Triathlon lies in the early 1970s, getting invented by the San Diego Track Club. As that sport became known in most parts of the world, in 1989 the International Triathlon Union (ITU) was founded in Avignon, France. Since that year, World Championships are organized

every year with the distance of 1.5 km Swim, 40 km Bike and 10 km Run. In 1994, the International Olympic Committee decided Triathlon to become part of the Olympic Games, starting in Sydney in the year 2000. Especially since then, the sport grew rapidly and gained much more recognition[1]. Comparing the results of World Cup Series, World Championships, World Championship Series and Olympic Games since 2000 show the domination of male athletes from Australia, New Zealand, Spain, Germany and Great Britain, occasionally Switzerland and Canada and in the future also from Russia and France. Dominating female athletes come from Australia, USA, New Zealand, Great Britain, Portugal, Switzerland, occasionally Germany and Sweden, and prospectively from Canada.

2.3 Competition Distances

Triathlon has a great variety on distances. Main competition distances are Sprint, Olympic/Short, Long Distance and Ironman. Table 1 shows the length and age groups it refers mainly to. Furthermore, there are some other distances but those are either shorter due to young ages (till 15 years) or longer, e.g. Triple Long Distance.

Table 1 – Age groups, distances and competition names based on International Triathlon Union (ITU).

Age	Swim [km]	Bike [km]	Run [km]	Distance Name
16-19	0.75	20	5	Sprint
18+	1.5	40	10	Olympic/Short
20+	3	80	20	Middle Distance
20+	4	120	30	Long Distance
20+	3,8	180	42	Ironman

Deutsche Triathon Union (DTU). Sportordnung. 2012 (1). Frankfurt am Main.

This work concentrates mainly on the transition from Sprint Distance to Olympic Distance. In the age between 18 and 20 years the juniors start to switch their competitions towards double the distance and duration they used to compete before. That means a change of work load from approximately 55-60 Minutes to 1 hour and 50 Minutes for male and 5-8 respectively 10-15 Minutes more for female athletes. Therefore, great attention has to be paid during this phase, on the one hand, to ensure the athlete to still compete on the Sprint Distance on a high level but, on the other hand, also to ensure a short-lasting but safe change to the longer distance, building up a

[1] International Triathlon Union (ITU), A Brief Triathlon History, <http://www.triathlon.org/?call=TVRZMg==&sh=keep> (access on 2011-01-08).

basic performance ability to compete on international level. Usually, athletes need 2 to 4 years before they are able to compete on high level. With a correct training and assessment of competitions it is possible to reduce that transition time to 2 to 3 years. Importance of Sprint Distance abilities for Olympic Distance Triathletes still proceeds even on Elite level. It is used within youth/juniors age groups, as preparation for Olympic Distance events and, recently introduced, giving Triathlon another new competition format, as Team World Championships and National Championships.

2.4 The future of Triathlon

Although Triathlon is a young sport, it became recognized quickly in the countries which have good athletes in the individual sports of the disciplines within Triathlon, especially among swimmers and runners. Own investigations on that matter showed that the majority of the best triathletes, placed first till fifth in the World Championships/Championship Series and Olympic Games during the last decade, have their background in swimming or running as individual sport. Triathlon as a first sport becomes more important nowadays. The sport developed fast because the material and knowledge of the individual disciplines were adopted, at first. During the last decade, Triathlon became much more popular and known, and scientific investigations have been examined referring to Triathlon as a sport itself, not as a mixture of three sports. In Germany, Triathlon experienced a quick gain of recognition and popularity, on both amateur and top level. This is, among other reasons, due to the good and steady performances of the athletes on top level, especially the win of the silver medal at the Olympics in 2000 (Stefan Vuckovic) and the gold medal win of Jan Frodeno in Beijing 2008. The new format of World Championship Series, like mentioned above a series of competitions to determine the World Champion, demands a very good performance on all disciplines throughout several parts of or the whole season. Athletes who are usually best in preparing for one special event have less good results in the beginning than so-called “compact” triathletes who maintain a good performance over the whole season. All above mentioned reasons mean that more triathletes on top level will have Triathlon as their first sport and it will not be sufficient just to adopt the individual sports’ training. Another important impact is the influence of drafting on the bike part. That leads the focus more and more on the swimming and running performances which will lead to and actually appears within the World Championship Series by bigger pelotons after the bike sessions.

3 Performance Demands Analysis

Triathlon is highly complex with its demands for best performances. Of course, the long duration requires a high aerobic capacity. But, additionally, a balance between high demands on anaerobic capacity, strength, technique and coordination has to be reached because of the different, partially contrary demands for all disciplines. Figure 1 below shows an exemplary distribution of those requirements for Olympic Distance Triathlon on world class level.

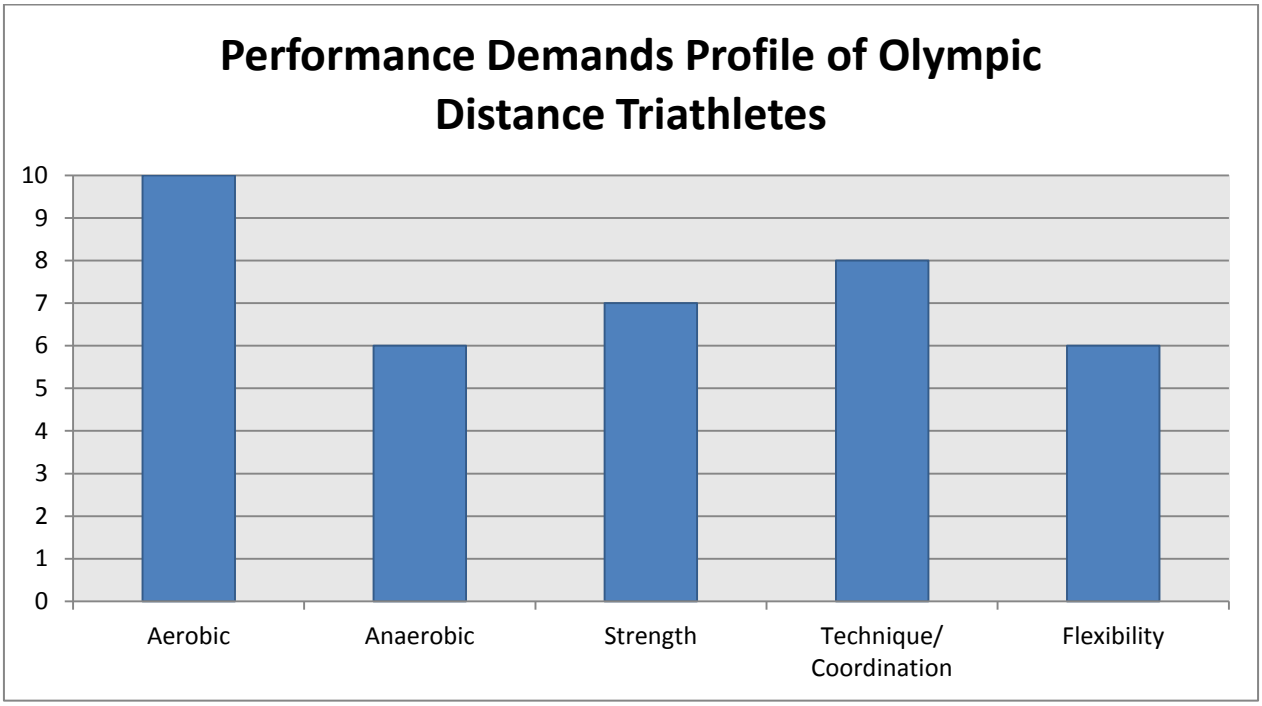

Figure 1 – Exemplary distribution of performance demands in Olympic Distance Triathlon.

3.1 Aerobic Capacity

Triathlon is an endurance sport which places high demands especially on aerobic capacities due to the duration of 55 Minutes to 2 hours (depending on distance, course profile, gender, extrinsic factors like weather etc.). Both aerobic capacity and effect play a dominant role for being able to perform a long time at high velocities and to withstand exhaustion. In general, aerobic capacity is also needed to generate a basis for intensive training and to recover fast.

On international level, male athletes reached values for maximum oxygen consumption (VO_2max) of 74.7 ± 5.7 for juniors and 74.3 ± 4.4 $ml \cdot kg^{-1} \cdot min^{-1}$ for elite athletes on a cycling ergometer test. At the same laboratory test, female athletes reached values of 60.1 ± 1.8 and 61.0 ± 5.0 $ml \cdot kg^{-1} \cdot min^{-1}$ for juniors and elite triathletes respectively[2]. Running tests showed values of

[2] Millet et al., 2004, p. 194.

up to 78.5 ± 3.6 and 63.2 ± 3.6 $ml \cdot kg^{-1} \cdot min^{-1}$ for male and female elite athletes respectively. VO_2max values have the highest amounts at running, closely followed by cycling and minimum values at the swimming part among all three disciplines[3]. Comparisons between isolated running tests and combined cycling and running tests revealed that elite athletes have a lower energy cost difference than juniors, i.e. lower loss of running performance after an exhaustive bike part[4].

3.2 Anaerobic Capacity

Anaerobic Capacity is important in different situations during a Triathlon. The swim start, breakaways in each discipline, hilly courses or the final part of a Triathlon, just to name a few, require a great anaerobic capacity. In combination with the aerobic demands it enables the athlete to recover fast and produce high and repetitive loads for tactical variation within a race.
In relation to the maximum oxygen consumption athletes achieve higher values for anaerobic threshold in running than in cycling or even swimming. Those relative values were stated as 66.8 ± 3.7 and 71.9 ± 6.6% of VO_2max for running and cycling respectively[5].

3.3 Strength

An important role for triathletes plays the proportional segmental length of body extremities which have an influence on swimming performance. Proportionally long levers demand a good control, so that a good level of strength in shoulder, arms but as well in hip and legs is required[6]. Triathletes need to have a balanced ratio between hypertrophy and intra- and intermuscular coordination to be most efficient in all disciplines[7].

3.4 Technique/Coordination

Triathletes have, compared to swimmers deficits in the energy cost and propelling efficiency. As an important factor the D_S-to-height-ratio (distance per stroke) was stated.
Drafting in the water during the swimming part as well as on the bike are essential techniques to save energy. Another energy saving but performance efficient aspect is the discussion of metabolically (60-80 RPM) and biomechanically (90 RPM) optimal pedaling cadences[8].
For best possible positioning in a Triathlon variation of 6-beat and 2-beat leg kicks is necessary.

[3] Suriano et al., 2010.
[4] Millet et al., 2004, p. 194.
[5] Millet et al., 2011.
[6] Landers et al., 2000, p. 397.
[7] Lavin, 2007, p. 15-17.
[8] Bentley et al., 2002.

3.5 Flexibility

No information could be obtained referring to flexibility for triathletes on international level.

4 Development Area

Despite Triathlon places high demands on aerobic capacity due to reasons mentioned before, this work focuses on strength training, in particular on core strength and stability in combination with balance and stabilization training for lower extremities. The choice for that specific subject was made because balance and stability at lower extremities as well as core strength and stability are essential demands basically for everyday movements but especially for sporting movements with high loads, resisted and dynamic movements. Triathletes often neglect balance, stability and core exercises, mostly because of inexperience and a lack of knowledge or the volume of training they invest for good performances due to three different, partially contrary, disciplines. Many athletes and trainers still prefer quantity before quality. So this work concentrates on possible and essential alternative and additional training methods for improving performance either indirectly, in form of injury prevention and stable posture, and/or directly, e.g. by rate of force development, and increasing quality.

5 Objective with the Specialization

This work focuses on possible and qualitative ways of training for stability and balance of core and lower extremities. Emphasis lies on the critical transition phase from Sprint Distance to Olympic Distance within the athletes' ages of 19 to 21 years. The new information and knowledge will help to consider and highlight the integration of that specific subject into the entire process of training planning. A multi-annual training plan will serve as a basis to reach the aim to compete on national top level (Top 7) within Elite National Championships and win the National U23-Championships in Germany at the age of 21 years. Furthermore, a more detailed, exemplary training plan will be part of this work.

6 Method

The lectures and seminars, especially within Träningslära III, served as a basis in advance. Further search for literature and scientific articles referring to the specialized area was made by

looking on the internet via Sportdiscus, Pubmed and the library of Gymnastik- och Idrottshögskolan.

7 Results

Catapusan et al. stated the coordination of core and limb being the solid base for the control and stability of deep hip muscles and flexors, as they are the key muscle groups for the named task. Therewith, they presented several simple exercises to strengthen and stabilize the three muscle groups: deep abdominals, deep hip and deep shoulder muscles[9].

An article of Blackburn et al. explained the connection between balance and joint stability. Tests in form of balance assessments before and after a 6-week training program (18 sessions) should reveal if proprioceptive, strength training or the combination of both is the most effective training to act, in the first place, as injury prevention and possibly performance improving. Balance was described as a function of joint stability with the ankle joint regulating the balance. Proprioception represents the neuromuscular control. There was no superior method found whether proprioceptive or muscle strength training is most effective, but it was suggested to involve a combined form into rehabilitative purposes[10].

McKeon et al. tested the effect of a progressive balance training program with static and dynamic postural control after a 4-week training period and 12 sessions which lasted 20 minutes each. Results showed that there is significant improvement of function, static and dynamic postural control[11].

As an alternative method for building up core stability Stanton et al. referred to short-term Swiss Ball training. Tests before and after 6 weeks training, including 2 training sessions per week, gave evidence of significant effect of Swiss Ball training on core stability. No direct improvement on swim times or running economy and performance could be recorded[12].

[9] Catapusan & Spaulding, 2009, p.46.
[10] Blackburn et al., 2000.
[11] McKeon et al., 2008.
[12] Stanton et al., 2004.

The article from Hibbs et al. described the connection how to optimize performance with improved core stability and core strength. Most commonly, core training programs are involved into the rehabilitation sector. That leads to the fact that there is no clear definition for core stability and strength within the athlete sector. Core training programs target mainly muscular strengthening and motor control of the core musculature which is the essential part in everyday and sporting activities. So, various investigations, shortly described in this article, revealed that performance improvement could only be achieved if a combination of low- and high-load training within all three planes and ranges of movement is arranged[13].

Myer et al. investigated the difference of effects of plyometric compared with dynamic stabilization and balance training on lower extremity biomechanics. Improvements were recorded for drop vertical jump (reduce of initial contact, maximum hip adduction, maximum ankle aversion angle) and medial drop landing (decreased initial contact and maximum knee abduction angle) for both plyometric and balance training[14].

Another alternative and quite new method represents slackline training. Highly demanding balance tasks on tubular nylon webbing which is stretched tight between 2 anchor points (objects) showed, following a progressive 4-week training program with three sessions per week, a significant improvement for Rate of Force Development (RFD) of plantar flexors[15].

Rowbottom described in his article "Periodization of Training" the importance of structure and specification of training in order to achieve the best possible performance. A balance between training and recovery is essential, on the one hand, to ensure a certain stage of "overreaching" but, on the other hand, to avoid overtraining. Therefore, in general, training is periodized and subdivided into Macro-, Meso- and Microcycles, starting at a multi-annual point of view and ending in detailed training sessions and exercises[16].

[13] Hibbs et al., 2008.
[14] Myer et al., 2006.
[15] Granacher et al., 2010.
[16] Rowbottom, 2000.

8 Training Planning

The first step in the process of training planning is to know the demands the sport places on athletes, i.e. the performance requirements to compete on international top level. This criterion is obtained through a performance profile of the best athletes in the world. An exemplary performance demands profile has been shown before. The following step is to compare the athlete's actual capacity profile with the performance demands in Triathlon. That means to figure out where to find differences and the dimension of those. That concludes the principle of individuality, in order to know the background of the athlete and, as well, to decide which goals to focus on.

8.1 Individual Background

This report focuses on a male german athlete who competes in the last year of the juniors' age group. So, main competition distance is Sprint Distance (0,75 – 20 – 5 km) for one season still but he starts to compete also in Olympic Distance races as it is his main competition distance, nationally and internationally, starting with the second year of planning.

Anthropometric Details: Age: 20 years
Height: 187 cm
Weight: 70 kg

The athlete has recently finished his school, so he is able to focus on doing triathlon on professional level. During the last years the athlete was placed among Top 3 at German National Championships in Triathlon and Duathlon (Run – Bike – Run) and participated at European and World Championships, all at youth and junior stages. In Saarbrücken, Germany, the athlete has the possibility to train and live with other National Team members at the Olympic Training Center. All training possibilities, facilities and support are given to focus triathlon onto professional level.

Current Training Status (Average per week)

Training Sessions: 13 Total training hours: 22 h

Swim: 5 sessions, 17 km Bike: 3 sessions, 220 km Run: 5 sessions, 60 km

Strength/Athletic: 1 session, 1.5 h

Personal Records

Table 2 – Personal Records of the athlete on competition and test referring distances in swimming and running.

	Swim			Run	
	400 m	750 m	1500 m	5 km	10 km
Single Competition	4:35	-	18:50	15:25	32:20
Triathlon	-	8:45	-	15:50	-

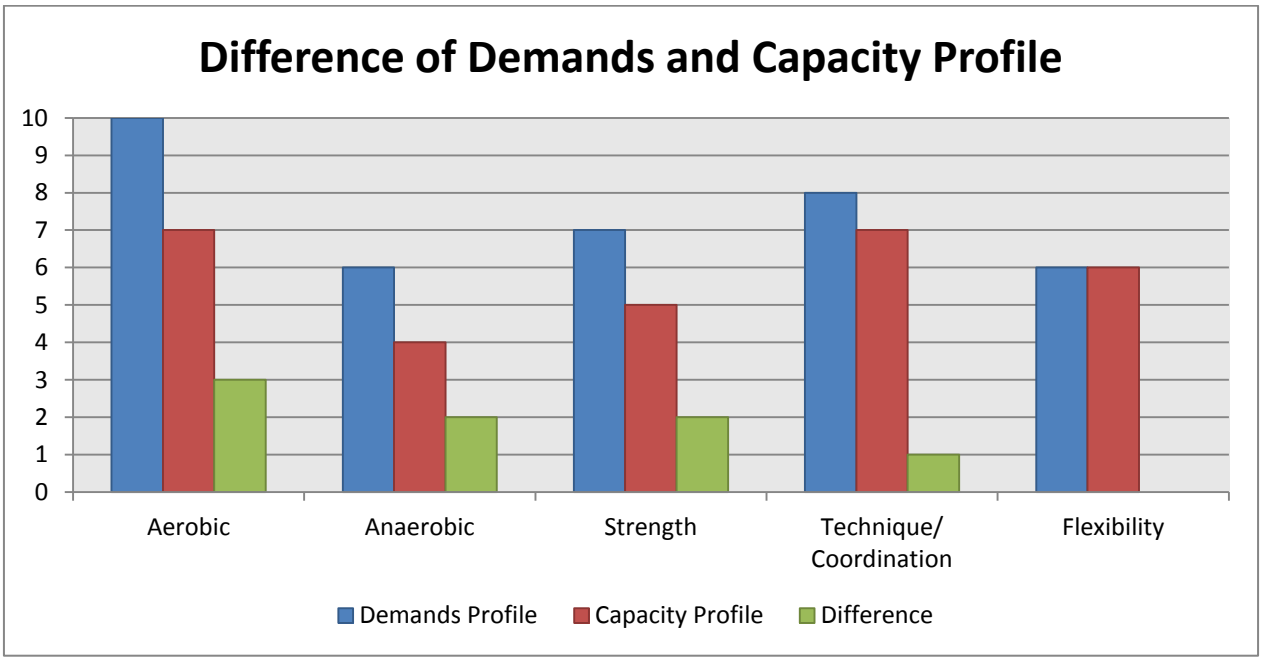

Figure 2 – Exemplary Capacity Profile of a junior Triathlete and Difference to Olympic Distance Triathletes.

8.2 Basic Training Principles

A good training plan demands a good structure. To realize a specific and functional improvement of the athlete's performance it is essential to observe certain basic training principles. Most important principles for a Triathlete are:

- ✓ Individuality: Every athlete has his/her own specific needs and abilities, referring to adaptation, skills, abilities, background etc., which should be highly considered.

- ✓ Specificity: The choice of the type of activity as well as volume and intensity of training should match the structure and goals of the sport, so that adaptations will result in adequate performances.
- ✓ Continuity: To avoid loss of performance within any capacity and to gain power it is important to continue training all season long.
- ✓ Periodization: Specificity, volume and intensity of training are adjusted within longer and shorter cycles during a season to realize optimal development.
- ✓ Progressive Overload and Adaptation:
  Training stimulates the athlete's abilities, first, degrading the performance through intensity, then, overcompensating with appropriate recovery. Furthermore, progression in intensity and difficulty should be involved to avoid stagnation.
- ✓ Variation: Modifications and Variations in training is needed to prevent injury and avoid a lack of motivation.
- ✓ Control: This principle is important to overview the training and therewith the improvement of performance, in form of training diary, tests, competitions etc.

8.3 Macrocycle – Multi-Annual Training Plan

This multi-annual training plan includes three years of planning with specific goals to achieve at the end of this period. The main goal is to compete on national top level (Top 7) at the Elite National Championships and win the U23 National Championships on the Olympic Distance at the age of 21 years.

Table 3 – Main goals during multi-annual plan.

	Year 1 (19)	**Year 2 (20)**	**Year 3 (21)**
Result Goals	- Win Junior NC Tria/Dua - Win German Junior Cup - Top 5 Junior WC	- Top 15 Elite NC - Top 3 U23 NC - Top 15 European Cup	- Top 7 Elite NC - Win U23 NC - Qualify for WCS
Performance/Skill Goals	- improve transitions (Swim-Bike & Bike-Run) - technique improvement - develop tactical skills - best focus and motivation at important competitions - high focus and motivation in training		

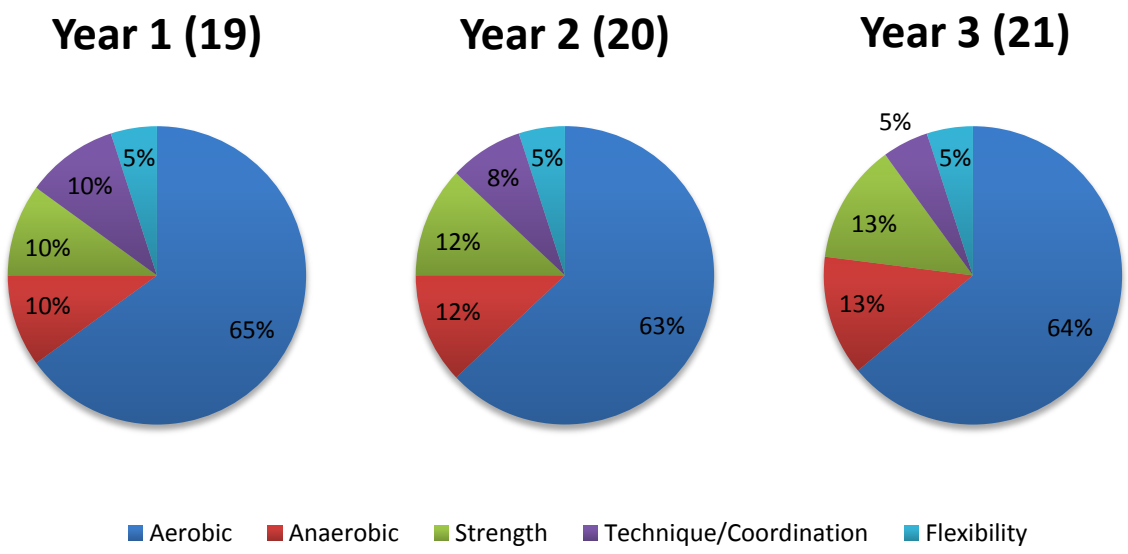

Figure 3 – Multi-Annual Planning for Distribution of Capacities. The values are stated as percentile of total training time.

The total training time will increase to an average of 23, 25 and 26 hours in the course of the years respectively. The distribution of trained capacities shown in Figure 3 state a almost constant percentile values for aerobic training. Considering the increase of total training time aerobic training will increase with the absolute volume. Especially, more high-intensive aerobic training will be included as there will be longer intervals due to the double distance in each discipline. The other capacities have their percentile change referring to the actual time of training within a session. The amount of anaerobic training sessions will increase to improve mainly anaerobic capacity with tolerance training. Strength training will experience an increase as well but it will be an alternative way, inter alia, to introduce more balance and stability training as well as developing strength endurance.

8.4 Macrocycle – Annual Training Plan

The annual training plan serves as an overview and organization of one season. The training plan shown in Figure 4 includes only the important competitions during the season, that means competitions for preparation or other than Triathlons are not involved. Such an annual plan is a broad but already detailed and important overview for the season where competitions, tests and training camps as well as general training goals are given.

Period	PP 1							PP 2		CP				RP
Month	Oct	Nov	Dec	Jan	Feb	Mar		Apr	May	June	July	Aug	Sept	Oct
Week	42-43	44-47	48-52	1-4	5-8	9-13		14-17	18-21	22-26	27-30	31-34	35-39	40-41
Main Competitions									21: BuLi	26: BuLi	**28: WCS**	**34: NC**	35: BuLi	
Tests		44: LT				11: LT		14: No		22: LT				
Training Camps			48-49		5-6				18-19		30-31			

Figure 4 – Annual Training Plan for third year (21 years). (PP = Preparation Period, CP = Competitive Period, RP = Recovery Period; LT = Laboratory Test, No = Nomination Test; BuLi = Bundesliga, WCS = World Championship Series, NC = National Championships).

Preparation Period:

This period is subdivided into 2 parts. The complete period has the objective to progressively improve the performance with the aim to have a high basis when entering the competitive phase. Preparation period 1 has a basic task to develop mainly aerobic performance in combination with technique and strength. Mostly, low- and medium-intensive aerobic training is used. Volume and intensity of training is progressively increased. Anaerobic training is started during the last weeks of this period. When entering preparation period 2 the volume of training has reached its highest extent, so that volume decreases but intensity proceeds to increase. Technical and strength training has a lower volume than before. During the second period it is usual to participate in competitions to prepare for the competitive part, but yet with more focus on quality. Combined training in form of Swim-Bike or Bike-Run combinations is a usual training then.

Competitive Period:

Volume and intensity decreases during that phase, compared to the extent before. Participations in main competitions can appear to be weekly before having a break of 2 weeks. Main triathlon competitions in Germany take place between the beginning of June and September, usually having the National Championships at the end of the season.

Recovery Period:

This part of the season lasts between 3 and 6 weeks and has the aim to ensure a full regeneration of the athlete to prevent injury, motivate and start the next season recovered from the exhaustions

before. Volume and intensity are extremely reduced but still active regeneration is recommended. So-called cross-training, doing alternative sports, can be done.

8.5 Macrocycle – Period Training Plan

During this period volume is lower than in Preparation Period 1 but intensity is high. Therewith, anaerobic and high-intensive aerobic training is introduced within all disciplines. Due to the different disciplines to develop the amount of sessions is quite high, even though it is not the maximum yet. But, regeneration for triathletes has to be used with low-intensive sessions and low volume. Balance training includes stability exercises, plyometric training and muscle strengthening.

Week 18	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Morning	S (tec)		S (tempo)	R	R	S (long)	Balance
Day		R (interval)	B	Balance		B (long)	Bike-Run Combi
Evening	Strength			S (Sprint)	R (tempo)		
Totals	**S: 16.5 km**	**B: 250 km**	**R: 75 km**	**Strength: 4 h**			
Week 19	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
Morning		S (tec)	S (tempo)	R		S (long)	Test
Day	B	R (interval)	B		R (tempo)	B (long)	
Evening	R		Strength	S (Sprint)			R
Totals	**S: 17.5 km**	**B: 280 km**	**R: 80 km**	**Strength: 1.5 h**			

Week 20	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Morning	S (long)		S (tempo)	R		Swim-Bike Combi	R (long)
Day		R (interval)	B	Balance	R (tempo)		B (long)
Evening	Strength			S (Sprint)			
Totals	**S: 15 km**	**B: 250 km**	**R: 70 km**	**Strength: 2.5 h**			
Week 21	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
Morning	S (tec)	Balance	S (Sprints)	R		S (prep)	
Day		B	R (interval)		B		BuLi
Evening	R			S (tec)		R (prep)	
Totals	**S: 14 km**	**B: 180 km**	**R: 55 km**	**Strength: 1.5 h**			

Figure 5 – Period Training Plan of Weeks 18-21 of Preparation Period 2, ending with an Olympic Distance Triathlon. (S = Swim, B = Bike, R = Run; tec = technique; prep = preparation; BuLi = Bundesliga).

8.6 Mesocycle – Weekly Training Plan

Figure 6, as shown below, states a training plan for week 18, Preparation Period 2, third year, including the contents of the main program as well as intensities.

As this phase of the training has the main purpose to develop the high intensive aerobic as well as anaerobic abilities, especially running and swimming contain those training sessions. Strength and balance training is lowered referring to the volume during Preparation Period 2 but, of course, needs still a progressive and continuous scheme so that the shown week contains three units of different strength training sessions, what also is the largest volume in strength training during Preparation Period 2. Those sessions include strength endurance, which is important to develop and use high power and force over a long period, as well as static and dynamic balance training. Those both sessions are to improve core and lower extremity stability and strength, but especially with the dynamic balance training adding particularly strength endurance contents.

Week 18	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Morning	S (l/m): (4.0 km) - 8x50 Tec + 10x200 (50 Tec + 100 F + 50 Combi)		S (m/h): (4.0 km) - Pyramid 50-800, (1500 pace)	R - before breakfast - 50' (l)	R - 12 km (l)	S (long): 5.0 km - 4x500 + 2x1000	Balance – Dynamic Stability 1 h
Day		R (h): (18 km) - 8x1000m	B - 80 km (long Sprints)	Balance - Static Stability - 1.5 h		B (long) - 120 km	Bike-Run Combi - (5x2km R + 4x5km B alt.) (m/h)
Evening	Strength - Strength Endurance 1.5 h			S (Sprint): 3.5 km - 5x4x25 M	R (m) - (21 km) - 15 km		
Totals	S: 16.5 km	B: 250 km	R: 75 km	Strength: 4 h			

Figure 6 – Weekly Training Plan for Week 18 of Preparation Period 2. (S = Swim, B = Bike, R = Run; Tec = Technique; F = Freestyle, M = Medley; l/m/h = low/medium/high intensity); (first distances in brackets state total distances).

8.7 Microcycle – Daily Training Plan & Training Session

Table 4, shown below, includes the sessions and the daily plan of Sunday in calendar week 18, Preparation Period 2. Important facts to observe are the session time, to include adequate Warm-Up and Cool Down parts as well as appropriate resting time between the units.

Table 4 - Exemplary Daily Training Plan for Sunday, Calender Week 18 within Preparation Period 2.

Preparation Period 2, Calender Week 18, Sunday					
Time	**Session**	**Exercise**	**Time**	**Intensity**	
09.30 - 11.00	Dynamic Balance Training	Run (3.5 km)	15 min	low	Warm-Up
		Dynamic Stretching	5 min		
		Static Stability	10 min		
		Dynamic Stability/Strengthing	45 min	various	Main
		Static Stretching	10 min		Cool Down
		Bike (Spinning Bike)	15 min	low	
15.00- 18.00	Bike-Run Combi	Bike (20 km)	45 min	low	Warm-Up
		Run (2 km)	9 min	low	
		Dynamic Stretching	5 min		
		Bike -Run Combination	65 min	medium/high	Main
		Bike (20 km)	45 min	low	Cool Down
		Static Stretching	10 min		

Tables 5 and 6 show the detailed contents of the training sessions, stated in the daily plan above (Table 4). Different but adequate equipment and exercises are used to achieve the purpose of dynamic stability and strength, always related to the three disciplines' demands. Distribution and extent of strength and stability can be varied by adjusting the workout and resting times as well as the amount of repetitions. The bike-run combination training in the afternoon is important to improve the aerobic capacity and effect as well as technical and coordinative abilities to switch fast between the different disciplines for being able to perform best right from the start of the partially controversial disciplines.

Table 5 – Exemplary Training Session, Run-Bike Combination, Sunday, Calender Week 18, Preparation Period 2.

Exercise	Time	Run Intensity	Bike Intensity
2 - 5 - 2 - 5 - 2 - 5 - 2 - 5 - 2 km (Run – Bike – Run –…)	Run: 6'45"-6'50" Bike: 7'30"-7'40"	95% of 10 km Race Velocity	90%

Table 6 – Exemplary Training Session, Balance/Dynamic Stability, Sunday, Calender Week 18, Preparation Period 2 (alt. legs = alternating legs).

Exercise	Time [s]	Reps	Rest [s]	Information
Double BOSU (F) deep hold, partner perturbations	25	5	25	
BOSU (F) drop single-legged Airex stick deep hold		10 each		5s hold, alt. legs
BOSU (R) single-legged deep partner ball toss	45	2 each	30	
Swiss Ball, both knees, deep hold, partner perturbations	30	3	30	
BOSU (R) single-legged hop stick deep hold		8 each		5s hold, alt. legs
BOSU (F) single-legged ball low/high	45	2 each	30	
Airex walking lunges		12 each		alt. legs
BOSU (F) single-legged squats		2x8 each	20	
BOSU (F) single-legged, deep hold, partner perturbations	30	2 each	30	
Straight leg lifts, reverse plank		15 each		
Straight leg lateral double crunch		12 each	20	

9 Discussion

The planning of training in Triathlon is highly complex in order to achieve best performances within all three disciplines. High quantity is reached easily by raising the volume of all units and time within each unit. In that case, the balance between load/overload and recovery is considerably essential. Three disciplines, placing different, partially controversial demands, have to be developed and improved. To regulate the effective combination of swimming, biking, running and each transition, quality plays the most important role. Athletes and trainers should, inter alia, follow training principles, the trainer should know and consider the athlete's feelings and condition (both social and sportive environment) and the trainer should have a sense for empathy towards the athlete in order to plan qualitative training. Those aspects in combination with a preferred qualitative, adequate and appropriate rather than quantitative view are essential in Triathlon, what basically includes high volume caused by three disciplines.

For the improvement of abilities related to Triathlon as well as for motivation and the improvement of further skills and abilities, which support the triathlete's process, different, alternative and effective training methods should be introduced. These methods, as this work focuses on following, include the implementation of stability and strength exercises, especially

core and lower extremities as both parts are important for everyday and sporting movements[17, 18]. If strength or stability workouts are examined solely or integrated into training not in a qualitative matter only injury-preventive effects are achieved. This, as a basis, influences training indirectly by enabling the athlete to train more volume and intensively with lowering the risk of injury, so that this form should be at least included. But if integrated in a smart way with qualitative consideration stability and strength training for core and lower extremities can help to improve performance within the sport[19]. So, it is important to develop the coordination of core and limb because "…limb strength effectively combined with core strength results in the speed we seek while swimming, biking and running."[20] This can be reached through static and dynamic balance as well as plyometric training. Those affect both neuromuscular control/awareness (proprioception) and muscle strength[21, 22]. Therefore, qualitative training needs the implementation of functional and specific workouts and exercises to improve performance, correct deficiencies (e.g. joint stability and range etc.) and lower the risk for injuries as well as minimizing and eliminating errors in technique (due to insufficient core strength and stability)[23]. Core strength and stability are low-load motor control training methods which need to be involved more and more in sport-specific training programs. For reaching the above mentioned goals this low-load motor control training has to be combined with high-load training, which is done for example by strength endurance and balance training units, both within the discipline training but also in separate strength training. Propulsive forces (power-producing extremities) and dynamic muscular strength are based on the foundation of core strength development, as to name the importance of such. For best possible efficiency and performance the sub-areas of core training should be considered, as there are motor-control stability, core strength and systematic strength training. An essential fact to improve power, abilities and skills is the 3-dimensional nature of sporting movements what means to use all three planes and ranges of movement within training because the muscles have different functional roles. Therewith, movements should include flexion, extension and rotation.[24]

[17] Hibbs et al., 2008.
[18] Blackburn et al., 2000.
[19] Hibbs et al., 2008.
[20] Catapusan & Spaulding, 2009.
[21] Stanton et al., 2004.
[22] Hibbs et al., 2008.
[23] Hibbs et al., 2008.
[24] Hibbs et al., 2008.

Workouts in form of strength training should not involve only the usual strengthening. For raising efficiency, quality and therewith improvement in Triathlon, both directly and indirectly, a complex of functional and sport-specific strength, balance, flexibility, stability and proprioception training represent additional, alternative, qualitative, varying and new methods. Furthermore, it motivates the athlete by variation and newly introduced exercises within training. All in all, a range of facts as determining factors should considered and observed to ensure qualitative and useful strength training in a sport that places high demands on quantity basically in advance. Essential basics should generally include the athlete's and trainer's interest for knowledge and education about training planning to know what and why to train.

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